Prosthetic joint infection: managing infection in a bionic era

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There is increasing demand for prosthetic joint surgery and patients are becoming more challenging due to an ageing population often with comorbidities and immunosuppression. While prosthetic joint infection (PJI) rates are generally low, infection can be catastrophic for the patient and hence prevention of infection is critical. Infection, when it does occur, is further complicated by the global rise in antimicrobial resistance. This article introduces a series of papers on the epidemiology of PJI, its diagnosis, use of novel inflammatory markers and molecular techniques, clinical presentation, importance of biofilms, treatment guidelines and, finally, various strategies and novel antibiotic treatment regimens.

Keywords: septic arthritis, antibiotics, surgical infection, infection rates

Two critical and interrelated factors in the success of ever-more-technical surgery to replace or reconstruct damaged biological structures such as joints with prosthetic or foreign material are the prevention of infection and having means to treat infection when it occurs. While the demand for such surgery is increasing, ensuring good clinical outcomes is becoming more challenging due to an ageing population often with comorbidities, such as obesity or immunosuppression. In addition, there is increasing concern that rising global antibiotic resistance may make such surgery less effective in the future. It is imperative that there is global cooperation in ensuring responsible antibiotic use in human medicine, veterinary practice and agriculture, improving public health and infection control and supporting research in infection management.

This Supplement comprises a series of articles that provide a combination of review of current practice as well as discussions of novel approaches to the optimal diagnosis and management of prosthetic joint infection (PJI) and discussions of novel and optimal treatments of PJI. Replacement of damaged joints improves quality of life immensely. Infection is among the most serious complications as this can subject the sufferer to weeks and months of pain, discomfort and misery. Many of the standard techniques involved in prosthetic joint surgery have been developed to prevent infection and by and large these work well. Among the strategies that are employed are screening patients pre-operatively for staphylococcal carriage, pre-operative antiseptic baths, skin antisepsis at operation, antibiotic prophylaxis, laminar air flow in the operating theatre, skilled and aseptic surgical technique, minimizing blood loss and maintaining body temperature.

Trends in the epidemiology of PJI in the UK are reported by Lamagni. Infection rates are generally low and voluntary reporting in the UK to Public Health England (formerly the HPA) gives national figures for surgical site infection (SSI) and PJI. Approximately 1 in 100 patients undergoing hip prosthesis surgery and 1 in 200 undergoing knee prosthesis surgery developed an SSI. Of these infections, just over half affected the deeper tissue or joint. The risk of SSI was highest in repair of neck of femur procedures, where ~1 in 60 patients developed an SSI. Rates of SSI increased with patient age and the number of risk factors for infection present at the time of operation. Inclusion of post-discharge surveillance data (readmissions) has increased the number of SSIs detected. Post-discharge infections comprised 41% of SSIs overall and 58% in knee prosthesis during 2009/10. In 485,194 procedures in the UK over 5 years (2005–10), there were 3,496 (0.72%) reported SSIs. European and international PJI rates are similar. The diagnosis of PJI remains difficult. In addition to conventional diagnosis, novel techniques in molecular diagnosis and assessment of novel inflammatory markers are reviewed. Saeed reports a wide range of existing and experimental diagnostic techniques and Hartley comments on highly sensitive molecular diagnosis, which may also provide greater insights into the aetiology of PJI. Diagnostic investigations often involve complex collaboration between the orthopaedic surgeon, radiologist and microbiologist/infection specialist. The main challenge is often establishing the depth of infection and whether the prosthesis is actually involved. As highlighted by Barrett and Atkins in their article on clinical presentation, the diagnosis of PJI can be a challenge and has major consequences for the patient.

Conventional microbiology remains relatively straightforward. Staphylococcus aureus remains the most common pathogen and is reported as causing ~40% of SSIs. In knee prostheses, the most common organisms reported for inpatient SSIs were coagulase-negative staphylococci (30%). The second most common organisms were Enterobacteriaceae for inpatient SSIs.
However, the proportion of infections associated with these pathogens was higher in recent years. The proportion of *S. aureus* isolates resistant to methicillin (MRSA) was lower than the proportion of methicillin-susceptible *S. aureus* (MSSA). MRSA and MSSA now account for 16% and 22% of all inpatient SSIs, respectively, with MSSA now the most common cause of all inpatient SSIs. The data suggest that in the UK at least, the proportion of MRSA causing SSI is falling.

The surveillance of the microbial aetiology is important because guidelines for treatment, reviewed by Minassian et al. in this Supplement, will need to be reviewed as the epidemiology changes and in relation to geographical differences. The specific challenges of biofilms in PJI and antibiotic penetration are reviewed by Jaqueline and Caillon while other authors discuss their experiences or review the roles of newer antibiotics, singly or in combination, in the treatment of PJI in two European centres.

Preventing infection is a critically important aspect of joint replacement. However, when complications arise, infection, if present, must be accurately diagnosed. If infection is present, successful treatment of confirmed PJI requires close collaboration between the surgeon and infection specialist. No two patients are the same and treatment strategies often need to be individually tailor-made involving antimicrobial treatment, soft tissue care, removal of prostheses and early or late revision. All of these have a place, as occasionally does long-term antibiotic suppressive therapy for those patients who are medically unfit or mechanically unsuitable for further surgery.

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**References**