Proceedings of the International Consensus Meeting on Periprosthetic Joint Infection

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Foreword

"The doorstep to the temple of wisdom is a knowledge of our own ignorance."

Benjamin Franklin

The battle against infection is as old as human civilization. During the last few centuries, great scholars such as Louis Pasteur, Ignaz Philipp Semmelweis, Alexander Fleming, and Joseph Lister have transformed the practice of medicine through their extraordinary discoveries. Despite the progress made and strides gained, our mission to prevent infection following surgery remains unaccomplished. It is not an exaggeration to claim that fear of infection lives in the hearts of every surgeon who steps into the operating room daily.

Periprosthetic joint infection (PJI), with all its disastrous consequences, continues to pose a challenge to the orthopaedic community. Practicing orthopaedic surgeons have invested great efforts to implement strategies that may minimize surgical site infection (SSI). Although high level evidence may support some of these practices, many are based on little to no scientific foundation. Thus, there is a remarkable variation in practices across the globe for prevention and management of PJI.

The medical community comprehends the importance of high-level evidence and engages in the generation of such whenever possible. The community also recognizes that some aspects of medicine will never lend themselves to the generation of high-level evidence nor should one attempt to do so. It is with the recognition of the latter that The International Consensus Meeting on Periprosthetic Joint Infection was organized. Delegates from various disciplines including orthopaedic surgery, infectious disease, musculoskeletal pathology, microbiology, anesthesiology, dermatology, nuclear medicine, rheumatology, musculoskeletal radiology, veterinary surgery, pharmacy, and numerous scientists with interest in orthopaedic infections came together to evaluate the available evidence, when present, or reach consensus regarding current practices for management of SSI/PJI.

The process of generating the consensus has spanned over 10 months. Every stone has been turned in search of evidence for these questions, with over 3,500 related publications evaluated. The evidence, when available, has been assessed. Otherwise the cumulative wisdom of 400 delegates from 52 countries and over 160 societies has been amassed to reach consensus about practices that lack higher level of evidence. The leadership of the Musculoskeletal Infection Society (MSIS) and the European Bone and Joint Infection Society (EBJIS), the two societies whose mission is to improve care of patients with musculoskeletal infection, have, in particular, contributed to this initiative immensely.

The delegates have been engaged every step of the way by communicating through a "social" website generated for this purpose (www.ForMD.com), with over 25,000 communications exchanged. The consensus document has been developed using the Delphi method under the leadership of Dr. Cats-Baril, a world-renowned expert in consensus development. The design of the consensus process was to include as many stakeholders as possible, allow participation in multiple forums, and provide a comprehensive review of the literature. All relevant topics on PJI were assigned into one of 15 different workgroups as follows: mitigation and education on co-morbidities associated with increased SSI/PJI, perioperative skin preparation, perioperative antibiotics, operative environment, blood conservation, prosthesis selection, diagnosis of PJI, wound management, spacers, irrigation and debridement, antibiotic treatment and timing of reimplantation, one-stage versus two-stage exchange arthroplasty, management of fungal or atypical PJI, oral antibiotic therapy, and prevention of late PJI. Every consensus statement has undergone extreme scrutiny, especially by those with expertise in a specific area to ensure that implementation of these practices will lead to improvement of patient care.

After synthesizing the literature and assembling a preliminary draft of the consensus statement, over 300 delegates attended the face-to-face meeting in Philadelphia and were involved in active discussions and voting on the questions/consensus statements.

The delegates first met on July 31 in smaller workgroups to discuss and resolve any discrepancies and finalize their statements. Then, the delegates met in the general assembly for further discussion of questions and consensus statements. After revision, the finalized consensus statement was assembled and the document was forwarded to the Audience Response System that evening for voting to begin the next day.

On August 1, 2013 the delegates came into the general assembly and voted on the 207 questions/consensus statements that were presented. The voting process was conducted using electronic keypads, where one could agree with the consensus statement, disagree, or abstain from voting. The strength of the consensus was judged according to the following scale: 1) Simple Majority: No Consensus (50.1%-59% agreement), 2) Majority: Weak Consensus (60%-65% agreement), 3) Super Majority: Strong Consensus (66%-99% agreement), and 4) Unanimous: 100% agreement. Of the 207 questions, there was unanimous vote for one question (controlling OR traffic), 202 questions received super majority (strong consensus), two questions had weak consensus, and only two questions did not achieve any consensus.

The document presented here is the result of innumerable hours of work by the liaisons, leaders, and delegates dedicated to this historic initiative. The information conveyed in this document is based on evidence, whenever present, or is the result of the cumulative wisdom of over 400 of the world's experts in musculoskeletal infection from 52 countries. We are certain that the "best practice guide" set forth by this initiative will serve many of our patients for years to come. It is essential to state that the information contained in this document is merely a guide to practicing physicians who treat patients with musculoskeletal infection and should not be considered as a standard of care. Clinicians should exercise their wisdom and clinical acumen in making decisions related to each individual patient. In some circumstances this may require implementation of care that differs from what is stated in this document.

On with our fight against infection.

Javad Parvizi MD, FRCS

Question 15: Do FAW blankets increase the risk of SSI?

Consensus: We recognize the theoretical risk posed by FAW blankets and that no studies have shown an increase in SSI related to the use of these devices. We recommend further study but no change to current practice.

Delegate Vote: Agree: 89%, Disagree: 5%, Abstain: 6% (Strong Consensus)

Justification: Recent studies have raised concern about the possibility of bacterial air contamination by FAW devices. Some authors evaluated disruptions in airflow. McGovern et al. conducted an experimental study where they found that FAW blankets lead to a disruption in the airflow at the surgical site under LAF conditions when compared to conductive fabric warmers in simulated THA and spine surgery.[76] Legg et al. found increased air particles above the surgical site when using FAW compared to radiant warming.[77] On the contrary, Sessler et al. did not identify any worsening in air quality with use of FAW under laminar flow conditions.[78] Memarzadeh et al. reported the results of a computational study conducted by the National Institutes of Health which showed negligible disruption of laminar flow by FAW.[79]

Other authors have investigated the bacterial contamination of OR air. Moretti et al. undertook air sampling in experimental conditions and demonstrated increased bacterial contamination of air after turning FAW blankets on; however, this was much lower than worsening of air quality induced by personnel placing a patient in the OR.[80] Tumia et al. undertook air sampling under LAF conditions in orthopaedic procedures and failed to identify any significant rise in air bacterial counts with the use of FAW.[81] Sharp et al. also performed air sampling in LAF equipped ORs to study the effect of FAW on air quality using volunteer patients with psoriasis who had increased shedding of skin cells.[82] Air at 30cm from a theoretical operating site was sampled and there were no positive cultures. In addition, a smoke test that was used to visually assess airflow found no disturbance by the FAW device. Zink et al. were also concerned by possible contamination of the OR environment with FAW, but did not resort to air sampling. Instead, they placed culture plates on the abdomen of volunteers with use of FAW and failed to identify increased contamination rates with this method.[83]

Albrecht et al. found that the intake filters used in air blowers were not optimally efficient and resulted in colonization of the internal parts of the device. Overall, 92% of the devices they tested resulted in positive bacterial growth with organisms that are typically implicated in PJI (mostly Staphylococci species).[84] However, there is no concrete evidence to link the use of FAW system with SSI/PJI. McGovern et al studied a change of a warming system from forced air to an alternative system in 1,437 patients. A significant increase in deep joint infection, as demonstrated by an elevated infection odds ratio (3.8, p=0.024), was identified during a period when FAW was used compared to a period when conductive fabric warming was used. The authors conceded that the study was observational and may have been affected by other infection prevention measures instituted by the hospital.[76]

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