■ ONCOLOGY

A modified Delphi consensus on periprosthetic infection in orthopaedic oncology

A REPORT FROM THE BIRMINGHAM ORTHOPAEDIC ONCOLOGY MEETING (BOOM)

L. Jeys,
E. Botello,
R. A. Boyle,
W. Ebeid,
M. T. Houdek,
V. J. Kurisunkal,
R. Morgan-Jones,
G. V. Morris,
A. Puri,
P. Ruggieri,
BOOM Consensus Meeting Participants,
M. K. Laitinen

From The Royal Orthopaedic Hospital NHS Foundation Trust, Birmingham, UK

Aims
The aim of this study was to achieve consensus for important topics related to periprosthetic infection (PJI) in orthopaedic oncology, and to identify areas for future research.

Methods
In January 2024, the Birmingham Orthopaedic Oncology Meeting (BOOM) held in Birmingham, UK, gathered 309 delegates from 53 countries to debate 20 consensus statements on PJI in orthopaedic oncology using a modified Delphi process.

Results
Of 20 questions and statements on PJI in orthopaedic oncology, none achieved unanimous consensus, 18 achieved strong consensus, one achieved moderate consensus, and one achieved weak consensus. The statements that reached consensus with notable agreement were on the prophylaxis of infection, management of leaking wounds, and surgical strategies for the treatment of PJI. Short-duration antibiotic prophylaxis was deemed as effective as longer courses for lower-risk reconstructions, and aggressive management was recommended for wounds draining beyond five to seven days to prevent deep infection. Furthermore, single-stage, two-stage, and 1.5-stage revision were recognized as valid strategies, with two-stage revision remaining the most reliable. The statements that did not achieve consensus were on the role of debridement, antibiotics, and implant retention and prolonged antibiotic use post-revision.

Conclusion
The BOOM meeting achieved consensus for important topics on periprosthetic infection in orthopaedic oncology, but highlighted the low quality of the underlying evidence. This study has provided recommendations for the treatment of leaky wounds, duration of postoperative antibiotic prophylaxis, and choice of revision strategy.

Cite this article: ***Bone Joint J*** **2025;107-B(12):1352–1359.**

Introduction
Periprosthetic infection is a serious complication after bone tumour resection and reconstruction.[1] Compared with primary joint arthroplasty, where infection rates for periprosthetic joint infections (PJIs) are reported to be between 1% and 2%,[2] oncological reconstructions have a significantly higher rate, approaching 10.%[3] When infection does occur, treatment less frequently results in cure: it has been estimated that around one-third of infected oncological reconstructions result in amputation.[4]

The principles for managing infection in orthopaedic oncology overlap with the treatment of PJI and fracture-related infection.[5] However, patients undergoing orthopaedic oncology procedures present distinct challenges, as their infections often occur in the context of large resections, extensive dead space, compromised soft-tissue coverage, adjuvant therapies, and complex or custom implants.[4]

Patient-specific risk factors for periprosthetic infection in oncology include local radiotherapy, immunosuppression, and anatomical locations such as the proximal tibia or pelvis.[4,6] Surgical

Correspondence should be sent to M. K. Laitinen; email: minna.laitinen@hus.fi

doi:10.1302/0301-620X.107B12.BJJ-2024-1039.R4 $2.00

Bone Joint J 2025;107-B(12):1352–1359.

Table I. Birmingham Orthopaedic Oncology Meeting consensus strength categories.

Proportion	Consensus strength
Simple majority (50.1% to 59%)	No consensus
Majority (60% to 69%)	Weak consensus
Large majority (70% to 79%)	Moderate consensus
Super majority (80% to 99%)	Strong consensus
Unanimous (100%)	Unanimous consensus

The category criteria in the table are adapted from common consensus thresholds used in expert opinion or group decision-making methods. Hsu and Sanford,[18] Fink et al,[19] and Tripp and Caplan.[20]

risk factors that contribute to periprosthetic infection include prolonged operating time, compromised soft-tissue coverage, intraoperative transfusion, and postoperative haematoma formation.[6] Recognition of the challenge of surgical site infection (SSI), particularly PJI, has prompted the implementation of enhanced prevention procedures such as implants coated with silver or iodine, early postoperative interventions for prolonged wound drainage, and closed-incision negative-pressure wound therapy.[7,8]

There is an unmet need for guidelines to support the management of periprosthetic infection in orthopaedic oncology patients. Due to the low quality of evidence in orthopaedic oncology, a consensus approach was favoured over a systematic review. Therefore, the aim of this study was to achieve consensus for important topics related to periprosthetic infection in orthopaedic oncology, and to identify areas for future research.

Methods

This study was conducted in accordance with the Conducting and REporting of DElphi Studies) and followed by the consensus statement guidelines by Murray et al.[9,10] The ACCORD checklist was also used to ensure comprehensive and transparent reporting.[11] The study process was not preregistered.

A modified Delphi method was used to achieve consensus. This method involves multiple rounds of questionnaires designed to capture expert opinion, ultimately culminating in consensus statements. By systematically incorporating expert knowledge, the modified Delphi process provides a structured approach to formulating strategies for the diagnosis and management of complex conditions.[12] While not a classical Delphi process due to partial loss of anonymity, our approach also differed from the nominal group technique, which typically involves small, focused discussions. Spanning several months with multiple iterative rounds, and concluding with final voting at a single meeting, our method was better suited to the complexity of the topics addressed. With input from over 300 orthopaedic oncology experts globally, the process adhered closely to core Delphi principles.

The process with the formation of a local organizing committee and an additional scientific committee has been described previously.[13,14]

A series of online questionnaires were used to develop a panel of 120 questions for the two-day Birmingham Orthopaedic Oncology Meeting (BOOM) meeting, which were subsequently ranked by the scientific committee based on priority. The highest priority questions were then categorized into ten key themes related to periprosthetic infections on day two. The resulting consensus statements addressed the following areas: risk factors; antibiotic prophylaxis; wound management; debridement, antibiotics and implant retention (DAIR); single-stage revision; two-stage revision; infection in biology versus endoprosthetic reconstruction (EPR); acute infection during chemotherapy; extended antibiotic use and suppression strategies; and organisms associated with periprosthetic infection.

Each theme was assigned to two different units from separate continents to compile a narrative review of the available evidence. These reviews included an assessment of the strength of evidence, a personal/unit perspective on the question, and the development of a consensus statement supported by references. However, a formal grading of the evidence, such as that described by the GRADE framework,[15] was not applied, although we followed the GRADE when rating the evidence as low (when evidence was based on case series, case reports, and expert opinion without systematic review or well-designed studies), moderate (well-conducted cohort studies or case-control studies, or randomized controlled trials (RCTs) with some limitations (e.g. risk of bias or methodological flaws)), and high (high-quality RCTs, systematic reviews of RCTs, and meta-analyses with low risk of bias). An anonymous pre-meeting poll of registered delegates, without disseminating the evidence, was used to gauge the likely level of consensus, to guide the time for debate for each theme during the meeting, depending upon the level of controversy. The evidence gathered by both units was consolidated, and the suggested consensus statements were refined collaboratively to ensure agreement between the evidence reviewers. The units were invited to provide free-text responses to the suggested consensus statements. Before the face-to-face meeting, the evidence booklet and suggested consensus statements were then circulated to the delegates four weeks prior to the meeting. This booklet, along with the results of the consensus meeting, video recordings, and scientific outputs, is freely available for download from the BOOM Consensus website (Supplementary Material).[16] No ethical approval was applicable for the consensus meeting.

In January 2024, 309 delegates from 53 countries participated in a two-day consensus meeting in Birmingham, UK, to vote on the 41 consensus statements and present the evidence. Scientific committee members who were physically present were eligible to participate in the voting process. On the first day, 21 consensus statements on chondrosarcoma were presented and voted on, while the second day focused on 20 consensus statements related to periprosthetic infection utilizing the modified Delphi process. Among the 309 participants, the majority were orthopaedic oncologists (n = 272; 88%), followed by medical oncologists (n = 17; 6%), radiologists (n = 5; 2%), pathologists (n = 2; 1%), and a diverse group (n = 13; 4%) including PhD students, nurses, and internal medicine specialists, including infectious disease physicians. All responses and votes were anonymized. The delegates represented diverse global regions: Europe 133/309 (43%), North America 53/309 (17%), South America 49/309 (16%), Asia 40/309 (13%), Australasia 16/309 (5%), the Middle East 12/309 (4%), and Africa 6/309 (2%). A separate consensus article focusing on the chondrosarcoma topics discussed on the first day has already been published.[14]

On the second day of the meeting, each session was chaired by three individuals: a member of the organizing committee, a regional lead, and an independent moderator (RMJ), an expert in orthopaedic PJIs but not an orthopaedic oncologist. Each unit presented a concise overview of the salient points of their research, and the audience debated the proposed consensus statement. If more than 10% of the delegates expressed a desire to modify the wording of the statement, changes were permitted at the chair's discretion, provided that the revisions did not alter the intent of the statement or contradict the presented evidence. Delegates were then asked to vote to either agree, disagree, or abstain from voting on each statement. Abstentions were excluded from the calculation of consensus strength, which was determined based on the criteria outlined in Table I, following the International Consensus Meeting (ICM) framework.[17] The category criteria outlined in Table I are adapted from common consensus thresholds used in expert opinion or group decision-making methods.[18–20]

Results were compiled to ensure voter anonymity. To ensure accuracy, two authors (LJ, ML) independently reviewed the registered votes after the meeting to confirm that no delegate had cast multiple votes for the same statement. No honoraria were provided to the scientific committee or the expert voting panel for participating in this initiative. The official language of the meeting and statement process was English.

Results

Of the 20 questions and statements, none achieved unanimous consensus, 18 achieved strong consensus, one achieved moderate consensus, and one achieved weak consensus. The 20 questions and the final consensus statements are described below.

What are the risk factors for PJI in oncology patients? The risk of infection in tumour prostheses is high. Patient risk factors for PJI in oncology patients include the presence of medical comorbidities. Disease risk factors include radiotherapy to the local site, proximal tibial, or pelvis location. Operative risk factors include long operating time, intraoperative transfusion, and postoperative haematoma formation. Other risk factors have been described in the literature.

Do coated (e.g. silver/iodine) implants reduce the risk of subsequent PJI and should these be used routinely? Limited retrospective evidence suggests implants coated with silver or iodine have lower early infection rates and less reinfection after two-stage revision. The longer-term effect on infection-free survival is less clear.

What is the optimal antibiotic choice and duration for prophylaxis in limb oncology reconstructions? The most frequent choice for prophylaxis in limb oncology reconstructions remains a beta-lactam antibiotic (first- or second-generation cephalosporin), although broader spectrum coverage may be considered. Randomized evidence showed that prophylaxis for 24 hours postoperatively is as effective as a longer duration and shows a lower risk of antibiotic-related complications.

Should we give high-risk reconstructions (e.g. pelvic reconstructions) extended prophylaxis and if so, how long and what type? Pelvic sarcoma surgery has a higher incidence of postoperative infection with Gram-negative organisms compared with limb surgery, therefore prophylaxis should cover both Gram-positive and Gram-negative organisms. Limited evidence suggests that extended duration (> 24 hours) of prophylaxis may be of benefit, although the optimal duration has not been defined.

How aggressive we should be with leaking wounds to reduce the risk of PJI? Continued wound drainage beyond five to seven days is considered a risk factor for deep infection. A wound persistently draining longer than seven to ten days should be considered for surgical intervention after patient optimization. Surgery should include debridement and lavage, and consideration could be given to exchange of modular implants with local antibiotic delivery.

What wound strategies (e.g. dressings and drains) can be used to reduce the risk of PJI and how long should we use them for? There is little evidence for wound management in orthopaedic oncology. Limited evidence suggests that closed-incision negative-pressure wound therapy (ciNPWT) and occlusive/silver-impregnated dressings may reduce SSI/PJI but may lead to increased skin blistering. The optimal duration of drain use is not clear, and the use of drains may lead to increased transfusion requirements.

Is DAIR an acceptable way to treat PJI in oncology, how should we do it, and when should DAIR be used? DAIR is an acceptable treatment strategy for PJI in oncology. DAIR involves surgical removal of all infected material including pseudomembrane (debridement), a prolonged course of antibiotics targeted to the infecting organism (antibiotics), and exchange of all parts of the reconstruction which are not well fixed (implant retention). DAIR has best results in acute infections with short duration of symptoms caused by bacteria which are sensitive to oral antibiotics. The probability of long-term infection control appears to be lower than a staged strategy, but the morbidity to the patient is less.

What adjuvants (e.g. local irrigation solutions, antibiotic carriers) should we use in a DAIR? Local antibiotic delivery at surgery has a higher concentration at the implant surface compared with the same dose administered systemically. Polymethyl methacrylate (PMMA) and calcium sulphate preparations can act as reservoirs for antibiotic delivery over several weeks and could be considered during a DAIR. Irrigation protocols suggest that high volumes of fluid should be used, but there is little evidence to suggest any type is superior to saline in reducing recurrent infection.

Is single-stage revision an acceptable way to treat PJI in oncology and when should it be used? Single-stage revision is acceptable in megaprosthetic PJI but should include exchange of all components, and is less likely to control infection than two-stage exchange. It is most effective where the infecting organism is highly sensitive to oral antibiotics.

How long should antibiotics be administered after a single-stage treatment of PJI? There is little evidence for this. Commonly used strategies are for six- to 12-week of antibiotics but longer may be required in individual cases.

Should all implants (including femoral/humeral components) be removed at a two-stage revision of PJI? In a two-stage revision for PJI, we recommend thorough surgical debridement at the first stage including the removal of all

Table II. Summary of consensus statements, evidence levels, and voting results.

Statement	Evidence level	Votes, n	Results (%)			Consensus level
			Agree	Disagree	Abstain	
Risk factors						
What are the risk factors for PJI in oncology patients?	Moderate	175	98	2	1	Strong consensus (98% super majority)
Do coated (e.g. silver/iodine) implants reduce the risk of subsequent PJI and should these be used routinely?	Moderate	180	82	16	2	Strong consensus (84% super majority)
Antibiotics prophylaxis						
What is the optimal antibiotic choice and duration for prophylaxis in limb oncology reconstructions?	Low	181	88	9	2	Strong consensus (90% super majority)
Should we give high-risk reconstructions (e.g. pelvic reconstructions) extended prophylaxis and if so, how long and what type?	Low/moderate	190	97	2	1	Strong consensus (98% super majority)
Wound management						
How aggressive we should be with leaking wounds to reduce the risk of PJI?	Low	190	88	11	1	Strong consensus (89% super majority)
What wound strategies (e.g. dressings and drains) can be used to reduce the risk of PJI and how long should we use them for?	Moderate	194	84	13	3	Strong consensus (86% super majority)
DAIR						
Is DAIR an acceptable way to treat PJI in oncology, how should we do it, and when should DAIR be used?	Low/moderate	192	58	33	8	Weak consensus (64% majority)
What adjuvants (e.g. local irrigation solutions, antibiotic carriers) should we use in a DAIR?	Moderate	194	84	13	3	Strong consensus (86% super majority)
Single-stage revision						
Is single-stage revision an acceptable way to treat PJI in oncology and when should it be used?	Moderate	192	87	12	1	Strong consensus (88% super majority)
How long should antibiotics be administered following a single-stage treatment of PJI?	Moderate	190	97	1	2	Strong consensus (99% super majority)
Two-stage revision						
Should all implants (including femoral/humeral components) be removed at a two-stage revision of PJI?	Low	157	92	5	3	Strong consensus (95% super majority)
How do we know it is safe to proceed with the second-stage revision of PJI?	Low	159	92	7	1	Strong consensus (93% super majority)
Infection in biology vs EPR (allograft reconstruction)						
Is there a difference in the rates of PJI following biological vs metallic reconstruction?	Low	157	87	8	4	Strong consensus (90% super majority)
What is the optimal management of an infected allograft reconstruction?	Low	154	88	8	6	Strong consensus (92% super majority)
Acute infection during chemotherapy						
What is the optimal management during an acute PJI while the patient is still receiving chemotherapy?	Moderate	147	95	3	2	Strong consensus (97% super majority)
Can chemotherapy safely be continued with a low-grade PJI?	Low	138	94	3	3	Strong consensus (97% super majority)
Extended antibiotics/suppression						
Is there a role for prolonged antibiotics following the second stage of a two-stage revision?	Low	147	71	22	6	Large majority (76% Moderate consensus)
When should we consider long-term antibiotic/antifungal suppression after PJI?	Low	140	89	7	4	Strong consensus (95% super majority)
Organisms in PJI						
Are there organisms which have a less favourable prognosis with a treatment rationale for PJI (e.g. DAIR/single-stage/two-stage)?	Moderate	135	98	1	1	Strong consensus (99% super majority)
Is 1.5-stage revision (interval prosthesis with local antibiotic delivery) an acceptable way to treat PJI? Is it suitable for all organisms?	Low	131	80	15	5	Strong consensus (85% super majority)

DAIR, debridement, antibiotics and implant retention; EPR, endoprosthetic reconstruction; PJI, periprosthetic joint infection.

implants (including allograft, components, and plates), copious lavage, and an antibiotic-loaded spacer.

How do we know it is safe to proceed with the second-stage revision of PJI? Factors indicating that it is safe to proceed to second-stage surgery include reduced signs of clinical inflammation, a well-healed wound, and decreasing levels of inflammatory blood markers. Most surgeons would recommend a period off antibiotic therapy before second-stage surgery. Preoperative aspiration can be considered, but has a false-negative rate of 10% to 30% in the literature.

Is there a difference in the rates of PJI following biological compared with metallic reconstruction? There are no differences in modern series in infection rates between biological and endoprosthetic reconstruction. PJI risk should not be a factor when considering whether an allograft or metallic reconstruction is more appropriate.

What is the optimal management of an infected allograft reconstruction? A DAIR procedure can be considered for an acute PJI after allograft reconstruction, but has a low chance of success (20%). Two-stage revision to an endoprosthesis at second stage is the most commonly recommended treatment for an infected allograft.

What is the optimal management during an acute periprosthetic infection while the patient is still receiving chemotherapy? The optimal management of an acute PJI while the patient is still receiving chemotherapy should be a multidisciplinary decision including surgical, oncological, and microbiological input. The chemotherapy should be temporarily suspended and the infection treated urgently with the surgical strategy most likely to control the sepsis quickly, in order to allow resumption of chemotherapy, which should be the priority.

Can chemotherapy safely be continued with a low-grade PJI? Decisions regarding continuation of chemotherapy with a low-grade PJI should be multidisciplinary and consider the type of chemotherapy, and patients' local and systemic symptoms. Aspiration of the affected joint is recommended off antibiotics to allow targeted antibiotic therapy. If antibiotic treatment or limited surgical intervention controls local and systemic symptoms, then chemotherapy may be continued safely with consideration of long-term antibiotics until chemotherapy has been completed and definitive surgical management is possible.

Is there a role for prolonged antibiotics following the second stage of a two-stage revision? Emerging evidence from non-megaprosthetic PJI suggests that oral antibiotics for six weeks (if cultures are negative at second stage) and 12 weeks (if cultures are positive at second stage) may reduce reinfection rates after two-stage revision surgery.

When should we consider long-term antibiotic/antifungal suppression after PJI? Megaprosthetic PJI suffers with a higher rate of multidrug-resistant organisms, making antibiotic suppression challenging. Patients with *Staphylococcus aureus* or streptococcal PJI, those with positive culture results at second-stage arthroplasty, or those who have been treated with DAIR may benefit from prolonged antibiotic treatment. Antibiotic suppression in an oncological setting can be considered as a safe and effective option if surgical treatment has failed, or is not possible but results in a high rate of amputation and therefore should be considered a last resort.

Are there organisms which have a less favourable prognosis with a treatment rationale for PJI (e.g. DAIR/single-stage/two-stage)? The type of bacteria or fungus causing PJI can affect the success of treatment, and it is recommended that a multidisciplinary team and/or microbiologist is involved in treatment decisions. PJI associated with Gram-negative bacteria, methicillin-resistant *S. aureus* (MRSA), fungal, multidrug-resistant, or polymicrobial infections have a less favourable prognosis, regardless of the treatment rationale used.

Is 1.5-stage revision (interval prosthesis with local antibiotic delivery) an acceptable way to treat PJI? Is it suitable for all organisms? There is a need for standardization of what defines a one-stage revision, a 1.5-revision, and a DAIR in oncology. A 1.5-stage revision is an acceptable strategy and should involve removal of implants with insertion of a functional spacer (endoprosthesis) allowing local antibiotic delivery (PMMA implant coating with appropriate antibiotics with or without calcium sulphate with appropriate antibiotics). It has the same indications as a two-stage revision, and has the advantage that a significant proportion of patients do not proceed to a second stage in the medium term. The results appear acceptable, but there is currently insufficient evidence to recommend it over a two-stage revision.

Results from the statements are summarized in Table II.

Discussion

A strong consensus was achieved for most statements, 18 out of 20 receiving strong agreement. Key areas of consensus on controversial topics included the prophylaxis of infection, management of prolonged leaking wounds, surgical strategies for treating periprosthetic infection, and infection in biological (including allograft) reconstructions.

The consensus acknowledged that most evidence supporting infection prophylaxis in orthopaedic oncology is of low level. The PARITY trial is the only RCT addressing the antibiotic prophylaxis of periprosthetic infection in orthopaedic oncology.[21] It showed that a short course of antibiotics is as effective as a longer course, with fewer antibiotic-related complications, in primary lower-risk reconstructions. This finding marked a significant departure from previous International Consensus Meeting (ICM) recommendations,[3] as the PARITY trial results were published in 2022.

For complex or high-risk reconstructions (e.g. pelvic surgery), there was consensus that an extended course of antibiotic prophylaxis, lasting up to 48 hours, may be beneficial.[22] Additionally, implants coated with silver or iodine were found to potentially reduce early infection rates and improve outcomes in two-stage revisions, although their long-term impact on infection-free survival remains unclear.[7,23]

Traditionally, prolonged wound drainage in large oncology wounds is expected. However, there was strong consensus that wound drainage that persists beyond five to seven days poses a significant risk of deep infection. Wounds draining for more than seven to ten days should be considered for surgical intervention. This statement emphasizes the correlation between persistent leaking wounds and deep infections, advocating aggressive management rather than its acceptance as a consequence of surgery. This differs from previous ICM recommendations, which suggested removing drains within 24 hours.[24,25]

The rate of periprosthetic infection is significantly higher with orthopaedic oncology prostheses than with standard arthroplasties, and infection cure rates are lower in this patient group.[4,26,27] In accordance with ICM, there was strong consensus that single-, two-, and 1.5-stage (use of an interval prosthesis with local antibiotic delivery) revision were acceptable methods for treating PJI in oncological reconstructions, with two-stage revisions being the most reliable, based on published results. It

was noted that the best results for two-stage and single-stage revisions are obtained when all the implants (including well-fixed components) are removed.[3] Single-stage revisions were found to be most effective when the infecting organism is highly sensitive to oral antibiotics.[5] There was strong consensus that primary infection rates do not differ significantly between metallic and biological (allograft) reconstructions, and this factor should not influence decisions about reconstruction.[28] However, for infected biological allograft reconstructions, the success rate of DAIR is low. In such cases, a two-stage strategy transitioning to metallic reconstruction was the most commonly recommended treatment.[29]

Literature on managing acute infections during chemotherapy remains sparse. The consensus emphasized that decisions about chemotherapy interruption should be based on the patient's local and systemic condition and involve a multidisciplinary team. Chemotherapy should continue if minor or conservative surgical treatment is possible. However, major surgical interventions may need a temporary interruption of chemotherapy for several weeks.[30]

Two areas of controversy achieved moderate to weak consensus during the meeting: the role of prolonged antibiotics after the second stage of a two-stage revision, and the role of DAIR in managing periprosthetic infection in orthopaedic oncology. A moderate consensus (76%) was reached about the use of prolonged oral antibiotics after a two-stage revision. Evidence from non-megaprosthetic infections suggests that a six-week course of antibiotics may be effective if cultures are negative at the second stage, while a 12-week course may reduce reinfection rates if cultures are positive. However, the limited evidence supporting this practice led to significant debate, with participants emphasizing the need for more robust data to achieve stronger consensus.[31,32]

The role of DAIR achieved only weak consensus (64%), a result that contrasted sharply with the ICM, where unanimous agreement (100%) was reached on DAIR as a viable option for managing infected endoprostheses.[3] While most surgeons acknowledged DAIR as a treatment option for PJI, substantial debate arose about its definition and common practice. The statement suggested that all membrane and non-well-fixed implants should be removed during a DAIR. It was clear during the debate, however, that practice varies widely. It was also clear during the debate that surgeons, particularly in lower-resource healthcare systems, remove and disinfect the implants and reinsert them during a DAIR, while others debride and retain all the implants, often for economic reasons, especially where patients bear the financial burden of their healthcare costs. Clearly those surgeons who favour a biological reconstruction retain the allograft and often the fixation method. The lack of a standardized definition for DAIR, DAIR-plus, single-stage revision, and 1.5-stage revision was a central point of contention. To address this, a study group has been formed, a separate questionnaire has been distributed, and a pragmatic study proposal is being developed to investigate these questions further.

The clinical impact of specific organism profiles on prognosis in infections involving megaprostheses is poorly studied. Available evidence suggests that infections caused by MRSA, polymicrobial organisms, or fungi are associated with worse outcomes. This underscores the need for further research to better understand and standardize treatment strategies in these challenging cases.[33,34]

These consensus statements serve as a practical reference for clinicians, enabling orthopaedic oncology surgeons and multidisciplinary team members to adapt the recommendations to their centres' resources and facilities, ultimately improving patient outcomes globally. While the consensus marks a significant step forward, certain areas, such as the role of DAIR and the optimal duration of antibiotic use following revision surgery, remain contentious and require further research. The collaborative network established through BOOM offers a robust platform for refining these areas and fostering ongoing research to address unresolved controversies and advance the field of orthopaedic oncology.

This study has its limitations. First, consensus statements are not based on a systematic review of each topic, but are considered to be level V information, as they represent expert opinion. This reliance on expert opinion introduces susceptibility to bias in the selection and allocation of participants.[35,36] Second, the questions and topics addressed may represent a source of bias, as there was no standardized process for generating them, but they were discussed and agreed upon by 150 specialist units worldwide before the formation of the groups and after a review of the literature. Third, although 267 delegates were registered to vote, the maximum number of votes achieved was 194 and the average delegate voted on a mean of 73% (5,296/7,220) of the statements. This discrepancy is likely to be attributable to the composition of the participants. Several delegates were trainees, allied healthcare professionals, and observers, and chose not to vote. As the meeting included multidisciplinary specialists including radiologists, pathologists, and surgeons, some delegates felt uncomfortable voting on questions outside their field of expertise and either abstained or did not vote. A fourth potential limitation of this study is the influence that strong and prominent individuals within the field may have had on the consensus process. During discussions, particularly in a large and diverse assembly, it is possible that the strongly held opinions of a few well-respected or influential delegates shaped the perspectives of others. This effect may occur due to the cognitive bias known as 'authority bias', where individuals are swayed by the opinions of those perceived as experts or leaders in the field. However, to minimize this authority bias, a two-minute time limit allocated for individual views was applied and an inclusive academic discussion was achieved. A fifth limitation was that no pilot testing was done to affirm the comprehensibility of the questionnaire and the usefulness of the response option. Lastly, the global nature of the meeting introduced logistical challenges. Some delegates arrived late or attended only portions of the sessions, resulting in missed opportunities to vote. These factors highlight the inherent complexities of organizing a large international consensus meeting.

A strength of the consensus statements is that BOOM represents the largest global consensus meeting in orthopaedic oncology, with participation from a diverse spectrum of clinicians across the world, working in varied settings and managing periprosthetic infections in oncology reconstructions. Their

involvement reflects particular interest and expertise in this area, as evidenced by their clinical and academic achievement.

In conclusion, BOOM was the largest global consensus meeting in orthopaedic oncology with representation from a broad spectrum of clinicians across the globe working in diverse scenarios treating periprosthetic infection in oncology reconstructions. Strong consensus was achieved in 18 out of 20 statements providing valuable guidance on day-to-day clinical problems in treating periprosthetic infections.

Take home message

- Strong international consensus was reached on several key aspects of periprosthetic infection management in orthopaedic oncology, particularly regarding antibiotic prophylaxis, wound management, and revision strategies.
- Despite the consensus, the overall evidence quality remains low, highlighting an urgent need for further research in areas such as debridement, antibiotics and implant retention, and prolonged antibiotic use.

Supplementary material

BOOM Booklet 2024, and full list of the BOOM participants.

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Author information:

L. Jeys, MSc, DSc, FRCS, Consultant Orthopaedic Surgeon
V. J. Kurisunkal, MS, Consultant Orthopaedic Surgeon
G. V. Morris, MBChB, BSc (Hons), FRCS, Consultant Orthopaedic Surgeon
Royal Orthopaedic Hospital, Birmingham, UK.

E. Botello, MD, Orthopaedic Surgeon, Pontificia Universidad Catolica de Chile, Santiago, Chile.

R. A. Boyle, FRACS, Consultant Orthopaedic Surgeon, Royal Prince Alfred Hospital, Sydney, Australia.

W. Ebeid, MD, Orthopedic Surgeon, Orthopedic Surgery Department, Cairo University, Cairo, Egypt.

M. T. Houdek, MD, Associate Professor, Orthopedic Surgeon, Surgical Oncologist, Mayo Clinic Department of Orthopaedic Surgery, Rochester, Minnesota, USA.

R. Morgan-Jones, MB, BCh, FRCS (Ed), MMedSci (Tr&Orth), Consultant Orthopaedic Surgeon, East Suffolk and Essex Orthopaedic Centre, Colchester Hospital University, Colchester, UK.

A. Puri, MS (Ortho), Orthopedic Surgeon, Head of Department of Surgical Oncology, Homi Bhabha National Institute, Tata Memorial Hospital, Mumbai, India.

P. Ruggieri, MD, PhD, Orthopaedic Surgeon, Department of Orthopedics and Orthopedic Oncology, University of Padova, Padova, Italy.

M. K. Laitinen, MD, Orthopaedic Surgeon, Department of Orthopedics and Traumatology, Helsinki University Central Hospital, Helsinki, Finland.

Author contributions:
L. Jeys: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing, Supervision.
E. Botello: Writing – original draft, Writing – review & editing, Methodology.
R. A. Boyle: Writing – original draft, Writing – review & editing, Methodology.
W. Ebeid: Writing – original draft, Writing – review & editing, Methodology.
M. T. Houdek: Writing – original draft, Writing – review & editing, Methodology.
V. J. Kurisunkal: Conceptualization, Methodology, Writing – original draft, Writing – review & editing.
R. Morgan-Jones: Writing – original draft, Writing – review & editing, Methodology.
G. V. Morris: Conceptualization, Methodology, Writing – original draft, Writing – review & editing.
A. Puri: Methodology, Writing – original draft, Writing – review & editing.
P. Ruggieri: Writing – original draft, Writing – review & editing, Methodology.
M. K. Laitinen: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Data curation, Validation.

Funding statement:
The authors received no financial or material support for the research, authorship, and/or publication of this article.

ICMJE COI statement:
E. Botello reports consulting fees, payment for lectures, presentations, speakers bureaus, manuscript writing or educational events, and payment for expert testimony from Zimmer Biomet, which are unrelated to this study. E. Botello is also membership chairman of the ISOLS board, and past president of SLATME. R. Boyle reports royalties or licenses from Adler and Medacta, consulting fees from Stryker and Zimmer Biomet, and payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Zimmer Biomet and LifeHealthcare, as well as a leadership or fiduciary role in OEI, all of which are unrelated to this study. M. T. Houdek reports consulting fees from Stryker Orthopedics and a leadership or fiduciary role in the Connective Tissue Oncology Society, unrelated to this study. L. Jeys reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from ImplantCast and Biocomposites, unrelated to this study, and is a board member of ISOLS and President Elect of the British Orthopaedic Oncology Society. M. Laitinen reports support for attending meetings and/or travel from Tree-Step, unrelated to this study. R. Morgan-Jones reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Zimmer Biomet, MoInlyke, Biocomposites, LINK, and Smith & Nephew, and support for attending meetings and/or travel from Zimmer Biomet, MoInlyke, and Smith & Nephew, all of which are unrelated to this study. R. Morgan-Jones is also a Trustee of the BOA and President of the Bone and Joint Infection Society. G. Morris reports educational contracts with Implantcast and Stryker, unrelated to this study. A. Puri sits on the International Advisory Board of APMSTS and the editorial board for *The Bone & Joint Journal*, *Bone & Joint 360*, and *Bone & Joint Open*. P. Ruggieri reports royalties or licences from Stryker and Exactech, unrelated to this study, and is President of EFORT and Secretary General of ISOLS.

Data sharing:
The data that support the findings for this study are available to other researchers from the corresponding author upon reasonable request.

Ethical review statement:
Ethical approval was not required for this study as it did not involve patient data. The project was conducted as an international expert consensus (Delphi) survey. According to institutional and national guidelines, such studies are exempt from institutional review board review.

Open access funding:
The open access publication of this work was supported by funding from the state for university-level research, Helsinki University Hospital, Finland, under grant number TYH 2023317.

This article was primary edited by A. C. Ross.