PROGRAMME & ABSTRACTS

CELEBRATION 40 ANNIVERSARY

40th Annual Meeting of the European Bone and Joint Infection Society

8 -10 September 2022 · Graz · Austria

European Bone & Joint Infection Society EBJIS

www.ebjis2022.org

EBJIS 2022

40th Annual Meeting of the European Bone and Joint Infection Society

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EBJIS Membership

Join now the European Bone and Joint Infection Society and experience new opportunities on volunteering and being on the other side of the board table

Member benefits

- You will receive a discount from the Annual EBJIS Meeting registration fee which is similar to the annual membership fee (130 euros).
- Become an EBJIS Fellow: members are eligible to apply for the fully-funded annual Travelling Fellowship program www.ebjis.org/fellowship Three Travelling Fellowships are awarded every year.
- As a member of EBJIS you are eligible to receive reduced article processing charges when publishing an open-access article in The Journal of Bone and Joint Infection (JBJI). admini-strator.copernicus.org/authentication
- Access all EBJIS Newsletters and all the re-cent news related to Bone and Joint Infection.
- Access the EBJIS Annual General Assembly with voting rights on key decisions.
- Access the EBJIS community that encourages discussion and collaboration between the EBJIS Members on clinical cases.
- The Executive Committee support Members who organise scientific meetings and promote them among our Members and in the EBJIS website.
- Apply for a Country Delegate position - a Committee which serves to improve the promotion of the EBJIS in many coun-tries around the world, to facilitate contacts with interested colleagues and to encourage Bone and Joint Infection centres.

Annual membership fee: € 130

For further details, contact us here:
info@ebjis.org

Information and registration through the EBJIS website
www.ebjis.org/membership

Welcome

Dear colleagues and friends,

It is a great honour to host and organise the 40th Annual Meeting of the European Bone and Joint Infection Society in Graz, Austria on 8-10 September 2022. The conference is held at the Congress Graz, conveniently located in the heart of the city. For the participants that will not be able to come to Graz, the programme is also available online.

Graz is known as Austria's culinary and cultural capital. In the historic old town with its roads, streets, squares and courtyards there's lots to explore and even more to be enjoyed. Discovering the city is a stroll through centuries right into the future. With its historic buildings and the futuristic Kunsthaus and the Mur Island it is for a good reason a UNESCO world heritage site and a UNESCO city of design at the same time.

The conference will bring together experts, practitioners and companies involved in the treatment of bone and joint infections. Professionals attending the conference will benefit from high-level scientific presentations, knowledge sharing and networking opportunities. We have prepared an interesting programme that includes keynote lectures, free paper sessions, industry symposia and posters.

We hope you will enjoy the conference and your time in Graz.
Welcome to the EBJIS 2022 Annual Meeting!

On behalf of the Local Organising Committee and the EBJIS Executive Committee,

Mathias Glehr
Local chair

Alex Soriano
President of EBJIS

Organisation

EBJIS Executive Committee

President
Alex Soriano

Vice President
Ricardo Sousa

Immediate Past President
Rihard Trebse

Secretary General
Willem-Jan Metsemakers

Treasurer
Martin Clauss

Ordinary Members
Marjan Wouthuyzen-Bakker
Irene Sigmund

The Local Organising Committee

Local Chair
Mathias Glehr

Members
Irene Sigmund
Florian Amerstorfer

Country Delegates Chair
Christof Wagner

Programme Coordinator
Martin McNally

General information

Conference website
www.ebjis2022.org

Conference venue
Congress Graz
Albrechtgasse 1
8010 Graz
Austria

Badges
The conference name badges must be always worn during the conference. Access to the conference venue will not be granted without the name badge issued by the conference organisers.

Entitlements for participants
Admission to all scientific sessions and industry symposia, admission to exhibition, conference bag with programme- and abstract book, CME credits, coffee breaks and lunch, welcome reception on Thursday 8 September, farewell lunch on Saturday 10 September and certificate of attendance.

CME credits
The conference has been accredited with European CME credits (ECMEC) by the European Accreditation Council for Continuing Medical Education (EACCME). Participants who wish to apply for CME credits should go to the registration desk to confirm their attendance each day. You will receive an email with more information and the link to download the certificate after the conference.

Cloak room
A manned cloak room will be available by the main entrance during the scheduled programme.

Conference language
The conference will be held in English.

Information for Speakers
Please bring your presentation, on a USB stick, to the Speakers' Preview room located on the ground floor. An assistant will help you upload the presentation to the computer. Please make sure to upload your presentation at least 2 hours before your session starts.
We do not allow the use of personal laptops for presentations.
At the end of the conference, all presentations will be deleted to secure that no copyright issues will arise.

Speakers' Preview room (Ground Floor)

Opening hours:

Thursday, 8 September	7:00 - 17:00
Friday, 9 September	7:45 - 17:00
Saturday, 10 September	8:00 - 12:00

WIFI
Free access to the WIFI at the conference venue is provided.
Name: congressgraz
Password: ebjis2022

EBJIS Conference Organiser
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www.ebjis.org

Social events

Welcome Reception
Date 8 September 2022
Time 18:30 - 20:00
Place Exhibition area at the conference venue

The reception is included in the registration fee.

EBJIS Gala Dinner
Date 9 September 2022
Time 20:00 - 24:00
Place Alte Universität Graz (Old University of Graz) Hofgasse 14

NB: The dinner is not included in the registration fee.

Connect with EBJIS on social media

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Programme

Thursday 8 September 2022

	Plenary Room: Stefaniensaal	
7:00	**Registration**	
08:30-08:50	**Opening Ceremony**	**Alex Soriano & Mathias Glehr**
08:50-09:15	**Key session 1: 40th anniversary of the EBJIS Annual Meeting**	**Chairs: Mathias Glehr & Christof Wagner**
	How it all started 1982-1993	Geert H.I.M. Walenkamp
	The difficult teenage years 1994-2021	Martin McNally
	A Society for the future	Alex Soriano
09:15-10:15	**Key session 2: Definition and diagnostic criteria for PJI**	**Chairs: Rihard Trebse & Florian Amerstorfer**
	Classification of Bone and Joint Infection	Martin McNally
	EBJIS PJI defintion and how to make a diagnosis: tips and tricks	Ricardo Sousa
	Validation and the future	Marjan Wouthuyzen-Bakker
	Discussion	
10:15-10:45	***Coffee Break / Posters / Exhibition***	
10:45-12:15	**Free Paper Session A (6 min + 2 min)**	**Chairs: Ricardo Sousa & Mathias Glehr**
FP A1	Alpha-Defensin And Microbiological Spectrum In Revision Total Knee Arthroplasties With Unexpected Positive Intraoperative Cultures (UPIC)	Sebastian Simon
FP A2	A Comparison Of Infection Definitions For The Diagnosis Of Periprosthetic Joint Infections	Irene Katharina Sigmund
FP A3	Meta-Analysis Of Metagenomic Next Generation Sequencing As A Diagnostic Tool For Pathogen Detection In Prosthetic Joint Infections	Neža Trebše
FP A4	Multicentre Evaluation Of Rapid Molecular Syndromic Approach In Joint Infections Using A New Dedicated Panel: Preliminary Results	Tiphaine Roussel-Gaillard
FP A5	Comparison Between Culture-Based Methods And The Joint Infection (JI) Panel Approach For The Diagnosis Of Hip And Knee Prosthetic Joint Infection	Susana Hartmann
FP A6	Diagnostic Accuracy Of A Multiplex PCR Panel For Rapid Detection Of Pathogens In Acute Septic Arthritis And Prosthetic Joint Infections, A Pilot Study	Jorrit Schoenmakers
FP A8	Evaluation Of Synovial Calprotectin Levels To Support The Diagnosis Of Prosthetic Joint Infections	Marta Bottagisio
FP A9	Synovial Fluid Small Extracellular Vesicles (sEVs) In The Diagnostics Of Periprosthetic Joint Infection (PJI)	André Busch
FP A10	Periprosthetic Joint Infection Diagnosis Using Nuclear Magnetic Resonance Based Metabolom Analysis	Sebastian Klim
12:15-13:45	**Lunch break**	

Due to CME regulations no industry names or logos are allowed in the scientific programme.
Detailed programme of industry sessions is available on pages 21.

Thursday 8 September 2022

	Parallel Session Room: Saal Steiermark	
10:15-10:45	***Coffee Break / Posters / Exhibition***	
10:45-12:15	**Free Paper Session B (6 min + 2 min)**	**Chairs: Mario Morgenstern & Florian Amerstorfer**
FP B1	Use Of Negative Pressure Wound Therapy In Patients With Fracture Related Infections Is Associated With A Two-And-A-Half-Fold Increased Risk Of Recurrence	Geertje Govaert
FP B2	Risk Of Reoperation Due To Deep Surgical Site Infection In 74.771 Hip Fractures	Nicolai Kristensen
FP B3	Intertrochanteric Osteosynthesis Failure: Is There A High Rate Of Undetected Infections?	Daniel Pérez-Prieto
FP B4	Isolated Pathogens Do Not Differ Between Early, Delayed Or Late Fracture Related Infections	Ruth Corrigan
FP B5	The Microbiological Etiology Of Fracture-Related Infection	Jonathan Sliepen
FP B6	Femoral Fracture Related Infections (FRI) In A Low Income Country: Management Choices And Long Term Outcomes	Antonio Loro
FP B7	Predictive Factors Of Chronic Osteomyelitis After Open Tibial Fractures In A Low-Income Setting	Fonkoue Loïc
FP B9	Tibial Bone And Soft-Tissue Concentrations Following Combination Therapy With Vancomycin And Meropenem - Evaluated By Microdialysis In A Porcine Model: Should Patients With Open Fractures Have Higher Doses Of Antibiotics?	Sofus Vittrup
FP B10	Is Implant Removal Needed For The Treatment Of Intramedullary Nail Infections In Elderly Hip Fracture Patients?	Margarita Veloso
12:15-13:45	**Lunch break**	
12:30-13:30	Industry Symposium A	

Thursday 8 September 2022

	Plenary Room: Stefaniensaal	
13:45-15:00	**Key session 3: Treatment strategies for hip PJI**	**Chairs: Martin Clauss & Mathias Glehr**
	When to use which approach?	Irene Sigmund
	How to do a DAIR (including videos)	Martin Clauss
	How to do a 1-stage exhange (including videos)	Olivier Borens
	How to do a 2-stage exchange (including videos)	Rihard Trebse
	How to do a Girdlestone interposition arthroplasty	Mathias Glehr
	Discussion	
15:00-16:00	**Free Paper Session C (6 min + 2 min)**	**Chairs: Marjan Wouthuyzen-Bakker & Mathias Glehr**
FP C1	Treatment Failure In Late Acute Periprosthetic Joint Infection In Patients With Rheumatoid Arthritis	Maria Schenk
FP C2	Effectiveness Of Different Antimicrobial Strategies For Staphylococcal Prosthetic Joint Infection: Results From A Large Prospective Registry-Based Cohort Study	Henk Scheper
FP C3	What Is The Effect Of A Failed DAIR On The Survival And Subsequent Revision Done For PJI? A Multicentric Study	Alvaro Auñon Rubio
FP C4	Microbiological Analysis And Outcome Of Debridement; Antibiotics And Inplant Retention Following Two-Stage Exchange Arthroplasty Of The Hip And Knee	Bernhard J.H. Frank
FP C5	Single Center, Exploratory, Open-Label Prospective Study Using The Minimally Invasive LysinDAIR Procedure (Administration Of The Lysin Cf-301 During The Performance Of An Arthroscopic Dair) In Patients With Chronic Coagulase-Negative Staphylococci Knee PJI With Two Different Clinical Presentations And Treatment Paradigms	Tristan Ferry
FP C6	Systemic Antibiotics Are Not Required For Successful Two-Stage Revision Hip Arthroplasty	Michael Petrie
FP C7	Surgical Outcomes Of A Novel Bone Substitutes And Allograft Bone Chips For The Treatment Of Severe Acetabular Defects During Hip Revision Surgeries	Matteo Romagnoli
16:00-16:30	**Coffee Break / Posters / Exhibition**	
16:30-17:30	**Key Session 4: Polymicrobial BJI**	**Chairs: Alex Soriano & Thomas Valentin**
	What should we know about Polymicrobial infection	Marjan Wouthuyzen-Bakker
	Which pathogens are clinically relevant?	Tobias Kramer
	Adaptive bacterial resistance mechanisms in PJI	Edward McPherson
	Discussion	
17:35-18:35	Industry Symposium B	
18:35-20:00	**Welcome Reception - in the exhibition area at the conference venue**	

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Thursday 8 September 2022

	Parallel Session Room: Saal Steiermark	
15:00-16:00	**Free Paper Session D (6 min + 2 min)**	**Chairs: Bridget Atkins & Ines Zollner-Schwetz**
FP D1	On The Value And Limitations Of Incorporating A "Clean Phase" Into The Surgical Treatment Of Prosthetic Joint Infections - An Illustrative Cadaveric Study Using Fluorescent Powder	Georges Vles
FP D2	Rifampicin Does Not Reduce Moxifloxacin Tissue Concentrations Following 1-Stage Revision In A Porcine Model Of Implant Associated Osteomyelitis	Nis Jørgensen
FP D3	Testing Of Bone Cement With Gentamicin Against *Staphylococcus Aureus* Infections In *Galleria Mellonella*	Gopala Mannala
FP D4	Establishment Of A Novel Gram-Negative Prosthetic Joint Infection Rat Model Using Uncemented Hip Hemiarthroplasty	Mazen Ibrahim
FP D5	New Inorganic/Organic Nano-Structured Xerogel Coating Prevents Development Of Osteomyelitis In A Porcine Model	Louise Kruse Jensen
FP D6	Biodistribution Of A Radiolabeled Antibody Targeting *Staphylococcus Aureus* Implant Infection In Mice	F. Ruben H. A. Nurmohamed
FP D7	High Cefuroxime Concentrations And Long Elimination In An Orthopaedic Surgical Deadspace - A Microdialysis Porcine Study	Mats Bue
16:00-16:30	**Coffee Break / Posters / Exhibition**	
16:30-17:30	**Key session 5: Native Osteomyelitis**	**Chairs: Martin McNally & Irene Sigmund**
	Imaging of osteomyelitis	Frank Ijpma
	Debridement techniques in osteomyelitis	Jamie Ferguson
	Soft tissue reconstruction in osteomyelitis	Rik Osinga
	Discussion	
17:35-18:35	Industry Symposium C	

Friday 9 September 2022

	Plenary Room: Stefaniensaal	
7.45	**Registration**	
08:30-09:30	**Key Session 6:** **Optimising post-operative antibiotic therapy**	**Chairs:** **Marjan Wouthuyzen-Bakker & Florian Thalhammer**
	Gold standard of antibiotic therapy, does it exist?	Alex Soriano
	Antibiotic therapy: a matter of time	Eric Senneville
	Antibiotic therapy: How we detect failure; how and when to react?	Bridget Atkins
	Aspects of the future of Antibiotic therapy: resistances, local evolutions, new threats	Jaime Lora-Tamayo
	Discussion	
09:30-10:30	**Key Session 7:** **Bacteriophage therapy**	**Chairs:** **Andrej Trampuz & Ricardo Sousa**
	Current (pre)clinical experience: the Leuven perspective	Willem-Jan Metsemakers
	Current clinical experience: the Eliava perspective	Mzia Kutateladze
	Current clinical experience: the Lyon perspective	Tristan Ferry
	Discussion	
10:30-11:00	**Coffee Break / Posters / Exhibition**	
11:00-12:30	**Free Paper Session E** **(6 min + 2 min)**	**Chairs:** **Rihard Trebse & Irene Sigmund**
FP E1	Bacteriophage Injections Under Sonography After Conservative Surgery In Patients With Complex *S. Aureus* And/Or *P. Aeruginosa* Prosthetic Joint Infection For Whom Explantation Is Not Desirable: A Potential Evolution Of The PhagoDAIR Procedure	Tristan Ferry
FP E2	The Impact Of Smoking On Treatment Failure In Surgically-Treated Orthopaedic Infections	Maria Dudareva
FP E3	Increased Short- And Long-Term Mortality Amongst Patients With Early Periprosthetic Knee Joint Infections	Anna Stefánsdóttir
FP E4	Next Generation Sequencing: Can Aspiration Technique Cause Contamination in Joint Arthroplasty?	Edward McPherson
FP E5	Validation Of Reported Revisions For Deep Infection To A National Arthroplasty Register	Olav Lutro
FP E6	PJI Managed With Two Stage Surgery: Forgotten Deaths And Not Negligible Complications	Olivier Cornu
FP E7	Prevalence And Impact Of Unexpected Positive Intra-Operative Cultures In Total Hip Or Knee Revision Surgery	Caribay Vargas Reverón
FP E8	Unexpected Positive Intra-Operative Cultures In Cup Revision Of Total Hip Replacement, What Happens To The Stem?	Karsten Ottink
FP E9	Unexpected Positive Cultures In Patients With A History Of Septic Revision In The Same Joint	Ana Ribau
FP E10	Higher 1-Year Risk Of Implant Removal For Culture-Positive Than For Culture-Negative Dairs Following 359 Primary Hip Or Knee Arthroplasties	Jon Goosen
12:30-13:45	**Lunch break**	
12.35-13.35	Industry Symposium D	

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Friday 9 September 2022

	Parallel Session Room: Saal Steiermark	
09:30-10:00	**EBJIS Country Delegates Session**	**Chairs:** **Christof Wagner & Charles Vogely**
	EBJIS Project – Country Delegates	Christof Wagner
	CD Project "Health Economic Burden Of Periprosthetic Joint Infections In Europe"	Volker Alt
	CD Project "Impact Of Positive Cultures During The Second Stage Of A 2-Stage Replacement"	Marta Sabater
10:30-11:00	**Coffee Break / Posters / Exhibition**	
11:00-12:30	**Free Paper Session F** **(6 min + 2 min)**	**Chairs:** **Alex Soriano & Thomas Valentin**
FP F1	Killing Of A Multispecies Biofilm Using A Gram-Negative And Gram-Positive Targeted Antibiotic Released From High Purity Calcium Sulfate	Kelly Moore
FP F2	Local Antibiotic Use Is Not Associated With An Increase In Specific Antimicrobial Resistance At Surgery For Recurrence	Bernadette Young
FP F3	Antibiotic Loaded Cement In Total Knee Arthroplasty: Role In Infection Prevention	Albert Fontanellas Fes
FP F4	Antibiotic Spacers In Chronic Shoulder Infections: Modular Tailored Preformed Spacer Vs Hand-Made Spacer	Marta Montanari
FP F5	Is Gentamycin Elution From Bone Coment Influenced By The Timing Of Application Of The Antibiotic Powder In Articulating Spacer For Periprosthetic Joint Infections?	Federico De Meo
FP F6	Quantification Of Beta-Lactam Antibiotics At The Site Of Infection In Periprosthetic Joint Infection, Using Ultra-Performance Convergence Chromatography-Tandem Mass Spectrometry	Jakob van Oldenrijk
FP F7	Antibiotic Prophylaxis And Empiric Antibiotic Therapy In Primary Arthroplasty And Periprosthetic Joint Infections: Current Practice And Need For Therapy Optimization	Nike Walter
FP F8	The Need For An Early Therapeutic Drug Monitoring Of Vancomycin Concetrations For The Management Of Bone And Joint Infections	Sonia Luque Pardos
FP F9	Oral Antibiotics To Treat Staphylococcal Infections After Removal Of Infected Orthopaedic Metalwork	Tariq Azamgarhi
FP F10	Comparative Analysis Of The Antibiofilm Effect Of Different Bag-S53p4 Formulations Alone And In Combination With Vancomycin	Nele Müller
12:30-13:45	**Lunch break**	
12.35-13.35	Industry Symposium E	

Friday 9 September 2022

	Plenary Room: Stefaniensaal	
13:45-14:45	**Key Session 8: Periprosthetic joint infection of the upper extremity**	**Chairs: Mathias Glehr & Rihard Trebse**
	Diagnostic strategies for PJI of the shoulder	Thomas Falstie-Jensen
	Surgical strategies for PJI of the shoulder	Simon Lambert
	Surgical strategies for PJI of the elbow	Stefaan Nijs
	Discussion	
14:45-15:45	**Free Paper Session G (6 min + 2 min)**	**Chairs: Klaus Kirketerp-Møller & Jochen Hofstätter**
FP G2	Does Recurrence Of Bone And Joint Infection Affect Quality Of Life In The First Year After Surgery?	Andrew Hotchen
FP G3	Significant Difference In Antimicrobial Resistance Of Bacteria In Septic Revision Between Total Knee Arthroplasty And Total Hip Arthroplasty	Stella Stevoska
FP G4	Microbiology Of Recurrent Bone And Joint Infections Demonstrates Both Microbial Persistence And Replacement	Bernadette Young
FP G5	Immunomodulatory And Antibacterial Properties Of Host Defense Peptides Against *Staphylococcus Aureus*	Leonardo Cecotto
FP G6	Comparative Phenotypic And Genomic Features Of Staphylococci From Sonication Fluid Of Orthopedic Implant-Associated Infections With Poor Outcome	Mauro Salles
FP G7	Host Factors That Predict Recurrence In Surgically-Treated Orthopaedic Infections	Maria Dudareva
15:45-16:15	**Coffee Break / Posters / Exhibition**	
16:15-17:15	**Free Paper Session I (6 min + 2 min)**	**Chairs: Olivier Borens & Jochen Hofstätter**
FP I1	Increasing Risk Of Revision Due To Infection After Total Hip Arthroplasty In The Nordic Countries	Håvard Dale
FP I2	Risk For Revision And Antibiotic Loaded Cement Use In Hip And Knee (Revision) Arthroplasty Based On Dutch Registry Data (2007-2020).	Koen Bos
FP I3	A Series Of 100 Consecutive DAIR Procedures In Primary Total Knee And Hip Arthroplasty Infection: Single Centre Outcome Report	Samo Roskar
FP I4	High Mortality Rate And Poor Outcome After Debridement And Implant Retention For Acute Hematogenous Periprosthetic Joint Infection: A Retrospective Cohort Study	Marianne Westberg
FP I5	Management Of Hip And Knee Prosthesis Joint Infection (PJI) Due To *S. Aureus* By The "Debridement Antibiotics And Implant Retention" (DAIR) Procedure In French Reference Centers (CRIOAcs) In 2019: A Retrospective Cohort Study	Tristan Ferry
FP I6	Good Functional Outcomes And High Cure Rate After Acute Hemato-genous Infection Following Total Knee Arthroplasty At Long Term Follow Up	Daniel Pérez-Prieto
FP I7	Etiology And Risk Factors Of Metachronous Periprosthetic Joint Infection	Mustafa Citak
20:00-24:00	**EBJIS Gala Dinner at the Old University (Hofgasse 14)**	

	Parallel Session Room: Saal Steiermark	
13:45-14:45	**Key Session 9: Spinal implanted related infections**	**Chairs: Charles Vogely & Jochen Hofstätter**
	Diagnostic algorithm of spinal infections	Andrej Trampuz
	Practical clinical aspects: operative and postoperative management of spinal infections, tips and tricks	Ricardo Rodrigues-Pinto
	Selected free paper presentations:	
FP S1 6+2min.	Incidence And Risk Factors Of Acute Infection After Instrumented Thoracolumbar Fusion. A Case-Control Study	Carlos García Cardona
FP S2 6+2min.	Spondylodiscitis In Children: A Retrospective Study	Andrzej Krzysztofiak
FP S3 6+2min.	Changes Of The Microbiological Spectrum And Antibiotic Resistance Pattern In Postoperative Spinal Implant Infections With Multiple Culture-Positive Revision Surgeries	Jennyfer A Mitterer
14:45-15:45	**Free Paper Session H (6 min + 2 min)**	**Chairs: Willem-Jan Metsemarkers & Martin McNally**
FP H1	Treatment Of Implant-Associated Osteomyelitis With Injectable In Situ-Forming Depot Drug Delivery System	Albert Fuglsang-Madsen
FP H2	Management Of Hand And Wrist Osteomyelitis	Katherine Browne
FP H3	Ultrastructural Analysis Of Mitochondria From Osteoblasts And Osteocytes From Patients With Osteomyelitis	Daniel Hendrik Mendelsohn
FP H4	Haematogenous Osteomyelitis With Burkholderia Pseudo-mallei: A Single Centre Retrospective Observational Study	Aditya Menon
FP H5	Surgical Related Infections In Foot And Ankle Surgery: A Treatment Algorithm	Eline Steggink
FP H6	FDG PET/MRI For Chronic Osteomyelitis	Chris Arts
15:45-16:15	**Coffee Break / Posters / Exhibition**	
16:15-17:15	**Free Paper Session J (6 min + 2 min)**	**Chairs: Mathias Glehr & Martin Clauss**
FP J1	Muscle-Only Versus Chimeric Musculocutaneous Gastrocnemius Flap In Complex Orthoplastic Reconstruction Around The Knee: A Retrospective Multicentre Outcome Study	Rik Osinga
FP J2	DAIR And Flap	Laia Boadas
FP J3	Pressure-Ulcer Related Pelvic Osteomyelitis: Survey Of Orthopaedic Management	Maria Dudareva
FP J4	Limb Salvage Using A Total Femur Replacement In Revision Surgery	Jan Schwarze
FP J5	Articulating Molded Knee Spacer Reducing Bone Defect Progression During The Interval Period Of Two-Stage Revision Of The Knee	Giorgio Cacciola
FP J6	Biofilm Removal Using Pulse Lavage And Electrical Fields: An In Vitro Study	Marti Bernaus
FP J7	Synovial Fluid D-Lactate, A Pathogen-Specific Biomarker For The Diagnosis Of Septic Arthritis	Paula Morovic
17:30-18:45	**EBJIS General Assembly – Room: Blauer Salon (for EBJIS members, by invitation only)**	

Programme

Saturday 10 September 2022

	Plenary Room: Stefaniensaal	
08:30-09:00	**Travelling Fellowship Report** Presented by: Maria Dudareva, United Kingdom Florian Ludwig Amerstorfer, Austria Frank Ijpma, Netherlands	**Chair: Alex Soriano**
09:00-10:15	**Key Session 10:** **Fracture-related infection: management strategies**	**Chairs: Willem-Jan Metsemakers & Mathias Glehr**
	Definition of fracture-related infection and nonunion: is there a time related cut-off?	Mario Morgenstern
	Pathogenesis of FRI	Volker Alt
	Can we DAIR in FRI?	Geertje Govaert
	Bone defect management	Martin McNally
	Discussion	
10:15-10:45	**Coffee Break / Posters / Exhibition**	
10:45-12:15	**Best Papers Session** **(6 min + 2 min)**	**Chairs:** **Olivier Borens & Irene Sigmund**
BP 1	Cefuroxime Concentrations In The Anterior And Posterior Column Of The Lumbar Spine - An Experimental Porcine Microdialysis Study	Magnus A. Hvistendahl
BP 2	Association Between Postoperative Wound Leakage And Infection After Anthroplasty: Results Of A National Wound Care App Implementation Study	Henk Scheper
BP 3	Characteristics And Outcomes Of Culture-Negative Prosthetic Joint Infections From The Prosthetic Joint Infection In Australia And New Zealand Observational (PIANO) Cohort.	Joshua Saul Davis
BP 4	Does The Use Of Local Antibiotics Affect Clinical Outcome Of Patients With Fracture-Related Infection?	Jonathan Sliepen
BP 5	*Galleria Mellonella* As Alternative In Vivo Model For Implant-Associated Fungal Infections	Gopala Mannala
BP 6	Mid- To Long-Term Results Of Single Stage Management Of Osteomyelitis, Facilitated By A Bioabsorbable, Gentamicin-Loaded Ceramic	Martin McNally
BP 8	On Demand Activation Of A Novel Anti-Infective Biopolymer Implant Coating With High-Energy Shockwaves	Jan Puetzler
BP 9	Unsuspected Low-Grade Infection In Revision Surgery For Nonunion In Foot And Ankle Arthrodesis: Incidence, Causative Microorganism And Treatment	Eline Steggink
BP 10	Functional Results And Complications At 2 And 5 Years In Patients With A Reverse Shoulder Prosthesis With Contamination By *C Acnes*	Albert Alier
BP 11	Histopathological Characterization Of The First And Last Removed Bone Tissue During Debridement Of Chronic Osteomyelitis	Louise Kruse Jensen
12:15-12:45	**Honorary lecture**	Antonio Loro
12:45-13:00	**Closing Remarks & Prizes**	
13:00-14:00	**Farewell lunch**	

Industry symposia

Industry symposium A

ZIMMER BIOMET Institute®

Thursday, 8 September, 12:30 - 13:30
Room: Saal Steiermark

Biofilm formation on implants: Current insights and latest advances

Agenda

12:30	Introduction by ZBI
12:35	Biofilm - Infection - Antibiotic resistance: The killing triad! Speaker: Prof. Peter Giannoudis, Leeds Teaching Hospital, Leeds, United Kingdom
12:55	Alternative technologies to reduce the impact of the killing triad-Early clinical results Speaker: Prof. Steffen Ruchholtz, Universitätsklinik Giessen-Marburg, Marburg, Germany
13:15	Discussion – Question and Answer session
13:30	End of the session

Industry symposium B

Thursday, 8 September, 17:35 - 18:35
Room: Stefaniensaal

Diagnosis of joint infections - a multidisciplinary perspective on a new rapid syndromic multiplex-PCR assay and its theoretical clinical impacts

Agenda

Chair: Dr. Marjan Wouthuyzen-Bakker, Internist-infectiologist, University Medical Center Groningen, The Netherlands

17:35 BIOFIRE® Joint Infection Panel pre-launch evaluation overview
Speaker: Stéphanie Pascual, Global Medical Affairs, bioMérieux, France

17:50 Time to pathogen identification - How does the BIOFIRE® Joint Infection Panel compare with our Standard Methods?
Speaker: Dr. Catherine Aldridge, Microbiology Consultant, Newcastle Upon Tyne NHS, United Kingdom

18:05 How rapid syndromic testing impacts PJI treatment? A case series to answer
Speaker: Prof. Rihard Trebše, Orthopedic Surgeon, Valdoltra Orthopaedic Hospital, Slovenia

18:20 Questions and Answers

Industry symposium C

INFECTOPHARM
Knowledge is Health

Thursday, 8 September, 17:35 - 18:35
Room: Saal Steiermark

Proof is in the pudding: Prosthetic Joint Infection Outcome with IV Fosfomycin from the PROOF-study

Agenda

Introduction and Opening
Speaker: Andrej Trampuz

Critical evaluation of current treatment strategies for prostheticjoint infections: Standardized definition and diagnosis, surgical and antibiotic therapy in daily clinical practice
Speaker: Olivier Borens

What can we learn from the PROOF-study?
Speaker: Andrej Trampuz

Overall discussion and closing remarks

Industry symposium D

BONESUPPORT™

Friday, 9 September, 12:35 - 13:35
Room: Stefaniensaal

Team-based decision making in bone infections – Delivering patient-friendly surgery with CERAMENT® G and CERAMENT® V

Agenda

Welcome and introduction to the Oxford experience – Prof. Martin McNally
Case presentation – Dr. Geertje Govaert
Case presentation – Prof. Ricardo Sousa
Case presentation – Mr. Adrian Kendal
Panel discussion and questions from the audience – All
Summary and take home messages – Prof. Martin McNally

Panel

- Prof. Martin McNally, Lead Consultant in Limb Reconstruction Surgery, Oxford Bone Infection Unit, Nuffield Orthopaedic Centre, UK
- Mr. Jamie Ferguson, Consultant in Limb Reconstruction Surgery and Trauma, Oxford Bone Infection Unit and Oxford Trauma Unit, UK
- Dr. Bridget Atkins, Consultant in Infectious Diseases and Microbiology, Oxford Bone Infection Unit, Nuffield Orthopaedic Centre, UK
- Mr. Alex Ramsden, Consultant Plastic and Reconstructive Surgeon, Oxford Bone Infection Unit, Nuffield Orthopaedic Centre, UK

Case Presenters

- Dr. Geertje Govaert, Consultant Trauma Surgeon, University Medical Centre Utrecht, Netherlands
- Prof. Ricardo Sousa, Orthopaedics Department, Centro Hospitalar Universitário do Porto, Portugal
- Mr. Adrian Kendal, Consultant in Foot & Ankle Surgery, Nuffield Orthopaedic Centre, Oxford, United Kingdom

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Symposium

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STIMULAN® - The importance of addressing infected soft tissue

Friday 9 September - 12:35 - 13:35 - Parallel Session Room (Saal Steiermark)

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Meet the panel:

Mr. Bilal Jamal
Consultant Orthopaedic Surgeon
Glasgow, UK

PD. Dr. Med. Yvonne Achermann
Infectious Disease Specialist
Spital Zollikerberg, Switzerland

Dr. Bianca Price
Technical & Clinical Research Manager
Biocomposites, UK

Biocomposites®

Industry symposium E

Biocomposites®

Friday, 9 September, 12:35 - 13:35
Room: Saal Steiermark

BONE AND SOFT TISSUE INFECTIONS

Agenda
STIMULAN® - The importance of addressing infected soft tissue

Panel
- Mr. Bilal Jamal, Consultant Orthopaedic Surgeon Glasgow, UK
- PD. Dr. Med. Yvonne Achermann, Infectious Disease Specialist, Spital Zollikerberg, Austria
- Dr. Bianca Price, Technical & Clinical Research Manager Biocomposites, UK

Exhibitor directory

Platinum Partners

Company	Contact details	Company description
Biocomposites	**Biocomposites Ltd** www.biocomposites.com Booth 2	At Biocomposites, we are distinct in that our team of specialists is singularly focused on the development of innovative calcium compounds for surgical use. With over 30 years' experience and an unrivalled dedication to quality, the products we research, engineer and manufacture are at the forefront of calcium technology. We are proud to be driving improved outcomes across a wide range of clinical applications, in musculoskeletal infection, trauma, spine and sports injuries, for surgeons and patients alike.
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Heraeus	**Heraeus Medical GmbH** www.heraeus.com Booth 4	Heraeus Medical stands for delivering value to the patient, the healthcare professional and the healthcare system through innovation and evidence based medicine in Implant Fixation, Infection Management and regenerative treatments for bone, cartilage and soft tissue. Over the years the company built up extensive experience in the field of therapeutic support for PJI with local antibiotics and is a reliable and committed partner in all aspects that deal with the management of musculoskeletal infections. Please visit www.heraeus.com for more information.

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Company	Contact details	Company description
BIOMÉRIEUX	**bioMérieux** www.biomerieux.com Booth 1	A world leader in the field of in vitro diagnostics for over 50 years, bioMérieux provides fast & robust technologies that support clinicians in making informed decisions from actionable results. Our future BioFire® Joint Infection Panel will detect multiple bacteria, fungi, and antimicrobial resistance genes directly from a single patient sample with results available in about 1 hour. Please visit www.biomerieux.com for more information.
InfectoPharm Knowledge is Health	**InfectoPharm** en.infectopharm.com Booth 7	InfectoPharm is a family-owned company located in Germany. With IV FOSFOMYCIN (product names Fomicyt®, InfectoFos® and Fosfomycin InfectoPharm), InfectoPharm offers a therapeutic option to fight severe infections in a broad indication spectrum. It is an antibiotic of it´s own class with unique product characteristics: unique mode of action, a tissue penetration champion, capable of penetrating tissue with poor accessibility with high bactericidal levels with broad spectrum against Gram positive and - negative pathogens including MDR bacteria. Please visit en.infectopharm.com/international-partners for more information.
ZIMMER BIOMET Moving You Forward	**Zimmer Biomet** www.zimmerbiomet.eu Booth 3	Zimmer Biomet is a global medical technology leader with a comprehensive portfolio designed to maximize mobility and improve health. For more information visit www.zimmerbiomet.com, follow us on LinkedIn at www.linkedin.com/company/zimmer-biomet-emea/ and on Twitter at www.twitter.com/zimmerbiomet.

Silver Partners

Company	Contact details	Company description
curasan Regenerative Medicine	**curasan AG** www.curasan.de/en Booth 12	curasan develops and manufactures biomaterials and medical devices in the field of bone and tissue regeneration. As an industry pioneer, curasan is specialized primarily on biomimetic bone grafting materials for dental and orthopaedic applications. curasan maintains its own high-tech facilities for research, development and manufacturing of biomaterials in Frankfurt/Main, Germany. Please visit www.curasan.de/en/orthopedics/ for more information.
ECTB	**EUROPEAN CELL AND TISSUE BANK** www.ectb.eu Booth 8	EUROPEAN CELL AND TISSUE BANK, a non-profit association, based in Austria. In compliance with the EU directives, we procure, store, processes and distribute tissue, and offer with OSmycin™, a human bone allograft, impregnated with antibiotics (Vancomycin or Tobramycin). OSmycin™ for simultaneously preventing infection and biofilm while reconstructing of bone defects.
LYFSTONE	**Lyfstone AS** www.lyfstone.com Booth 9	Lyfstone AS provides the orthopaedic health care professionals with a point-of-care test for ruling out Prosthetic Joint Infection (PJI) by measuring the levels of Calprotectin in synovial fluid. Rapidly ruling out infection creates the opportunity for same-day diagnostics for evidence-based decisions and patient flow. Lyfstone® Calprotectin for synovial fluid is a quantitative, accurate, cost-saving and efficient tool providing results within 15 minutes. The test is a diagnostic aid for screening of suspected PJI patients.
OHK Medical Devices Oneg HaKarmel Ltd.	**Oneg HaKarmel Ltd. (OHK)** www.hemaclear.com Booth 16	Oneg HaKarmel Ltd. (OHK) is an established Israeli Company dedicated to prevention of Surgical Site Infection (SSI) in orthopedic limb surgeries. It is well-known for its HemaClear® Sterile Exsanguination Tourniquet (www.HemaClear.com) used to create a dry surgical field. OHK is now bringing to market the PrepSleeve® for simplified efficient disinfection of the limbs . Both products reduce SSI while improving OR work-flow and reducing OR clutter.
OSARTIS	**OSARTIS GmbH** www.osartis.de/en Booth 10	OSARTIS GmbH is a medical device company located in Germany. The company is focusing on the development, registration, production and distribution of medical biomaterials and PMMA bone cements for orthopaedics, trauma & spinal surgery and oral & maxillofacial surgery. The product portfolio consists of PMMA bone cements and associated accessories, e.g. mixing systems & biomaterials.

Bronze Partners

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G21 STRENGTH FOR LIFE	**G21** www.g21.it Booth 15	G21 is a leading developer and manufacturer of bone cements and acrylic resins with long experience in orthopedics, orthopaedic oncology and minimal invasive spine surgery. We are proud to affirm our unique and complete range of products for PJI care, in particular our custom modular spacer SpaceFlex for hip, knee and shoulder. Please visit www.g-21.it for more information.
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RESORBA BIOSURGICALS	**RESORBA** www.resorba.com Booth 11	RESORBA's core competencies lie in the manufacturing and distribution of collagen products and surgical sutures for all surgical disciplines in hospitals and private practices.
TECRES	**TECRES** www.tecres.it Booth 5	TECRES has got nearly forty years of experience as manufacturer of bone cements for orthopaedics. Cemex bone cements and Spacer, the unique temporary antibiotics-loaded prostheses for two-stage septic revision, are successfully sold worldwide. These products are available also in the combination Vancomycin-Gentamicin. CalCEMEX is our innovative reinforced bone substitute.

Exhibitors

Company	Contact details
inbiome	**inbiome** www.inbiome.com Booth 18
Königsee Implantate	**Königsee Implantate** www.koenigsee-implantate.de Booth 14
NuVasive Specialized Orthopedics	**NuVasive** www.nuvasive.com/surgical-solutions/nuvasive-specialized-orthopedics/de Booth 19

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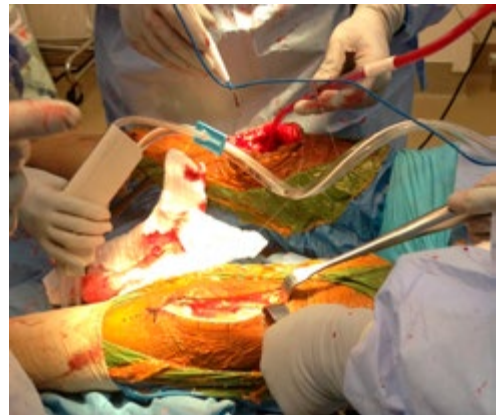

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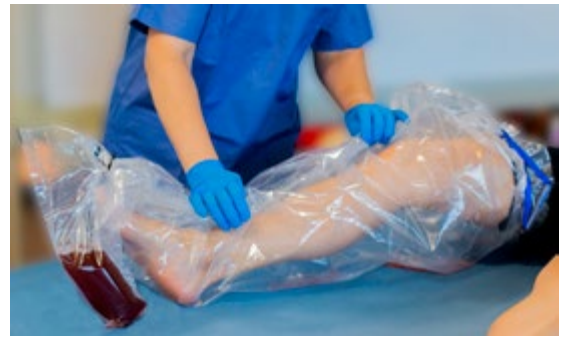

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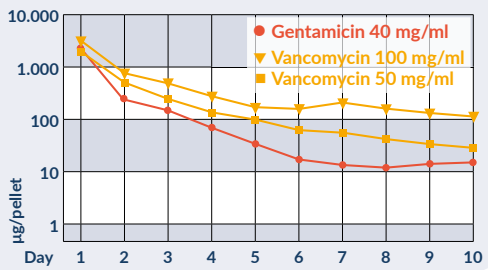

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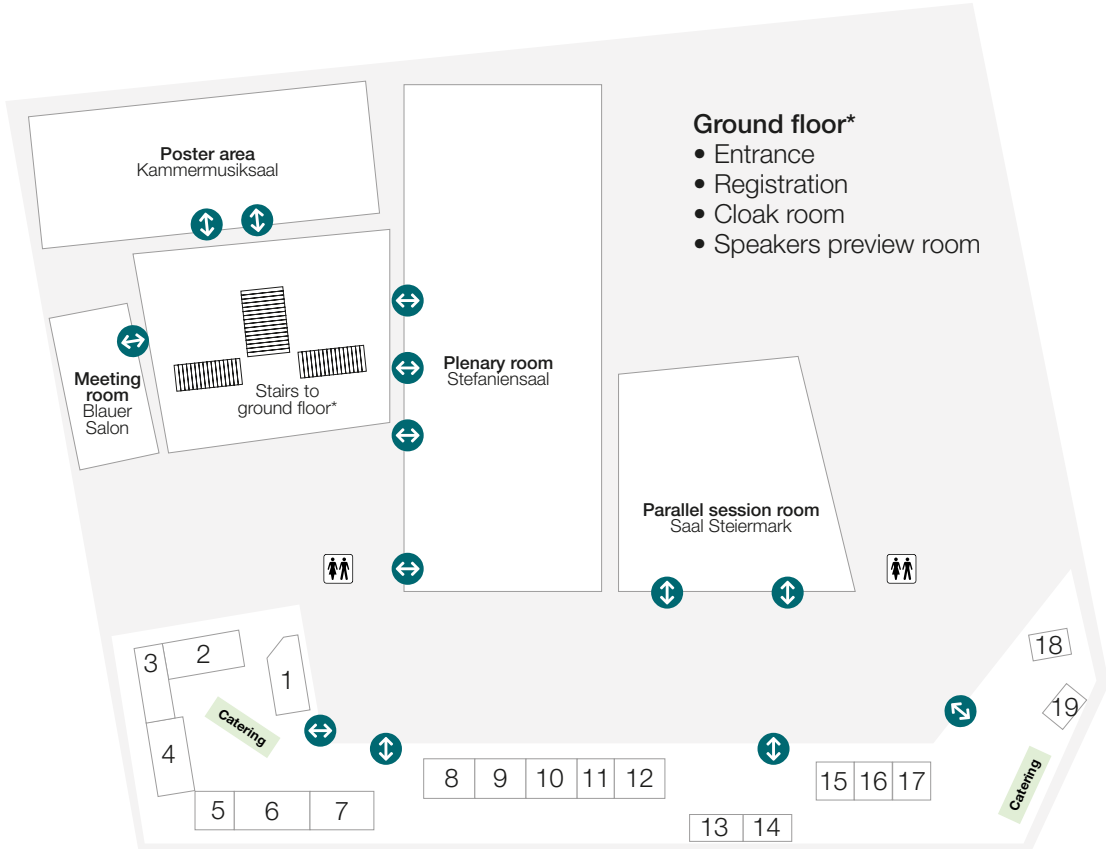

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Oral abstracts

[FP A1] ALPHA-DEFENSIN AND MICROBIOLOGICAL SPECTRUM IN REVISION TOTAL KNEE ARTHROPLASTIES WITH UNEXPECTED POSITIVE INTRAOPERATIVE CULTURES (UPIC)

Sebastian Simon[1], Bernahrd J.H. Frank[1], Alexander Aichmair[1], Martin Dominkus[1], Jennyfer A. Mitterer[1], Susana Hartmann[1], Michael Kasparek[1], Jochen Hofstätter[1]

[1]*Michael Ogon Laboratory for Orthopaedic Research, Orthopaedic Hospital Vienna-Speising, Austria*

Objectives: Unexpected-positive-intraoperative-cultures (UPIC) in presumed aseptic revision-total-knee-arthroplasties (rTKA) are common in the orthopaedic clinical setting, even though their relevance is controversial. Synovial alpha defensin (AD) is an established biomarker for periprosthetic joint infections (PJIs). However, synovial AD in rTKA with UPIC has not been investigated.

Methods: In this prospective single center study, we evaluated synovial AD levels from 145 rTKAs. Synovial AD levels associated to presumed aseptic rTKA, but with UPIC were compared to clear septic and aseptic rTKAs. Moreover, we compared the performance of both AD-lateral-flow-assay (ADLF) and an enzyme-linked-immunosorbent-assay (ELISA) to test the presence of AD in native and centrifuged synovial fluid. Overall, 20 rTKA with UPIC (MSIS 2->6) were compared to 50 septic culture-positive (MSIS ≥6) and 75 aseptic culture-negative (MSIS 0-1) rTKAs. Concentration of AD determined by ELISA and ADLF methods, as well as microbiological, and histopathological results, and serum and synovial parameters along with demographic factors were considered.

Results: There were no positive AD samples in both the UPIC and the aseptic-groups, while AD was detected in 46/50 (92.0%) samples from the septic-group. Positive AD samples were highly ($p<0.001$) associated with culture positive and infection related histopathological results. There were significantly ($p=0.007$) more high-virulent microorganisms (13/50) in the septic-group compared to the UPIC-group (0/20). All samples with high virulent microorganisms (13/13) showed a positive AD. The presence of methicillin resistant ***Staphylococcus epidermis*** (MRSE) led to increased AD ($p=0.003$) when compared to that observed for methicillin susceptible ***S. epidermdis*** (MSSE). ELISA and ADLF tests were positive with centrifuged (8/8) and native (8/8) synovial fluid.

Conclusion: Detection of AD seems to be a potential tool in the diagnosis of clear PJI patients, but has a limited use in UPICs. The levels of AD in PJIs caused by high-virulent microorganisms and MRSE is significantly higher compared to those determined for low-virulent microorganisms and MSSE, respectively. Centrifugation of the synovial fluid had no influence in the outcome of ADLF results.

Keywords: Alpha-defensin, UPIC, revision-knee-arthroplasty

[FP A2] A COMPARISON OF INFECTION DEFINITIONS FOR THE DIAGNOSIS OF PERI-PROSTHETIC JOINT INFECTIONS

Irene Katharina Sigmund[1], Markus Luger[2], Reinhard Windhager[2], Martin McNally[3]

[1]*Medical University of Vienna, Department of Orthopedics and Trauma Surgery, Austria*
[2]*Medical University of Vienna, Orthopaedics, Vienna, Austria*
[3]*Bone Infection Unit, Nuffield Orthopaedic Centre, Oxford University Hospitals, Oxford, United Kingdom*

Aim: Diagnosing periprosthetic joint infections (PJI) can be very challenging, especially infections caused by low virulence microorganisms. No single test with a 100% accuracy is available yet. Hence, different infection definitions were introduced to improve the diagnostic confidence and quality of research articles. Due to constant developments in this field, infection definitions are adopted continuously. The aim of our study was to find the most sensitive currently available infection definition among three currently used criteria (International Consensus Meeting – criteria 2018 (ICM), Infectious Diseases Society of America - criteria 2013 (IDSA), and European Bone and Joint Infection Society – criteria 2021 (EBJIS)) for the diagnosis of PJI.

Method: Between 2015 and 2020, patients with an indicated revision surgery due to septic or aseptic failure after a total hip or knee replacement were included in this retrospective analysis of prospectively collected data. A standardized diagnostic workup was done in all patients. The components of the IDSA-, ICM-, and EBJIS- criteria for the diagnosis of PJI were identified in each patient.

Results: Overall, 206 patients (hip: n=104 (50%); knee: n=102 (50%)) with a median age of 74 years (IQR 65 – 80y) were included. 101 patients (49%) were diagnosed with PJI when using the EBJIS- criteria. Based on the IDSA- and ICM- criteria, 99 patients (48%, IDSA) and 86 patients (42%, ICM) were classified as septic. Based on all three criteria, 84 cases (41%) had an infection. 15 septic cases (n=15/206; 7%) were only identified by the IDSA- and EBJIS- criteria.
In 2 patients (n=2/206, 1%), an infection was present based on only the ICM and EBJIS criteria. No case was classified as infected by one infection definition alone.
A statistically significant higher number of inconclusive cases was observed when the ICM criteria (n=30/206; 15%) were used in comparison to the EBJIS criteria (likely infections: n=16/206; 8%) (Fisher's exact test, $p=0.041$). The EBJIS definition showed a better preoperative performance in comparison to the other two definitions ($p<0.0001$).

Conclusions: The most sensitive infection definition seems to be the novel EBJIS– criteria covering all infections diagnosed by the IDSA- and ICM-criteria without detecting any further infection. In addition, less inconclusive (infection likely) cases were detected by the EBJIS-criteria in comparison with the ICM-criteria reducing the so called 'grey zone' significantly which is of utmost importance in clinical routine.

[FP A3] META-ANALYSIS OF METAGENOMIC NEXT GENERATION SEQUENCING AS A DIAGNOSTIC TOOL FOR PATHOGEN DETECTION IN PROSTHETIC JOINT INFECTIONS

Neža Trebše[1], Marko Pokorn[2]

[1]*University Medical Center, Department of Infectious Diseases, Ljubljana, Slovenia*
[2]*University Medical Center Ljubljana, Department of Infectious Diseases, Department of Pediatric Diseases, Ljubljana, Slovenia*

Aim: metagenomic next-generation sequencing (mNGS) has shown to be a useful method for pathogen detection in prosthetic joint infections (PJI). The technique promises to minimize the PJIs without the known causative agent. Our study aimed to compare diagnostic accuracies of cultures and mNGS.

Method: In this study, a meta-analysis following PRISMA recommendations was performed. PubMed and OVID Medline databases were used for article search. The studies using mNGS whole-genome sequencing method and the ones where PJI diagnosis was based on one of the currently recognized criteria were included. Studies were excluded if they comprised less than twenty cases and the ones with insufficient data for the analyses (true positive, true negative, false positive and false negative values for both mNGS and culture results). Univariate metanalysis using a random-effect model has been performed in R studio with a "meta" package. Pooled sensitivity, pooled specificity and DOR (diagnostic odds ratio) were calculated.

Results: Seven studies with a total of 826 cases were included in the meta-analysis, 481 cases defined as PJI and 345 controls. Two studies using IDSA (Infectious Diseases Society of America) diagnostic criteria used the Illumina HiSeq 2500 platform for sequencing and five studies that used MSIS (MusculoSkeletal Infection society) used the BGISEQ-500 platform. Studies were performed on prosthetic hip and knee joints. Through meta-analysis, it was observed that mNGS technique is more sensitive than cultures with 90% (CI 80%- 95%) and 73% (CI 67%-77%) respectively (p=0.006). The specificity between methods was similar, for mNGS reaching 94% (CI 89%-96%) and for cultures 97% (CI 90%-99%) (p=0.285). Combined DOR for mNGS was 93.6 (37.1 – 236.5) and 52.38 (17.2 – 159.4) for cultures (p=0.43). In the PJI group, 115 new possible pathogens that were not isolated by microbiological culture were detected by the mNGS, most frequently anaerobes in 25/115 (21.7%) cases and coagulase-negative staphylococci in 21/115 (18.3%) cases. Fifteen new organisms were detected in the control group and were mostly regarded as contaminants.

Conclusions: Metagenomic sequencing has shown to be more sensitive than microbiological cultures in pathogen detection and thus has a great potential to improve the diagnosis and treatment of PJI. More studies on different prosthetic joints and comparing different diagnostic criteria for PJI would be needed to better understand the true diagnostic power of this method.

[FP A4] MULTICENTRE EVALUATION OF RAPID MOLECULAR SYNDROMIC APPROACH IN JOINT INFECTIONS USING A NEW DEDICATED PANEL: PRELIMINARY RESULTS

Céline Dupieux[1], Adeline Dubois[2], Caroline Loiez[3], Hélène Marchandin[2], Jean Philippe Lavigne[4], Clément Munier[5], Emmanuel Chanard[6], Vincent Gazzano[5], Camille Courboulès[7], Anne-Laure Roux[8], Eve Tessier[9], Stephane Corvec[10], Pascale Bemer[11], Frederic Laurent[12], Tiphaine Rousel-Gaillard[13]

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[2]*Chu Nimes, Associated Regional Reference Centre for Complex Bjis (Crioac Marseille), Laboratoire de Microbiologie, Nimes, France*
[3]*Chu Lille, Centre de Biologie Pathologie - Service de Bactériologie, Lille, France*
[4]*Chu Nîmes, U1047, National Institute of Health and Medical Research, Montpellier University, Faculty of Medecine,, Service de Microbiologie, Nîmes, France*
[5]*Laboratoire Villon, Plateau Technique de Microbiologie, Cerballiance Rhône-Alpes, Lyon, France*
[6]*Cerballiance Lyon, Laboratoire Villon, Plateau Technique de Microbiologie, Cerballiance Rhône-Alpes, Lyon, France*
[7]*Centre Hospitalo-Universitaire Ambroise Paré, Hauts-de-Seine, Boulogne-Billlancourt, France*
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[10]*Service de Bactériologie-Hygiène Hospitalière. Institut de Biologie - Chu de Nantes, Université de Nantes, Service de Bactériologie-Hygiène Hospitalière,, Nantes, France*
[11]*University Hospital, Nantes University Hospital, Bacteriology, Nantes, France*
[12]*Hospices Civils de Lyon, Institute for Infectious Agents, Croix Rousse Hospital, Lyon, France, Lyon, France*
[13]*Hospices Civils de Lyon, Institut des Agents Infectieux, Hospices Civils de Lyon, Regional Reference Centre for Complex Bjis (Crioac Lyon), Plateau de Microbiologie, France*

Aim: Bone and joint infections (BJIs) are serious infections requiring early optimized antimicrobial therapy. BJIs can be polymicrobial or caused by fastidious bacteria, and the patient may have received antibiotics prior to sampling, which may decrease the sensitivity of culture-based diagnosis. Furthermore, culture-based diagnosis can take up to 14days. Molecular approaches can be useful to overcome these concerns. The BioFire® system performs syndromic multiplex PCR in 1hour, with only a few minutes of sample preparation. The BioFire® Joint Infection (JI) panel (BF-JI), IUO (submitted to regulatory bodies for IVDR), detects both Gram-positive (n=15) and Gram-negative bacteria (n=14), ***Candida***, and eight antibiotic resistance genes directly from synovial fluids. The aim of this study was to evaluate its performance in acute JIs in real-life conditions.

Method: BF-JI was performed on synovial fluid from patients with clinical suspicion of acute JI, either septic arthritis or periprosthetic JI, in 6 French centers. The results of BF-JI were compared with the results of culture of synovial fluid and other concomitantly collected osteoarticular samples obtained in routine testing in the clinical microbiology laboratory.

Results: From July 2021 to April 2022, 222 patients (including 14 children and 95 periprosthetic infections) had been included in the study. The BF-JI test was invalid for one patient (not retested). Among the 221 remaining patients, overall concordance with conventional microbiology methods was 76.9% (170/221): 81 samples were negative with both BF-JI and culture, and 89 samples were positive with the same microorganisms using both techniques. In 23 cases (10.4%) corresponding to 25 microorganisms in culture, BF-JI was negative while culture was

positive: 14 microorganisms were not targeted by BF-JI (including ***Staphylococcus epidermidis,***n=8, and ***Cutibacterium acnes,***n=2); 11 microorganisms targeted by BF-JI were obtained in culture but not by the molecular test (false-negative 5.0%). In 15 cases, BF-JI was positive while culture was not: 7 patients had received antibiotics before sampling, and 6 cases involved fragile and fastidious bacteria (***Kingella kingae,*** n=4; ***Neisseria gonorrhoeae***, n=2). In 13 cases, both BF-JI and culture were positive, but no yielding the same bacteria (polymicrobial specimens).

Conclusions: In acute JIs, the BF-JI panel shows a good concordance with culture for the microorganisms targeted by the panel. Therefore, this molecular tool may have a place in microbiological diagnosis of acute JIs in order to confirm JI faster than culture. Moreover, it allows easy detection of difficult-to-culture bacteria.

Acknowledgements: This study was supported by bioMérieux, who provided all reagents.

[FP A5] COMPARISON BETWEEN CULTURE-BASED METHODS AND THE JOINT INFECTION (JI) PANEL APPROACH FOR THE DIAGNOSIS OF HIP AND KNEE PROSTHETIC JOINT INFECTION

Susana Hartmann[1], Jennyfer A Mitterer[1], Bernhard J.H. Frank[1], Sebastian Simon[1], Mojgan Prinz[2], Martin Dominkus[3], Jochen Hofstätter[1]

[1]Orthopädisches Spital Speising - Oss, Michael Ogon Laboratory for Orthopaedic Research, Orthopaedic Hospital Vienna-Speising, Austria, Michael-Ogon-Forschungslabor, Wien, Austria
[2]Labcon Medical Laboratories, Vienna, Austria
[3]Orthopädisches Spital Speising, Orthopaedic Hospital Vienna-Speising, [2]. Abteilung für Endoprothetik und Revisionschirurgie, Wien, Austria

Aim: Culture-based conventional methods are still the gold standard to identify microorganisms in hip and knee PJIs diagnosis. However, such approach presents some limitations due to prior antimicrobial treatment or the presence of unusual and fastidious organisms. Molecular techniques, in particular specific real-time and broad-range polymerase chain reaction (PCR), are available for diagnostic use in a suspected PJI. However, limited data is available on their sensitivity and specificity.
This study aimed to evaluate the performance of a rapid and simple Investigational Use Only (IUO) version of the BioFire® JI multiplex PCR panel when compared to traditional microbiological procedures.

Method: Fifty-eight native synovial fluid samples were recovered from 49 patients (female n=26; male =23) who underwent one or multiple septic or aseptic revision arthroplasties of the hip (n=12) and knee (n=46). The JI panel methodology was used either on specimens freshly collected (n=6) or stored at -80°C in our Musculoskeletal Biobank (n=52). The JI panel performance was evaluated by comparison with culture reference methods. Patient's medical records were retrieved from our institutional arthroplasty registry as well as our prospectively maintained PJI infection database.

Results: The JI panel identified additional microorganisms in 3/39 (7.7%) positive cases, and a different microorganism in 1/39 (2.6%) sample. Out of 9/58 (15.5%) culture negative samples, two (22%) were positively detected by the JI panel. In total 49/58 (84%) native synovial fluid specimens were positive by culture methods, versus 39/58 (81.2%) with the JI panel. Ten samples are currently under investigation for confirmatory results. Out of 39 positive detections with the JI panel, 35 (89.7%) were concordant with the identified microorganism (n=29 same species; n=6 same genus). The combined information from the JI panel results and clinical records revealed the existence of 6/58 (10.3%) PJIs' cases which would have required a different antibiotic therapeutic approach.

Conclusions: The work presented, provides additional value for the clinical use of the JI panel to the improvement of PJI management in terms of rapid and successful treatment decisions, patient outcome, and healthcare costs. This technique shows high sensitivity to detect PJIs specific microorganisms in both fresh as well frozen native synovial fluid samples, thus emphasizing its use for retrospective studies analysis.

[FP A6] DIAGNOSTIC ACCURACY OF A MULTIPLEX PCR PANEL FOR RAPID DETECTION OF PATHOGENS IN ACUTE SEPTIC ARTHRITIS AND PROSTHETIC JOINT INFECTIONS, A PILOT STUDY

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Aim: Prompt recognition and identification of the causative microorganism in acute septic arthritis of native and prosthetic joints is vital to increase the chances of successful treatment. The aim of this study was to independently assess the diagnostic accuracy of the multiplex BIOFIRE® Joint Infection (JI) Panel (investigational use only) in synovial fluid for rapid diagnosis

Method: Synovial fluid samples were prospectively collected at the University Medical Center Groningen from patients who had a clinical suspicion of a native septic arthritis, early acute (post-operative, within 3 months after arthroplasty) periprosthetic joint infection (PJI) or late acute (hematogenous) PJI. JI Panel results were compared to culture-based methods as reference standard.

Results: A total of 45 samples were analyzed. The BIOFIRE JI Panel showed a high specificity (100%, 95% CI 73 – 100) and positive predictive value (100%, 95% CI 79 – 100) in all patient categories. Sensitivity and negative predictive value were 83% (95% CI 36 – 99) and 88% (95% CI 47 – 99) respectively for patients with a clinical suspicion of native septic arthritis (n=12), 77% (95% CI: 46 – 94) and 63% (95% CI: 26 – 90) for patients with a clinical suspicion of a late acute PJI (n=14), and 27% (95% CI 7 – 61) and 27% (95% CI: 7 – 61) for patients with a clinical suspicion of an early acute PJI (n=19).

Conclusions: The results of this pilot study indicate a clear clinical benefit of the BIOFIRE JI Panel in patients with a suspected native septic arthritis and late acute (hematogenous) PJI, but a low clinical benefit in patients with an early acute (post-operative) PJI due to the absence of low-grade microorganisms in the panel.

[FP A8] EVALUATION OF SYNOVIAL CALPROTECTIN LEVELS TO SUPPORT THE DIAGNOSIS OF PROSTHETIC JOINT INFECTIONS

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Aim: The analysis of synovial fluid has proved to be of crucial importance in the diagnostic process of prosthetic joint infections (PJI), suggesting the presence of an infection before the microbiological culture results. In this context, several studies illustrated the efficacy of synovial calprotectin in supporting the diagnosis of PJI [1, 2]. However, several testing methods have been explored to detect synovial calprotectin levels, emphasizing the need to use a standardized, rapid and rapid test. In this study, synovial calprotectin was analyzed by means of a commercial stool test [3] to explore whether the detected levels might predict PJIs and, therefore, being a promising tool for the fast and reliable diagnosis of this complication.

Method: The synovial fluid of 55 patients underwent to revision of the prosthetic implant were analyzed. The measurement of calprotectin was carried out by of commercial stool test, following the protocol for liquid samples. Calprotectin levels were then compared to other synovial biomarkers of PJI such as leucocyte esterase and count and percentage of polymorphonuclear cells.
Data analysis were performed using R software v4.1.1 (R Core Team) and package "pROC" [4]. Receiver operator characteristics curves were designed using culture test as gold standard to evaluate the area under curve (AUC) of each method (with DeLong method for confidence-interval calculation). Thresholds were calculated to maximize Youden's index; sensitivity and specificity were reported. One-to-one Pearson's correlations coefficient were calculated for each pair of methods. P value <0.05 were considered statistically significant.

Results: Of the 55 synovial fluids analyzed, 13 patients were diagnosed with PJI and 42 with an aseptic failure of the implant. The specificity, sensitivity, and AUC of calprotectin resulted 0.90, 0.85, and 0.86 (95%CI: 0.72-0.99), respectively with a set threshold of 226.5 µg/g.
The values of calprotectin had a moderate and statistically relevant correlation with the synovial leucocyte counts (r_s = 0.54, p = 0.0003) and the percentage of polymorphonuclear cells (r_s = 0.68, p = 0.0000).

Conclusions: From this analysis, it can be concluded that synovial calprotectin is a valuable biomarker that correlates with other established indicator of local infection, delivering a rapid and reliable results and supporting the diagnostic process of PJI.

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[FP A9] SYNOVIAL FLUID SMALL EXTRACELLULAR VESICLES (SEVS) IN THE DIAGNOSTICS OF PERIPROSTHETIC JOINT INFECTION (PJI)

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Aim: Periprosthetic joint infections (PJI) are severe complications after total joint arthroplasty (TJA). Up to now, a gold standard in the diagnostics of PJI is missing. Small extracellular vesicles (sEVs) are secreted by all types of cells and play a key role in immune response in presence of infection (1).
1 Yanez-Mo M., et al. Journal of Extracellular Vesicles (2015)

In this prospective study, the diagnostic accuracy of sEVs in the synovial fluid to detect PJI of knee, hip and shoulder joints was investigated. We hypothesized increased surface markers of sEVs in PJI compared to aseptic complications (e.g. implant loosening, stress shielding related pain).

Method: Synovial fluid from 48 patients with painful arthroplasty was examined. The distinction between aseptic and infectious cases was made on the basis of the 2018 Definition of Periprosthetic Hip and Knee Infection (2). 35 (72,9%) probands assigned to aseptic and 13 patients (27,1%) to PJI group. Immuno-fluorescence flow cytometry served to document the concentrations of CD9, CD63, CD66b, CD82 and HLA-DR on sEVs.
2 Parvizi, J., et al. The Journal of Arthroplasty (2018)

Results: The concentration of CD9 surface marker on sEVs in synovial fluid was significantly lower (p=0.002) in PJI group than in aseptic group. In contrast, the levels of CD82 on sEVs in synovial fluid was significantly higher (p<0.0001) in the PJI group than in aseptic group. The concentrations of CD63, CD66b and HLA-DR on sEVs in synovial fluid did not differ significantly between the two cohorts (CD63: p=0.372; CD66b: p=0.634; HLA-DR: p=0.558).

Conclusions: Overall, the significance of sEVs in the diagnostics of PJI is not well enough understood and the subject of current research and scientific discussion. Our data suggest, that CD82 and CD9 on sEVs in synovial fluid are promising biomarkers to differentiate between PJI and aseptic complications.

[FP A10] PERIPROSTHETIC JOINT INFECTION DIAGNOSIS USING NUCLEAR MAGNETIC RESONANCE BASED METABOLOM ANALYSIS

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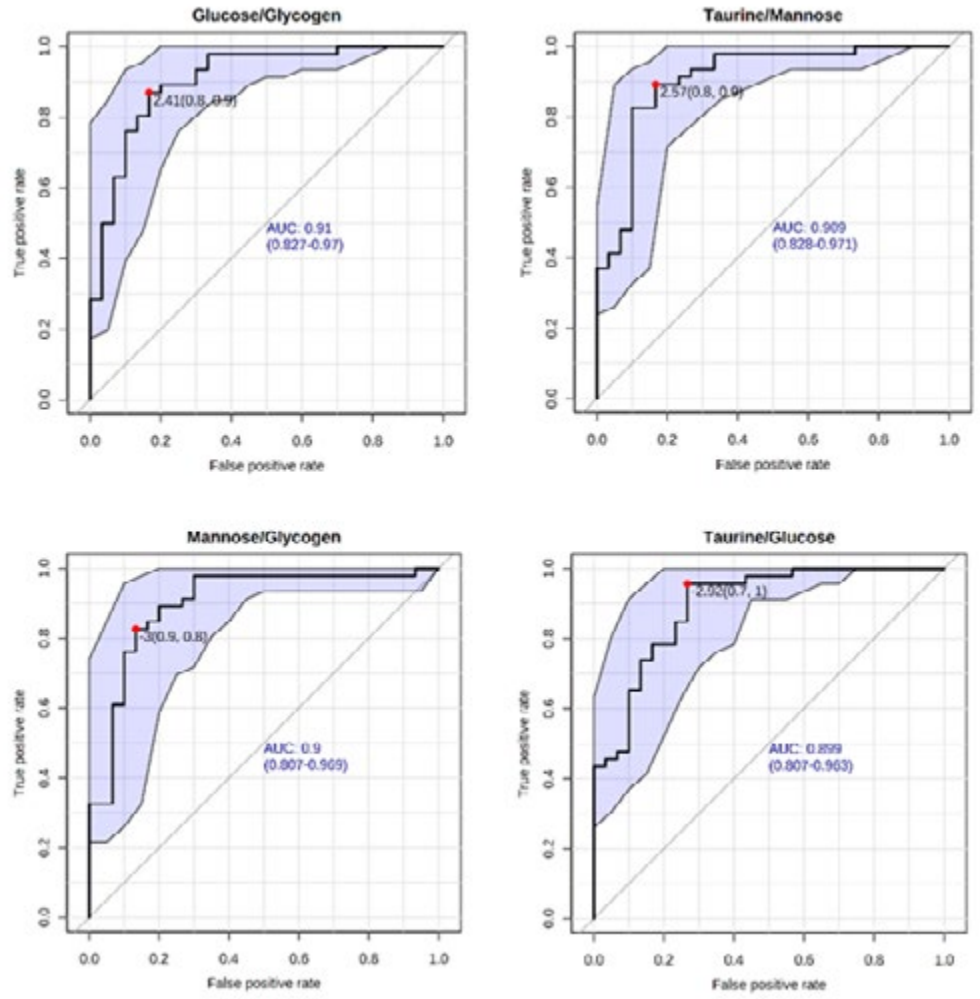
Aim: The aim of this study was to investigate the metabolomic profile of synovial fluid in periprosthetic joint infection (PJI) cases regarding a possible diagnostic approach. Also, further information about the metabolic composition of synovial fluid in PJI may point to future diagnostic and therapeutic approaches.

Method: Patients with a clinical suspicion of a prosthesis infection who underwent a joint puncture in our outpatient department or ward were included. After sample preparation, the nuclear magnetic resonance (NMR) experiments were performed at 310 K on an AVANCE™ NeoBruker Ultrashield 600 MHz spectrometer. Bruker Topspin version 4.0.2 was used for NMR data acquisition. The spectra for all samples were automatically processed (exponential line broadening of 0.3 Hz), phased, and referenced using TSP at 0.0 ppm. In total, 37 metabolites were analysed using a volume of 200 µl per synovial sample. The PJI and aseptic cases were assigned according to the EBJIS criteria.

Results: In total, 76 samples were included in the final analysis with 48 PJI cases and 28 aseptic cases. Five measured metabolites have shown an area under the curve (AUC) over 0.8, with Taurine (AUC 0.8558, p<0.0001) and Glutamine (AUC 0.8333, p<0.0001) showing the best diagnostic performance. When combining two metabolites, the AUC indicated even higher diagnostic performance: Glucose/Glycogen (AUC 0.9073, p<0.0001), Taurine/Mannose (AUC 0.9073, p<0.0001), Mannose/Glycogen (AUC 0.8992, p<0.0001) and Taurine/Glucose (AUC 0.8956, p<0.0001).
Conclusions: While NMR as a method in PJI diagnostics is currently not broadly available for daily clinical work, our results indicate that certain synovial metabolites and their combinations can be used for PJI diagnosis.



ROC curves depicting the true positive rate and the false positive rate and the standard deviation of the best performing metabolite ratios in the diagnosis of PJI.

[FP B1] USE OF NEGATIVE PRESSURE WOUND THERAPY IN PATIENTS WITH FRACTURE RELATED INFECTIONS IS ASSOCIATED WITH A TWO-AND-A-HALF-FOLD INCREASED RISK OF RECURRENCE

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Use of negative pressure wound therapy in patients with fracture related infections is associated with a two-and-a-half-fold increased risk of recurrence.

Aim: Fracture-related infection (FRI) is one of the most serious complications in orthopedic trauma surgery [1]. The role of Negative Pressure Wound Therapy (NPWT) remains controversial in the management pathway of FRI [2]. Currently, as scientific evidence is lacking, most recommendations for NPWT with respect to the treatment of FRI are based on expert opinion [3]causing challenges in bony and soft tissue management. Currently, negative-pressure wound therapy (NPWT. The aim of this study was to assess the influence of NPWT and its duration on recurrence of infection in operatively treated FRI patients.

Methods: This is a retrospective cohort study based on the FRI database of three Level 1 Trauma Centres. To be included, patients had to be at least 16 years of age and needed to be surgically treated for FRI between January 1st 2015 and September 1st 2020. Included patients were subdivided in either the NPWT group, or in the control group, when no NPWT had been applied. To avoid confounding, patients were excluded if they (also) underwent NPWT prior to the FRI diagnosis. The relation between the duration of NPWT during FRI treatment and the recurrence rate of infection was analyzed using a multivariable logistic regression model.

Results: 99 patients were included in the NPWT group with a mean age of 51.4 ± 17.0 years. Most patients were male (n = 66). Tibia/fibula was the most common FRI location (n = 68). The median duration of NPWT was 18.0 (IQR 15.8) days. Overall, 28 patients (28.3%) developed a recurrent FRI. In the control group (n = 164), 19 patients (11.6%) developed a recurrent FRI (p = 0.001, 95% CI [0.174 – 0.635]). There were no significant differences in baseline characteristics between the recurrence and non-recurrence category in NPWT group. The duration of NPWT was associated with a higher risk of re-infections (p = 0.013, OR 1.036, 95% CI [1.008 – 1.066]).

Conclusion: The application of NPWT is associated with a two-and-a-half-fold increased risk of recurrence in patients with soft tissue defects due to FRI. Also, the duration of NWPT is an independent risk factor for recurrence. Therefore, NPWT should be used with caution in the treatment of orthopedic trauma patients with FRI. It is advised to consider its use only as a short-term necessity to bridge the period until definitive wound closure can be established and to keep this interval as short as possible.

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[FP B2] RISK OF REOPERATION DUE TO DEEP SURGICAL SITE INFECTION IN 74.771 HIP FRACTURES

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Aim: To investigate the incidence and time-trend in reoperation due to deep Surgical Site Infection (SSI) following hip fracture surgery.

Method: This was a population-based, nationwide, cohort study. We included 74,771 from the Danish Multidisciplinary Hip Fractures Register (1) consisting of patients 65 years of age or older, who underwent surgery between January 1st 2005 and December 31st 2016 for all types of hip fracture. Cross-linkage with the Danish National Patient Register and The Danish Civil Registration system was made.
Demographic data extracted included vital status, civil status, gender, age, Body Mass Index (BMI), fracture classification (AO/OTA 31A-C) and surgical procedures binary registered as joint replacement or internal fixation, Charlson comorbidity index (CCI) and secondary diseases not included in CCI. Outcome was reoperations due to deep SSI in accordance with the definition from Centre for Disease Control (2). We computed cumulative incidence rates and risk ratios (RR) by calendar year periods and by different risk factors, considering death as competing risk and adjusting for age, gender, CCI, fracture type and surgery type.

Results: Within 365 days of primary surgery 2.1% of all hip fractures had undergone reoperation due to deep SSI. During the period 2005-2016, the incidence of reoperation due to SSI decreased from 2.7% to 1.7%,
We could not identify differences in reoperation due to SSI within one year regarding gender, BMI or CCI. Patients aged above 85 had about 50% lower risk of being reoperated compared with the youngest age group; 65-74 years (RR: 0.5; 95% CI: 0.4:0.6).
The RR for reoperation due to deep SSI was lower for patients with pertrochanteric or subtrochanteric fractures (AO/OTA: 31A1-3) versus femoral neck fractures (AO/OTA: 31B1-3), RR was 0.7 (95%CI: 0.7:0.8). However, RR for surgery type (joint replacement vs internal fixation) at 365 days was significantly lower for joint replacement, RR: 0.6 (95% CI: 0.6:0.7).

Conclusions: This study shows reoperation risk due to SSI for all types of hip fractures of 2.1%. There was a 45% decrease in reoperation over time from 2005 to 2016. However, the risk of revision is still high, and further action in avoidance of SSI should be taken.

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[FP B3] INTERTROCHANTERIC OSTEOSYNTHESIS FAILURE: IS THERE A HIGH RATE OF UNDETECTED INFECTIONS?

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Aim: The most frequent mechanical failure in the osteosynthesis of intertrochanteric fractures is the cut-out. Fracture pattern, reduction quality, tip-apex distance or the position of the cervico-cephalic screw are some of the factors that have been associated with higher cut-out rates. To date, it has not been established whether underlying bacterial colonization or concomitant infection may be the cause of osteosynthesis failure in proximal femur fractures (PFF). The primary objective of this study is to assess the incidence of infection in patients with cut-out after PFF osteosynthesis.

Method: Retrospective cohort study on patients with cut-out after PFF osteosynthesis with endomedullary nail, from January 2007 to December 2020. Demographic data of patients (such as sex, age, ASA), fracture characteristics (pattern, laterality, causal mechanism) and initial surgery parameters were collected (time from fall to intervention, duration of surgery, intraoperative complications). Radiographic parameters were also analyzed (tip-apex distance and Chang criteria). In all cut-out cases, 5 microbiological cultures and 1 anatomopathological sample were taken and the osteosynthesis material was sent for sonication. Fracture-related infection (FRI) was diagnosed based on Metsemakers et al (2018) and McNally et al (2020) diagnostic criteria.

Results: Of the 67 cut-out cases, 16 (23.9%) presented clinical, analytical or microbiological criteria of infection. Of these sixteen patients, only in 3 of them the presence of an underlying infection was suspected preoperatively. A new osteosynthesis was performed in 24 cases (35.8%) and a conversion to arthroplasty in the remaining 43 (64.2%).
A comparative analysis was performed between cases with and without infection. The groups were comparable in terms of demographic data and postoperative radiological data (using Chang criteria and tip-apex distance). Patients with underlying infection had a higher rate of surgical wound complication (56.3% vs 22%, p = 0.014), higher rates of leukocytes counts (11.560 vs 7.890, p = 0.023) and time to surgery (5.88 vs 3.88 days, p = 0.072).

Conclusions: One out of four osteosynthesis failure in PFF is due to underlying FRI and in almost 20% were not unsuspected before surgery. In PFF osteosynthesis failures, underlying infection should be taken into account as a possible etiological factor and thus a preoperative and intraoperative infection study should be always performed.

[FP B4] ISOLATED PATHOGENS DO NOT DIFFER BETWEEN EARLY, DELAYED OR LATE FRACTURE RELATED INFECTIONS

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Aim: Fracture related infection (FRI) is classically defined as early (0-2 weeks), delayed (3-10 weeks) or late (>10 weeks). Treatment strategies reflect this, particularly with debridement and implant retention (DAIR), but there is little evidence to support this. This multinational study clarified the relationship between pathogens isolated and time from injury.

Methods: All confirmed FRI cases, managed surgically, at three hospitals were included. Data were analyzed on patient demographics, time from injury and pathogens isolated. Patients who underwent DAIR were also analyzed separately.

Results: 433 FRIs were studied, including 51 early cases (mean time from injury 1.6 weeks), 82 delayed cases (mean 5.5 weeks) and 300 late cases (mean 467.3 weeks, range 11-3432 weeks). 140 patients underwent DAIR (mean time since injury 56.8 weeks, range 0-946 weeks).
Negative cultures were uncommon before 10 weeks but more frequent in late FRIs (4% vs 24%; p<0.0001). Over half of early and delayed FRIs were polymicrobial (59% and 56%) but only one quarter of late FRIs (26%; p=0.0004, p<0.0001). Cases treated with DAIR, at any time, had no difference in culture type (p=0.25).

Staphylococcus aureus was the most frequent isolate. There was no significant difference in the range of bacterial species isolated in early, delayed or late infections (p=0.20) or in those patients who underwent DAIR (p=0.56).

Conclusions: Bacterial species isolated in FRI do not change significantly over time. Up to 10 weeks, there was also no difference in the type of infection (polymicrobial, monomicrobial or culture negative). The increase in late culture negative FRIs may reflect more prolonged antibiotic use.

Decisions on FRI treatment should not assume microbiological differences related to time from injury. We found no evidence of more virulent organisms in early infections with less virulent species presenting later. The clinical relevance of classifying FRI by time from injury remains unclear.

Patient Demographics and Microbiological Results by Time from Injury					
	0-2 weeks	3-10 weeks	>10 weeks	Whole Group	Significance
Number of cases	51	82	300	433	
Age (mean)	48.4	49.4	50.0	49.2	P=0.85
Age (range)	17-84	17-77	16-84	17-84	
Sex (% male)	66.7	67.1	76.3	70.0	P=0.12
BMI (average)	24.6*	26.3	28.3*	26.4	*P=0.002
BMI (range)	17.2-37.1	14.0-41.8	12.5-46.8	14.0-46.8	
Time since injury (average)	1.6	5.5	467.3	158.1	
Time since injury (range)	0-2	3-10	11-8432	0-8432	
Bone involved					
Tib/Fib	24	47	166	237	
Femur	10	8	76	94	
Pelvis	8	11	7	26	
Foot	4	7	8	19	
Upper Limb	5	8	39	52	
Other	0	1	4	5	
Culture Type					
Culture negative	2(4%)**	6(7.3%)	72(24%)**	80(18.5%)	**P<0.0001
Monomicrobial	19(37.3%)	30(36.6%)	150(50%)	199(45.9%)	
Polymicrobial	30(58.8%)*	46(56.1%)**	78(26%)* **	154(35.6%)	*P=0.0004 ** P<0.0001
Species Isolated					
Staphylococcus aureus	23	48	129	200	P=0.20
Staphylococcus epidermidis	11	15	34	60	
Other Staphylococcus	6	8	18	32	
Streptococcus	5	7	33	45	
Enterococcus	9	13	27	49	
Corynebacterium	6	7	13	26	
Gram negatives	20	34	88	142	
Anaerobes	9	26	35	70	
Other	5	3	5	13	
Total	94	161	382	637	

[FP B5] THE MICROBIOLOGICAL ETIOLOGY OF FRACTURE-RELATED INFECTION

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Purpose: Fracture-related infection (FRI) is an important complication related to orthopaedic trauma. Although the scientific interest with respect to the diagnosis and treatment of FRI is increasing, data on the microbiological epidemiology remains limited. Therefore, the primary aim of this study was to evaluate the microbiological epidemiology related to FRI, including the association with clinical symptoms and antimicrobial susceptibility data. The secondary aim was to analyze whether there was a relationship between the time to onset of infection and the microbiological etiology of FRI.

Methods: Over a five-year period, FRI patients treated at the University Hospitals of Leuven, Belgium, were retrospectively included. The microbiological etiology and antimicrobial susceptibility data were analyzed. Patients were classified as having an early (<2 weeks after implantation), delayed (2-10 weeks) or late-onset (> 10 weeks) FRI.

Results: One hundred ninety-one patients with 194 FRIs, mainly involving the tibia (23.7%) and femur (18.6%), were included. ***Staphylococcus aureus*** was the most frequently isolated pathogen, regardless of time to onset (n=61; 31.4%), followed by ***S. epidermidis*** (n=50; 25.8%) and non-***epidermidis*** coagulase-negative staphylococci (n=35; 18.0%). Polymicrobial infections (n=49; 25.3%), mainly involving Gram-negative bacilli (n=32; 65.3%), were less common than monomicrobial infections (n=138; 71.1%). Virulent pathogens in monomicrobial FRIs were more likely to cause pus or purulent discharge (n=45;54.9%; p=0.002) and fistulas (n=21;25.6%; p=0.030). Susceptibility to piperacillin/tazobactam for GNB was 75.9%. Vancomycin covered 100% of Gram-positive cocci.

Conclusion: The high frequency of polymicrobial infections, including Enterobacterales and enterococci, should be considered when choosing an empirical regimen, especially for early FRI. However, since antibiotic stewardship is the cornerstone of good antibiotic practice, overuse and misuse of broad-spectrum empiric therapy should be avoided at all costs. Large multicenter prospective studies are necessary to gain more insight into the added value of (broad) empirical antibiotic therapy.

[FP B6] FEMORAL FRACTURE RELATED INFECTIONS (FRI) IN A LOW INCOME COUNTRY: MANAGEMENT CHOICES AND LONG TERM OUTCOMES.

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Aim: In recent years, the number of victims of road traffic accidents (RTAs) and resulting surgeries have been on the rise in low income countries. Treatments are often long and costly; resources required to treat fracture related infections (FRI) continue to be a limiting factor in low income countries and standardized management protocols are lacking. This retrospective study reports our facility's experience of femoral FRI management in a low income country and evaluates the surgical outcomes with a minimum follow up of five years.

Methods: The clinical and radiographic records of patients who underwent surgery for femoral FRI in our facility between 2005-2016 were analyzed. Twenty-six patients were included (15 males), with a median age of 29 years (range 4-71). The initial fracture was caused by RTA in 22 patients, gunshot in 2, accidental fall in 1 and acute osteomyelitis in 1. Polytrauma was observed in 10. All patients but one were referred for limb reconstruction from other institutions. Surgical treatment was instituted in all: site debridement (SD) alone was performed in 2 patients; SD and hardware removal in 4; SD and external fixation in 4; SD, hardware removal and external fixation in 16. In this latter group, complex treatments such as bone transport (BT) and vascularized fibula flap (VFF) were utilized in 4 and 3 patients respectively.

Results: The mean follow-up was 8.4 years. Bone union was achieved in all cases with eradication of the infection in all but one. A total of 109 surgeries were carried out with an average of 4 surgeries per patient (range 1-13). The external fixation stayed in place for an average of 9.2 months (range 3-20). Complications were common at the last follow-up: limb length discrepancy (LLD) was observed in 18 patients; stiff knee was noted in 16; stiffness of ipsilateral knee and hip in 3; stiff hip in 1 and fused knee in 3. All patients ambulated without assistive devices.

Conclusions: The treatment of femoral FRI is complex, long and often requires the combined effort of the orthopedic and plastic surgical teams. Despite limited resources, our institution achieved good long term surgical outcomes through a variety of methods. Further studies are required across multiple sites to better outline optimal management of femoral FRI in low income countries.

[FP B7] PREDICTIVE FACTORS OF CHRONIC OSTEOMYELITIS AFTER OPEN TIBIAL FRACTURES IN A LOW-INCOME SETTING

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Introduction: Open tibial fractures (OTF) rank first among lower limb fractures in sub-Saharan Africa and bone infection remains the main challenge. The aim of this study was to identify the factors associated with chronic bone infection after OTF in a limited-resource setting.

Methods: Patients aged 18 years and older, who underwent OTF treatment in a tertiary care hospital during the period from December 2015 to December 2020 were included in this retrospective study. Patients were contacted via phone calls and invited for a final clinical and radiological evaluation. Patients who met diagnostic criteria of chronic osteomyelitis were identified. Logistic regression was used to determine the predictive factors of OTF related chronic osteomyelitis.

Results: With a mean follow-up period of 29.5±16.6 months, 33 patients out of 105 (31.4%) presented with chronic osteomyelitis. We found that time to first debridement within 6 hours (OR=0.18, 95% CI: 0.05 – 0.75, p=0.018) and severity of OTF according to Gustilo-Anderson classification (OR=2.06, 95% CI:1.34 – 3.16, p=0.001) were the independent predictive factors of chronic bone infection. Neither age, gender, socio-economic level, polytrauma, HIV status, diabetes mellitus, time to definitive surgery, were associated with chronic osteomyelitis.

Conclusion: The rate of chronic bone infections after OTF is still high in the sub-Saharan African context. In addition to the overall improvement in the management of open leg fractures in those settings, emphasis should be placed on very early initial debridement to reduce the burden of these infections.

Keys words: open tibial fractures, chronic bone infection, predictive factors.

[FP B9] TIBIAL BONE AND SOFT-TISSUE CONCENTRATIONS FOLLOWING COMBINATION THERAPY WITH VANCOMYCIN AND MEROPENEM - EVALUATED BY MICRODIALYSIS IN A PORCINE MODEL: SHOULD PATIENTS WITH OPEN FRACTURES HAVE HIGHER DOSES OF ANTIBIOTICS?

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Aim: Prompt and sufficient broad spectrum empirical antibiotic treatment is key to prevent infection following open tibial fractures. Succeeding co-administration, we dynamically assessed the time for which vancomycin and meropenem concentrations were above relevant epidemiological cut-off minimal inhibitory concentrations (T>MIC) in tibial compartments for the bacteria most frequently encountered in open fractures. Low and high MIC-targets were applied: 1 and 4 µg/mL for vancomycin and 0.125 and 2 µg/mL for meropenem.

Materials and methods: 8 pigs received a single dose of 1000 mg vancomycin and 1000 mg meropenem simultaneously over 100 min and 10 min, respectively. Microdialysis catheters were placed for sampling over 8 h in tibial cancellous bone, cortical bone, and adjacent subcutaneous adipose tissue. Venous blood samples were collected as references.

Results: Across the targeted epidemiological cut-off values, vancomycin displayed longer T>MIC in all the investigated compartments in comparison to meropenem. For both drugs, cortical bone exhibited the shortest T>MIC. For the low MIC targets and across compartments, T>MIC ranged between 208-499 min (46-100%) for vancomycin and 189-406 min (42-90%) for meropenem. For the high MIC targets, T>MIC ranged between 30-446 min (7-99%) for vancomycin and 45-181 min (10-40%) for meropenem.

Conclusion: The differences in the T>MIC between the low and high targets illustrates how the interpretation of these results is highly susceptible to the defined MIC target. To encompass any trauma, contaminating or individual tissue differences, a more aggressive dosing approach may be considered to achieve longer T>MIC in all the exposed tissues and thereby lowering the risk of acquiring an infection after open tibial fractures.

[FP B10] IS IMPLANT REMOVAL NEEDED FOR THE TREATMENT OF INTRAMEDULLARY NAIL INFECTIONS IN ELDERLY HIP FRACTURE PATIENTS?

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Aim: The treatment of fracture-related infections (FRI) focuses on obtaining fracture healing and eradicating infection to prevent osteomyelitis. Treatment guidelines include removal, exchange, or retention of the implants used according to the stability of the fracture and the time from the infection. Infection of a fracture in the process of healing with a stable fixation may be treated with implant retention, debridement, and antibiotics. Nonetheless, the retention of an intramedullary nail is a potential risk factor for failure, and it is recommended to exchange or remove the nail. This surgical approach implies additional life-threatening risks in elderly fragile hip fracture patients.
Our study aimed to analyze the results of implant retention for the treatment of infected nails in elderly hip fracture patients.

Methods: Our retrospective analysis included patients 65 years of age or older with an acute fracture-related infection treated with implant retention from 2012 to 2020 in 6 Spanish hospitals with a minimum 1-year follow-up. Patients that required open reduction during the initial fracture surgery were excluded. Variables included in our analysis were patient demographics, type of fracture, date of FRI diagnosis, causative microorganism, and outcome. Treatment success was defined as fracture healing with infection eradication without the need for further hospitalization.

Results: A total of 48 patients were identified. Eight patients with open reduction were excluded and 11 did not complete a 1-year follow-up. Out of the 29 remaining patients, the mean age was 81.5 years, with a 21:9, female to male ratio. FRI was diagnosed between 10 and 48 days after initial surgery (mean 26 days). Treatment success was achieved in 24 patients (82.7%). Failure was objectivated in polymicrobial infections or infections caused by microorganisms resistant to antibiofilm antibiotics. Seven patients required more than one debridement with a success rate of 57%. Twelve patients had an infection diagnosed after 21 days from the initial surgery and implant retention was successful in all of them.

Conclusion: Our results suggest implant retention is a valid therapeutic approach for fracture-related infection in elderly hip fracture patients treated by closed reduction and intramedullary nailing.

[FP C1] TREATMENT FAILURE IN LATE ACUTE PERIPROSTHETIC JOINT INFECTION IN PATIENTS WITH RHEUMATOID ARTHRITIS

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Aim: Patients with late acute periprosthetic joint infections (PJI) and treated with surgical debridement have a high failure rate. Previous studies have shown that rheumatoid arthritis (RA) is an independent risk factor for treatment failure. We conducted a case-control study to identify predictors for failure in late acute PJI treatment in RA patients. We hypothesize that patients with RA have a higher failure rate compared to controls due to the use of immunosuppressive drugs.

Method: Data of an international multicenter retrospective observational study was used. Late acute PJI was defined as a sudden onset of symptoms and signs of a PJI, more than 3 months after implantation. Failure of treatment was defined as persistent signs of infection, relapse with the same or reinfection with a different micro-organism, need for prosthesis removal or death. Cases with RA were matched with cases without RA based on the affected joint. A Cox survival analyses, stratified for RA, was used to calculate hazard ratio's (HR) for failure. Subgroup analyses were used to explore other predictors for treatment failure in RA patients.

Results: A total of 40 patients with RA and 80 controls without RA were included. Treatment failure occurred in 65% patients with RA compared to 45% for controls (***p***= 0.052). 68% of patients with RA used immunosuppressive drugs at time of PJI diagnosis. The use or continuation of immunosuppressive drugs in PJI was not associated with a higher failure rate; neither were the duration of symptoms, causative microorganism and exchange of mobile components. The time between implantation of the prosthetic joint and diagnosis of infection was longer in RA patients: median 110 (IQR 41-171) vs 29 months (IQR 7.5–101.25), and was associated with a higher failure rate (HR 1.01, 95% CI 1.00-1.01, ***p***-value 0.036).

Conclusions: The use of immunosuppressive drugs does not seem to be associated with a higher failure rate in patients with RA. A positive association between failure and the age of the prosthesis in the RA population was found. Future studies are needed to explore this association and its underlying pathogenesis.

[FP C2] EFFECTIVENESS OF DIFFERENT ANTIMICROBIAL STRATEGIES FOR STAPHYLOCOCCAL PROSTHETIC JOINT INFECTION: RESULTS FROM A LARGE PROSPECTIVE REGISTRY-BASED COHORT STUDY

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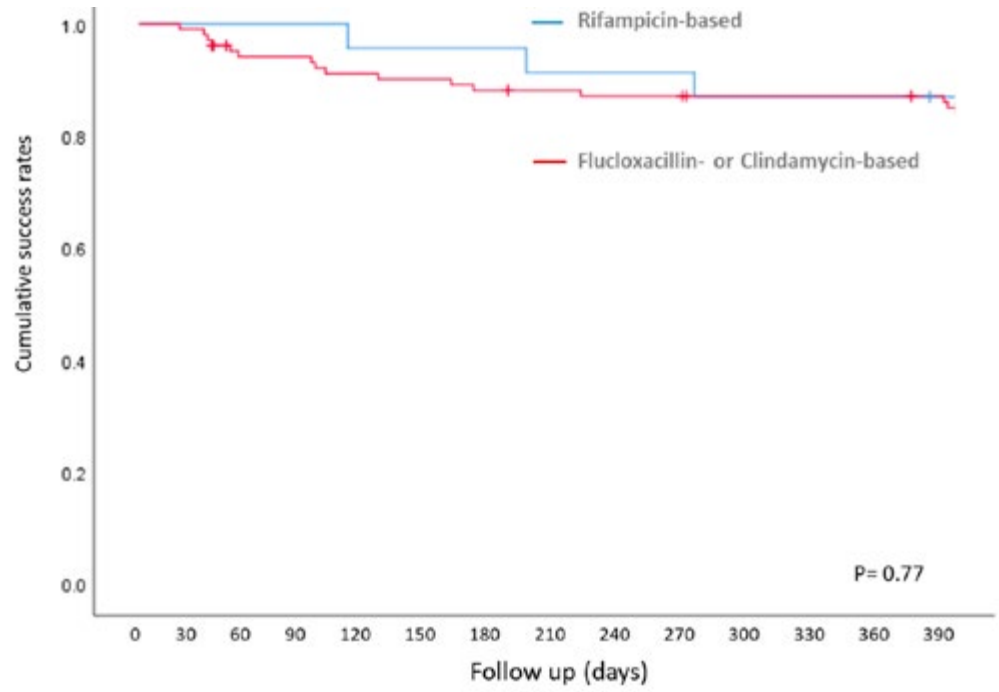
Background: Treatment of staphylococcal prosthetic joint infection (PJI) usually consists of surgical debridement and prolonged rifampicin combination therapy. Tailored antimicrobial treatment alternatives are needed due to frequent side effects and drug-drug interactions with rifampicin combination therapy. We aimed to assess the effectiveness of several alternative antibiotic strategies in patients with staphylococcal PJI.

Methods: In this prospective, multicenter registry-based study, all consecutive patients with a staphylococcal PJI , treated with DAIR or one-stage revision surgery between January 1st, 2015 and November 3rd, 2020, were included. Patients were treated according to a predefined protocol for PJI. Antimicrobial treatment strategies differed between centers, which was accepted and used as pseudorandomization. Depending on the hospital patients were admitted to, they were treated with either a long-term rifampicin strategy (consisting of 12 weeks rifampicin combination therapy) ore one of several short-term rifampicin strategies, consisting of only five days of rifampicin combination treatment, started immediately postoperative, followed by clindamycin, flucloxacillin or vancomycin monotherapy. Patients were stratified in different groups, depending on the used antimicrobial strategy. Cox proportional hazards models were used to compare outcome between the groups.

Results: Two hundred patients were included and, based on the antimicrobial treatment, stratified in one long-term rifampicin group (n=23) or one of the three short-term rifampicin groups: clindamycin (n=56), flucloxacillin (n=47), vancomycin (n=26), other (n=48). Outcome of PJI after DAIR or one-stage exchange was not statistically different between patients treated with long-term rifampicin combination therapy and patients treated with clindamycin or flucloxacillin monotherapy including only five days of rifampicin combination therapy. Moreover, treatment duration was four weeks shorter in the clindamycin-based and flucloxacillin-based groups. Adjusted hazard ratios for failure for patients treated with either flucloxacillin or clindamycin were almost equal to patients treated with long-term rifampicin combination therapy (aHR 1.21, 95%CI 0.34-4.40).

Conclusions: A short-term rifampicin strategy with either clindamycin or flucloxacillin and only five days of rifampicin was found to be as effective as traditional long-term rifampicin combination therapy. A randomized controlled trial is needed to further address efficacy and safety of alternative treatment strategies for staphylococcal PJI.



[FP C3] WHAT IS THE EFFECT OF A FAILED DAIR ON THE SURVIVAL AND SUBSEQUENT REVISION DONE FOR PJI? A MULTICENTRIC STUDY

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Aim: To describe the impact of a failed DAIR in the further prognosis of the prosthesis after a PJI

Method: A retrospective multicentrically study was conducted, including 10 institutions from all over the country. PJI-confirmed patients who underwent DAIR clinical records were revised. Age, sex, relevant previous conditions, Charlson comorbidity score, previous surgery, PJI diagnosis and surgical and antibiotic treatment, from the index surgery onwards. DAIR failure was defined as the removal of the prosthesis and/or an antibiotic suppressive treatment.

Results: 95 failed DAIR were identified, 43 of whom were treated with another DAIR (70% success rate), 20 with one-stage revision (75% success rate) and 25 with two-stage revision (92% success rate).
As risk factors for the failure of a second DAIR, a non-specialized surgical team(p=.0034), mobile components exchange(p=.009) and polymicrobial infections(p=.03) were identified.
Regarding to one-stage revisions, no risk factors were identified, and regarding to two-stage revisions, polymicrobial infection were identified (p=.028)

Conclusions: A second DAIR could sabe up to 70% of the prosthesis in our series. Furthermore, the outcome of the subsequent one or two-stage revision does not seem to be affected bay the previous failed DAIR. In terms of risk factors of failure, non-specialized surgical team, no mobile components exchange, and polymicrobial infections were identified for the DAIR, and polymicrobial infections for the two-stage revisions.

[FP C4] MICROBIOLOGICAL ANALYSIS AND OUTCOME OF DEBRIDEMENT; ANTIBIOTICS AND INPLANT RETENTION FOLLOWING TWO-STAGE EXCHANGE ARTHROPLASTYOF THE HIP AND KNEE

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Aim: Analysis of microbiological spectrum and resistance patterns as well as the clinical outcome of patients who underwent a Debridement, antibiotics and implant retention (DAIR) procedure in the early phase following failed two-stage exchange arthroplasty of the knee and hip.

Method: Of 312 patients treated with two-stage exchange arthroplasty between January 2011 and December 2019, 16 (5.1%) patients (9 knee, 7 hip) underwent a DAIR procedure within 6 months following second stage. We retrospectively analyzed the microbiological results as well as changes in the microbiological spectrum and antibiotic resistance patterns between stages of two-stage exchange arthroplasties and DAIR procedures. Patient's re-revision rates after a minimum follow-up of 12 months following DAIR procedure were evaluated. Moreover, differences between knee and hip and between infected primary total joint replacement (TJRs) and infected revision TJRs as well as patient's host factors and microbiological results regarding the outcome of DAIR were analyzed.

Results: In 7/16 (43.8%) patients the first and second stage procedure was culture positive, in 5/16 (31.2%) patients the first and second stage procedure was culture negative and in 4/16 (25%) patients the first stage procedure was culture positive, and the second stage procedure was culture negative. Moreover, 6 (37.5%) out of 16 DAIR procedures showed a positive microbiological result. In 5/7 (71.4%) patients with culture positive second stage procedure a different microorganism compared to first stage procedure was detected. In 6/6 (100%) patients with culture positive DAIR procedure, the isolated microorganisms were not detected during first or second stage procedure. An additional re-revision surgery was necessary in 4/16 (25%) patients after a median time of 31 months (range, 12 to 138 months) at a mean follow up of 63.1 ± 32 months following DAIR procedure. Highest re-revision rates were found in patients with culture positive second stage procedures (3/7 [42.9%]) and patients with culture positive DAIR procedures (2/6 [33.3%]).

Conclusions: DAIR procedure seems to be a useful early treatment option following failed two-stage exchange arthroplasty. The re-revision rates were independent of different combinations of culture positive and culture negative first and second stage procedures. The high number of changes in the microbiological spectrum needs to be considered in the treatment of PJI.

[FP C5] SINGLE CENTER, EXPLORATORY, OPEN-LABEL PROSPECTIVE STUDY USING THE MINIMALLY INVASIVE LYSINDAIR PROCEDURE (ADMINISTRATION OF THE LYSIN CF-301 DURING THE PERFORMANCE OF AN ARTHROSCOPIC DAIR) IN PATIENTS WITH CHRONIC COAGULASE-NEGATIVE STAPHYLOCOCCI KNEE PJI WITH TWO DIFFERENT CLINICAL PRESENTATIONS AND TREATMENT PARADIGMS

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Background: Exebacase, an antistaphylococcal lysin in Phase 3 of development as a treatment for ***S. aureus*** bacteremia/right-sided endocarditis has demonstrated antibiofilm activity ***in vitro*** and has previously been used as salvage therapy in four patients with relapsing multidrug-resistant (MDR) ***S. epidermidis*** knee prosthetic joint infection (PJI) using a procedure called LysinDAIR (administration of the lysin during the performance of an arthroscopic DAIR).

Materials/methods: We performed a single center, exploratory, open-label prospective study using the LysinDAIR procedure in patients with chronic (inoculation >3 months prior to treatment) coagulase-negative staphylococci (CNS) PJI of the knee with two different clinical presentations and treatment paradigms. Cohort A: first episode of CNS knee PJI, for whom the LysinDAIR was followed by clindamycin + levofloxacin planned to be prescribed for three months and then stopped; and Cohort B: relapsing episodes of MDR CNS knee PJI for whom the LysinDAIR was followed by primary antimicrobial therapy for three months, followed by suppressive antimicrobial therapy (SAT). Exebacae susceptibility testing was performed before treatment for each patient. In agreement with the French Health authority, exebacase (2 to 3.5 total mg in 30-50 ml (~0.067 – 0.075 mg/m) was administered directly into the joint during arthroscopy.

Results: Eigh**t** patients were treated. Exebacase administration was well tolerated by all patients and no serious adverse drug reactions to exebacase were reported. In cohort A (n=4), patients had susceptible ***S. epidermidis*** PJI, a painful joint effusion without fistula and without loosening, and received three months of levofloxacin + clindamycin (one patient received an alternative regimen following antibiotic adverse events) and then antibiotics were stopped. During a follow-up of 14, 19, 26 and 36 months, no relapse, no recurrence of the joint effusion and no loosening occurred. In cohort B (n=4), patients had MDR CNS, clinical signs of septic arthritis with a joint effusion without fistula and without loosening and received daptomycin + linezolid or doxycycline. One patient died from COVID-19 at week 4. SAT (tedizolide, n=2; doxycycline, n=1) was then prescribed to other patients. One experienced an infection relapse involving ***S. caprae*** under tedizolid therapy at six months. The two other patients continue to do well under SAT 8 and 12 months after the LysinDAIR procedure.

Conclusions: The LysinDAIR procedure is a minimally invasive procedure, which has been shown to be easy-to-perform, safe, and has the potential for use as initial treatment or salvage therapy in patients with CNS chronic knee PJI.

[FP C6] SYSTEMIC ANTIBIOTICS ARE NOT REQUIRED FOR SUCCESSFUL TWO-STAGE REVISION HIP ARTHROPLASTY

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Aim: The duration of systemic antibiotic therapy following first-stage surgery is contentious. Our Institution's philosophy is to perform an aggressive debridement, use high concentration targeted antibiotics through cement beads and systemic prophylactic antibiotics alone. In the presence of significant soft tissue infection or microbiological diagnostic uncertainty; systemic antibiotics may be prescribed for 5 days whilst awaiting tissue culture results. The aim of this study was to assess the success of our philosophy in the management of PJI of the hip using our two-stage protocol.

Method: A retrospective review of our Institution's prospectively-collected database was performed to identify those patients who were planned to undergo a two-stage hip revision procedure for PJI. All patients had a confirmed diagnosis of PJI as per the major criteria of MSIS 2013, a minimum 5-years follow up and were assessed at the time of review using the MSIS working group outcome-reporting tool (2018). They were then grouped into "successful" or "unsuccessful" (suppressive antibiotics, further revision for infection, death within 1 year).

Results: 299 intended two-stage hip revisions in 289 patients (6 repeat ipsilateral two-stage, 4 bilateral two-stage) met our inclusion criteria. 258 (86%) patients proceeded to 2nd stage surgery. Median follow up was 10.7 years. 91% success rate was observed for those patients who underwent reimplantation; dropping to 86% when including the patients who did not proceed to second stage surgery. The median duration of post-operative systemic antibiotics following first stage surgery was 5 days (IQR 5-9). No significant difference in outcome was observed in patients who received either; < / = 48 hours (86%; n=70) compared to > 48 hours antibiotics (86%; n=229; p=0.96) or </= 5 days of antibiotics (88%; n=202) compared to > 5 days antibiotics (82%; p=0.38). A significant majority had gram-positive (88%) infection with 30% being polymicrobial. Greater success rates were observed for gram-positive PJI (87%); than for gram-negative PJI (84%) and mixed Gram infection (72%; p=0.098).

Conclusion: Aggressive surgical debridement with high concentration, targeted local antibiotic delivery at time of first stage hip surgery, without prolonged systemic antibiotics, provides a high rate of success, responsible antibiotic stewardship and reduced hospital costs.

[FP C7] SURGICAL OUTCOMES OF A NOVEL BONE SUBSTITUTES AND ALLOGRAFT BONE CHIPS FOR THE TREATMENT OF SEVERE ACETABULAR DEFECTS DURING HIP REVISION SURGERIES.

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Aim: Aim of this monocentric, prospective study was to evaluate the safety, efficacy, clinical and radiographical results at 24-month follow-up (N = 6 patients) undergoing hip revision surgery with severe acetabular bone defects (Paprosky 2C-3A-3B) using a combination of a novel phase-pure betatricalciumphosphate - collagen 3D matrix with allograft bone chips.

Method: Prospective follow-up of 6 consecutive patients, who underwent revision surgery of the acetabular component in presence of massive bone defects between April 2018 and July 2019. Indications for revision included mechanical loosening in 4 cases and history of hip infection in 2 cases. Acetabular deficiencies were evaluated radiographically and CT and classified according to the Paprosky classification. Initial diagnosis of the patients included osteoarthritis (N = 4), a traumatic fracture and a congenital hip dislocation. 5 patients underwent first revision surgery, 1 patient underwent a second revision surgery.

Results: All patients were followed-up radiographically with a mean of 25,8 months. No complications were observed direct postoperatively. HHS improved significantly from 23.9 preoperatively to 81.5 at the last follow-up. 5 patients achieved a defined good result, and one patient achieved a fair result. No periprosthetic joint infection, no dislocations, no deep vein thrombosis, no vessel damage, and no complaint about limbs length discrepancy could be observed. Postoperative dysmetria was found to be + 0.2cm (0cm/+1.0cm) compared to the preoperative dysmetria of - 2.4 cm (+0.3cm/-5.7cm).

Conclusions: Although used in severe acetabular bone defects, the novel phase-pure betatricalciumphosphate - collagen 3D matrixshowed complete resorption and replacement by newly formed bone, leading to a full implant integration at 24 months follow-up and thus represents a promising method with excellent bone regeneration capacities for complex cases, where synthetic bone grafting material is used in addition to autografts.

[FP D1] ON THE VALUE AND LIMITATIONS OF INCORPORATING A "CLEAN PHASE" INTO THE SURGICAL TREATMENT OF PROSTHETIC JOINT INFECTIONS - AN ILLUSTRATIVE CADAVERIC STUDY USING FLUORESCENT POWDER

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Aim: A septic revision of an artificial joint is routinely split up in a so-called ***dirty phase*** and a ***clean phase***. The measures taken to initiate the start of the clean phase vary significantly between musculoskeletal infection centers. We performed simulations of one-step exchanges of infected THAs and sought to 1) determine the effect of different clean phase protocols on the sterile field, and 2) determine whether or not it is possible to re-implant the new prosthesis completely clean.

Method: Nine fresh frozen cadaveric hips were used and primary THA was undertaken via a direct anterior approach. Before implantation of the components varying amounts of fluorescent powder (GloGerm) were deposited, simulating bacterial infection. Second, a one-step exchange was performed via a posterolateral approach. After implant removal, debridement, and lavage, randomization determined which clean phase protocol was followed, i.e. no, some or full additional measures. Finally, the new prosthesis was re-implanted (fig. 1).
In order to determine the effect of different clean phase protocols on contamination of the sterile field standardized UV light-enhanced photographs were obtained of 1) the gloves, 2) the instrument table, 3) the drapes, and 4) the wound and these were ranked on cleanliness by a blind panel of hip surgeons.
In order to determine whether or not it is possible to re-implant the prosthesis completely clean, the implant was taken out again at the end of the one-step exchange and inspected for contamination under UV light.

Results: The gloves, the instrument table, the drapes (fig. 2) and the wound were significantly cleaner after a clean phase using full additional measures compared to partial or no additional measures ($p < 0.000$). Partial measures were able to reduce some of the contamination of the gloves and the wound, but had no effect on the drapes and the instrument table. All re-implanted implants were contaminated with some amount of fluorescent powder at the end of the one-step exchange.

Conclusions: We advise to incorporate a clean phase with full additional measures into the surgical treatment of prosthetic joint infections, as the effect of partial measures seems to be a poor compromise.

Figure 1.

Figure 2.

[FP D2] RIFAMPICIN DOES NOT REDUCE MOXIFLOXACIN TISSUE CONCENTRATIONS FOLLOWING 1-STAGE REVISION IN A PORCINE MODEL OF IMPLANT ASSOCIATED OSTEOMYELITIS

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Aim: This study investigated if co-administration of rifampicin with moxifloxacin led to a decrease in moxifloxacin concentrations in relevant tissues in a porcine model of implant-associated osteomyelitis caused ***S. aureus.*** Pharmacokinetics were measured using microdialysis and treatment effect was measured by quantifying bacterial load from implant and periprosthetic bone following a 1-stage revision and antibiotics.

Method: 15 female pigs received a stainless-steel implant in the right proximal tibia and were randomized into two groups. Infection was introduced by inoculating the implant with ***Staphylococcus aureus*** as previously described[1]. On day 7 post surgery, all pigs were revised with implant removal, debridement of implant cavity and insertion of a sterile implant. 7 days of treatment was then initiated with either moxifloxacin 400 mg iv q.d. **(M)** or moxifloxacin and rifampicin 450 mg iv b.i.d. **(RM)**. At day 14, animals were sedated and microdialysis was applied for continuous sampling of moxifloxacin concentrations during 8 h in five compartments: the implant cavity, cancellous bone in both the infected and non-infected proximal tibia, and adjacent subcutaneous tissue on both the infected and non-infected side using a previously described setup[2]. Venous blood samples were collected. Implant and adjacent bone were removed for analysis.

Results: Comparable cure rates (sterilization of both implant and bone) were observed with 5/8 pigs in the RM group compared to 3/7 in the M group, p= 0.62 (Fisher's exact test). Due to the small number of samples with growth, median log CFU/ml was 0 for implant and bones in both groups. $AUC_{0\text{-last}}$ was significantly smaller in plasma for the RM group, 407; 315 – 499 min µg/mL vs 625; 536 – 724 min µg/mL (mean;95% CI), p= 0.002 (Student's t-test). For the implant cavity, there was a trend toward a lower $AUC_{0\text{-last}}$ 425; 327 – 524 min µg/ml vs 297; 205 – 389 min µg/ml in the RM group compared to M, yet this difference was not statistically different, p = 0.06. For the other compartments for other parameters (C_{max} and T_{max}) across all compartments, there was no difference.

Conclusions: While the $AUC_{0\text{-last}}$ was lower in plasma for animals treated with RM, both the concentrations at the site of infection and treatment outcomes were comparable between groups.

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[FP D3] TESTING OF BONE CEMENT WITH GENTAMICIN AGAINST STAPHYLOCOCCUS AUREUS INFECTIONS IN GALLERIA MELLONELLA

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Aim: ***Galleria mellonella*** larvae is a well-known insect infection model that has been used to test the virulence of bacterial and fungal strains as well as for the high throughput screening of antimicrobial compounds against infections. Recently, we have developed insect infection model ***G. mellonella*** larvae to study implant associated biofilm infections using small K-wire as implant material. Here, we aimed to further expand the use of ***G. mellonella*** to test other materials such as bone cement with combination of gentamicin to treat implant-associated infections.

Method: The poly methyl methacrylate (PMMA) with and without gentamicin and liquid methyl methacrylate (MMA) were kindly provided by Heraeus Medical GmbH, Wehrheim. To make the bone cement implants as cubes, Teflon plate (Karl Lettenbauer, Erlangen) with specified well size was used. The Radiopaque polymer and monomer were mixed well in a bowl, applied over on to the Teflon plate and pressed with spatula to form fine and uniform cubes. After polymerization, the bone cement implants were taken out of the Teflon well plate with the help of pin. For the infection process, bone cement cubes were pre-incubated with ***S. aureus*** EDCC 5055 culture at $5x10^6$ CFU/ml for 30 min at 150 rpm shaking conditions. Later, these implants were washed with 10ml PBS and implanted in the larvae as mentioned. Survival of the larvae were observed at 37°C in an incubator. To analyze the susceptibility of the bacterial infections towards gentamicin, survival of the larvae compared with control group implanted only with bone cement. The effect of gentamicin was also measured in terms of ***S. aureus*** load in larvae on 2nd day. SEM analysis was performed to see the effect of gentamicin on biofilm formation on bone cement.

Results: Our experiments established the ***G. mellonella*** as an excellent model to screen bone cement with antimicrobial compounds against bacterial infections. The gentamicin bone cement samples showed excellent ***S. aureus*** bacterial load reduction after the implantation in ***G. mellonella*** model. The bone cement with gentamicin showed better survival of larvae infected with ***S. aureus*** compared to control. Finally, the gentamicin also affected the biofilm formation on the bone cement surface with ***S. aureus***.

Conclusions: Thus, our work showed ***G. mellonella*** is a rapid, cheap economical pre-clinical model to study the bone cement associate bacterial infections as well as screening of the various antimicrobial compounds.

[FP D4] ESTABLISHMENT OF A NOVEL GRAM-NEGATIVE PROSTHETIC JOINT INFECTION RAT MODEL USING UNCEMENTED HIP HEMIARTHROPLASTY

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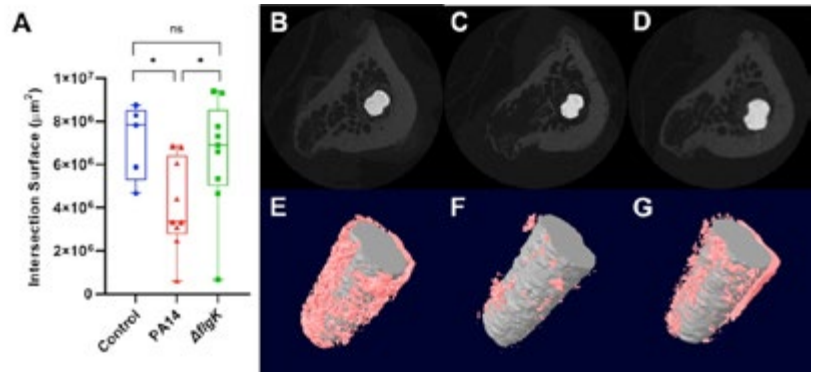
Introduction: Gram-negative prosthetic joint infections (GN-PJI) present unique challenges in management due to their distinct pathogenesis of biofilm formation on implant surfaces. The purpose of this study is to establish a clinically representative GN-PJI model that can reliably recapitulate biofilm formation on titanium implant surface ***in vivo***. We hypothesized that biofilm formation on an implant surface will affect its ability to osseointegrate.

Methods: The model was developed using 3D-printed titanium hip implants, to replace the femoral head of male Sprague-Dawley rats. GN-PJI was induced using two bioluminescent ***Pseudomonas aeruginosa*** strains: a reference strain (PA14-***lux***) and a mutant biofilm-defective strain (Δ***flgK-lux***). Infection was monitored in real-time using the ***in vivo imaging system*** (IVIS) and Magnetic Resonance Imaging (MRI). Bacterial loads on implant surface and in periprosthetic tissues were quantified utilizing viable-colony-count. Field-emission scanning-electron-microscopy of the explanted implants was used to visualize the biofilm formation at the bone-implant-interface. The implant stability, as an outcome, was directly assessed by quantifying the osseointegration ***in vitro*** using microCT scan, and indirectly assessed by identifying the gait pattern changes using DigiGait™ system ***in vivo***.

Results: Localized infection was established within the hip joint and was followed by IVIS in real-time. There was a quantitative and qualitative difference in the bacterial load and biofilm formation between PA14-***lux*** and Δ***flgK-lux.*** This difference in the ability to persist in the model between the two strains was reflected in the gait pattern and implant osseointegration.

Conclusions: We developed a novel uncemented hip hemiarthroplasty, GN-PJI rat model. To date, the proposed ***in vivo*** biofilm-based model is the most clinically representative for GN-PJI since animals can bear weight on the implant and poor osseointegration correlates with biofilm formation. In addition, localized PJI was detected by various modalities.

Clinical Relevance: The proposed ***in vivo*** GN-PJI model will allow for more reliable testing of novel biofilm-targeting therapeutics.



Testing osseointegration utilizing microCT scanning of the collected femurs with retained implants A) A box plot demonstrating bone to implant contact (BIC) at the distal end of the implant by Intersection Surface (IS) of PA14-***lux***-PJI (n=9) group (C, F) compared to Δ***flgK-lux***-PJI (n=9) (D, G) and the non-infected surgical control (n=5) groups (B, E). CT images on top (B, C, D) and quantified by the corresponding 3D model below (E, F, G).

[FP D5] NEW INORGANIC/ORGANIC NANO-STRUCTURED XEROGEL COATING PREVENTS DEVELOPMENT OF OSTEOMYELITIS IN A PORCINE MODEL

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Aim: To develop a new system for antibacterial coating of joint prosthesis and osteosynthesis material. The new coating system was designed to release gentamicin immediately after insertion to eradicate surgical contamination.

Method: Steel implants (2x15mm) were coated with a solid nanocomposite xerogel made from silica and the dendritic polymer, hyperbranched polyethyleneimine. The xerogel was anchored inside a porous surface made by pre-coating with titanium microspheres. Finally, gentamicin was encapsulated in the xerogel, i.e. no chemical binding. A total of 50 µg gentamicin was captured into each implant. The efficacy of the new coating was evaluated in a porcine model of implant associated osteomyelitis. In total, 30 female pigs were randomized into 3 study groups (n=10). Group A; plain implants + saline, Group B; plain implants + 10^4 CFU of ***Staphylococcus aureus***, and Group C; coated implants + 10^4 CFU of ***S. aureus***. Implant + inoculum was placed into a pre-drilled implant cavity of the right tibia and the pig was euthanized 5 days afterwards. Postmortem microbiology and pathology were performed. Two additional pigs were used in a pharmacokinetic study where microdialysis (MD) catheters were placed alongside coated implants. Extracellular fluid was sampled regularly for 24 hours from the MD catheters and analyzed for gentamicin content.

Results: Within Groups A and C, all implants were found sterile by sonication and bacteria could not be identified within the surrounding bone tissue. In contrast, all Group B animals had ***S. aureus*** positive implant and tissue microbiology. Macroscopic and microscopic pathological examinations confirmed that Group A and C animals were complete identic, i.e. no pus around implants and only minor peri-implant inflammation related to insertion of implants ***per se***. All Group B animals had pus around their implants and a massive peri-implant inflammatory response dominated by neutrophil granulocytes. Maximum gentamicin release (35 µg /mL) was measured in the first obtained MD sample, i.e. after 30 min, and the concentration stayed above the MIC level for the used ***S. aureus*** strain for 8 hours.

Conclusions: The new xerogel coating prevented development of osteomyelitis. Prevention was due to a fast gentamicin release immediately following insertion and antimicrobial active concentrations were detectable several hours after implantation. This means that the critical time point of most relevant surgical procedures potentially could be protected by the novel coating. The new coating will be investigated on larger scale implants and full-size prosthesis in the future.

[FP D6] BIODISTRIBUTION OF A RADIOLABELED ANTIBODY TARGETING STAPHYLOCOCCUS AUREUS IMPLANT INFECTION IN MICE

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Aim: Implant infections caused by ***Staphylococcus aureus*** are difficult to treat due to biofilm formation, which complicates surgical and antibiotic treatment. Herewith we introduce an alternative approach using monoclonal antibodies (mAbs) targeting ***S. aureus*** and provide the biodistribution and specificity in a mouse implant infection model.

Methods: 4497-IgG1targeting ***S. aureus*** Wall Teichoic Acid was labeled to Indium-111 using "CHXA" as a chelator. SPECT-CT scans were performed at 24, 72 and 120 hours after administration in Balb/cAnNCrl mice with a subcutaneous implant pre-colonized with biofilm of ***S. aureus***. Biodistribution over the various organs of this labelled antibody was visualized and quantified using SPECT-CT imaging and compared to uptake at the target tissue with implant infection.

Results: Uptake of the ^{111}In-4497 mAbs (half-life 59 hours) at the infected implant gradually increased from 8.34%ID/g at 24 hours to 9.22%ID/g at 120 hours. Uptake at the heart/blood pool decreased over time from 11.60 to 7.58%ID/g whereas the uptake in other organs decreased from 7.26 to less than 4.66%ID/g at 120 hours.

Conclusion: ^{111}In-4497 mAbs was found to specifically detect ***S. aureus*** and its biofilm with excellent and prolonged accumulation at the colonized implant site. Therefore, it holds great promise as a drug delivery system for diagnostic and bactericidal treatment of biofilm. However, high activity in the blood pool must be considered as it could pose a risk to healthy tissue.

[FP D7] HIGH CEFUROXIME CONCENTRATIONS AND LONG ELIMINATION IN AN ORTHOPAEDIC SURGICAL DEADSPACE - A MICRODIALYSIS PORCINE STUDY

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Aim: Deadspace is the tissue and bony defect in a surgical wound after closure. This space is presumably poorly perfused favouring bacterial proliferation and biofilm formation. In arthroplasty surgery, an obligate deadspace surrounding the prosthesis is introduced and deadspace management, in combination with obtaining therapeutic prophylactic antibiotic concentrations, is important for limiting the risk of acquiring a periprosthetic joint infection (PJI). This study aimed to investigate cefuroxime distribution to an orthopaedic surgical deadspace in comparison with plasma and bone concentrations during two dosing intervals (8 h × 2).

Method: In a setup imitating shoulder arthroplasty surgery, but without insertion of a prosthesis, microdialysis catheters were placed for cefuroxime sampling in a deadspace in the glenohumeral joint and in cancellous bone of the scapular neck in eighteen pigs. Blood samples were collected from a central venous catheter as a reference. Cefuroxime was administered according to weight (20 mg/kg). The primary endpoint was time above the cefuroxime minimal inhibitory concentration of the free fraction of cefuroxime for Staphylococcus aureus ($fT > MIC$ (4 µg/mL)).

Results: During the two dosing intervals, mean $fT > MIC$ (4 µg/mL) was significantly longer in deadspace (605 min) compared with plasma (284 min) and bone (334 min). For deadspace, the mean time to reach 4 µg/mL was prolonged from the first dosing interval (8 min) to the second dosing interval (21 min), while the peak drug concentration was lower and half-life was longer in the second dosing interval.

Conclusions: In conclusion, weight-adjusted cefuroxime $fT > MIC$ (4 µg/mL) and elimination from the deadspace was longer in comparison to plasma and bone. Our results suggest a deadspace consolidation and a longer diffusions distance, resulting in a low cefuroxime turn-over. Based on theoretical targets, cefuroxime appears to be an appropriate prophylactic drug for the prevention of PJI.

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[FP E1] BACTERIOPHAGE INJECTIONS UNDER SONOGRAPHY AFTER CONSERVATIVE SURGERY IN PATIENTS WITH COMPLEX S. AUREUS AND/OR P. AERUGINOSA PROSTHETIC JOINT INFECTION FOR WHOM EXPLANTATION IS NOT DESIRABLE: A POTENTIAL EVOLUTION OF THE PHAGODAIR PROCEDURE

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Background: Bacteriophages are natural viruses of interest in the field of PJI. A paper previously reported the PhagoDAIR procedure (use of phages during DAIR) in three patients with PJI for whom explantation was not desirable. As the need to isolate the pathogen before surgery to perform phage susceptibility testing is a strong hindrance for the development of this procedure, we developed post-operative phage injections using ultrasound, in patients infected with ***S. aureus*** and/or ***P. aeruginosa*** who were eligible for the PhagoDAIR procedure, but for whom phages were not available at the time of surgery.

Materials/Methods: We performed a single center, exploratory, prospective cohort study including patients with knee PJI who received phage therapy with ultrasound after performance of a DAIR or a partial prosthesis exchange. All patients had PJI requiring conservative surgery and suppressive antimicrobial therapy (SAT) as salvage procedure. Each case was discussed in multidisciplinary meetings in agreement with French health authority, based on the clinical presentation, and the phage susceptibility testing. The cocktail of highly concentrate active phages (5 mL; about 10^e9 PFU/mL) was extemporaneous prepared and administered three times directly into the joint using sonography (1 injection per week during 3 weeks) during the postoperative period, before switching antibiotics to SAT.

Results: Six patients received phages under sonography after the DAIR, and one after a partial exchange (mean age 71 years). All had resection prosthesis or constrained knee prosthesis. Among these seven patients, three were infected with ***S. aureus*** (including one MRSA), two were infected with ***P. aeruginosa*** (one was a multidrug-resistant isolate), one was infected with both ***S. aureus*** and ***P. aeruginosa*** and the last one was infected with MRSA, ***S. epidermidis*** and ***Corynebacterium spp.***. All patients received a cocktail of active phages provided by Pherecydes Pharma targeting ***S. aureus*** or ***P. aeruginosa***. No adverse event was recorded during or after the local injections. All patients were switched to SAT after a primary postoperative antimicrobial therapy of three months. Under SAT, the patient with ***S. epidermidis*** co-infection developed a relapse due to the ***S. epidermidis***. With a mean follow-up of 13 months after surgery (from 9 to 24 months), the outcome was favorable for all patients without any sign of infection; none of the them had abnormal pain, joint effusion or loosening.

Conclusions: Postoperative administration of phages using sonography is a potentially useful procedure in patients with complex PJI for whom a conservative approach is desirable.

[FP E2] THE IMPACT OF SMOKING ON TREATMENT FAILURE IN SURGICALLY-TREATED ORTHOPAEDIC INFECTIONS

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Aim: Smoking is known to impair wound healing and to increase the risk of peri-operative adverse events, and is associated with orthopaedic infection and fracture non-union. Understanding the magnitude of the causal effect on orthopaedic infectionrecurrence may improve pre-operative patient counselling.

Methods: Four prospectively-collected datasets including 1173 participants treated in European centres between 2003 and 2021, followed up to 12 months after surgery for clinically diagnosed orthopaedic infections, were included in logistic regression modelling with Inverse Probability of Treatment Weighting for current smoking status [1-3]. Host factors including age, gender and ASA score were included as potential confounding variables, interacting through surgical treatment as a collider variable in a pre-specified structural causal model informed by clinical experience. The definition of infection recurrence was identical and ascertained separately from baseline factors in three contributing cohorts. A subset of 669 participants with positive histology, microbiology or a sinus at the time of surgery, were analysed separately.

Results: Participants were 64% male, with a median age of 60 years (range 18-95); 16% of participants experienced treatment failure by 12 months. 1171 of 1173 participants had current smoking status recorded. As expected for the European population, current smoking was less frequent in older participants (Table 1).There was no baseline association between Charlson score or ASA score and smoking status (p=0.9, p=1, Chi squared test). The estimated adjusted odds ratio for treatment failure at 12 months, resulting from current smoking at the time of surgery, was 1.37 for all participants (95% CI 0.75 to 2.50) and 1.53 for participants with recorded confirmatory criteria (95% CI 1.14 to 6.37).

Conclusions: Smoking contributes to infection recurrence, particularly in people with unequivocal evidence of osteomyelitis or PJI. People awaiting surgery for orthopaedic infection should be supported to cease smoking, not only to reduce anaesthetic risk, but to improve treatment outcomes. Limitations of this study include unmeasured socioeconomic confounding and social desirability bias resulting in uncertainty in true smoking status, resulting in underestimated effect size.

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Table 1. Age distribution of current smoking in study participants

Age quartiles	18 to 48 years	49 to 60 years	61 to 70 years	71 to 95 years
Proportion of current smokers (%)	72/276 (26%)	69/300 (23%)	32/277 (12%)	26/319 (8%)

[FP E3] INCREASED SHORT- AND LONG-TERM MORTALITY AMONGST PATIENTS WITH EARLY PERIPROSTHETIC KNEE JOINT INFECTIONS

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Background: Periprosthetic joint infection (PJI) following total knee arthroplasty (TKA) is a severe complication in terms of disability, morbidity, and cost. We performed a study to investigate whether early PJI (within 90 days of primary TKA) is associated with increased mortality. Secondary aims were to compare mortality rates over time and between surgical treatment methods.

Methods: Patients with suspected PJI were identified by linkage of the Swedish Knee Arthroplasty Register (SKAR) and the Swedish Prescribed Drug Register (SPDR) in 2007-2008 and 2012-2013. Medical records of patients receiving more than 4 weeks of continuous antibiotic therapy were subsequently reviewed to verify the PJI diagnosis. Information on mortality was obtained through the SKAR which is updated daily from the tax agency and patients with PJI were compared to patients without PJI.

Results: 466 patients were diagnosed with PJI within 90 days and compared to 40,362 patients without PJI. Mortality rates were significantly higher for PJI patients in both short- and long term: 2.6% vs. 0.8% at 1 year, 4.9% vs. 1.9% at 2 years, 15.7% vs. 7.1% at 5 years, and 38% vs. 21.4% at 10 years. The difference in mortality rate remained after adjusting for sex, age, diagnosis, and time period for surgery with Hazard Ratio 1.8 (95% CI:1.6-2.1). Mortality rates did not differ between time periods, and we found no correlation to surgical treatment.

Conclusion: Patients with early PJI after primary TKA have an increased mortality rate compared to TKA patients without PJI. Improvements in surgical treatment strategy has not resulted in better survival. Long term difference in mortality rates indicates that PJI is not the sole reason for mortality suggesting a general frailty in PJI patients.

[FP E4] NEXT GENERATION SEQUENCING: CAN ASPIRATION TECHNIQUE CAUSE CONTAMINATION IN JOINT ARTHROPLASTY?

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Background: A significant challenge in Periprosthetic Joint Infection (PJI) is the detection of microbiota in culture negative cases. Molecular nucleotide sequencing using Next Generation Sequencing (NGS) technology is an adjuvant method for microbial detection. False positive results are of concern, the sources of which remain in debate. We performed a simulated joint aspiration study to assess false positive rates with NGS testing.

Methods: The simulated joint was a 50cc bottle of sterile saline. Four aspiration methods were tested utilizing sterile technique. Fluid aspirates were inserted into sterile vacutainers. Exchange points where a vacuum effect allowed ambient air into the needle bore were analyzed for potential detection with NGS.

Results: 80 simulated aspirations were performed, with two NGS tests performed on each aspiration bottle collected at different steps in the fluid transfer process. In three simulated techniques, there was one positive detection in 120 NGS samples (0.8%). In the fourth technique, where 10cc of ambient air was aspirated into the syringe after fluid aspiration, there were two positive detections in 20 NGS samples (10%). There was one positive NGS detection in 80 negative control bottles (1.2%).

Conclusions: NGS detected microbial relevant molecular signals in simulated joint aspirations of sterile saline bottles using clinical sterile technique. However, the false positive rate was very low (0.8%). We theorize errant microbe contamination from ambient air laden with microbes (fomites) sucked into the needle bore. To prevent airborne contamination, we advocate needle exchange at fluid transfer points where a generated negative pressure effect can draw ambient air into a needle bore.

Clinical Relevance: This study provides assurance that the false positive rate using NGS technology in the detection of microbiota during joint fluid aspirations using sterile clinical technique is very low. For joint aspirations, we recommend using a single syringe, and using a new transfer needle with each fluid transfer into a vacutainer.

KEY WORDS:

Microbial Identification, Nucleotide Sequencing, Next Generation Sequencing, Contamination, Aspiration, Periprosthetic Joint Infection.

[FP E5] VALIDATION OF REPORTED REVISIONS FOR DEEP INFECTION TO A NATIONAL ARTHROPLASTY REGISTER

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Aim: In recent years, many studies on ***revision for infection*** after arthroplasty have been published. In national arthroplasty registers, ***revision for infection*** is defined as surgical debridement, with or without removal or exchange of the entire or parts of the prosthesis due to deep infection, and should be reported to the register immediately after surgery. The diagnosis of infection is made at the surgeon's discretion, based on pre- and perioperative assessment and evaluation, and is not to be corrected to the register based on peroperative bacterial cultures. Due to this lack of validation, the rate of revision for infection will only be an approximation of the true rate of ***periprosthetic joint infection (PJI).*** Our aim was to validate the reporting of infection after total hip arthroplasty, and to assess if revisions for infection actually represented true PJI.

Methods: We investigated the reported ***revisions for infection*** and ***aseptic loosening*** after total hip arthroplasty from 12 hospitals, representing one region of the country, reported during the period 2010-2020. The electronic patient charts were investigated for information on surgical treatment, use of antibiotics, biochemistry and microbiology findings. PJI was defined as growth of at least two phenotypically identical microbes in perioperative tissue samples. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated.

Results: 145 ***revisions for infection*** and 137 revisions for aseptic loosening were reported. The validation was as follows:

	Reported Infection	Reported Aseptic Loosening	
Actual Infection	True positives=141	False negatives=11	Positive predictive value=0.97
Actual Aseptic Loosening	False positives=4	True negatives=126	Negative predictive value=0.92
	Sensitivity=0.93	Specificity=0.97	Accuracy=0.95

Interpretation: We found the reporting ***revision for infection*** after total hip arthroplasty to the national register accurate. There was high correlation between reported ***revision for infection*** and ***PJI***. Studies on ***revision for infection*** from arthroplasty registers may therefore be considered as reliable as studies of true ***PJI***.

[FP E6] PJI MANAGED WITH TWO STAGE SURGERY: FORGOTTEN DEATHS AND NOT NEGLIGIBLE COMPLICATIONS

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Introduction: The surgical management of late PJI was usually done in two stages with the placement of a temporary cement spacer. The development of one-stage surgical care raises questions about the two-stage strategy. The objectives of this study are to identify the complications related to the presence of the cement spacer within a two-stage strategy. The septic recurrence rate is also evaluated after a minimum follow-up of two years.

Material and methods: Medical files of 208 patients (101 knees and 107 hips) who underwent a two-stage revision for late PJI prosthesis infection were retrospectively reviewed. Antibiotic loaded articulated homemade cement spacers were used. Second stage was usually planned on average 4 to 6 weeks after the first stage. Patients were allowed to walk without loading. The success rate was defined as the absence of septic recurrence after a minimum follow-up of two years. Descriptive statistics and uni- and multivariate analysis were conducted.

Results: The spacers were left in place for an average of 42 days for the knees and 30 days for the hips. Six patients (3%) died before performing the second stage. Hip spacers were associated with 8 fractures for only one observed in the knee (4%). Spacer dislocation (11%) was observed in 23 cases (13 for the hip and 10 for the knee respectively). Treatment failure with recurrence of the infection within 2 years was observed in 26 patients (12%). Resistance to the antibiotic present in the cement was found in one third of infectious failures. The presence of a prior cemented prosthesis was significantly associated with the presence of a germ resistant to gentamicin and the persistence of the germ at the second stage. However, it was not associated with failure at two years.

Discussion: the two-stage management of PJI is associated with a non-negligible mortality rate before the second stage, rarely reported in studies. The presence of an initially cemented prosthesis is associated with the presence of germs resistant to the antibiotic contained in the cement and exposes to the persistence of the resistant germ at the second stage. Spacer fractures are observed more at the hip, but less frequently than in previous reports, while dislocations are observed at both the hip and the knee, particularly due to loss of tibial fixation in this area. These observations are all arguments for further consideration of revision surgery in 1 stage.

[FP E7] PREVALENCE AND IMPACT OF UNEXPECTED POSITIVE INTRA-OPERATIVE CULTURES IN TOTAL HIP OR KNEE REVISION SURGERY

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Aim: Our aim was to evaluate the prevalence and impact of unexpected intraoperative cultures on the outcome of total presumed aseptic knee and hip revision surgery.

Method: Data regarding patients prospectively recruited in our center, who had undergone elective complete hip and knee revision surgery from January 2000 to December 2018 with a preoperative diagnosis of aseptic loosening was retrospectively reviewed. Partial revisions were excluded from the study. The protocol of revision included at least 3 intraoperative cultures. Failure was defined as the need for re-revision due to any-cause at 5 years and/or the need for antibiotic suppressive therapy.

Results: A total of 589 cases were initially included in the study, 68 cases were excluded for having a previous revision surgery performed. 102 hip and 419 knee revision surgeries were included. 414 cases (79.5%) had all cultures negative, 82 (15.7%) a single positive culture and 24 (4.6%) had at least 2 positive cultures. Early failure was found in 7.47% of the 107 cases with unexpected positive cultures. The presence of positive cultures during total exchange was not associated with a higher failure rate than in those with negative cultures (43 of 414, 10.38%).

Conclusions: Total hip and knee revisions with unexpected positive cultures were not significantly associated with a higher re-revision risk at 5 years of follow-up.

[FP E8] UNEXPECTED POSITIVE INTRA-OPERATIVE CULTURES IN CUP REVISION OF TOTAL HIP REPLACEMENT, WHAT HAPPENS TO THE STEM?

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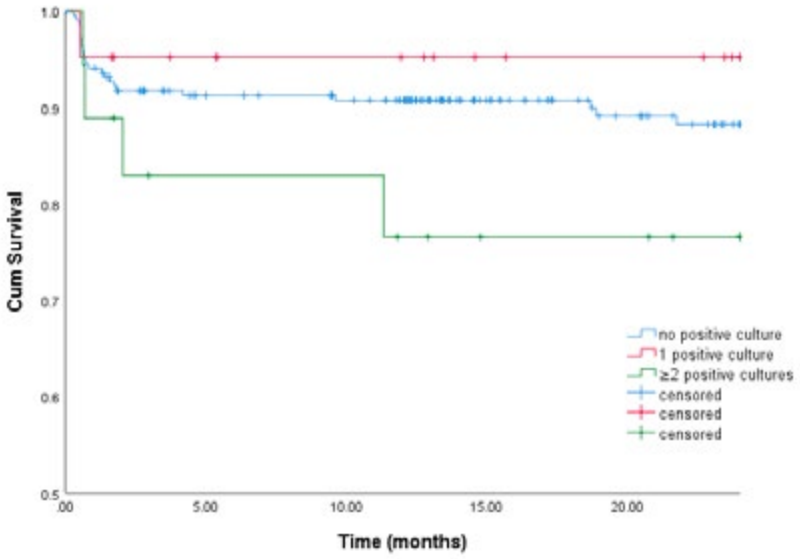
Background: A few patients undergoing a total hip replacement need a subsequent revision of the cup. In some of these cases, the treating surgeon may be confronted with Unexpected Positive Intraoperative Cultures (UPIC). The exact incidence of this finding is unclear. Moreover, it is unknown what the clinical outcome of these patients is when the stem is left in situ. The aim of our study was to describe the incidence of UPIC in patients undergoing cup revision and to determine the need for total revision in this patient group during follow-up.

Methods/design: In this retrospective multicenter cohort study, we included all consecutive patients that underwent a cup revision between 2015-2017 and had a minimal follow-up of 2 years. Patients were divided in 3 cohorts: i) no positive intra operative cultures; ii) one UPIC; iii) two or more UPIC. Cases in whom 2 or fewer cultures were obtained during cup revision were excluded from the analysis.

Results: From the 334 evaluated cases, 77 were excluded because an inadequate number of cultures were obtained. From the total of 257 included cases, the incidence of UPIC was 16% (n=39). 21 cases had one (8%), and 18 cases had two or more UPIC (7%). After two years of follow up, implant survival in the no UPIC group was 88% (95% CI 0.83 – 0.93), in the one UPIC group 95% (95% CI 0.86 – 1.0), and in the two or more UPIC group 77% (95% CI 0.57 – 0.97). Survival analysis showed no statistically significant differences between the cohorts as determined by cox regressive analysis and log rank test (P = 0.19).

Conclusion: The incidence of UPIC in patients who undergo cup revision is relatively high but does not seem to have a major influence on the need for total revision of the hip during a follow-up of 2 years.



[FP E9] UNEXPECTED POSITIVE CULTURES IN PATIENTS WITH A HISTORY OF SEPTIC REVISION IN THE SAME JOINT

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Aim: The prevalence of unexpected positive cultures (UPC) in aseptic revision surgery of the joint with a prior septic revision procedure in the same joint remain unknown. The purpose of this study was to determine the prevalence of UPC in aseptic revisions performed in patients with a previous septic revision in the same joint. As secondary outcome measure, we explore possible risk factors associated with UPC and the re-revision rates.

Method: This retrospective single-center study includes all patients between January 2016 and October 2018 with an aseptic revision total hip or knee arthroplasty procedure with a prior septic revision in the same joint. Patients with less than three microbiology samples, without joint aspiration or with aseptic revision surgery performed <3 weeks after a septic revision were excluded. UPC was defined as a single positive culture in a revision that the surgeon had classified as aseptic according to the 2018 International Consensus Meeting.

Results: A total of 139 revision total hip/knee arthroplasties in patients with a previous septic revision were performed during the study period. After excluding 47 cases with insufficient information, a total of 92 patients were recruited for final analysis. The patient cohort consist of 52 males and 40 females with a mean age of 70 years (±10.6). There were 66 (71.7%) hips and 26 (28.3%) knees. The mean time between the septic and the aseptic revision was 83 months (±89). The two main causes for the aseptic revision were aseptic loosening (n=57, 62%) followed by instability (n=21, 22.9%). We identified 11 (12%) UPC in the entire cohort, while in 3 cases there was a concordance of the germ compared to the previous septic surgery.
There were no differences for the presence of UPC between hips and knees (p=0.282), diabetes (p=0.701), immunosuppression (p= 0.252), previous one-stage or two-stages septic revision (p=0.316), or between the causes for the aseptic revision ((p=0.429). There was no correlation between the UPC and time after the septic revision (p=0.773).

Conclusions: The prevalence of UPC in this specific group was similar to those reported in the literature for aseptic revisons. More studies, regarding this patient group are necessitated to better understand and more securely interprete the results in those high-risk aseptic revisions.

[FP E10] HIGHER 1-YEAR RISK OF IMPLANT REMOVAL FOR CULTURE-POSITIVE THAN FOR CULTURE-NEGATIVE DAIRS FOLLOWING 359 PRIMARY HIP OR KNEE ARTHROPLASTIES

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Aim: To date, the value of culture results after a debridement, antibiotics and implant retention (DAIR) for early (suspected) prosthetic joint infection (PJI) as risk indicators in terms of prosthesis retention is not clear. At one year follow-up, the relative risk of prosthesis removal was determined for culture-positive and culture-negative DAIRs after primary total hip or knee arthroplasty. The secondary aim was to explore differences in patient characteristics, infection characteristics and outcomes between these two groups.

Methods: A retrospective regional registry study was performed in a group of 359 patients (positive cultures: n = 299, negative cultures n = 60) undergoing DAIR for high suspicion of early PJI in the period from 2014 to 2019. Differences in patient characteristics, deceased patients and number of subsequent DAIRs between the positive and negative DAIR groups were analyzed using independent t-tests, Mann-Whitney, Pearson's Chi-square tests and Fisher's Exact tests.

Results: Overall implant survival rate following DAIR was 89%. The relative risk for prosthesis removal was 7.4 times higher (95% confidence interval (CI) 1.0-53.1) in the positive DAIR group (37/299, 12.4%) compared to the negative DAIR group (1/60, 1.7%). The positive group had a higher body mass index (p = 0.034), rate of wound leakage of >10 days (p = 0.016) and more subsequent DAIRs (p = 0.006).

Conclusion: Since implant survival results after DAIR are favorable, the threshold to perform a DAIR procedure in early PJI should be low in order to retain the prosthesis. A DAIR procedure in case of negative cultures does not seem to have unfavorable results in terms of prosthesis retention.

[FP F1] KILLING OF A MULTISPECIES BIOFILM USING A GRAM-NEGATIVE AND GRAM-POSITIVE TARGETED ANTIBIOTIC RELEASED FROM HIGH PURITY CALCIUM SULFATE

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Aim: Multispecies biofilms are associated with difficult periprosthetic joint infections (PJI), particularly if they have different antibiotic sensitivities. We aimed to determine if we could generate and kill a multispecies biofilm consisting of a Gram negative and Gram positive pathogen ***in-vitr***o with antibiotic loaded calcium sulfate beads containing single or combination antibiotics.

Methods: To establish whether we could co-culture mixed species biofilms various combinations of ***Pseudomonas aeruginosa*** (PA), ***Enterococcus faecalis*** (EF), ***Staphylococcus aureus*** (SA) and ***Enterobacter faecalis*** (EF) were grown together on 316L stainless steel coupons and agar plates. Based on this screen we focused on PA + EF and challenged them with high purity calcium sulfate beads (Stimulan Rapid Cure) loaded with vancomycin (V), alone tobramycin (T) alone or vancomycin and tobramycin in combination (V+T). Bioluminescence, light imaging, plate count, confocal microscopy and scanning electron microscopy were used to quantify growth.

Results: On 316LSS the V loaded bead reduced both EF and PA by approximately 2 logs compared to unloaded control beads. A T alone loaded bead eliminated PA from the dual species biofilm and caused a 2-log reduction in EF. The V+T-beads reduced PA by 9-logs and EF by 8.3 logs. In terms of total CFUs V+T beads reduced the bioburden by 8.4 logs compared to V or T alone. which resulted in 2.1 and 2.6 log reductions respectively. (* P<0.05, *** P<0.001). On agar PA dominated the culture for the unloaded and V loaded beads. However, when challenged with a T loaded bead both species were able to coexist and a zone of killing was generated in both species in the multispecies biofilms. However, this zone was smaller and included more tolerant variants than the zone generated by V+T-loaded beads.

Conclusions: There were species proportion differences between biofilms grown on agar and 316LSS demonstrating the importance of growth conditions on species interactions. Antibiotics against strains with differing sensitivities can shift species interactions. High purity calcium sulfate beads containing tobramycin a broad-spectrum Gram positive and negative antibiotic vancomycin, a Gram-positive targeted antibiotic killed a larger percentage of a multispecies in an *in-vitro* biofilm than either single gram-specific antibiotic alone, demonstrating the advantage of using combination antibiotics for treating multispecies biofilms.

[FP F2] LOCAL ANTIBIOTIC USE IS NOT ASSOCIATED WITH AN INCREASE IN SPECIFIC ANTIMICROBIAL RESISTANCE AT SURGERY FOR RECURRENCE

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Aim: Local antibiotic treatment for bone and joint infections offers direct delivery of high concentrations of antibiotics with reduced systemic exposure and favourable safety profile. However, the possibility of prolonged release of antibiotics at sub-therapeutic levels creates concern about the possible development of antimicrobial resistance.

We investigated patients with recurrent bone and joint infection for evidence of antimicrobial resistance emerging from the use of local antibiotics.

Method: 125 patients with recurrent infection (prosthetic joint infection, fracture related infection and osteomyelitis) in the UK between 2007 and 2021 were identified. Electronic patient records (including operative notes, pathology results and prescriptions) were reviewed to extract site of infection, date of surgery, the use of local antibiotics, culture results, empiric and definitive antibiotic therapy. All antibiotic sensitivity results were recorded as sensitive, intermediate or resistant according to contemporary guidelines (BSAC and EUCAST).

Results: Local antibiotics were used in 74/125 (59.2%) of patients. Agents used were Gentamicin 53/125 (42.4%), Tobramycin 18/125 (14.4%), and vancomycin in 19/125 (15.2%). Combined gentamicin and vancomycin usage was seen in 16/125 patients (12.8%).

Gentamicin non-sensitivity was common in this cohort with frequent aminoglycoside use. At index procedure, a Gentamicin non-sensitive organism was cultured in 51/125 patients (40.8%). At reoperation this proportion was lower: 40/125 (32%). There was no statistically significant difference in the rate of Gentamicin resistance at reoperation comparing patients who previously received local aminoglycosides with those who had not (21/71, 29.8% vs 19/54, 35.2% p=0.6, chi-squared test).

In 48/125 (38.4%) of patients, the same species was isolated during the index and recurrence surgery. We identified 7 cases with new aminoglycoside resistance arising at the second procedure. In 2/7 – ***S. aureus*** and ***E. faecalis*** - aminoglycoside resistance was the only change in antimicrobial sensitivity. In 5/7, there were at least 2 additional changes in observed antimicrobial sensitivity. 3/74 (4%) of cases who initially received local aminoglycoside cultured organisms with aminoglycoside resistance at recurrence. 4/51 (7.8%) of those who did not receive local or systemic aminoglycoside at index surgery cultured resistant organisms (chi square 0.82; p=0.365).

Conclusions: As a group, patients whose treatment for orthopaedic infection included local antibiotics did not exhibit higher rates of specific antimicrobial resistance compared with those not treated with local antibiotics. However we did identify cases where Gram positive bacteria developed aminoglycoside resistance regardless of their initial antimicrobial therapy. This should be considered in antimicrobial choice during surgery for recurrence.

[FP F3] ANTIBIOTIC LOADED CEMENT IN TOTAL KNEE ARTHROPLASTY: ROLE IN INFECTION PREVENTION

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Aim: One of the most severe complications of primary total knee arthroplasty (TKA) is periprosthetic joint infection (PJI). Nowadays, the use of antibiotic-loaded cement for prevention of infection is still controversial. The aim of the present study is to evaluate the use of an antibiotic-loaded cement to reduce the infection rate in primary total knee arthroplasty.

Method: Prospective randomized study, with 2893 cemented total knee arthroplasties performed between 2005 and 2010 in our institution. Two different groups were formed depending on which bone cement was used, without antibiotic (the control group) or loaded with erythromycin and colistin (the study group). All patients received the same systemic prophylactic antibiotics. The patients were followed for a minimum of twelve months. The rate of infection was analyzed according to the criteria of the Centers for Disease Control and Prevention (CDC).

Results: In 1452 patients the prosthetic components were fixed using bone cement without antibiotic and in 1441 patients bone cement loaded with erythromycin and colistin was used.
There were no differences between both groups in terms of demographic data (age, sex and BMI), either in operating time (p>0,05).
The rate of infection was similar in both groups, being 2,0% (n=29) in the control group and 1,7% in the study group (p=0,58) at 8,7 years (SD 5,1) of follow up.
In terms of prosthetic revision due to any cause (infected or aseptic), there wasn't differences between groups, performing a total of 61 revision arthroplasties in control group and 68 in study group (p>0,05).
Moreover, we analyzed the erythromycin resistance rate, being no differences between both groups (p=0.6).

Conclusions: The use of erythromycin and colistin-loaded bone cement in total knee arthroplasty did not lead to a decrease in the rate of infection when systemic prophylactic antibiotics were used, a finding that suggests that its use would not be indicated in the general population.

[FP F4] ANTIBIOTIC SPACERS IN CHRONIC SHOULDER INFECTIONS: MODULAR TAILORED PREFORMED SPACER VS HAND-MADE SPACER

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Aim: Studies have shown that retention of antibiotic cement spacer in selected elderly patients with low functional demand represents a viable option for periprosthetic joint infections (PJI) treatment[1,2].
The aim of this study is to compare the efficacy in infection treating among modular taylored preformed and hand-made antibiotic spacers. Our hypothesis is that modular tailored preformed spacer provides a better rate of infection resolution, better radiological and functional outcomes compared to hand-made spacers.

Materials and methods: We identified 48 patients treated with antibiotic cement spacer for shoulder chronic infection between 2015 and 2021 in our institution; (13 hand-made spacers and 35 modular tailored preformed spacers). We collected data about comorbidities, associated microorganism, infection resolution, clinical and radiographic evaluation.

Results: The mean age at surgery was 63.2 years, (45.8% female - 54.2% male), mean BMI 28.3. The mean time of infection diagnosis after first surgery was 30 months; (31.2% infection after ORIF in proximal humeral fractures, 68.8% PJI after shoulder arthroplasty). The main pathogens were Propionibacterium Acnes (37.5%), Staphylococcus Epidermidis (29.2%), Staphylococcus Aureus (16.7%), negative intraoperative coltures (14.6%), Enterococcus (4.17%), Pseudomonas Aeruginosa (4.17%).
The mean time of antibiotic spacer retention was 18 months: 23 patients (47.9%) underwent second stage surgery for prosthesis implantation; 2 removed the spacer because of spacer dislocation, 2 died during follow up; while 21 patients still hold the antibiotic spacer (17 patients in treatment with prefabricated spacers and 4 with self-constructed spacer).
The mean value for clinical assessment for patients with modular tailored preformed spacer were: Constant Score 34 – QuickDASH 40 – SST 33 – ASES Score 66 – VAS 2. Patients treated with hand-made spacer registered the following scores: Constant Score 20 – QuickDASH 51 – SST 25 – ASES Score 38 – VAS 6. Two patients presented fracture of the spacer (one hand-made spacer and one tailored preformed).

Conclusions: According to our data patients treated with modular tailored preformed antibiotic spacer show better functional outcomes. Patients are more likely to retain the spacer as a permanent implant, avoiding the risks of a second stage surgery in those low-demanding patients, achieving a reasonable satisfying quality of shoulder motion without pain.

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[FP F5] IS GENTAMYCIN ELUTION FROM BONE COMENT INFLUENCED BY THE TIMING OF APPLICATION OF THE ANTIBIOTIC POWDER IN ARTICULATING SPACER FOR PERIPROSTHETIC JOINT INFECTIONS ?

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Aim: The aim of this study is to evaluate if the gentamycin elution from bone cement is influenced by the timing of application of the antibiotic powder.

Method: This was an experimental in vitro study that compared the elution properties of different formulation of gentamycin from a commercially available hip, knee and shoulder cement spacers. Four different experimental models were prepared. Five different spacers were prepared for each experimental mode and for each joint. We compared four different formulation of cement spacers: spacer #1, in which the spacer was prepared with a premixed bone-cement antibiotic mixture; spacer #2, in which the spacer was prepared by adding antibiotic powder to the bone cement at the time of spacer preparation; spacer #3, in which the spacer was prepared as spacer #2 but was stored for two months before starting the experiment; spacer #4, in addition to the gentamycin, other two antibiotics (tobramycin and vancomycin) were added to the bone cement. Gentamycin concentration was documented at seven intervals of time: T0 = 0h, T1 = 1h, T2 = 24h, T3 = 1W, T4 = 2W, T5 = 1M, T6 = 3M and T7 = 6M. The gentamycin elution at each interval of time was evaluated by using a T-student test.

Results: Spacer #2, in which the gentamycin powder was added to the bone cement at the time of spacer preparation showed the higher gentamycin elution at each interval of time observed. In addition, Spacer #1, in which gentamycin powder was premixed with the bone cement showed a higher gentamycin elution when compared with spacer #3, in which the spacers were stored for two months to simulate the preformed spacers. Lastly, the addition of different antibiotic to the bone cement increases the gentamycin elution from the spacers (as demonstrated by spacer #4 model).

Conclusions: a higher gentamycin elution was observed if spacer was prepared at the time of surgery when compared with preformed spacer. Lastly, our study confirmed the synergistic effect of adding one or more antibiotics with the aims to increase gentamycin elution.

Free Paper Session F

[FP F6] QUANTIFICATION OF BETA-LACTAM ANTIBIOTICS AT THE SITE OF INFECTION IN PERIPROSTHETIC JOINT INFECTION, USING ULTRA-PERFORMANCE CONVERGENCE CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY

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Aim: The current antibiotic treatment of periprosthetic joint infection (PJI) is optimized by measuring concentrations in plasma. However, it remains unclear whether effective concentrations of the antibiotics are reached at the site of PJI. Nonetheless, adequate target site concentrations are important to achieve effective eradication of the micro-organism. In order to determine the efficacy of cefuroxime and flucloxacillin in synovial fluid, synovial tissue and bone tissue in relation to the minimal inhibitory concentration (MIC) of the pathogen causing the PJI, we perform a pharmacokinetic/pharmacodynamic (PK/PD) study. Therefore, we aimed to develop validated analytical methods for analysis of cefuroxime and flucloxacillin in synovial fluid, synovial tissue and bone tissue.

Method: Blank samples of synovial fluid, synovial tissue and bone tissue were obtained by orthopedic surgeons during surgery. For validation the samples of each matrix were spiked with both cefuroxime and flucloxacillin. Synovial tissue and bone tissue was pulverized with a mikro-dismembrator. Samples were kept frozen at -20^{o}C until analysis. After a sample preparation quantification of cefuroxime and flucloxacillin in each matrix was performed on the ultra-performance convergence chromatography-tandem mass spectrometry (UPC2-MS/MS). Stable-isotope-labeled meropenem-d6 served as internal standard. The linearity, limits of quantification, accuracy and precision and carry-over were determined for all methods separately. The methods were validated according to the European Medicine Agency (EMA) and Food and Drug Administration (FDA) guidelines on bioanalytical method validation.

Results: These methods were successfully validated for cefuroxime and flucloxacillin quantification in all matrices according to the EMA and FDA guidelines. The limits of quantification were adequate to cover potential cefuroxime and flucloxacillin concentration in synovial fluid, synovial tissue and bone tissue as described in literature, with a range of 1-100mg/L for synovial fluid and 1-20 µg/g for synovial tissue and bone tissue (r >0.995). Accuracy and within-run precision were validated according to acceptance values (RSD <15%). Carry over was less than 20%. Matrix effects and recovery were investigated for synovial fluid. The results were within the range of 80-120%

Conclusions: The results of the validation fall within the limits of quantification according to the EMA and FDA guidelines. Therefore, these methods can be applied during a PK/PD study to discover the exposure of antibiotics in synovial fluid, synovial tissue and bone tissue at the site of infection in patients with a PJI.

[FP F7] ANTIBIOTIC PROPHYLAXIS AND EMPIRIC ANTIBIOTIC THERAPY IN PRIMARY ARTHROPLASTY AND PERIPROSTHETIC JOINT INFECTIONS: CURRENT PRACTICE AND NEED FOR THERAPY OPTIMIZATION

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Aim: The aim of the present work was (i) to survey the situation of healthcare regarding the use of antibiotics in orthopaedics and trauma surgery in Germany, (ii) to determine which empiric antibiotic regimens are preferred in the treatment of periprosthethic joint infections (PJI) and (iii) to evaluate the hypothetical antibiotic adequacy of the applied empirical antibiotic therapy regimens based on a patient collective of a German university hospital.

Method: A survey on empirical and prophylactic antibiotic therapy was conducted at German university and occupational health clinics (BG clinics), each in the specialties of orthopedics and trauma surgery. A total of 71 clinics were contacted by email. The questionnaire sent included open-ended questions on systemic antibiotic prophylaxis in primary hip arthroplasty; a distinction was made between hip arthroplasty due to femoral fractures and elective hip arthroplasty. In addition, the empirical antibiotic therapy used in PJIs was surveyed. To determine the success rate of prophylaxis and therapy according to sensitivity to the antibiotics applied, the survey results were compared with previously published data on antimicrobial treatment in n=81 PJI patients treated in our department between 2017 and 2020.

Results. In 93.2% (elective) and 88.6% (fracture care) of the hospitals, 1st- and 2nd-generation cephalosporins are administered perioperatively for infection prophylaxis in primary hip arthroplasty. In contrast, empiric antibiotic treatment for PJI showed a clearly inhomogeneous therapeutic picture. Monotherapy with an aminopenicillin/betalactamase inhibitor is most frequently used (38.7%); 1st- and 2nd-generation cephalosporins are second most frequently used as monotherapy (18.2%). In addition, dual combination therapies have become established, mostly aminopenicillin/betalactamase inhibitor or 1st- and 2nd-generation cephalosporins, whose administration is supplemented with another antibiotic. The most common combination in PJI is aminopenicillin/betalactamase inhibitor + vancomycin (11.4%).
The most widely used therapy (monotherapy with aminopenicillin/betalactamase inhibitor) would have covered 69.0% of PJI patients. Monotherapy with 1st- and 2nd-generation cephalosporins would have been susceptible to 57.8% of PJI patients. In contrast, a combination of vancomycin + 1st- and 2nd-generation cephalosporins would have been most effective, with an efficacy of 91.5% according to the resistograms, but this was used by only two hospitals.

Conclusions: Empirical antibiotic therapy for the treatment of PJI is applied in more than half of the clinics with a single broad-spectrum beta-lactamase inhibitor antibiotic. This discrepancy between the everyday care in the clinics and the administration of clearly more effective combination therapies underlines the need for recommendation guidelines.

[FP F8] THE NEED FOR AN EARLY THERAPEUTIC DRUG MONITORING OF VANCOMYCIN CONCETRATIONS FOR THE MANAGEMENT OF BONE AND JOINT INFECTIONS

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Aim: Vancomycin is frequently used for bone and joint infections (BJI) because of the main role of Gram-positive bacteria as potential causal agents. It is crucial to achieve optimal vancomycin plasma concentrations since the first day to maximize treatment clinical and microbiological efficacy

The aim was to describe the patients' profile that are more likely to achieve an optimal pharmacokinetic/pharmacodynamics (PK/PD) vancomycin target in the first therapeutic drug monitoring (TDM) sample.

Methods: Retrospective study (March 2018-January 2022) in a university hospital including all patients treated with vancomycin for a BJI and undergoing TDM. Initial dose (1g/8-12h) was selected by the responsible clinician. Vancomycin plasma concentrations were obtained pre-dose (Cmin,ss) and 60-minutes after the infusion on day 2 of treatment. Global exposure measured by the area under the curve of plasma concentrations during 24h (AUC024h) was estimated using a bicompartmental PK model.
An AUC024h/CMI=400-600mg*h/L was considered optimal, <400 infratherapeutic and >600 supratherapeutic, based on recent guidelines, and patients were classified into these 3 groups. A value of CMI=1 mg/L was considered, following guidelines recommendations.

Categorial data: percentages and quantitative data as mean (standard deviation).

Results: Ninety-five patients were included: 22(23.2%), 43(45.3%) and 30(31.6%) presented an infratherapeutic, optimal and supratherapeutic PKPD target, respectively. Table 1 shows comparative data.

Significant differences observed in age, body weight (BW), baseline renal function and dose/frequency of vancomycin. Dosage adjustments recommendations were made in 62(65.3%) patients: 31(32.6%) dose-increase, 29(30.5%) reduction and 2 cases(2.1%) a temporary suspension.

Table 1.

	AUC24h/ MIC<400 n=22	AUC24h/ MIC=400-600 n=43	AUC24h/ MIC>600 n=30	p
Male, n(%)	13(59.1)	25(58.1)	10(33.3)	0,075
Age, years	57.2(16.3)	63.3(15.1)	75.8(13.5)	<0.001
BW, kg	80.8(18.4)	78.1(18.1)	66.8(15.5)	0.007
Vancomycin dose, mg/kg/day	34.5(10.8)	38.7(9.4)	43.5(12.4)	0.012
Dose 1g/8h, (%)	6 (27.3)	25(58.1)	17(56.7)	0.045
Dose 1g/12h, n(%)	16 (72.7)	18(41.9)	13(43.3)	0.045
Baseline glomerular filtration eGFR (CKD-EPI) (mL/min/1.73m2)	100.0 (19.9)	94.5(17,4)	71.5(20.1)	<0.001
eGFR <90ml/min, n(%)	4 (18.2)	14(32.6)	24(80)	<0.001
Cmin,ss, mg/L	6.4 (1.9)	11.4(2.5)	19.9(5.3)	<0.001
AUC24h/CMI, mg*h/L	323.7(55.4)	497.5(56.0)	788.0(186,1)	<0.001

Conclusions: Less than 50% of patients achieved an optimal exposure of vancomycin on day 2 of treatment.

Patients with infratherapeutic levels had a younger age and a higher body weight and glomerular filtration rate. In addition, they had received a lower vancomycin initial dose. On the contrary, a potentially toxic exposure was observed within older patients with impaired baseline renal function.

These data suggest the relevance of an early vancomycin TDM for optimizing the treatment of BJI.

[FP F9] ORAL ANTIBIOTICS TO TREAT STAPHYLOCOCCAL INFECTIONS AFTER REMOVAL OF INFECTED ORTHOPAEDIC METALWORK

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Aim: There is a lack of data supporting the use of doxycycline as a single agent after the removal of infected orthopaedic metalwork. We evaluated the efficacy and safety of doxycycline compared with other single antibiotic regimens used at our tertiary orthopaedic hospital.

Methods: A retrospective observational study including all adult patients diagnosed with an orthopaedic metalwork infection due to staphylococci. All patients were managed with the removal of metalwork and multiple intraoperative samples sent for culture, followed by administration of at least six weeks of oral antibiotics. Antibiotic selection was on the recommendation of an infection consultant.
Infection outcome was assessed as the proportion of infection-free patients at follow-up. The probability of infection-free survival for the doxycycline and other antibiotic groups was estimated using the Kaplan-Meier survival method. All adverse drug reactions (ADR) during treatment were analysed.

Results: We currently have data for 41 patients, but we anticipate more.
41 orthopaedic metalwork infections were identified between July 2017 and July 2019. The types of orthopaedic metalwork were prosthetic joints (n=38) and ankle fusions (n=3). In 21 cases the infecting organism was ***Staphylococcus aureus*** and 20 were due to coagulase-negative staphylococci. 24 were treated with doxycycline 100mg 12 hourly and 17 were treated with other antibiotics (flucloxacillin 1g 6-hourly n=9, clindamycin 450mg 6-hourly n=7 and co-trimoxazole 960mg 12-hourly n=1). Overall, 35 patients (85.4%) were infection-free after a median follow-up of 39 months (IQR, 16.1 – 60.7). 20 (83.3%) were infection-free in the doxycycline group compared with 15 (88.2%) in patients treated with other antibiotics. Of the failures in the other antibiotic group 1 received clindamycin and 1 flucloxacillin.
4 patients experienced an ADR: 1 rash and 1 diarrhoea both due to clindamycin; 2 nausea both due to doxycycline. Only 1 patient with a rash (due to clindamycin) required discontinuation of therapy.

Conclusions: In our cohort of patients, doxycycline monotherapy was an effective and well-tolerated oral option for the treatment of staphylococcal infection following debridement and removal of orthopaedic metalwork.

[FP F10] COMPARATIVE ANALYSIS OF THE ANTIBIOFILM EFFECT OF DIFFERENT BAG-S53P4 FORMULATIONS ALONE AND IN COMBINATION WITH VANCOMYCIN

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Aim: The rise of multidrug-resistant bacteria and the decreasing efficacy of antibiotic therapy in successfully treating biofilm-associated infections are prompting the exploration of alternative treatment options. This study investigates the efficacy of different bioactive glass (BAG) formulations - alone or combined with vancomycin - to eradicate biofilm. Further, we study the influence of BAG on pH and osmotic pressure as important factors limiting bacterial growth.

Method: Different BAG-S53P4 formulations were used for this study, including (a) BAG-powder (<45 µm), (b) BAG-granules (500-800 µm), (c) a cone-shaped BAG-scaffold and (d) two kinds of BAG-putty containing granules, with no powder (putty-A) or with additional powder (putty-B), and a synthetic binder. Inert glass beads were included as control. All formulations were tested in a concentration of 1750 g/ml in Müller-Hinton-Broth. Targeted bacteria included methicillin-resistant ***Staphylococcus aureus*** (MRSA) and ***epidermidis*** (MRSE). Vancomycin was tested at the minimum-inhibitory-concentration for each strain (1 µg/ml for MRSA; 2 µg/ml for MRSE).
To investigate the antibiofilm effect of BAG alone or combined with vancomycin, 3 hour-old MRSA or MRSE biofilms were formed on porous glass beads and exposed to BAG ± vancomycin for 24h, 72h and 168h. After co-incubation, biofilm-beads were deep-washed in phosphate-buffered saline and placed in glass vials containing fresh medium. Recovering biofilm bacteria were detected by measuring growth-related heat production at 37°C for 24h by isothermal microcalorimetry.
Changes in pH and osmotic pressure over time were assessed after co-incubation of each BAG formulation in Müller-Hinton-Broth for 0h, 24h, 72h and 168h.

Results: All BAG formulations showed antibiofilm activity against MRSA and MRSE in a time-dependent manner, where longer incubation times revealed higher antibiofilm activity. BAG-powder and BAG-putty-B were the most effective formulations suppressing biofilm, followed by BAG-granules, BAG-scaffold and finally BAG-putty-A. The addition of vancomycin had no substantial impact on biofilm suppression.
An increase in pH and osmotic pressure over time could be observed for all BAG formulations. BAG-powder reached the highest pH value of 12.5, whereas BAG-putty-A resulted in the lowest pH of 9. Both BAG-putty formulations displayed the greatest increase on osmotic pressure.

Conclusions: BAG-S53P4 has demonstrated efficient biofilm suppression against MRSA and MRSE, especially in powder-containing formulations. Our data indicates no additional antibiofilm improvement with addition of vancomycin. Moreover, high pH appears to have a larger antimicrobial impact than high osmolarity.

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[FP S1] INCIDENCE AND RISK FACTORS OF ACUTE INFECTION AFTER INSTRUMENTED THORACOLUMBAR FUSION. A CASE-CONTROL STUDY

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Aim: Acute post-surgical infection is one of the most serious complications after instrumented thoracolumbar fusion with an incidence of 0.7%-12%. Acute infection can lead to an increase in morbidity, mortality, and economic costs for the healthcare system.
The main objective of our study was to determine the variables associated with a higher risk of acute infection after thoracolumbar instrumentation in our center.

Methods: We conducted an observational case-control study including instrumented fusions of the thoracolumbar spine performed between 2015 and 2021 at our institution. We included patients with thoracolumbar fusions after a fracture or for the treatment of degenerative pathology.
We analyzed demographic variables related to the surgical procedure, the causative microorganism of infection, the outcome of infection treatment, and complications.
We performed a descriptive analysis of all variables and a univariate comparison of cases and controls. The dichotomous variables were compared using the Fisher test, while the quantitative variables were compared using the Student's T-test. A p-value of <0.05 is taken into account to consider the statistical significance. SPSS v25 Windows program was used for statistical analyses.

Results: 455 patients were included, 53% were male with a mean age of 60 years. 35% of patients had a BMI (Body Mass Index) >30, 21.1% were classified as ASA (American Society of Anesthesiologists) >3, 15.8% were diabetic, and 2.6% were under chronic corticosteroid treatment. In 34.1% of the fusions, the procedure lasted more than 3 hours.
We identified 26 post-surgical acute infections (5.7%).
Patients with an infection had a higher prevalence of diabetes (14.7% vs 34.6% p=0.012), chronic corticosteroid treatment (2.1% vs 11.5% p=0.026), and a higher percentage of surgeries with duration > 3 hours (32.4% vs. 61.1%, p=0.019)
A trend towards significance was also observed in patients classified as ASA >3 (20.3% vs. 34.6%, p=0.088), and BMI >30 (33.8% vs. 53.8%, p=0.054).
No significant differences were observed in the rest of the variables studied.
The most frequent causative microorganism was ***S.epidermidis*** (38%), followed by ***S.aureus*** (34%) and polymicrobial infections (34%).

Conclusions: There is a significant increase in infection in diabetic patients, patients with chronic corticosteroid treatment, and in surgeries lasting > 3 hours.

[FP S2] SPONDYLODISCITIS IN CHILDREN: A RETROSPECTIVE STUDY

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Aim: To provide new data on pediatrics spondylodiscitis (PSD) for an optimal clinical management of this site-specific osteomyelitis.

Method: We retrospectively reviewed 48 cases of PSD. The diagnosis was both clinical and radiological (with or without a microbiological positivity). We reported demographic, clinical, and laboratory variables and searched for significant differences between patients with tubercular and non-tubercular spondylodiscitis and patients aged more or less than 5 years. Moreover, we compared these PSD cases with a cohort of 62 matched controls with non-vertebral osteomyelitis.

Results: In our case series, PSD accounted for 15% of all cases of pediatric osteomyelitis admitted during the study period. Most patients were older than 5 years, but we did not find significant differences in their clinical presentation and risk for sequelae compared to younger patients. Out of the 48 patients in our sample, 6 had a tuberculous PSD (tPSD); compared to non-tuberculous PSD, this subgroup showed an older age of onset and higher: rates of sequelae, positive microbiological findings, total antibiotic therapy duration, length of hospitalization. Compared to non-vertebral osteomyelitis, we found that PSD affects younger children, usually presenting with afebrile back pain, and requiring longer time to admission, hospitalization, and antibiotic therapy duration. None of the independent variables significantly predicted the length of hospitalization and sequelae in our logistic regression; in particular, the choice and duration of the antibiotic therapy did not prove to negatively correlate with the onset of sequelae.

Conclusions: PSD is a rare and insidious disease, whose diagnosis and treatment is often delayed, due to a non-specific presentation in childhood. The tubercular etiology is associated with higher rates of sequelae, probably due to the lack of signs and symptoms at presentation and, consequently, to delayed clinical suspicion and start of therapy. Although the current management of PSD is based on adult data and the experience of the treating clinicians, the outcome is still favorable in children who are treated aggressively with a broad-spectrum or targeted antibiotic therapy. However, it appears that prolonging the therapy after clinical remission does not improve the outcome.

[FP S3] CHANGES OF THE MICROBIOLOGICAL SPECTRUM AND ANTIBIOTIC RESISTANCE PATTERN IN POSTOPERATIVE SPINAL IMPLANT INFECTIONS WITH MULTIPLE CULTURE-POSITIVE REVISION SURGERIES

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Aim: In severe cases of postoperative spinal implant infections (PSII) multiple revision surgeries may be needed. Little is known if changes of the microbiological spectrum and antibiotic resistance pattern occur between revision surgeries. Therefore, the aim of this study was to analyze the microbiological spectrum and antibiotic resistance pattern in patients with multiple revision surgeries for the treatment of PSII. Furthermore, changes of the microbiological spectrum, distribution of mono vs. polymicrobial infections, and changes of the antimicrobial resistance profile in persistent microorganisms were evaluated.

Method: A retrospective analysis of a prospectively maintained single center spine infection database was performed with a minimum follow-up of 3 years. Between 01/2011 and 12/2018, 103 patients underwent 248 revision surgeries for the treatment of PSII. Overall, 20 patients (6 male/14 female) underwent 82 revisions for PSII (median 3; range 2-12). There were 55/82 (67.1%) procedures with a positive microbiological result. Microbiological analysis was performed on tissue and implant sonication fluid. Changes in microbial spectrum and antibiotic resistance pattern between surgeries were evaluated using Chi-Square and Fisher's exact test.

Results: In total, 74 microorganisms (83.3% gram-positive; 10.8% gram-negative) were identified. The most common microorganisms were Staphylococcus epidermidis (18.9%) and Cutibacterium acnes (18.9%). All S. epidermidis identified were methicillin-resistant (MRSE). Overall, there were 15/55 (27.3%) polymicrobial infections. The microbiological spectrum changed in 57.1% (20/35) between the revision stages over the entire PSII period. In 42.9% (15/35) the microorganism persisted between the revision surgeries stages. Overall, changes of the antibiotic resistance pattern were seen in 17.4% (8/46) of the detected microorganisms comparing index revision and all subsequent re-revisions. Moreover, higher resistance rates were found for moxifloxacin and for ciprofloxacin at first re-revision surgery compared with index PSII revision. Resistances against vancomycin increased from 4.5% (1/23) at index PSII revision to 7.7% (2/26) at first re-revision surgery.

Conclusions: Changes of the microbiological spectrum and the resistance pattern can occur in patients with severe PSII who require multiple revision surgeries. It is important to consider these findings in the antimicrobial treatment of PSII. The microbiological analysis of intraoperative tissue samples should be performed at every revision procedure for PSI.

[FP G2] DOES RECURRENCE OF BONE AND JOINT INFECTION AFFECT QUALITY OF LIFE IN THE FIRST YEAR AFTER SURGERY?

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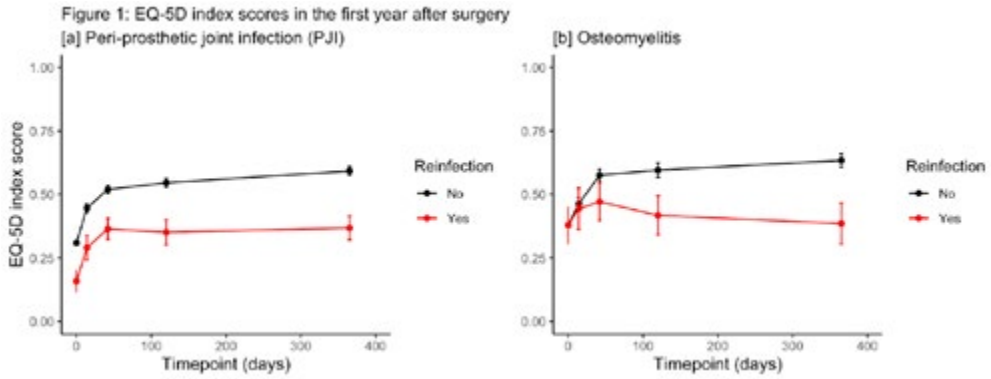
Aim: To assess whether recurrence of PJI and osteomyelitis impacts patient-reported quality of life (QoL).

Method: We studied patients receiving surgical treatment for confirmed PJI or osteomyelitis in one of 26 centres in the UK. Patients completed the EQ-5D-3L questionnaire, directly after surgery, at day 14, day 42, day 120 and day 365 after surgery and were assessed for evidence of recurrence.
Results: Of 621 patients with PJI, 99 had recurrent infection (15.9%). Patients with recurrence reported significantly lower QoL at one year after surgery compared to those without recurrence (EQ-5D-3L index score with recurrence: 0.368, SD0.344 vs. no recurrence: 0.592, SD0.315, p<0.001, figure 1a). Patients were grouped based on the timing of their recurrence: <42 days (n=27); 42-120 (n=28); or >120 days (n=44) post-surgery. At the time-point immediately preceding the diagnosis of recurrence, QoL was significantly lower than in corresponding patients without recurrence (recurrence <42 days, p<0.05; 42-120 days, p<0.001; >120 days, p<0.05).

In 358 cases of osteomyelitis, 39 patients had recurrent infection (10.9%). Recurrence of osteomyelitis produced significantly lower QoL at one year after surgery compared to patients without recurrent infection (EQ-5D-3L for recurrence: 0.385, SD0.345 vs. no recurrence: 0.634, SD0.349, p<0.001, figure 1b). Patients with recurrence after 120 days (n=21) reported significantly lower QoL than those with no recurrence at the time-point immediately preceding the diagnosis of recurrence (p<0.01). In contrast to patients with PJI, patients with osteomyelitis who had recurrence diagnosed before 120 days (n=18) reported similar outcome scores to patients who did not have recurrence.

Conclusion: Failure to eradicate infection greatly affects patient QoL. This study supports the monitoring of EQ-5D-3L among patients treated for bone and joint infections; patients with poorer QoL at follow up should prompt a low threshold for investigation to assess whether recurrence or continued infection is the underlying cause.

Figure 1: EQ-5D index scores in the first year after surgery



[FP G3] SIGNIFICANT DIFFERENCE IN ANTIMICROBIAL RESISTANCE OF BACTERIA IN SEPTIC REVISION BETWEEN TOTAL KNEE ARTHROPLASTY AND TOTAL HIP ARTHROPLASTY

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Aim: Antimicrobial resistance (AMR) aggravates an already difficult treatment of periprosthetic joint infections (PJI). The prevalence of drug-resistant pathogens varies across countries and increases over time. Regular monitoring of bacteriological analyses should be performed. Due to many factors influencing the AMR, the correct choice of antimicrobial management remains arguable. The primary purpose of this retrospective study was to identify and compare causative bacteria and to compare the incidence of antibiotic resistance between the septic revision total knee arthroplasty (TKA) and septic revision total hip arthroplasty (THA).

Method: A review of all revision TKAs and revision THAs, undertaken between 2007 and 2020 in a tertiary referral centre, was performed. Included were cases meeting the consensus criteria for PJI, in which an organism has been identified. There were no major differences in tissue sampling between revision TKAs and revision THAs over time.

Results: A total of 228 bacterial strains, isolated after revision TKA and THA, were analysed for their resistance to 20 different antibiotics. There was a statistically significant higher occurrence of Gram-negative bacteria (p=0.002) and Enterococcus species (p=0.026) identified after revision THAs compared to TKA.
The comparison of antibiotic resistance between revision TKAs and revision THAs was statistically significant in 9 of 20 analysed antibiotics. Pathogens isolated after revision THA were much more resistant compared to pathogens isolated after revision TKA. Resistance in revision THAs was significantly higher to oxacillin (p=0.03), ciprofloxacin (p<0.001), levofloxacin (p<0.001), moxifloxacin (p=0.005), clindamycin (p<0.001), co-trimoxazole (p<0.001), imipenem (p=0.01), rifampicin (p=0.005) and tetracycline (p=0.009). There was no significantly higher resistance of pathogens isolated after revision TKAs detected. No statistically significant difference in antibiotic resistance of Gram-negative bacteria between revision TKA and revision THA was observed.

Conclusions: The occurrence and the resistance of bacteria to antibiotics differs significantly between revision TKAs and revision THAs. This has implications on of the choice of empirical antibiotic in revision surgery as well as prophylactic antibiotic in primary surgery, depending on the joint that is to be replaced.

[FP G4] MICROBIOLOGY OF RECURRENT BONE AND JOINT INFECTIONS DEMONSTRATES BOTH MICROBIAL PERSISTENCE AND REPLACEMENT

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Aim: We reviewed a cohort of individuals with recurrent orthopaedic infection to describe the relative rates of microbial persistence vs re-infection at recurrence surgery.

Method: A cohort of 125 individuals with recurrent infection (prosthetic joint infection, fracture-related infection and osteomyelitis) from two centres in the UK between 2007 and 2021. Electronic patient records were reviewed to identify culture results from surgical samples at index surgery and the next operation for recurrent infection. Antibiotic sensitivity results were recorded as sensitive, intermediate or resistant according to contemporary sensitivity testing guidelines.

Results: Among patients with recurrent infection, 78/125 (62.4%) were male, with a median age 64 years (IQR 51-73y). 76 had prosthetic joint infection, and 49 had fracture related infection or osteomyelitis. Culture results at index procedure showed the most frequently isolated species were Staphylococci (Table 1). A single species was isolated in 75/125 (60%) and mixed species in 36/125 (28.8%). No organisms were cultured in 14/125 (11.2%).
At re-operation 48/125 (38.4%) individuals had an organism from the same species or group as at the index operation. In 49/125 (39.2%), none of the organisms isolated at re-operation were grown at first operation. In 28/125 (22.4%), re-operative cultures yielded no growth.
For each species isolated at the index procedure, the proportion with the same, different or no organisms isolated at the next procedure were reviewed (Table 1). Staphylococci (including S. aureus and coagulase-negative staphylococci) and Pseudomonas species showed the highest rate of persistence at the species level. Among coagulase-negative staphylococci, changes in antimicrobial sensitivity that make it unclear if these infections were truly persistent, or represented re-infection.

Conclusions: Infection with different organisms was seen at similar rates (39.2% vs 38.4%) to persistent infection with the same species in this cohort. ***Staphylococcus aureus*** is the organism most likely to be persistently identified in recurrent infections.

Organism/group found in culture at first operation	N	Same organism/group at recurrence N (%)	Same species and similar antibiogram N (%)	Different species at recurrence N (%)	Culture negative at recurrence N (%)
Staphylococcus aureus	41	19 (46.3)	17 (41.5)	14 (34.1)	8 (19.5)
Staphylococcus epidermidis	19	8 (42.1)	4 (21.1)	4 (21.1)	7 (36.8)
Staphylococcus lugdunensis	4	0	0	2 (50.0)	2 (50.0)
Other CoNS	16	8 (50.0)	4 (25.0)	5 (31.3)	3 (18.8)
Enterobacterales*	24	10 (41.7)	3 (12.5)	10 (41.7)	4 (16.7)
Enterococcus sp	19	3 (15.8)	1 (5.3)	13 (68.4)	3 (15.8)
Streptococcus sp	11	1 (9.1)	1 (9.1)	9 (81.8)	1 (9.1)
Pseudomonas sp	8	4 (50.0)	3 (37.5)	4 (50.0)	0
Diphtheroid	6	0		6 (100)	0
Anaerobic bacteria	4	1 (25.0)	0	1 (25.0)	2 (50.0)
Candida sp	1	0	0	1 (100)	0
No growth	14	n/a	n/a	11 (78.6)	3 (21.4)

Table 1: summary of organisms found at index procedure for infection and next operation for infection. Conserved antibiogram: up to 2 different results in antibiotic sensitivity testing. Other CoNS = Coagulase negative staphylococci, not otherwise speciated; Enterobacterales = genera of this family including *E. coli*, *Klebsiella* species, *Enterobacter* species, *Proteus* species; Diphtheroid = *Corynebacterium* species, *Cutibacterium* species.

[FP G5] IMMUNOMODULATORY AND ANTIBACTERIAL PROPERTIES OF HOST DEFENSE PEPTIDES AGAINST STAPHYLOCOCCUS AUREUS

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Aim: In the current study we aim to characterize the use of cationic host defense peptides (HDPs) as alternative antibacterial agents to include into novel antibacterial coatings for orthopedic implants.
Staphyloccous aureus represent one the most challenging cause of infections to treat by traditional antibacterial therapies. Thanks to their lack of microbial resistance described so far, HDPs represent an attractive therapeutic alternative to antibiotics. Furthermore, HDPs have been showed to control infections via a dual function: direct antimicrobial activity and regulation of immune response. However, HDPs functions characterization and comparison is controversial, as changing test conditions or cell type used might yield different effects from the same peptide. Therefore, before moving towards the development of HDP-based coatings, we need to characterize and compare the immunomodulatory and antibacterial functions under the same conditions in vitro of 3 well-known cathelicidins: human LL-37, chicken CATH-2, and bovine-derived IDR-1018.

Method: *S. aureus*, strain SH1000, was incubated with different concentrations of each HDP and bacterial growth was monitored overnight. Primary human monocytes were isolated from buffy coats using Ficoll-Paque density and CD14 microbeads and differentiated for 7 days to macrophages. After 24h incubation in presence of LPS and HDPs, macrophages cytokines production was measured by ELISA. Macrophages cultured for 24h in presence of HDPs were infected with serum-opsonized ***S. aureus***. 30 min and 24h after infection, bacterial phagocytosis and intracellular killing by macrophages were measured by flow cytometry and colony forming units (CFU) count respectively.

Results: All HDPs efficiently inhibit macrophages LPS-mediated activation, as observed by a reduced production of TNF-α and IL-10. Despite a comparable anti-inflammatory action, only CATH-2 shows direct antibacterial properties at concentrations 10-times lower than those needed to stimulate immune cells. Although stimulation with HDPs fails to improve macrophages' ability to kill intracellular ***S. aureus***, IDR-1018 decreases the proportion of cells phagocytosing bacteria.

Conclusions: In addition to a strong anti-inflammatory effect provided by all HDPs tested, CATH-2 has direct antibacterial effects while IDR-1018 reduces the proportion of macrophages infected by *S. aureus*. Use of these HDPs in combination with each other or with other conventional antibacterial agents could lead the way to the design of novel antibacterial coatings for orthopedic implants.

[FP G6] COMPARATIVE PHENOTYPIC AND GENOMIC FEATURES OF STAPHYLOCOCCI FROM SONICATION FLUID OF ORTHOPEDIC IMPLANT-ASSOCIATED INFECTIONS WITH POOR OUTCOME

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Ai*m: S. aureus* and ***S. epidermidis*** remain the leading biofilm-forming agents causing orthopedic implant-associated infections (OIAI), but other coagulase-negative ***Staphylococcus*** (CoNS) with clinical importance is emerging. Besides, few studies have assessed specific genomic traits associated with patient outcome. This is a preliminary descriptive study of phenotypic and genomic features identified in clinical isolates of ***S. aureus*** and CoNS isolates recovered from OIAIs patients that progressed to treatment failure.

Methods: Ten isolates were identified by matrix-time-of-flight laser-assisted desorption mass spectrometry (MALDI-TOF-MS) and tested for antibiotic susceptibility and biofilm formation. Genotypic characteristics, including, MLST (Multi Locus Sequence Typing), ***SCCmec typing,*** virulence and resistance genes were assessed by whole-genome sequencing (WGS) that was performed on an Illumina HiSeq 2500 platform. Bioinformatics analyzes were performed using CGE, PATRIC, VFDB, CARD RGI, SnapGene, BLAST, and PubMLST. ***S. aureus*** (215, 260 and 371) isolates belonged to CC5 (ST5 and ST105, spa type t002) and carried ***SCCmec*** type I (1B), II (2A) and V(5C2), respectively.

Results: They carried multiple resistance genes, with all resistant to methicillin (MRSA), and harboured ***mecA***, ***blaZ. S. aureus*** 215 and 371 carried ***ermA*** gene and multiple genes for aminoglycosides resistance including ***aph(***3')***-III, ant(***9***)-Ia,*** and ***ant(4)-Ib***, and for quinolones. ***S. aureus*** 260 also carried resistance genes for tetracycline, quinolones and trimethoprim (***dfrC***). All MRSA were strong biofilm producers harboring the complete ***ica***ADBC and ***ica***R operon, and also carried multiple adhesion and toxin-related virulence genes. Seven CoNS isolates comprising five species (***S. epidermidis***, ***S. haemolyticus***, ***S. sciuri***, ***S. capitis*** and ***S. lugdunensis***) were analyzed, with ***mecA gene*** detection in five isolates. ***S. haemolitycus*** (95) and ***S. lugdunensis*** were unable to form biofilm and did not harbor the complete ***icaADBCR*** operon. ***S. epidermidis*** (216, 403) and ***S. haemolyticus*** (53,95) isolates belonged to the ST2/CC2, ST183, ST9 and ST3, respectively. High variability of adhesion genes was detected, with ***atl***, ***ebp***, ***ica***ADBC ***operon*** and ***IS***256 being the most common.

Conclusions: In conclusion, this study provides insights into the phenotypic and genomic analysis of ***Staphylococci*** allowing elucidation of MRSA and CoNS specific features that are associated with treatment failure in OIAIs, including genes associated with biofilm production, and resistance to β-lactam and aminoglycosides.

[FP G7] HOST FACTORS THAT PREDICT RECURRENCE IN SURGICALLY-TREATED ORTHOPAEDIC INFECTIONS

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Aim: Recurrence of bone and joint infection, despite appropriate therapy, is well recognised and stimulates ongoing interest in identifying host factors that predict infection recurrence. Clinical prediction models exist for those treated with DAIR, but to date no models with a low risk of bias predict orthopaedic infection recurrence for people with surgically excised infection and removed metalwork. The aims of this study were to construct and internally validate a risk prediction model for infection recurrence at 12 months, and to identify factors that predict recurrence. Predictive factors must be easy to check in pre-operative assessment and relevant across patient groups.

Methods: Four prospectively-collected datasets including 1173 participants treated in European centres between 2003 and 2021, followed up to 12 months after surgery for orthopaedic infections, were included in logistic regression modelling [1-3]. The definition of infection recurrence was identical and ascertained separately from baseline factors in three contributing cohorts. Eight predictive factors were investigated following ***a priori*** sample size calculation: age, gender, BMI, ASA score, the number of prior operations, immunosuppressive medication, glycosylated haemoglobin (HbA1c), and smoking. Missing data, including systematically missing predictors, were imputed using Multiple Imputation by Chained Equations. Weekly alcohol intake was not included in modelling due to low inter-observer reliability (mean reported intake 12 units per week, 95% CI for mean inter-rater error -16.0 to +15.4 units per week).

Results: Participants were 64% male, with a median age of 60 years (range 18-95). 86% of participants had lower limb orthopaedic infections. 732 participants were treated for osteomyelitis, including FRI, and 432 for PJI. 16% of participants experienced treatment failure by 12 months. The full prediction model had moderate apparent discrimination: AUROC (C statistic) 0.67, Brier score 0.13, and reasonable apparent calibration. Of the predictors of interest, associations with failure were seen with prior operations at the same anatomical site (odds ratio for failure 1.51 for each additional prior surgery; 95% CI 1.02 to 2.22, p=0.06), and the current use of immunosuppressive medications (odds ratio for failure 2.94; 95% CI 0.89 to 9.77, p=0.08).

Conclusions: This association between number of prior surgeries and treatment failure supports the urgent need to streamline referral pathways for people with orthopaedic infection to specialist multidisciplinary units.

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[FP H1] TREATMENT OF IMPLANT-ASSOCIATED OSTEOMYELITIS WITH INJECTABLE IN SITU-FORMING DEPOT DRUG DELIVERY SYSTEM

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Aim: Several local antibiotic-eluting drug delivery systems have been developed to treat bacterial bone infections. However, available systems have significant shortcomings, including suboptimal drug-release profiles with a burst followed by subtherapeutic release, which may lead to treatment failure and selection for drug resistance.
Here, we present a novel injectable, biocompatible, ***in situ***-forming depot, termed CarboCells, which can be fine-tuned for the desired antibiotic-release profile. The CarboCell technology has flexible injection properties that allow surgeons to accurately place antibiotic-eluting depots within and surrounding infectious sites in soft tissue and bones. The CarboCell technology is furthermore compatible with clinical image-guided injection technologies.
These studies aimed to determine the therapeutic potential of CarboCell formulations for treatment of implant-associated osteomyelitis by mono- and dual antimicrobial therapy.

Methods: The solubility and stability of several antibiotics were determined in various CarboCell formulations, and ***in vitro*** drug release was characterized. Lead candidates for antimicrobial therapy were selected using a modified semi-solid biofilm model with 4-day-matured ***Staphylococcus aureus*** biofilm (osteomyelitis-isolate, strain S54F9). Efficacy was investigated in a rat implant-associated osteomyelitis model established in the femoral bone by intraosseous implantation of a stainless-steel pin with 4-day-old ***in vitro***-matured ***S. aureus*** biofilm. CarboCells were injected subcutaneously at the femur, and antimicrobial efficacy was evaluated 7 days post-implantation. Lead formulations were subsequently tested in a well-established translational implant-associated tibial ***S. aureus*** osteomyelitis pig model. Infection was established for 7 days before revision surgery consisting of debridement, washing, implantation of a new stainless-steel pin, and injection of antibiotic-releasing CarboCells into the debrided cavity and in the surrounding bone- and soft-tissue. Seven days post-revision, pigs were euthanized, and samples were collected for microbial and histopathological evaluation.

Results: Lead antimicrobial agents were soluble in high concentrations and were stable in CarboCell formulations. Three combinations completely eradicated bacteria in the ***in vitro*** semi-solid biofilm model. In the rat osteomyelitis model, CarboCell formulations of the lead combinations also eradicated bacteria in bone and implant in several rats and significantly reduced infection in all treated rats. In the pig model, CarboCell antimicrobial monotherapy demonstrated promising therapeutic efficacy, including complete eradication of infection in bone and implants in several pigs and significantly reduced bacterial burden in others.

Conclusions: Using the CarboCell technology for antimicrobial delivery exert substantial loco-regional efficacy. The attractive sustained high-dose antibiotic release profile combined with the flexible injection technology allows surgeons to accurately place effective drug-eluting depots in key areas not accessible to competing technologies.

[FP H2] MANAGEMENT OF HAND AND WRIST OSTEOMYELITIS

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Aim: There are no definitive criteria for the definition of osteomyelitis in the hand and wrist and published case series are small. It remains a relatively uncommon, but difficult to treat problem. We present a series of 30 cases from 2016 to 2021 from a tertiary referral centre. We propose that the principles of thorough surgical debridement, dead space management, skeletal stabilisation and culture driven antibiotic therapy are the key to management of osteomyelitis in the hand and wrist. In addition, we show how these basic principles can be used for both fuctional and aesthetic impact for the wrist and digits with illustrated cases.

Methods: We conducted a retrospective chart review over a 6 year period and recorded the site of the infection, the soft tissue and bony management, whether antibiotic eluting bone filler was used, the isolated bacterial species, the number of surgical procedures undertaken to treat the infection and the success rate for clearing the infection.

Results: 17/30 cases had pre-existing metalwork in-situ. There were 19 phalangeal/metacarpal infections and 11 carpal infections. 24 patients had native joint involvement. A drug eluting bone void filler was used in 23/30 cases in order to manage the dead space. In 7/30 cases had polymicrobial organisms isolated, 15/30 had only one organism cultured. The most common organism cultured was Staphylococcus aureus. Complete resolution of osteomyelitis or joint infection was achieved in 29/30 cases with follow up ranging from six months to six years. 2/30 cases required thorough debridement of the distal phalanx; bone void filler provided an aesthetically optimal result to improve fingertip contour whilst managing the dead space.

Conclusion: Osteomyelitis of the hand and wrist is optimally managed with thorough surgical debridement, dead space management with a drug eluting bone void filler, skeletal stabilisation and culture directed antibiotic therapy. In addition, the bone void filler provides pulp support and improves the aesthetic contour of fingertips in which distal phalangeal osteomyelitis was successfully treated

[FP H3] ULTRASTRUCTURAL ANALYSIS OF MITOCHONDRIA FROM OSTEOBLASTS AND OSTEOCYTES FROM PATIENTS WITH OSTEOMYELITIS

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Aim: Osteomyelitis is a difficult-to-treat disease with high chronification rates. The surgical amputation of the afflicted limb sometimes remains as the patients' last resort. Several studies suggest an increase in mitochondrial fission as a possible contributor to the accumulation of intracellular reactive oxygen species and thereby to cell death of infectious bone cells. The aim of this study is to analyze the ultrastructural impact of bacterial infection and its accompanying microenvironmental tissue hypoxia on osteocytic and osteoblastic mitochondria.

Method: 19 Human bone tissue samples from patients with osteomyelitis were visualized via light microscopy and transmission electron microscopy. Osteoblasts, osteocytes and their respective mitochondria were histomorphometrically analyzed. The results were compared to the control group of 5 non-infectious human bone tissue samples.

Results: The results depicted swollen hydropic mitochondria including depleted cristae and a decrease in matrix density in the infectious samples as a common finding in both cell types (Figure 1). Furthermore, perinuclear clustering of mitochondria could also be observed regularly. Additionally, increases in relative mitochondrial area and number could be found as a sign for increased mitochondrial fission.

Conclusions: The results show that mitochondrial morphology is altered during osteomyelitis in a comparable way to mitochondria from hypoxic tissues. This suggests that manipulation of mitochondrial dynamics in a way of inhibiting mitochondrial fission may improve bone cell survival and exploit bone cells regenerative potential to aid in the treatment of osteomyelitis.

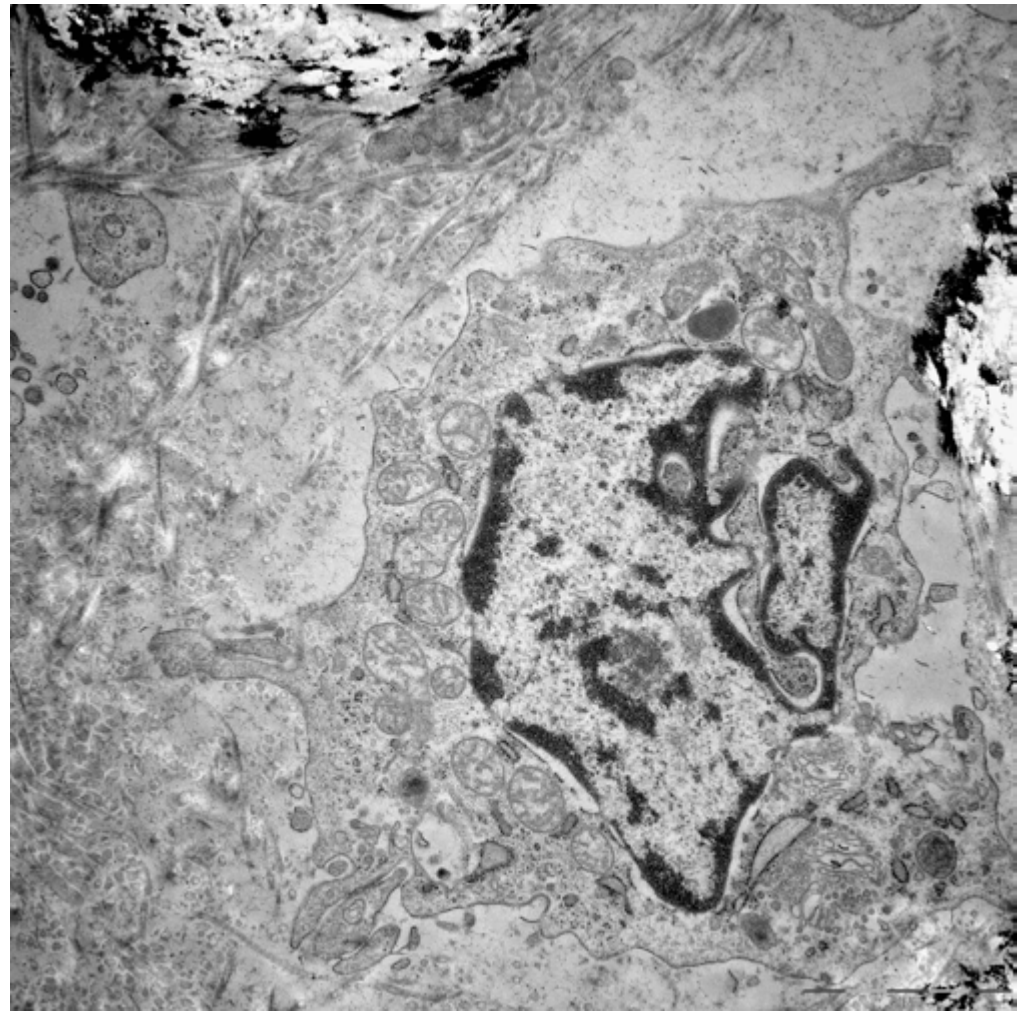

Figure 1: Transmission electron microscopic image of osteocyte from patient with osteomyelitis. Swollen hydropic mitochondria (examples indicated by black arrows) including depleted cristae and decreased matrix density (magnification x 5000)

[FP H4] HAEMATOGENOUS OSTEOMYELITIS WITH BURKHOLDERIA PSEUDOMALLEI: A SINGLE CENTRE RETROSPECTIVE OBSERVATIONAL STUD

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Aim: Melioidosis is a significant public health problem in endemic regions such as India. Lack of awareness, predominant empiric antibiotic use reducing culture yields, morphotypic variability of cultures and frequent misidentification by automated blood culture systems, pose myriad challenges in diagnosis and treatment. Through this series, we present our experience of Hematogenous Osteomyelitis with ***Burkholderia pseudomallei***.

Method: This was a single centre, retrospective, observational study performed at a tertiary case hospital in Mumbai, India from June 2011 to June 2021.

Results: The study comprised of 7 cases (6:1, M: F). Mean age was 53.7 years (5 to 75). All had an underlying co- morbidity or were immunosuppressed. 3 patients were misidentified by automated systems prior to presentation (***e coli, burkholderia cepacieae, acinetobacter***). Most common site of infection was femur (n= 3), followed by tibia and foot and ankle (n= 2, each). One had disseminated meliodosis involving the spleen, lymph nodes, pulmonary) in addition to involvement of bilateral feet and ankles. ***B. pseudomallei*** was identified in all following surgical debridement at our institute. Each patient underwent mean 2 procedures. 3 needed local rotation flap surgeries for wound cover. All were treated with ceftazidime along with trimethoprim- sulfamethoxazole (TMP-SMX) during the 6 week induction phase. TMP- SMX was continued for a further 6 months in the consolidation phase. All patients had infection remission at a mean 19.3 months follow up. There were no mortalities in our series.

Conclusions: Clinically ***Burkholderia*** infections mimic other pyogenic infections, Gram-negative sepsis, tuberculosis and has been referred to as the ‘‘remarkable imitator’’ and the ‘‘mimicker of maladies’’. Diabetes and alcoholism are risk factors. The need for diagnosing this entity is due to the fact that the septicemic form has a mortality rate that exceeds 90%. Melioidosis is frequently misidentified. A high clinical suspicion, communication with microbiologist, knowledge about the biochemical, cultural and phenotypic susceptibility patterns may help in optimising diagnosis. Adequate debridement coupled with targeted prolonged antibiotics help achieve good outcomes.

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Acknowledgements: None

[FP H5] SURGICAL RELATED INFECTIONS IN FOOT AND ANKLE SURGERY: A TREATMENT ALGORITHM

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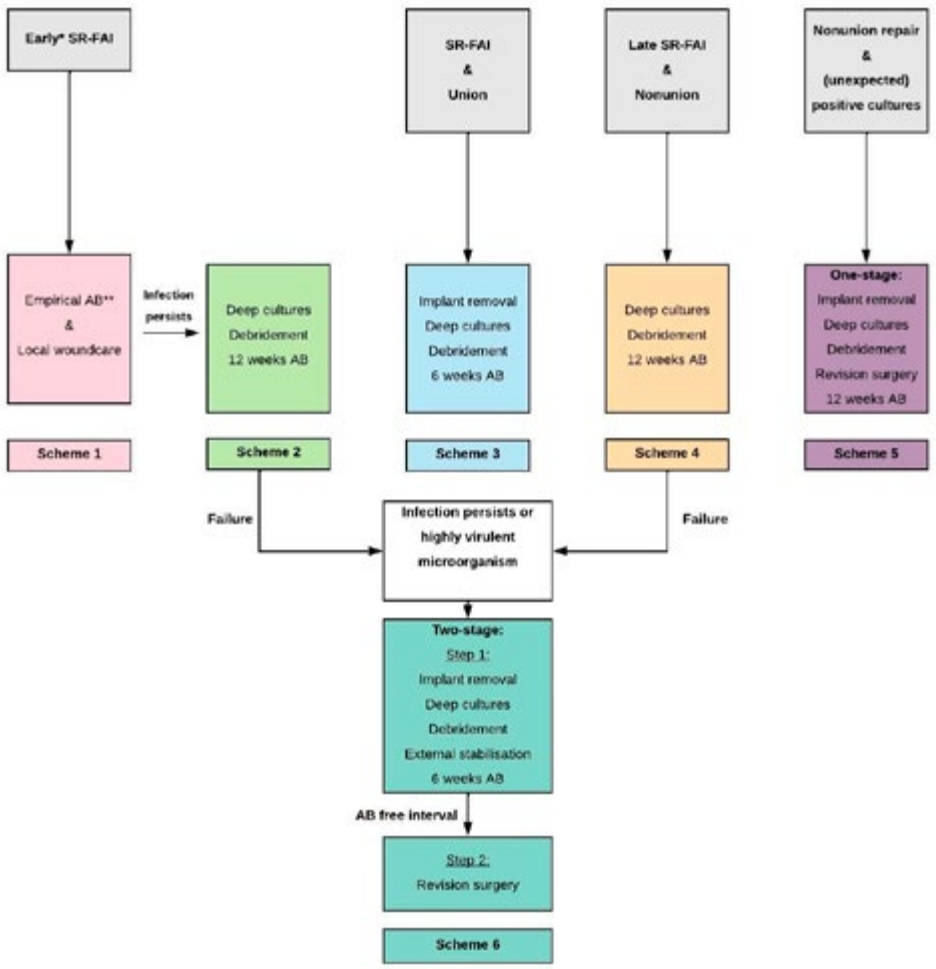
Aim: Treatment recommendations for periprosthetic joint infections (PJI) include surgical debridement, antibiotic therapy or staged revision. In surgical related foot and ankle infections (SR-FAI), implant removal will lead to instability. Debridement is difficult because the implant is outside the joint. Recommendations regarding PJI treatment can therefore not be extrapolated to the treatment of SR-FAI.

Method: We searched PubMed for the etiology and treatment of SR-FAI, taken into account the time of occurrence, causative microorganisms and surgical treatment options. We integrated this knowledge into a treatment algorithm for SR-FAI.

Results: Within the first 6 weeks after surgery, it is difficult to distinguish acute osteomyelitis from surgical site infection in which infection is limited to the soft tissue. The predominantly causative microorganism is Staphylococcus aureus. No debridement can be performed, because of the diffuse soft tissue inflammation and the absence of a joint space. If early SR- FAI is suspected without signs of systemic symptoms, fistula or abscess, empirical antibiotic treatment covering Staphylococcus aureus is recommended. If there is suspicion of ongoing SR-FAI after 2 weeks of empirical treatment, samples for culture after an antibiotic free window should be obtained to identify the causative microorganisms. If SR-FAI is confirmed, but there is no consolidation yet, targeted antibiotic treatment is given for 12 weeks without initial implant removal. In all other cases, debridement and samples for culture should be obtained after an antibiotic free window. Staged revision surgery will be performed if there is still a nonunion. (Figure)

Conclusions: Treatment algorithm regarding PJI cannot be extrapolated to the treatment of SR-FAI. Until now, no treatment guideline for SR-FAI is available. We have introduced a treatment algorithm for the treatment of SR-FAI. The guideline will be validated during the next 2 years.



Flowchart for treatment of surgical related foot and ankle infections

SR-FAI: surgical related foot ankle infection
AB free interval: 2 weeks
* **Early:** < 6 weeks
**** Empirical therapy:**

- First choice Clindamycin 600 mg oral, 3 times daily (based on local etiology and resistance rate)
- Second choice Flucloxacillin 500 mg oral, 4 times daily (based on local etiology and resistance rate)

[FP H6] FDG PET/MRI FOR CHRONIC OSTEOMYELITIS

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Aim: Magnetic resonance imaging (MRI) and 2-[^{18}F]-fluoro-2-deoxy-D-glucose (^{18}F-FDG) Positron Emission Tomography, paired with Computed Tomography (PET/CT) are two indicated advanced imaging modalities in the complicated diagnostic work-up of osteomyelitis. PET/MRI is a relatively novel hybrid modality with suggested applications in musculoskeletal infection imaging. The goal of this study was to assess the value of hybrid ^{18}F-FDG PET/MRI for chronic osteomyelitis diagnosis and surgical planning.

Method: Five suspected chronic osteomyelitis patients underwent a prospective ^{18}F-FDG single-injection/dual-imaging protocol with hybrid PET/CT and hybrid PET/MR. Diagnosis and relevant clinical features for the surgeon planning treatment were compared. Subsequently, 36 patients with ^{18}F-FDG PET/MRI scans for suspected osteomyelitis were analysed retrospectively. Sensitivity, specificity, and accuracy were determined with the clinical assessment as the ground truth. Standardized uptake values (SUV) were measured and analysed by means of receiver operating characteristics (ROC).

Results: The consensus diagnosis was identical for PET/CT and PET/MRI in the prospective cases, with PET/CT missing one clinical feature. The retrospective analysis yielded a sensitivity, specificity, and accuracy of 78%, 100%, and 86% respectively. Area under the ROC curve was .736, .755, and.769 for the SUVmax, target to background ratio, and SUVmax_ratio respectively. These results are in the same range and not statistically different compared to diagnostic value for ^{18}F-FDG PET/CT imaging of osteomyelitis in literature.

Conclusions: Based on our qualitative comparison, reduced radiation dose, and the diagnostic value that was found, the authors propose ^{18}F-FDG PET/MRI as an alternative to ^{18}F-FDG PET/CT in osteomyelitis diagnosis, if available.

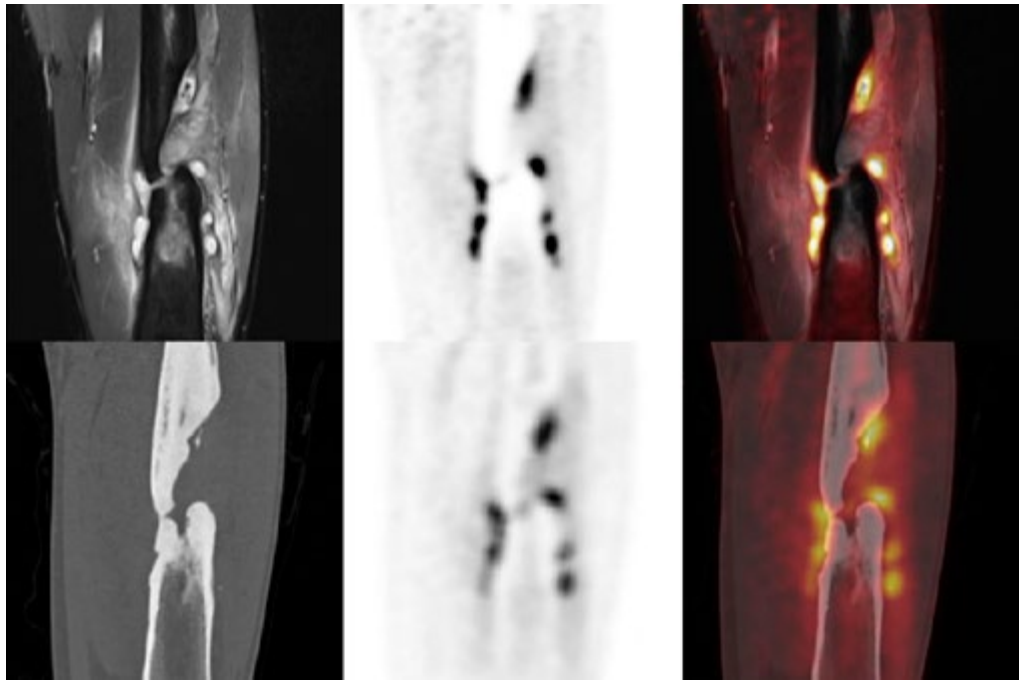

Figure 1. Images from a chronic osteomyelitis patient that received unsuccessful debridement treatment of the affected femur five years ago. Top row, left to right: T2 weighted MRI, ^{18}F-FDG PET component of PET/MRI, hybrid PET/MRI overlay. Bottom, from left to right: CT, ^{18}F-FDG PET component of PET/CT, hybrid PET/CT overlay.

[FP I1] INCREASING RISK OF REVISION DUE TO INFECTION AFTER TOTAL HIP ARTHROPLASTY IN THE NORDIC COUNTRIES

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Aim: Previous publications have suggested that the incidence of revisions due to infection after THA is increasing. We performed updated time-trend analyses of risk and timing of revision due to infection after primary THAs in the Nordic countries during the period 2004-2018.

Methods: 569,463 primary THAs reported to the Nordic Arthroplasty Register Association from 2004 through 2018 were studied. We estimated adjusted hazard ratios (aHR) with 95% confidence interval by Cox regression with the first revision due to infection after primary THA as endpoint. The risk of revision was investigated. In addition, we explored changes in the time span from primary THA to revision due to infection.

Results: 5,653 (1.0%) were revised due to infection. The risk of revision due to infection increased through the study period. Compared to the period 2004-2008, the aHRs were 1.4 (95%CI 1.3-1.5) for 2009-2013, and 1.9 (1.7-2.0) for 2014-2018. We found an increased risk in all four Nordic countries.
Compared to 2004-2008, the aHR due to infection 0-30 days after THA was 2.5 (2.1-2.9) for 2009-2013 and 3.4 (3.0-3.9) for 2013-2018. The aHR of revision due to infection 31-90 days after THA was 1.5 (1.3-1.9) for 2009-2013 and 2.5 (2.1-3.0) for 2013-2018, compared to 2004-2008. Beyond 91 days after THA, the risk of revision due to infection was stable over the whole study period.

Interpretation: The risk of revision due to deep infection after THA nearly doubled throughout the period 2004-2018. This increase was mainly due to an increased risk of early revisions. The cause for these changes may be multifactorial (patient selection, diagnostics, revision strategy, completeness of reporting, etc.), are not possible to disclose in the present study, and warrants further research.

[FP I2] RISK FOR REVISION AND ANTIBIOTIC LOADED CEMENT USE IN HIP AND KNEE (REVISION) ARTHROPLASTY BASED ON DUTCH REGISTRY DATA (2007-2020).

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Aim: Aim was to compare revision rates when using single versus dual antibiotic loaded cement (ABLC) in hip fracture arthroplasty and aseptic revision hip or knee arthroplasty using data from the Dutch national joint registry (LROI).

Methods: All primary cemented (hemi-)arthroplasties for acute hip fractures and cemented aseptic hip or knee revision arthroplasties, were incorporated in 3 datasets. All registered implants between 2007 and 2018 were included (minimum 2 years follow-up). Primary end-point was subsequent revision rates for infection and for any reason in the single and dual ABLC groups.
Cumulative crude incidence of revision was calculated using competing risk analysis.

Results: A total of 22,308 hip fracture arthroplasties, 2,529 hip revision and 7,124 knee revision arthroplasties were registered and analyzed in the study period. The majority of hip fracture patients (97.1%) was treated with single ABLC. For hip and knee revision arthroplasties dual ABLC was used in 33.8% and 25.7%.
The revision rate for infection in the fracture arthroplasty group was not different between groups (0.5% versus 0.8%, p=0.27). The re-revision rate following hip or knee revision based on single versus dual ABLC was not different between groups (3.2% versus 2.8%, p=0.82 for hip revision and 1.8% versus 2.5%, p=0.36 for knee revision). In addition, the re-revision rate for any reason was not different in all three datasets.
The crude cumulative revision and re-revision rates for any reason based on single ABLC versus dual ABLC showed no differences in all three datasets.
The crude cumulative 7-year re-revision rate for any reason following revision THA with Gentamicin ABLC use was 11.8%, with Gentamicin + Clindamycin ABLC use 13.1% and with Erythromycin + Colistin ABLC use 14.8% (ns). The crude cumulative 9-year re-revision rate for any reason following revision TKA with Gentamicin ABLC use was 17.7% and with Gentamicin + Clindamycin ABLC use 16.5% (ns).

Conclusions: In conclusion, we could not show a difference in revision rate for hip fracture arthroplasty or re-revision rates for revision hip- or knee arthroplasty with the use of dual ABLC compared to single ABLC bone cement, with 7and 9 year follow up. The low percentage of dual ABLC in hip fracture arthroplasties in our registry do not enable us to make a reliable estimation of the added value in this patient category.
The results of this study do not confirm the potential benefit of dual ABLC use in revision cases

[FP I3] A SERIES OF 100 CONSECUTIVE DAIR PROCEDURES IN PRIMARY TOTAL KNEE AND HIP ARTHROPLASTY INFECTION: SINGLE CENTRE OUTCOME REPORT

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Aim: Debridement, antibiotics and implant retention (DAIR) are considered as an optimal curative treatment option for prosthetic joint infection (PJI) when the biofilm is still immature and radical debridement is achievable. There are two main groups of patients suitable for DAIR. Those with an early acute PJI and patients with acute hematogenous PJI. However, there is also a third group of early PJI resulting from a wound healing problem or leaking hematoma. These may be either high or low grade depending on the microorganisms that infected the artificial joint "***per continuitatem***".

Methods: We retrospectively analysed 100 successive DAIR procedures on prosthetic hip and knee joints performed between January 2010 and January 2022, from total of 21000 primary arthroplasties implanted within the same time period. We only included PJI in primary total replacements with no previous surgeries on the affected joint. Patients data (demographics, biochemical, microbiological, histopathological results, and outcomes) were collected from hospital bone and joint infection registry. The aim of surgery was radical debridement and the mobile parts exchange. The standardized antibiotic regime based on antibiofilm antibiotics.

Results: The mean age of patients was 70 years (60% women, 43 hips, 57 knees) with a mean follow-up of 3 years. 45 cases were early acute or related to wound healing problems, 55 were hematogenous PJI. 25 patients received preoperative antibiotics. 6 of these were culture negative. The mean symptom duration was 7 days. Mean age of the prosthesis was 30 days for early, and 1064 days for the hematogenous group. Detailed microbiological and outcome data are in Table 1.

Conclusions: In our cohort the success rate of DAIR is 94% which indicates that the protocol is highly successful in PJI with short-lasting symptoms and "debridable" joints. Antibiotic protocol violation and duration of symptoms may have a role in failures.

Table 1. Results of microbiological diagnostics; * – 3 of them were incompliant to the prescribed antibiotic regime, 2 of them finished with antibiotics preterm without any reason, and 1 of them due to liver problems, ** – all of microbiological culture negative patients were cured with DAIR procedure at last follow-up, *** – 2 of them P. aeruginosa

Clinical outcome at last follow-up	n
cured	85
microbiological failure	6*
new PJI	5
mechanical failure	4
Outcome of microbiological investigation	**n**
culture negative	11**
Staphylococci	31
Streptococci	32
Gram-negative bacteria	9***
mixed bacteria culture	14
Listeria monocytogenes	1
Corynebacterium spp.	1
Cutibacterium spp.	1

[FP I4] HIGH MORTALITY RATE AND POOR OUTCOME AFTER DEBRIDEMENT AND IMPLANT RETENTION FOR ACUTE HEMATOGENOUS PERIPROSTHETIC JOINT INFECTION: A RETROSPECTIVE COHORT STUDY

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Aim: Acute hematogenous periprosthetic joint infection (AHI) is a diagnosis on the rise. The management is challenging and the optimum treatment is not clearly defined. The purpose of this study was to evaluate the characteristics of AHI, and to study risk factors affecting treatment outcome.

Methods: We retrospectively analysed 44 consecutive episodes with AHI in a total hip or knee arthroplasty beween 2013 and 2020 at a single center. AHI was defined as abrupt symptoms of infection ≥ 3 months after implantation in an otherwise well functioning arthroplasty. We used the Delphi criteria to define treatment failure with a minimum of 1-year follow-up.

Results: AIH was most often caused by ***Staphylococcus aureus*** (36%) and streptococcal species (32%), but a broad spectrum of microbes were identified. The majority of patients (25/44) were treated with debridement and retention of the implant (DAIR), with a success rate of 40%, significantly lower than in patients treated with removal of the implant (94%, p=0.001). ***Staph aureus*** infections (p=0.004), knee arthroplasties (p=0.03), and implant-age < 2 years (p=0.034) were associated with treatment failure. The 2-year mortality rate was 19%.

Conclusions: The main findings in this study were that outcome following DAIR in AHIs is poor, that the majority of infections were caused by virulent microbes, and we found a high mortality rate. Removal of the implant should more often be considered.

[FP I5] MANAGEMENT OF HIP AND KNEE PROSTHESIS JOINT INFECTION (PJI) DUE TO S. AUREUS BY THE "DEBRIDEMENT ANTIBIOTICS AND IMPLANT RETENTION" (DAIR) PROCEDURE IN FRENCH REFERENCE CENTERS (CRIOACS) IN 2019: A RETROSPECTIVE COHORT STUDY

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[10]*Pherecydes Pharma*

Aim: To describe the management of PJI due to ***S. aureus*** in CRIOAcs in 2019 and to particularly focus on the evaluation of the efficacy of DAIR regarding control of infection and risk factors for failure up to 12 months.

Method: Thirteen CRIOAcs were selected to participate to the study. Data concerning the management of all the PJI in the year 2019 were retrospectively collected and registered in eCRFs. Inclusion criteria were: ≥ 18 years old patients with ***S. aureus*** ± other bacteria (in per surgical procedure sample); knee or hip PJI and with clinical signs of infection. Patients treated with bacteriophages were excluded. All eligible patients were notified by an information letter. Patients treated by the DAIR procedure were selected, and rate of control of infection (no inflammatory local signs or no new surgical procedure or no ***S. aureus*** in case of puncture) was analyzed using Kaplan Meier method and risk factors for failure at 12 months were assessed using Cox regression model.

Results: A total of 978 PJI were managed in the 9 CRIOAcs**,** including 238 hip and knee PJI due to ***S. aureus*** and 79 to ***S. aureus*** plus another bacteria. Among all of them, 154 were managed with DAIR, and 100 fulfilled inclusion criteria, notifying no opposition to their data collection. The median age was 73.0 years; 57% were male, the median Charlson score was 4.0; 66% had hip PJI. A total of 45 failure were observed during the period studied. At 12 months, the control rate was 58. 7% [36.5-75.4], 49.3% [34.3-62.7] in in early and late PJI respectively according to Tsukuyama classification and 49.6% [30.5-66.1], 54.1% [37.7 – 68.0] in early and delayed/late PJI respectively according to Zimmerli classification, 56.6% [39.5-70.5] in case of mobile part exchange**,** 53.4% [35.3-68.5] for MRSA PJI and 63.4% [50.5-73. 8] in patients treated with rifampicin. No rifampicin intake was the only significative risk factor for failure in univariate analysis (HR=0.31 (0.17-0.57), p=0.0002), and remained significant after adjustment on Charlson score (aHR=0.34 (0.18-0.64), p=0.0008).

Conclusions: The DAIR procedure is frequently performed in patients with acute and late PJI, and is associated with a high rate of failure, especially for patients who cannot receive rifampin. There is a strong rational to assess the use of bacteriophages during the DAIR, as bacteriophages have antibiofilm activity ***in vitro***, and could improve the efficacy of the DAIR to control the disease.

[FP I6] GOOD FUNCTIONAL OUTCOMES AND HIGH CURE RATE AFTER ACUTE HEMATOGENOUS INFECTION FOLLOWING TOTAL KNEE ARTHROPLASTY AT LONG TERM FOLLOW UP

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Aim: The gold standard treatment for late acute hematogenous (LAH) periprosthetic joint infection (PJI) is surgical debridement, antibiotics and implant retention (DAIR). However, this strategy is still controversial in the case of total knee arthroplasty (TKA) as some studies report a higher failure rate. The aim of the present study is to report the functional outcomes and cure rate of LAH PJI following TKA treated by means of DAIR at a long-term follow-up.

Method: A consecutive prospective cohort consisting of 2,498 TKA procedures was followed for a minimum of 10 years (implanted between 2005 and 2009). The diagnosis of PJI and classification into LAH was done in accordance with the Zimmerli criteria (NEJM 2004). The primary outcome was the failure rate, defined as death before the end of antibiotic treatment, a further surgical intervention for treatment of infection was needed and life-long antibiotic treatment or chronic infection. The Knee Society Score (KSS) was used to evaluate clinical outcomes. Surgical management, antibiotic treatment, the source of infection (primary focus) and the microorganisms isolated were also assessed.

Results: Among the 2,498 TKA procedures, 10 patients were diagnosed with acute hematogenous PJI during the study period (0.4%). All those 10 patients were operated by means of DAIR, which of course included the polyethylene exchange. They were performed by a knee surgeon and/or PJI surgeon. The failure rate was 0% at the 8.5 years (SD, 2.4) follow-up mark.
The elapsed time between primary total knee replacement surgery and the DAIR intervention was 4.7 years (SD, 3.6). DAIR was performed at 2.75 days (SD 1.8) of the onset of symptoms. The most common infecting organism was ***S. aureus*** (30%) and E. coli (30%). There were 2 infections caused by coagulase-negative staphylococci and 2 culture-negative PJI. All culture-positive PJI microorganisms were susceptible to anti-biofilm antibiotics.
The source of infection was identified in only 3 cases. The mean duration of antibiotic treatment was 11.4 weeks (SD 1.9).
The postoperative clinical outcomes were excellent, with a mean KSS of 84.1 points (SD, 14.6).

Conclusions: Although the literature suggests that TKA DAIR for acute hematogenous periprosthetic joint infection is associated with high rates of failure, the results presented here suggest a high cure rate with good functional outcomes. Some explanations for this disparity in results may be the correct diagnosis of LHA, not misdiagnosing acute chronic PJI, and a thorough debridement by surgeons specialized in PJI.

[FP I7] ETIOLOGY AND RISK FACTORS OF METACHRONOUS PERIPROSTHETIC JOINT INFECTION

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Aims: Despite numerous studies on periprosthetic joint infections (PJI), there are no robust data on the risk factors and timing of metachronous infections. This study was performed to answer the following questions: 1) Is there any difference of manifestation time of metachronous PJIs between different localizations of multiple artificial joints? 2) Can we identify any specific risk factor for metachronous PJIs for different localizations of multiple artificial joints?

Methods: Between January 2010 and December 2018, 661 patients with more than one prosthetic joint at the time of PJI surgical treatment were recruited. Seventy-one developed metachronous PJI after a mean time interval of 101.4 months (range 37.5 to 161.5 months). The remaining patients were chosen as control group. The diagnosis of the PJI, including the metachronous PJI, was made according to the Muscoloskeletal Infection Society (MSIS) criteria. The metachronous infections were divided in group 1: metachronous infections in the same extremity (e.g. right hip and right knee); group 2: metachronous infections of the other extremity (e.g. right knee and left hip); group 3: metachronous infections of the lower extremity and upper extremity (e.g. right knee and left shoulder).

Results: We identified 32 PJI cases in group 1, 38 in group 2 and 1 in group 3. Diabetes mellitus was found higher in the metachronous infections ($p<0.05$). Rate of same side infection was significantly higher compared to contralateral and upper and lower infection ($p<0.05$). Time interval of metachrononous infection development was faster in same-side infections. Same bacteria sample rate between primary PJI and metachronous PJI in same side infections (21/32) was significantly higher than in the contralateral PJI group (13/38, $p<0.05$).

Conclusions: The current study underlined that the risk of metachronous infections are relatively high, particularly in the cases of prostheses on the same side.

[FP J1] MUSCLE-ONLY VERSUS CHIMERIC MUSCULOCUTANEOUS GASTROCNEMIUS FLAP IN COMPLEX ORTHOPLASTIC RECONSTRUCTION AROUND THE KNEE: A RETROSPECTIVE MULTICENTRE OUTCOME STUDY

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Aim: In the context of total knee arthroplasty (TKA), trauma with perigenicular fracture fixation or oncological surgical treatment, soft tissue defects can expose critical structures such as the extensor apparatus, the knee joint, bone or implants. This work compares soft tissue reconstruction (STR) between a classical pedicled gastrocnemius (GC) muscle flap and a pedicled chimeric sural artery perforator (SAP) musculocutaneous GC flap in complex orthoplastic scenarios.

Method: A retrospective study was conducted on prospectively maintained databases in three University Hospitals from January 2016 to February 2021 after orthopaedic, traumatological or oncological treatment. All patients with a perigenicular soft tissue defect and implant-associated infection were included undergoing STR either with a pedicled GC flap or with a pedicled chimeric SAP-GC flap. The outcome analysis included successful STR and flap related complications. The surgical timing, preoperative planning and surgical technique are discussed together with the postoperative rehabilitation protocol.

Results: 43 patients were included (22 GC muscle flaps, 21 SAP-GC musculocutaneous flaps). The GC and SAP-GC patient group were comparable in terms of age, comorbidities, defect size and follow-up. The incidence of flap related complications was comparable among the two groups. Specifically, in the SAP-GC group 1 wound dehiscence at the recipient site occurred as well as 1 distal muscle flap necrosis, 1 distal skin flap necrosis, 1 donor site infection and 1 donor site wound dehiscence. Furthermore, the donor site was closed in 9 patients while a skin graft was used in 12 patients. A significant difference was recorded with regard to re-raising the flap for further orthopaedic treatment: In the SAP-CG group (re-raise in 11 patients) no problems occurred while in the GC group (re-raise in 14 patients) in 6 patients the soft tissue did not heal completely.

Conclusions: According to our clinical experience, the pedicled chimeric SAP-CG musculocutaneous flap is a relevant further development of the classical GC workhorse flap for perigenicular STR, in multiple staged procedures.

[FP J2] DAIR AND FLAP

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Background: Acute soft tissue defects (wound dehiscence or necrosis) after a total knee arthroplasty (TKA) may be the cause of the devasting complication of deep infection. When a medium (4-6cm) defect is present, in patellar or infra-patellar localization, a medial hemi-gastrocnemius flap is widely used to cover it, because of its low morbidity and high functional results. Normally, this coverage is not associated to a debridement, antibiotics and implant retention surgery (DAIR).
When facing this situation, we should consider associating to the coverage treatment, like muscle flap, a DAIR procedure, in order to treat the possible acute infection, even when the diagnosis of infection is not clear. We could not find any studies comparing the benefice of this association in the same surgical act to isolated treatment of soft tissue defects.
Our hypothesis was that when a TKA surgical wound defect is present, the risk of an acute infection is elevated and the patient would benefit from a muscle flap with DAIR procedure and polyethylene exchange.

Methods: We performed a retrospective study to compare TKA infection clearance in patients with DAIR and flap in the same surgical act against those who received an isolated flap procedure for soft tissue coverage after an acute surgical wound defect. Patients were identified from a prospectively collated TKA database.
Between 2005 and 2021, 19 patients met our inclusion criteria. A medial hemi-gastrocnemius flap was performed in 15 patients (78%).
Healing or TKA infection clearance was defined as the presence of the original prosthesis after soft tissue coverage intervention, no need of DAIR after soft tissue coverage or no suppressive antibiotic treatment.

Results: We obtained two groups. The first one, included those patients who had received the association of DAIR with polyethylene exchange and Flap (n=12). The other group included those who had received an isolated flap (n=7). We did not find differences in comorbidities and risk factors between both groups.
In the combination treatment group 66,6% patients healed after treatment. In the other group, these favourable results decrease to 42,9%. Even though results were better in the combination treatment group, no significant differences were found.

Conclusion: Although no significant statistical differences were found, probably due to small sample, the association of DAIR with polyethylene exchange and muscle flap is recommended in the coverage over an acute dehiscence or necrosis after TKA. More studies, with bigger sample are needed to extrapolate results in general population.

[FP J3] PRESSURE-ULCER RELATED PELVIC OSTEOMYELITIS: SURVEY OF ORTHOPAEDIC MANAGEMENT

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Aim: Pelvic osteomyelitis following pressure ulceration results in substantial patient morbidity. Previous studies have reported a heterogenous approach to diagnosis and medical management by physicians, suggesting equipoise on key clinical questions. This study hypothesised that the same equipoise exists amongst Orthopaedic surgeons.

Method: An 18-question multiple-choice questionnaire was designed through an iterative feedback process until the final version was agreed by all authors. Likert-type scale responses were used with graded responses (***e.g.***, never/fewer than half of patients/around half of patients/more than half of patients/every patient). The online survey was sent to members of the Musculoskeletal Infection Society (MSIS), the European Bone and Joint Infection Society (EBJIS), and the ESCMID Study Group for Implant-Associated Infections (ESGIAI). No incentive for participation was provided.

Results: Amongst respondents, 22/41 were based in Europe and 10/41 from the USA. The majority (29/41) had been in clinical practice between 5—24 years. There was a high priority placed on bone biopsy histology, culture-positive bone sampling, and palpable bone without periosteal covering for diagnosis (Figure A). Multidisciplinary team approach with plastic surgery involvement at the index procedure was advocated (Figure B). The strongest indications for surgical intervention were source control for sepsis, presence of an abscess/collection, and prevention of local osteomyelitis progression (Figure C). Physiological/psychological optimisation and control of acute infection were the primary determinants of surgical timing (Figure D). There was low utilisation of adjunctive surgical therapies (Figure E). Local/regional primary tissue transfer or secondary healing with/without VAC were the preferred techniques for wound closure (Figure F). Recurrent osteomyelitis was the most common reason for prolonged antimicrobial therapy. The majority received bedside advice from an infectious disease-specialist but a quarter of respondents preferred telephone advice.

Conclusions: Amongst an international cohort of Orthopaedic Surgeons there was a heterogenous diagnostic and therapeutic approach to pressure-related pelvic osteomyelitis.

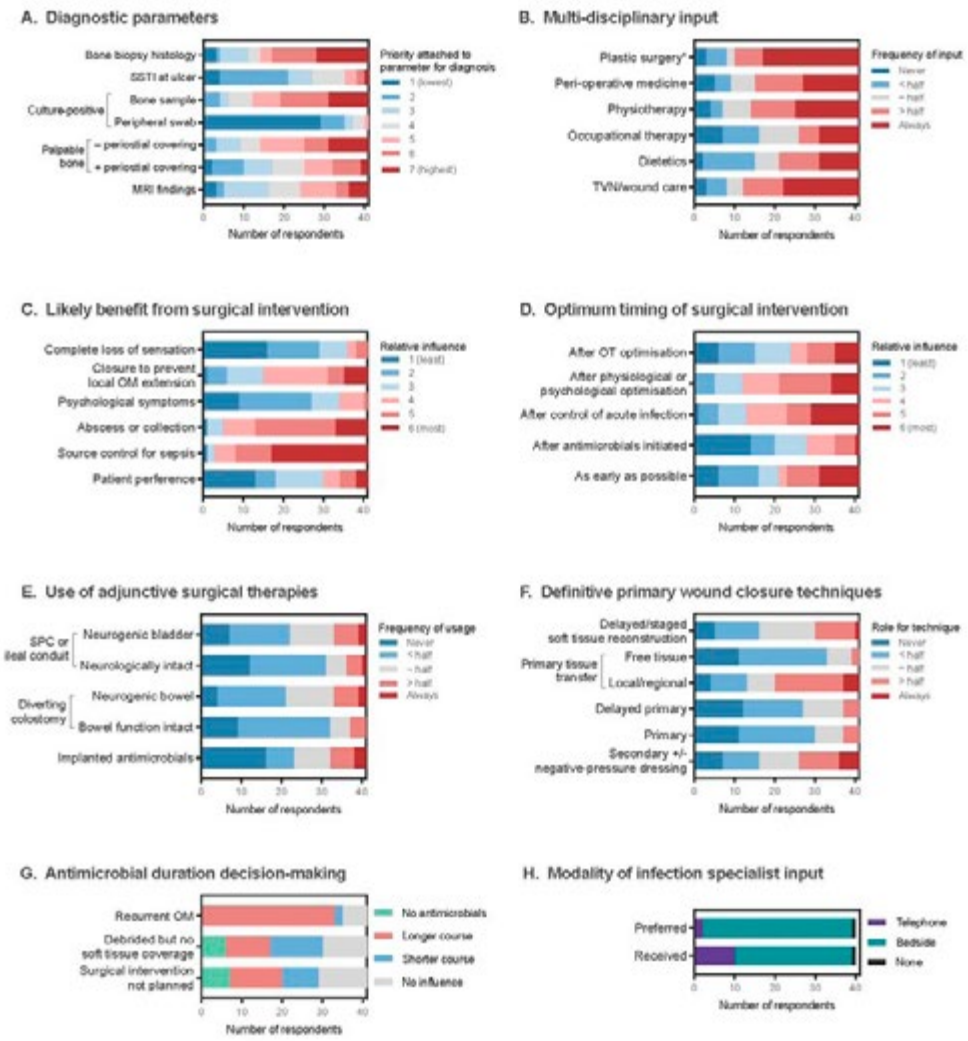

Figure: **Questionnaire responses**

(A) Priority placed on diagnostic parameters (B) Multidisciplinary input *Frequency of surgical input from a Plastic Surgeon during index procedure? (C) Influence of indicating factors for surgical intervention. (D) Influence of factors on the optimum timing of surgery. (E) Use of adjunctive surgical therapies (F) Wound management techniques (G) Duration of antimicrobial therapy ("Longer" is >2 weeks, "shorter" is 2 weeks or less) (H) Infection specialist input

The denominator is n=41 responses for all panels apart from panel H where n=40.

[FP J4] LIMB SALVAGE USING A TOTAL FEMUR REPLACEMENT IN REVISION SURGERY

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Aim: Repeat revision surgery of total hip or knee replacement may lead to massive bone loss of the femur. If these defects exceed a critical amount a stable fixation of a proximal or distal femur replacement may not be possible. In these extraordinary cases a total femur replacement (TFR) may be used as an option for limb salvage. In this retrospective study we examined complications, revision free survival (RFS), amputation free survival (AFS) and risk factors for decreased RFS and AFS following a TRF in cases of revision arthroplasty with a special focus on periprosthetic joint infection (PJI).

Method: We included all implantations of a TFR in revision surgery from 2006-2018. Patients with a primary implantation of a TFR for oncological indications were not included. Complications were classified using the Henderson Classification. Primary endpoints were revision of the TFR or disarticulation of the hip. The minimum follow up was 24 month. RFS and AFS were analyzed using Kaplan-Meier method, patients´ medical history was analyzed for possible risk factors for decreased RFS and AFS.

Results: After applying the inclusion criteria 58 cases of a TFR in revision surgery were included with a median follow-up of 48.5 month. The median age at surgery was 68 years and the median amount of prior surgeries was 3. A soft tissue failure (Henderson Type I) appeared in 16 cases (28%) of which 13 (22%) needed revision surgery. A PJI of the TFR (Henderson Type IV) appeared in 32 cases (55%) resulting in 18 (31%) removals of the TFR and implantation of a total femur spacer. Disarticulation of the hip following a therapy resistant PJI was performed in 17 cases (29%). The overall 2-year RFS was 36% (95% confidence interval(CI) 24-48%). Patients with a Body mass Index (BMI) >30kg/m² had a decreased RFS after 24 month (>30kg/m² 11% (95%CI 0-25%) vs. <30kg/m² 50% (95%CI 34-66%)p<0.01). The overall AFS after 5 years was 68% (95%CI 54-83%). A PJI of the TFR and a BMI >30kg/m² was significantly correlated with a lower 5-year AFS (PJI 46% (95%CI 27-66%) vs no PJI 100%p<0.001) (BMI >30kg/m² 30% (95% KI 3-57%) vs. <30km/m² 85% (95% KI 73-98%)p<0.01).

Conclusions: A TFR in revision arthroplasty is a valuable option for limb salvage but complications in need of further revision surgery are common. Patients with a BMI >30kg/m² should be informed regarding the increased risk for revision surgery and loss of extremity before operation.

[FP J5] ARTICULATING MOLDED KNEE SPACER REDUCING BONE DEFECT PROGRESSION DURING THE INTERVAL PERIOD OF TWO-STAGE REVISION OF THE KNEE

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Aim: The primary endpoint of this study is to characterize the progression of bone defects at the femoral and tibial side in patients who sustained PJI of the knee that underwent two-stage revision with spacer implantation. In addition, we want to analyze the differences between functional moulded and hand-made spacers.

Methods: A retrospective analysis of patients that underwent two-stage revision due to PJI of the knee between January 2014 and December 2021 at our institution. Diagnosis of infection was based on the criteria of the Muscoloskeletal Infection Society. The bone defect evaluation was performed intraoperatively based on the ***AORI classification***. The basal evaluation was performed at the time the resection arthroplasty and spacer implantation surgery. The final evaluation was performed at the second-stage surgery, at the time of spacer removal and revision implant positioning. The differences between groups were characterized by using T-test student for continuous variables, and by using chi-square for categorical variables. A p-value < 0.05 was defined as significant.

Results: Complete data of 37 two-stage TKAs revision were included in the study. An articulating moulded functional spacer was used in 14 (35.9%) cases, while a hand-made spacer was used in 23 (58.9%) cases. The average length of interval period (excluding the time for patients that retained the spacer) was 146.6 days. A bone defects progression based on the AORI classification was documented in 24 cases at the femoral side (61.6%), a bone defect progression was documented in 17 cases at the tibial side (43.6%), and a bone defect at both sides was documented in 13 cases (33.3%). A statistically significant greater bone defect progression at the tibial side was observed when hand-made spacers were used. A complication during the interval period was reported in five cases (12.8%) and postoperative complication was reported in 9 cases (23.1%).

Conclusions: When comparing patients in which a functional articulating spacer was used, with patients in which static spacer was used, we reported a statistically significant reduced bone defect progression during the interval period at the femoral side only when moulded spacers were used. We observed a higher incidence of bone defect progression also at the tibial and both sides when hand-made spacers were used. This is the first study that documented the bone defect progression during two-stage revision of the knee, the results observed in this study are very encouraging.

[FP J6] BIOFILM REMOVAL USING PULSE LAVAGE AND ELECTRICAL FIELDS: AN IN VITRO STUDY

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Aim: To evaluate the efficiency of pulse lavage combined with electrical fields to remove biofilm from a metallic surface.

Method: Using a 12-well culture plate designed for the application of electrical fields, strains of ***S. epidermidis*** were incubated at each well for 24 hours at 37ºC. After incubation, supernatant culture medium was removed, and each well was filled with 3ml of normal saline. Six different models were compared: a) control, b) low-pressure pulse lavage, c) high-pressure pulse lavage, d) pulsed electrical fields, e) low-pressure pulse lavage in combination with pulsed electrical fields, and f) high-pressure pulse lavage in combination with pulsed electrical fields. In all cases, exposure time was set to 25 seconds. In the electrical field models, 50 pulses were applied.
After exposure, each bottom electrode was scraped carefully to release adhered bacteria. Subsequently, different dilutions of biofilm removed were spread onto Müller Hinton agar plates and incubated for 24h at 37 ºC, and colony-forming units (CFU) per milliliters were counted. Bacterial counts were then compared to the control model.

Results: High-pressure pulse lavage combined with pulsed electrical fields showed the greatest biofilm removal with reductions of up to 11.9 logarithms when compared to the control group. The lowest reduction was achieved by low-pressure pulsed lavage (4.7 logs). All reductions showed statistically significant differences.

Conclusion: The results of our comparative study between different models demonstrates high reduction rates for biofilm removal. Further in vivo studies are needed to evaluate the capacity of the combination of high-pressure pulse lavage with pulsed electrical fields in removing bacterial biofilm in real conditions.

[FP J7] SYNOVIAL FLUID D-LACTATE, A PATHOGEN-SPECIFIC BIOMARKER FOR THE DIAGNOSIS OF SEPTIC ARTHRITIS

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Aim: Synovial fluid D-lactate may be useful for diagnosing septic arthritis (SA) as this biomarker is almost exclusively produced by bacteria. We evaluated the performance of synovial fluid D-lactate and determined its optimal cut-off value for diagnosing SA.

Method: Consecutive patients with suspicion of septic arthritis were prospectively included. They underwent joint aspiration and synovial fluid was collected for culture, leukocyte count and D-lactate concentration (by spectrophotometry). Youden's J statistic was used for determining optimal D-lactate cut-off value on the receiver operating characteristic (ROC) curve by maximizing sensitivity and specificity.

Results: A total of 155 patients were included. Using institutional criteria, 21 patients (14%) were diagnosed with SA and 134 (86%) patients with aseptic arthropathy, out of which 43 (27%) had osteoarthrosis, 80 (52%) had rheumatic arthropathy and 11 (7%) reactive arthritis. The optimal cut-off of synovial fluid D-lactate to differentiate SA from aseptic cases was 0,035 mmol/l. Synovial fluid D-lactate had a sensitivity 90% (95% CI: 70-99%) and specificity 87% (95% CI: 80-92%) compared to leukocyte count with sensitivity 81% (95% CI: 60-95%) and specificity 83% (95% CI: 76-90%). Culture was positive in only 17 (80%) out of 21 patients with SA.

Conclusions: The synovial fluid D-lactate showed high sensitivity and specificity for diagnosis of SA which was higher than the current gold standard of diagnosis (culture and leukocyte count). The high sensitivity makes this biomarker useful as a point-of-care screening test for SA.

[BP1] CEFUROXIME CONCENTRATIONS IN THE ANTERIOR AND POSTERIOR COLUMN OF THE LUMBAR SPINE - AN EXPERIMENTAL PORCINE MICRODIALYSIS STUDY

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Aim: Surgical site infection following spine surgery is associated with increased morbidity, mortality and increased cost for the health care system. The reported pooled incidence is 3%. Perioperative antibiotic prophylaxis is a key factor in lowering the risk of acquiring an infection. Previous studies have assessed perioperative cefuroxime concentrations in the anterior column of the cervical spine with an anterior surgical approach. However, the majority of surgeries are performed in the posterior column and often involve the lumbar spine. Accordingly, the objective was to compare the perioperative tissue concentrations of cefuroxime in the anterior and posterior column of the same lumbar vertebra using microdialysis in an experimental porcine model.

Method: The lumbar vertebral column was exposed in 8 female pigs. Microdialysis catheters were placed for sampling in the anterior column (vertebral body) and posterior column (posterior arch) within the same vertebra (L5). Cefuroxime (1.5 g) was administered intravenously over 10 min. Microdialysates and plasma samples were continuously obtained over 8 hours. Cefuroxime concentrations were quantified by Ultra High Performance Liquid Chromatography Tandem Mass Spectrometry. Microdialysis is a catheter-based pharmacokinetic tool, that allows dynamic sampling of unbound and pharmacologic active fraction of drugs e.g., cefuroxime. The primary endpoint was the time with cefuroxime above the clinical breakpoint minimal inhibitory concentration (T>MIC) for ***Staphylococcus aureus*** of 4 µg/mL as this has been suggested as the best predictor of efficacy for cefuroxime. The secondary endpoint was tissue penetration ($AUC_{tissue}/AUC_{plasma}$).

Results: Mean T>MIC 4 µg/mL (95% confidence interval) was 123 min (105-141) in plasma, 97 min (79-115) in the anterior column and 93 min (75-111) in the posterior column. Tissue penetration (95% confidence interval) was incomplete for both the anterior column 0.48 (0.40-0.56) and posterior column 0.40 (0.33-0.48).

Conclusions: Open lumbar spine surgery often involves extensive soft tissue dissection, stripping and retraction of the paraspinal muscles which may impair the local blood flow exposing the lumbar vertebra to postoperative infections. A single intravenous administration of 1.5 g cefuroxime resulted in comparable T>MIC between the anterior and posterior column of the lumbar spine. Mean cefuroxime concentrations decreased below the clinical breakpoint MIC for ***S. aureus*** of 4 µg/mL after 123 min (plasma), 97 min (anterior column) and 93 min (posterior column). This is shorter than the duration of most lumbar spine surgeries, and therefore alternative dosing regimens should be considered in posterior open lumbar spine surgeries lasting more than 1.5 hours.

[BP2] ASSOCIATION BETWEEN POSTOPERATIVE WOUND LEAKAGE AND INFECTION AFTER ANTHROPLASTY: RESULTS OF A NATIONAL WOUND CARE APP IMPLEMENTATION STUDY

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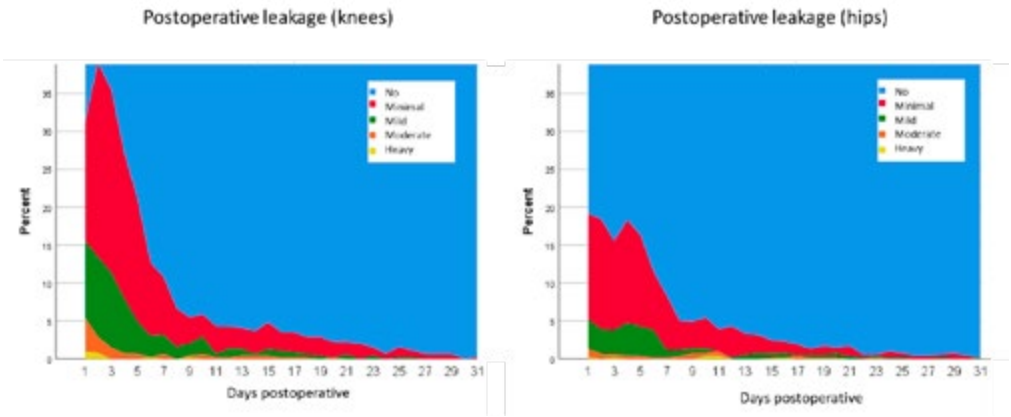
Background: The duration and extent of postoperative wound leakage after joint arthroplasty in patients with or without a complicated course, like a prosthetic joint infection (PJI), is currently unknown. Adequate differentiation between normal postoperative wound leakage and wound leakage due to a postoperative PJI is important and prevents unnecessary surgical procedures. We investigated the association between postoperative wound leakage and development of PJI in patients who used a previously developed mobile wound care app.

Methods: A multicenter, prospective cohort study with patients aged 18 years or older after primary implantation or revision of a total joint arthroplasty. During 30 post-operative days after arthroplasty, patients recorded their wound status in the woundcare app. An algorithm calculated a daily score from imputed data. If the daily score exceeded a predefined threshold, the patients received an alert that advised them to contact their physician.

Results: Of 1020 included patients from 11 centers, 14 patients developed a PJI. Of 1006 patients without PJI, any form of postoperative wound leakage occurred in 51%, 12%, 7% and 3% during the 1st, 2nd, 3rd and 4th postoperative week, respectively. Median duration of wound leakage was eight days (IQR 3.5-12.5) for patients with PJI and two days (IQR 0-4) for patients without PJI ($p < 0.001$). In total, 498 (49%) patients received 2589 alerts. Receiving an alert was not predictive for the development of a PJI. The odds ratio for a PJI was higher in patients with wound leakage compared to patients without wound leakage: OR 1.76 (0.59-5.29), OR 45.42 (10.04-205.53), OR 16.76 (3.68-76.28) and OR 18.09 (1.59-205.66) in the 1st, 2nd, 3rd and 4th postoperative week, respectively.

Conclusion: In patients who received a knee or hip arthroplasty, the odds ratios for PJI were significantly increased in patients with postoperative wound leakage. However, the high absolute number of patients with wound leakage and no PJI showed that wound leakage alone is not a sensitive, i.e. discriminative, indicator to guide the decision whether to reoperate patients for a suspected PJI.

Figure 1`. Postoperative wound leakage over time in hip and knee arthroplasty



The abstract was submitted on behalf of the Woundcare app study group: H.M.J. van der Linden, Leiden University Medical Centre; D. Broekhuis, Leiden University Medical Centre; M. de Jong, Leiden University Medical Centre; M.R. Benard, Alrijne Hospital; A.P. Wassenaar, Alrijne hospital; A.S.B. Mol, Alrijne Hospital; M. Rutgers, Reinier Haga Orthopedic Center; J.Pasma, Reinier Haga Orthopedic Center; R. Bazuin, Reinier Haga Orthopedic Center; N. Mathijssen, Reinier Haga Orthopedic Center; C.E. Van Der Wijngaart, Onze Lieve Vrouwe Gasthuis; N.W. Willigenburg, Onze Lieve Vrouwe Gasthuis; M.E. Van Der Hoorn, Onze Lieve Vrouwe Gasthuis; B. Dijkstra, Medical Center Leeuwarden; L.D. De Jong, Rijnstate Hospital; H. Haan, University Medical Centre Groningen; M. Stevens, University Medical Centre Groningen; M. Reijman, Erasmus Medical Centre Rotterdam; H. Hoogeboom, Nijsmellinghe Medical Centre; C. Meijer, Park Medical Centre + all authors listed above this article

[BP3] CHARACTERISTICS AND OUTCOMES OF CULTURE-NEGATIVE PROSTHETIC JOINT INFECTIONS FROM THE PROSTHETIC JOINT INFECTION IN AUSTRALIA AND NEW ZEALAND OBSERVATIONAL (PIANO) COHORT.

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Aim: Culture negative (CN) prosthetic joint infections (PJI) account for approximately 10% of all PJIs and present significant challenges for clinicians. We aimed to explore the significance of CN PJI within a large prospective cohort study, and to compare their characteristics and outcomes with culture positive cases.

Methods: The Prosthetic joint Infection in Australia and New Zealand Observational (PIANO) study is a prospective, binational, multicentre observational cohort study conducted at 27 hospitals between July 2014 and December 2017. We compared baseline characteristics and outcomes of all patients with culture negative (CN) prosthetic joint infection (PJI) from the PIANO cohort with culture positive (CP) cases. “Treatment success” was defined as absence of clinical or microbiological signs of infection, no need for ongoing antibiotics, and no need for revision or resection arthroplasty since the end of the initial treatment. We also describe PJI diagnostic criteria in the CN cohort and apply internationally recognised PJI diagnostic guideines.

Results: Of the 650 patients eligible for inclusion, 55 (8.5%) were CN and 595 were CP. Compared with the CP cohort, CN patients were more likely to be female [32 (58.2%) vs 245 (41.2%); p=0.02], involve the shoulder joint [5 (9.1%) vs. 16 (2.7%); p=0.03] and have a lower mean C-reactive protein (142 mg/L vs. 187 mg/L; p=0.02). Overall, outcomes were superior in CN patients, with culture negativity an independent predictor of treatment success at 24 months (aOR 3.78; 95%CI 1.65 – 8.67). Of the 55 CN cases meeting Infectious Diseases Society of America (IDSA) diagnostic criteria, 45 (82%) met European Bone and Joint Infection Society (EBJIS) criteria (probable or definite) and 39 (71%) met the 2013 Musculoskeletal Infection Society (MSIS) criteria.

Conclusions: Culture negativity is an independent predictor of treatment success in PJI. It is unclear whether this is because some of them are not actually infections, or for other reasons such as lower bacterial load or earlier effective antibiotic treatment. Diagnostic criteria for PJI vary substantially in their sensitivity, with MSIS criteria being the least sensitive.

Acknowledgements: This work is being presented on behalf of the broader PIANO investigators and the Australasian Society for Infectious Diseases Clinical Research Network. The PIANO study received seed funding from Heraeus Medical and the John Hunter Hospital Charitable Trust Fund.

[BP4] DOES THE USE OF LOCAL ANTIBIOTICS AFFECT CLINICAL OUTCOME OF PATIENTS WITH FRACTURE-RELATED INFECTION?

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Background Fracture-related infection (FRI) is treated by adequate debridement, lavage, fracture stabilization (if indicated), adequate soft tissue coverage and systemic antimicrobial therapy. Additional administration of local antibiotics (LA), placed directly in the surgical field, is thought to be beneficial for successful eradication of infection.

Aims 1) To evaluate the effect of local antibiotics on outcome in patients with FRI. 2) To evaluate whether bacterial resistance to the implanted local antibiotics influences its efficacy.

Methods A multinational cross-sectional study was performed in patients with FRI, diagnosed according to the FRI consensus definition, between January 2015 and December 2019. Patients who underwent surgical treatment for FRI at all time points after injury were considered for inclusion. Patients were followed-up for at least 12 months. The primary outcome was the recurrence rate of FRI at follow-up. Inverse Probability for Treatment Weighting (IPTW) modeling and multivariable regression analyses were used to assess the relationship between the application of LA and recurrence rate of FRI at 12 months, 24 months and final follow-up.

Results Overall, 433 FRIs in 429 patients were included. A total of 251 (58.0%) cases were treated with LA. Gentamicin was the most frequently used LA (247/251). Recurrence of infection after surgery occurred in 25/251 (10%) patients who received LA and in 34/182 (18.7%) patients who did not. The use of LA reduced the recurrence rate of FRI at 12 months (HR: 0.69; 95% CI [0.24-1.96]) and 24 months (HR: 0.55; 95% CI [0.22-1.35]). Resistance of cultured microorganisms to the LA was not associated with a higher risk of recurrence of FRI (HR: 0.75, 95% CI [0.32-1.74]).

Conclusion The application of LA in treatment of FRI is likely to reduce the risk of recurrence of FRI as the risk reduction was consistent and clinically relevant but it did not reach statistical significance. High local antibiotic concentrations eradicate most pathogens regardless of susceptibility test results

[BP5] GALLERIA MELLONELLA AS ALTERNATIVE IN VIVO MODEL FOR IMPLANT-ASSOCIATED FUNGAL INFECTIONS

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Aim: Fungal periprosthetic joint infections are difficult to treat and often associated with a limited outcome for patients**.** Candida species account for approximately 90% of all fungal infections. ***In vivo*** biofilm models play major role to study biofilm development, morphology, and regulatory molecules for bacteria. However, ***in vivo*** modeling of biofilm-associated fungi models are very rare. Furthermore, due to ethical restrictions, mammalian models are replaced with other alternative models in basic research. Recently, we have developed insect infection model ***G. mellonella*** larvae to study implant associated biofilm infections with bacteria. This model organism was not used for fungi biofilm infection yet. Thus, we aimed to establish ***G. mellonella*** as ***in vivo*** model to study fungal implant infections using ***Candida albicans*** as model organism and to test anti-fungal medication.

Method: Titanium and Stainless steel K-wires were cut into small pieces with size of 4mm. For the infection process, implants were pre-incubated in specified fungal growth culture ***Candida albicans*** at $1x10^7$ CFU/ml for 30 min at 150 rpm shaking conditions. Later, these implants were washed with 10ml PBS and implanted in the larvae as mentioned. To analyze the susceptibility of the implant-associated fungal infections towards anti fungal compounds, the larvae were treated with amphotericin B, fluconazole and voriconazole after 24h of implantation. The effect of anti-fungal compounds was measured in terms of survival observation for 5 days and fungal load in larvae on 2nd day. To reveal the fungal biofilm formation on implant, the implants were removed on day 3 and processed for SEM analysis.

Results: Pre-incubated K-wire caused the Candida infection and observed the death of the larvae. The treatment with antifungal compounds recovered the larvae from the implant-infection, except in case of Voriconazole. However, the recovery with treatment of anti fungal compounds was not effective as the larvae with planktonic infection, which highlights typical biofilm phenotype. Further, the treatment with anti-fungal compounds with Amphotericin B and Fluconazole reduced the fungal load in larvae tissue. The SEM analysis revealed the formation fungal biofilm with hyphae and spores associated with larvae tissue on implant surface.

Conclusions: The results from survival analysis, antifungal treatment and SEM analysis are very promising to use of ***G. mellonella*** as ***in vivo*** model to study fungal infections on implanted materials. Our study highlights the use of ***G. mellonella*** larvae as alternative in vivo model to study implant-associated fungal infections that reduces the use of the higher mammals.

[BP6] MID- TO LONG-TERM RESULTS OF SINGLE STAGE MANAGEMENT OF OSTEOMYELITIS, FACILITATED BY A BIOABSORBABLE, GENTAMICIN-LOADED CERAMIC

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Aim: Excision of chronic osteomyelitis (cOM) creates a dead space which must be managed to avoid early recurrence of infection. Systemic antimicrobials cannot penetrate this space in high concentration so local therapy has become an attractive adjunct to surgery. This study presents the mid- long-term results of local therapy with gentamicin in a bioabsorbable ceramic carrier.

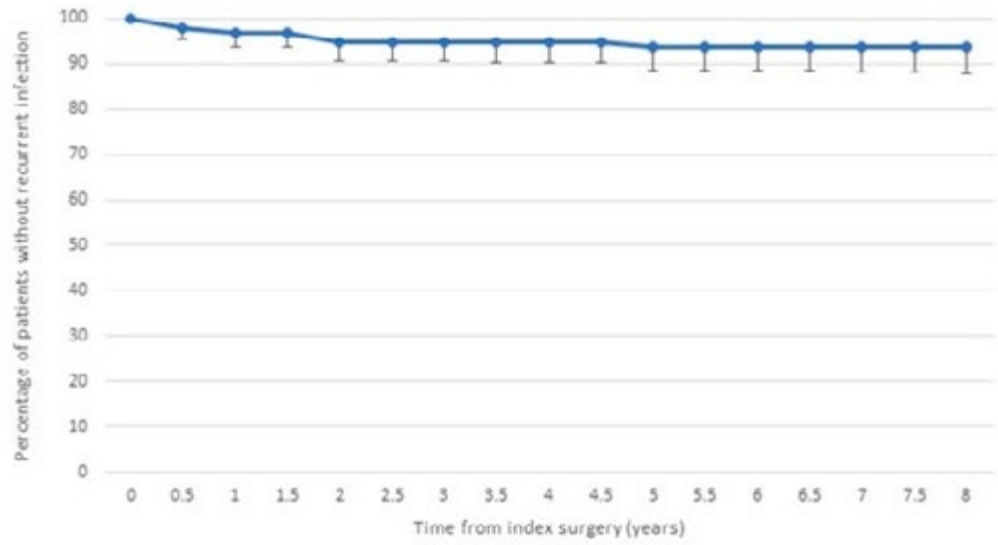
Method: A prospective series of 100 patients with Cierny & Mader Types III and IV cOM, affecting 105 bones, were treated with a single stage procedure, including debridement, deep tissue sampling, local and systemic antimicrobials, stabilization and immediate skin closure. cOM was confirmed with strict diagnostic criteria. Patients were followed up for a mean of 6.05 years (range 4.2-8.4 years).

Results: At final follow-up, 6 patients had evidence of recurrent infection (94% infection-free). 3 infections recurred in the first year, with 2 in the second year and one at 4.5 years after surgery (Figure 1). Recurrence was not dependent on host physiological class (1/20 Class A; 5% vs 5/80 Class B; 6.25%. p=0.833). Nor was it related to aetiology of the infection, microbial culture or the presence of an infected non-union before surgery (1/10 with non-union; 10% vs 5/90 without non-union; 5.6%. p=0.57).

Organisms which demonstrated intermediate or high-grade resistance to gentamicin were more likely in polymicrobial infections (9/21; 42.8%) compared to single isolate osteomyelitis (7/79; 8.9%) (p<0.001). However, recurrence was not more frequent when a resistant organism was present (1/16; 6.25% for resistant cases vs 5/84; 5.95% in sensitive culture infection) (p=0.96).

Conclusions: This study shows that the single stage protocol, including a high delivery local antibiotic ceramic, was effective over several years. The method can be applied to a wide range of patients, including those with significant comorbidities and infected non-union.

Figure 1 Kaplan-Meier Survival plot from 0-8 years after surgery



[BP7] OUTCOME AFTER REPEAT TWO-STAGE EXCHANGE ARTHROPLASTY FOR RECURRENT PERIPROSTHETIC HIP OR KNEE JOINT INFECTION

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Aim: Two-stage revision is a frequently chosen approach to treat chronic periprosthetic joint infection (PJI). However, management of recurrent infection after a two-stage exchange remains debated and the outcome of a repeat two-stage procedure is unclear. This study investigates the success rates of repeat two-stage exchange arthroplasty and analyzes possible risk factors for failure.

Method: We retrospectively identified 55 patients (23 hips, 32 knees) who were treated with repeat resection arthroplasty and planned delayed re-implantation for recurrent periprosthetic joint infection between 2010 and 2019 after a prior two-stage revision at the same institution. The minimum follow-up was twelve months with a median follow-up time of 34 months (IQR 22-51). The infection-free survival, associated revision surgeries and potential risk factors for further revision were analyzed using Kaplan-Meier survival curves and comparative non-parametric testing.

Results: 78% (43/55) underwent reimplantation after a repeat implant removal. Of those who completed the second-stage surgery, 37% (16/43) underwent additional revision for infection and 14% (6/55) underwent amputation. The reinfection-free implant survivorship amounted to 77% (95% CI 64%-89%) after one year and 38% (95% CI 18%-57%) after five years.
Patients with a higher comorbidity score were less likely to undergo second stage reimplantation (median 5 vs. 3, p=0.034). Furthermore, obese patients (p=0.026, Fisher's exact test) and diabetics (p<0.001, log-rank test) had a higher risk for further infection. Most common, cultures yielded polymicrobial growth at the repeat two-stage exchange (27%, 15/55) and at re-reinfection (32%, 9/28). Pathogen persistence was seen in 21% (6/28) of re-reinfected patients.

Conclusions: The success rates after repeat two-stage exchange arthroplasty are low. Patients must be counseled accordingly and different modes of treatment should be considered. Antibiotic suppression could be an option to reduce failure rates.

[BP8] ON DEMAND ACTIVATION OF A NOVEL ANTI-INFECTIVE BIOPOLYMER IMPLANT COATING WITH HIGH-ENERGY SHOCKWAVES

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Aim: A novel anti-infective biopolymer implant coating was developed to prevent bacterial biofilm formation and allow on-demand burst release of anti-infective silver (Ag) into the surrounding of the implant at any time after surgery via focused high-energy extracorporeal shock waves (fhESW).

Method: A semi-crystalline Poly-L-lactic acid (PLLA) was loaded with homogeneously dissolved silver (Ag) applied onto Ti6Al4V discs. A fibroblast WST-1 assay was performed to ensure adequate biocompatibility of the Ag concentration at 6%. The prevention of early biofilm formation was investigated in a biofilm model with ***Staphylococcus epidermidis*** RP62A after incubation for 24 hours via quantitative bacteriology.
In addition, the effect of released Ag after fhESW (Storz DUOLITH SD1: 4000 impulses, 1,24 mJ/mm^2, 3Hz, 162J) was assessed via optical density of bacterial cultures (***Escherichia coli*** TG1, ***Staphylococcus epidermidis*** RP62A, ***Staphylococcus aureus*** 6850) and compared to an established electroplated silver coating (Implantcast GmbH) (Figure 1a). The amount of released Ag after the application of different intensities of fhESW was measured and compared to a control group without fhESW via graphite furnace atomic absorption spectrometry (GF-AAS), scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS).

Results: The coating with 6% Ag reduced ***Staphylococcus epidermidis*** biofilm formation by 99.7% (mean±SD: 2.1x10^5 ± 3,9x10^5 CFU/µL) compared to uncoated controls (6.8x10^7 ± 4.9x10^7 CFU/µL); (p=0.0001).
After applying fhESW the commercially available electroplated silver coating did not prevent the growth of all tested bacterial strains. Bacterial growth is delayed with 4% Ag and completely inhibited with 6% Ag in the novel coating, except for a small increase of ***S. aureus*** after 17 hours (Figure 1b-d). SEM and EDS confirmed a local disruption of the coating after fhESW.

Conclusions: This novel anti-infective implant coating has the potential to prevent bacterial biofilm formation. The on-demand burst release of silver via fhESW could be an adjunctive in the treatment of implant related infection and is of particular interest in the concept of single stage revision surgery.

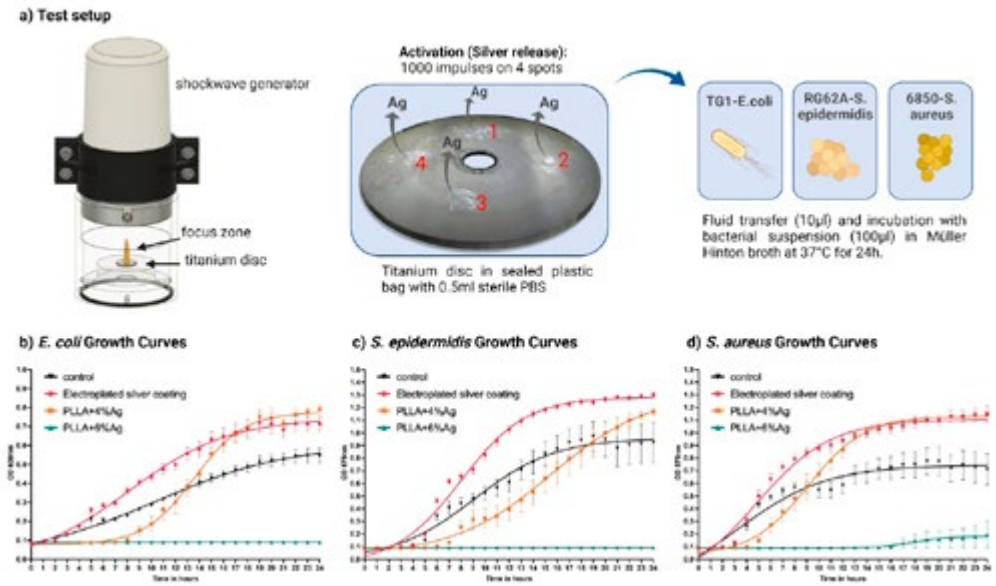

Figure 1 a) Test setup for the assessment of the effect of anti-infective silver released from the activated coating after application of focused high-energy extracorporeal shock waves; 1b-d) Bacterial growth curves assessed via optical density while incubated with different Ag concentrations compared to a control group without coating and a commercially available electroplated silver coating.

[BP9] UNSUSPECTED LOW-GRADE INFECTION IN REVISION SURGERY FOR NON-UNION IN FOOT AND ANKLE ARTHRODESIS: INCIDENCE, CAUSATIVE MICROORGANISM AND TREATMENT

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Aim: Failed consolidation (nonunion) after foot and ankle arthrodesis is a major complication, which can lead to additional revision arthrodesis with increased risk of morbidity. Multiple factors can contribute to developing a nonunion, including a low-grade infection. The aim of this study was to investigate the rate of unsuspected low-grade infection in revision arthrodesis for nonunions after foot and ankle arthrodesis. We also analyzed the outcome of unsuspected low-grade infections.

Method: We conducted a retrospective study in The Sint Maartenskliniek, The Netherlands. All patients who underwent revision arthrodesis for assumed aseptic nonunion after foot and ankle arthrodesis between January 2020 and July 2021 were included. Patients were excluded if no tissue samples were obtained during revision arthrodesis or if they were treated for infection after the index arthrodesis. For the included patients, at least 6 tissue samples for culture were taken during the revision arthrodesis. The causative microorganisms, antibiotic susceptibility and treatment were assessed. An unsuspected infection was defined as ≥2 positive cultures with phenotypical identical microorganisms. Success was defined as union on imaging during clinical follow-up, without signs of persistent infection after finishing the antibiotic treatment.

Results: In total 72 revision arthrodesis due to nonunion were performed. The mean duration between index and revision arthrodesis was 571 days. In 14 patients, an unexpected infection was diagnosed. The most frequent causative bacteria identified were Cutibacterium acnes (n=10) and Staphylococcus spps. (n=5). One infection was caused by a Gram-negative bacilli (Acinetobacter spps.). Two infections were polymicrobial. Of the 14 infections, 12 were treated with antibiotics for 12 weeks, 1 for 6 weeks and 1 was not treated. After one-year follow-up, the success rate was 93% and in one patient re-surgery was performed for a non-infectious reason.

Conclusions: In 19% of the revisions for nonunion after foot and ankle arthrodesis, an unexpected low- grade infection was the cause of the nonunion. Nonunion occurring after foot and ankle arthrodesis is a severe complication, leading to additional revision arthrodesis. Low-grade infection should be considered as possible explanation of the nonunion, despite the lack of local inflammatory signs. As 19% of the nonunions were unexpectedly caused by low-grade infection, we strongly recommend obtaining at least 5-6 tissue samples for culture during revision arthrodesis. The outcome of unexpected infection as cause of nonunion is good, when treated with antibiotics for 12 week.

[BP10] FUNCTIONAL RESULTS AND COMPLICATIONS AT 2 AND 5 YEARS IN PATIENTS WITH A REVERSE SHOULDER PROSTHESIS WITH CONTAMINATION BY C ACNES

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Aim: A significant number of patients undergoing shoulder arthroplasty surgery have C acnes contamination at the end of the primary surgery. The objective of this study is to determine whether patients with C acnes contamination at the end of their primary shoulder surgery have a worse prognosis than those who end up without C. acnes contamination.

Method: Prospective study including all patients who underwent a reverse shoulder prosthesis from January 2015 to December 2018. In all of them, 5 to 12 cultures were performed during primary surgery. The patients underwent surgery for shoulder arthritis secondary to rotator cuff tears, acute fracture of the proximal humerus, and sequelae of fracture of the proximal humerus. Exclusion criteria included the existence of previous surgeries on the affected shoulder, the presence of signs of infection, having received infiltrations and / or complementary invasive examinations (Arthro-MRI and Arthro-CT). Follow-up from 2 to 5 years. Functional assessment according to the Constant Functional Scale. All complications were also recorded.

Results: 162 patients were included. Of these, 25 had positive cultures for C. acnes at the end of primary shoulder surgery. Average age of 74.8 years. 136 women and 26 men. 75.9% Shoulder arthritis secondary to rotator cuff tears, 13.6% acute fractures and 10.5% sequelae of fractures. There were no differences between patients with C. acnes and those without C. acnes regarding age and indication for surgery. Predominance of men in the group with positive C. acnes ($p < 0.001$). No differences at 2 and 5 years in the Constant functional scale between the two groups (2 years, 59.6 vs 59.2 p 0.870) (5 years, 62.4 vs 59.5 p 0.360). Significant differences regarding the number of complications (p 0.001). Patients without C. acnes had 1 aseptic loosening of the metaglene and patients with C. acnes had 2 infections, 1 dislocation, and 1 revision surgery. Patients with contamination by C. acnes had more comorbidities (p 0.035) than patients without contamination.

Conclusions: Patients with C acnes contamination at the end of primary surgery do not have functional differences when compared with patients without contamination at 2 and 5 years, but they have a higher number of complications in the medium term.

[BP11] HISTOPATHOLOGICAL CHARACTERIZATION OF THE FIRST AND LAST REMOVED BONE TISSUE DURING DEBRIDEMENT OF CHRONIC OSTEOMYELITIS

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Aim: To describe the histopathology of the first and last debrided bone tissue in chronic osteomyelitis and answer the following research question; is the last debrided bone tissue viable and without signs of inflammation?

Method: In total, 15 patients with chronic osteomyelitis were allocated to surgical treatment using a one stage protocol including extensive debridement. Suspected infected bone tissue eradicated early in the debridement procedure was collected as a clearly infected sample (S1). Likewise, the last eradicated bone tissue was collected as a suspected non-infected sample (S2), representing the status of the bone void. In all cases, the surgeon debrided the bone until visual confirmation of healthy bleeding bone. The samples were processed for histology, i.e. decalcification and paraffin embedding, followed by cutting and staining with Haematoxylin and Eosin. Immunohistochemistry with MAC-387 antibodies towards the calprotectin of neutrophil granulocytes (NGs) was also performed and used for estimation of a neutrophil granulocyte (NG) score (0, 1, 2 or 3), by the method described for fracture related infections (1).

Results: For the S1 samples the median NG score was 3 which is considered confirmatory for infection. However, following debridement the median NG score was significantly ($p = 0.032$) reduced to 2. Often NGs were seen as single cells, but in seven S1 samples and in one S2 sample massive NG accumulations were observed. The S1 samples showed a mix of granulation tissue, fibrosis, viable bone, and bone necrosis. The S2 samples contained viable bone tissue and occasionally (10/15) small fragments of necrotic bone or bone debris were seen. Furthermore, a large number of erythrocytes were observed in most S2 samples.

Conclusions: The present study shows that the inflammatory response still existents after debridement, although the response fades from the center of infection. Therefore, sampling of debrided bone tissue for histology must be performed initially during surgery, to avoid underestimation of the inflammatory response, i.e. the NG score. The last debrided bone tissue cannot by definition be considered completely viable and caution should be made to remove blood (rinse) before intraoperative evaluation of the viability of debrided cancellous bone. Remnant necrotic bone fragments or debris could represent low-vascular hiding places for leftover bacteria. Application of local antibiotics might have a central role in clearing of these small non-viable bone pieces at the bone void interface.

Morgenstern M, Bone Joint J, 2018;100-B(7):966-972.

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