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Variation of Practice in Prophylactic Protocol to Reduce Prosthetic Joint Infection in Primary Hip and Knee Arthroplasty: A National Survey in the United Kingdom

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Purpose: Prosthetic joint infection (PJI) has an enormous physiological and psychological burden on patients. Surgeons rightly wish to minimise this risk. It has been shown that a standardised, evidence-based approach to perioperative care leads to better patient outcomes. A review of current practice was conducted using a cross-sectional survey among surgeons at multiple centers nationwide.
Materials and Methods: An 11-question electronic survey was circulated to hip and knee arthroplasty consultants nationally via the BOA (British Orthopaedic Association) e-newsletter.
Results: The respondents included 56 consultants working across 19 different trusts. Thirty-four (60.7%) screen patients for asymptomatic bacteriuria (ASB) preoperatively, with 19 (55.9%) would treating with antibiotics. Fifty-six (100%) screen for methicillin-resistant *Staphylococcus aureus* and treat if positive. Only 15 (26.8%) screen for methicillin-sensitive *S. aureus* (MSSA) or empirically eradicate. Zero (0%) routinely catheterise patients perioperatively. Forty-one (73.2%) would give intramuscular or intravenous gentamicin for a perioperative catheterisation. All surgeons use laminar flow theatres. Twenty-six (46.4%) use only an impervious gown, 6 (10.7%) exhaust pipes, and 24 (42.3%) surgical helmet system. Five different antimicrobial prophylaxis regimens are used 9 (16.1%) cefuroxime, 2 (3.6%) flucloxacillin, 19 (33.9%) flucloxacillin and gentamicin, 10 (17.9%) teicoplanin, 16 (28.6%) teicoplanin and gentamicin. Twenty-two (39.3%) routinely give further doses.
Conclusion: ASB screening, treatment and intramuscular gentamicin for perioperative catheterisation is routinely practiced despite no supporting evidence base. MSSA screening and treatment is underutilised. Multiple antibiotic regimens exist despite little variation in organisms in PJI. Practice varies between surgeons and centers, we should all be practicing evidence-based medicine.

Key Words: Arthroplasty, Prosthesis and implants, Hip joint, Knee joint, Prosthetic joint infection

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INTRODUCTION

In 2021, more than 160,000 primary hip and knee arthroplasties were performed in the United Kingdom (UK). In total, revision of 1,920 hip and knee arthroplasties was performed due to prosthetic joint infection (PJI)[1]. This corresponds with data from other similarly matched economically developed countries worldwide (Australia, United States, and Canada) where the incidence of PJI is approximately 2%[2,3]. PJI, one of the most significant complications following arthroplasty, is associated with substantial patient morbidity[4,5]. It also places a considerable burden on healthcare systems[6,7]. The estimated economic burden of PJI in the United States alone is expected to reach $1.85 billion by 2030[8]. Therefore, surgeons understandably wish to minimise the risk of this complication.

Use of an evidence-based approach to patient care has been proven to result in better outcomes. However, there is limited guidance with regard to standardised preoperative arthroplasty care to reduce the risk of PJI. The National Institute for Health and Care Excellence (NICE) emphasises the use of surgical site disinfection and laminar flow as standard preoperative procedures[9]. The British Orthopaedic Association (BOA) only maintains that "appropriate prophylactic antibiotics are given"[10,11]. According to the American Academy of Orthopaedic Surgeons (AAOS), there is a paucity of quality evidence to support many of the perioperative strategies employed in the effort to reduce the risk of PJI[12]. The American Association of Hip and Knee Surgeons (AAHKS) has not provided guidelines regarding measures for prevention of PJI that can be utilised in clinical practice. This lack of clarity is reflected in varying departmental policies for prevention of PJI.

The use of preoperative screening and eradication of methicillin-resistant *Staphylococcus aureus* (MRSA) and administration of intraoperative antibiotic regimens have been incorporated as standard operative practice. However, there is some variability in the duration and combination of these anti-microbials in the prevention of PJI[13-16]. Standard utilisation of laminar flow theatres[17-19] and surgical helmet systems in arthroplasty procedures has shown a rapid increase[16,20] despite conflicting evidence. Anecdotally, routine preoperative screening and treatment of asymptomatic bacteriuria (ASB)[21-23], perioperative catheterisation[24,25], and administration of antibiotics on insertion and removal[26-29] are still performed in some orthopaedic departments despite a lack of scientific evidence and a growing evidence base to support elimination of this practice. Routine screening of a patient's urine is not recommended by NICE unless "it will influence the decision to operate"[30]. AAHKS, AAOS, the British Hip Society (BHS), and the British Knee Society (BKS) have not provided guidance on routine screening and treatment of ASB.

We conducted a cross-sectional survey study in order to evaluate the current practice for perioperative preventative management of PJI in primary hip and knee arthroplasty within multiple centers located nationwide in the UK. The following areas were assessed: screening and treatment for ASB, MRSA and methicillin-sensitive *S. aureus* (MSSA), perioperative catheterisation and antibiotic administration, utilisation of laminar flow theatres, usage of surgical helmet systems and antibiotic regimens.

MATERIALS AND METHODS

An 11-question electronic survey (see Supplementary Material 1) on strategies for prevention of PJI described above was circulated nationally to hip and knee arthroplasty consultants using the BOA electronic newsletter. Data collection was conducted over a three-month period (01/01/2020 until 30/03/2020). Answers were collected electronically using Google forms. Analysis of the data was performed using basic descriptive statistics. The questionnaire was initially circulated to arthroplasty surgeons in the region (North-West England), and it was then expanded nationally via the BOA newsletter.

RESULTS

The respondents included 56 arthroplasty consultants working across 19 different trusts nationwide. Thirty-four respondents (60.7%) perform preoperative screening of patients for ASB (Fig. 1). Of these, 19 respondents (55.9%) would prescribe treatment of ASB patients with antimicrobial therapy (Fig. 1). Fifty-six respondents (100%) perform regular screening for MRSA and administer treatment in the case of a positive result. Twenty respondents (35.7%) do not provide skin decolonisation preparations preoperatively (Fig. 1). Only 15 respondents (26.8%) perform normal screening for MSSA or empirical eradication (Fig. 1). Routine preoperative catheterisation of patients is performed by 0 (0%) of respondents. Forty-one respondents (73.2%) would administer intramuscular or intravenous gentamicin to a patient requiring perioperative catheterisation.

All of the 56 surgeons (100%) use laminar flow theatres.

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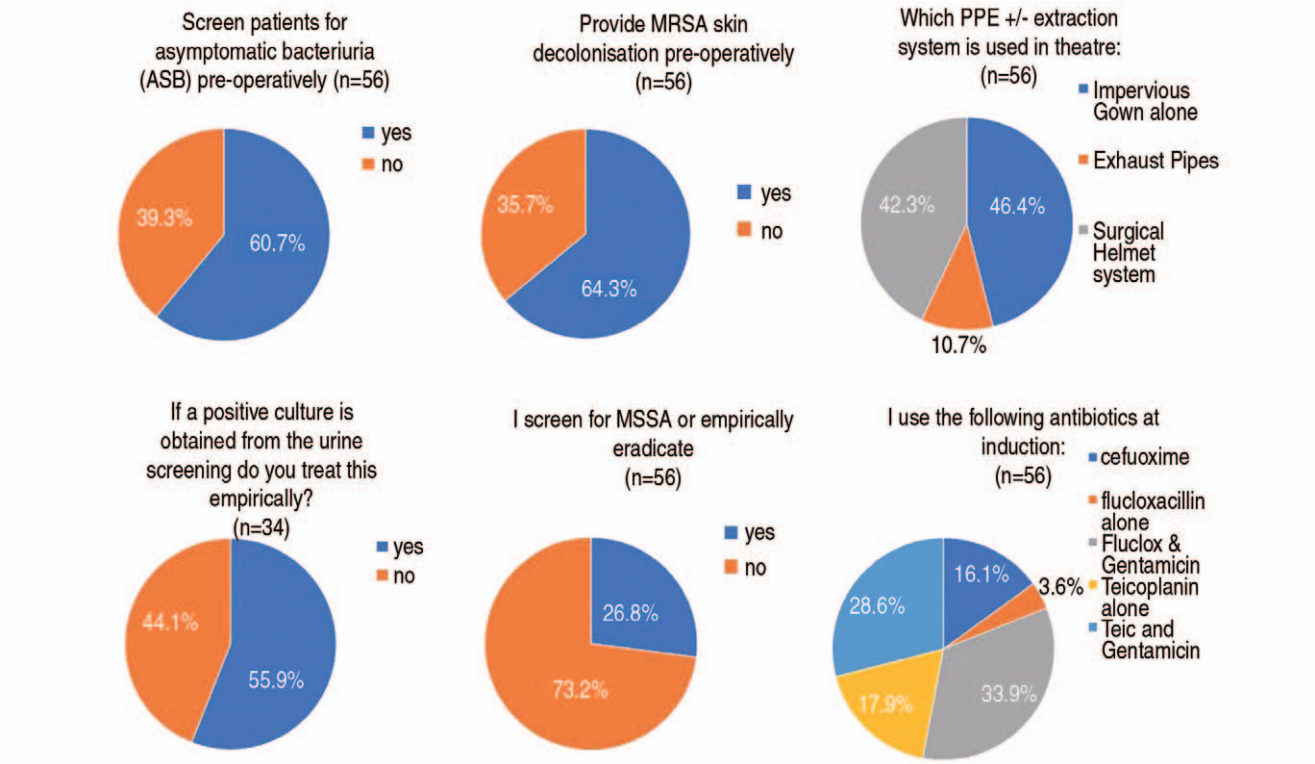

Fig. 1. Graphical representation of the responses received to the electronic survey.
MRSA: methicillin-resistant *Staphylococcus aureus*, MSSA: methicillin-sensitive *S. aureus*, PPE: personal protective equipment.

Twenty-six surgeons (46.4%) use only an impervious gown, six (10.7%) use Charnley like exhaust pipes, and 24 (42.3%) use a surgical helmet system (Fig. 1). Use of five different antimicrobial prophylaxis regimens was reported: nine surgeons (16.1%) use cefuroxime, two (3.6%) use flucloxacillin, 19 (33.9%) use flucloxacillin and gentamicin, 10 (17.9%) use teicoplanin, and 16 (28.6%) use teicoplanin and gentamicin.

DISCUSSION

The findings of this study have once again highlighted the disparities between arthroplasty surgeons in the prevention of PJI. Our study provides positive validation of the standard nationwide practice of incorporating the use and the elimination of routine catheterisation and shows agreement with the published scientific literature and representative bodies.

We recognise that our study has several limitations. The BOA includes more than 5,000 members and there are approximately 3,000 primary hip and knee arthroplasty surgeons in the UK[1]. Unfortunately, we were not able to access data confirming the precise number of arthroplasty surgeons who are members of the BOA in the UK. Nevertheless, our response rate (56 respondents) was low and may not be a representative reflection of practice in the UK. This is re-enforced by the fact that 48 out of the 56 respondents (85.7%) were from North-West England. Thus, there may be an element of response bias, and clinical practice might be affected and influenced by a variety of factors, such as training and methods already adopted by other colleagues in the locality. Again, the findings of this study may not represent the actual practice of the full cohort of arthroplasty surgeons from across the UK.

Screening and treatment for ASB and administration of antibiotics for perioperative catheterisation is practiced routinely despite little or no evidence base. The current evidence does not support routine preoperative screening and treatment of ASB[21-23]. Several studies have demonstrated that the risk of PJI is increased for patients with ASB; however, the causative microbes did not show correlation with the isolate from urine[21]. Detection of ASB could in fact be an identifier for immunocompromised patients requiring preoperative attention from staff as their postoperative recovery and rehabilitation may be protracted. Previous studies emphasised that administration of antibiotics did not result in a significant difference in surgical site infection (SSI) and cases of bacteraemia on removal of the

catheter[28,29]. Again, no correlation was observed between organisms detected in urine at the time of catheter insertion/removal and subsequent PJI[28]. Therefore, in prevention of PJI, it can be regarded as an unnecessary policy in units that adopt mandatory administration of antibiotic during the perioperative period.

A large proportion of respondents continue with postoperative administration of antibiotics as standard practice despite a number of studies demonstrating that further administration was not associated with a statistically significant difference in the prevention of SSIs[13,14]. Some local patterns of resistance preclude the usage of certain antimicrobials. However, there are multiple antibiotic regimens despite the fact that only seven causative organisms are responsible for 89% of PJIs[14]. Such variation in the number of regimens currently in use is not justified.

The findings of this study again highlight the lack of consistency in utilisation of surgical helmet systems in arthroplasty surgery. This has also been born out in the scientific literature. The BHS blue book recommends using either body exhaust suits or occlusive theatre clothing[16]. According to Young et al.[20], modern positive-pressure surgical helmet systems, compared with negative-pressure Charnley-type body exhaust suits, did not reduce contamination or deep infection during arthroplasty. This finding again highlights a critical aspect of measures for prevention of PJI that will require additional research in order to determine an optimal solution.

Screening and treatment for MSSA is underutilised, and most surgeons do not perform any type of screening. One study demonstrated that patients who show a positive finding on screening for MSSA are also at a higher risk of postoperative infection than those who show a negative finding on screening[31]. Its utilisation as a tool for prevention of PJI is supported by institutional bodies such as the AAOS despite the fact that there is only a consensus view and limited high-quality evidence[12]. Jeans at al.[32] reported that the overall rate of PJI fell from 1.92% to 1.41% (P=0.03), particularly MSSA associated PJI (3% to 1.5%, P=0.002), with use of a routine screening programme. In addition, comparison with the cost of prevented infections showed that it resulted in significant savings.

Although there are variations in practice between surgeons and centers, practice using a unified evidence-based approach in the prevention of PJI should be the goal for all of us. Based on the findings of this study, additional research and guidance is required from leading organisational bodies in the effort to standardise practice in the prevention of PJI.

CONCLUSION

ASB screening, treatment and intramuscular gentamicin for perioperative catheterisation is routinely practiced despite no supporting evidence base. MSSA screening and treatment is underutilised. Multiple antibiotic regimens exist despite little variation in organisms in PJI. Practice varies between surgeons and centers, we should all be practicing evidence-based medicine.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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SUPPLEMENTARY MATERIALS

Supplementary data is available at https://hipandpelvis.or.kr/.

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