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Original Article

Surgical site infection risk following pre-operative MRSA detection in elective orthopaedic surgery

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ABSTRACT

Aims: The aim of this study was to determine the risk of post-operative surgical site infection (SSI) in patients undergoing elective orthopaedic surgery who were colonised with MRSA.

Methods: All patients admitted for elective orthopaedic surgery from January 2008 to December 2012 were screened for MRSA. MRSA positive patients were identified and given topical suppression therapy.

Results: 11,567 patients were screened for MRSA. Ninety-nine (0.9%) were colonised and eighty-eight (88.9%) proceeded to surgery. Three patients (3.4%) developed post-operative superficial SSIs. Two were in patients who had total knee replacements (TKR).

Conclusion: We conclude that patients should be informed of an increased SSI risk if colonised with MRSA pre-operatively.

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1. Introduction

Post-surgery Methicillin-resistant *Staphylococcus aureus* (MRSA) infection can lead to considerable morbidity and mortality in orthopaedic patients. Mortality rates from MRSA bacteraemia are double that of methicillin-sensitive *Staphylococcus aureus* (MSSA) and therefore this is an important issue for all concerned.

Staphylococcus accounts for the majority of surgical site infections (SSI) in orthopaedic patients, with the risk of SSI in a colonised patient lying between two and nine times higher than that of an uncolonised individual.¹ Surgical site infections with *Staph. aureus* in orthopaedic patients are difficult to treat as this organism can form a biofilm on orthopaedic implants which leads to resistance to antibiotic treatment. This leads to persistence of infection leading to long-term

morbidity.² We have a very limited choice of compounds available for treating these resistant organisms.

Screening programmes for the detection of MRSA are recommended in all patients at high risk of MRSA carriage, those suffering serious MRSA infections (e.g. prosthetic implants) or in units with a high proportion of MRSA infections among colonised patients (e.g. intensive care, trauma and orthopaedic).

The aim of this study was to determine the risk of developing a post-operative SSI in patients who were identified to be colonised with MRSA, had suppression therapy and subsequently underwent elective orthopaedic surgery.

2. Patients and methods

All patients who were planned for elective orthopaedic surgery in our hospital from January 2008 to December 2012 were

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included in this study. Pre operatively, all patients had microbiological swabs taken from the nostrils, axillae and groins and cultured for MRSA. Culture-positive patients were entered into our hospital MRSA database and given suppression therapy prior to surgery in order to reduce the chance of spread and to decrease the risk of post-operative surgical site infection (SSI). This involved topical application of Hibiscrub (4% chlorhexidine gluconate solution) skin wash once daily for 5 days and nasal Mupirocin three times a day for 5 days. This treatment was initiated 2 days prior to surgery and finished 2 days following surgery, thus allowing maximal suppression on the day of surgery (i.e. day 3). Patients who had rapid screening for MRSA on the day of surgery and patients who were listed but subsequently did not have surgery were excluded from this study.

The MRSA colonised patients were further reviewed to look for post operative wound related complication and infection. We further determined the infection as superficial SSI and deep SSI. Deep SSI was defined by the World Health Organization (WHO) as involving deep soft tissues such as fascia and muscle layers, whereas superficial SSIs involve only the skin and subcutaneous tissues.³ We also determined the site of MRSA colonisation in these patients, type of surgery they underwent and the specific organism responsible for the SSI. We also looked at any further intervention required and the outcome.

Between January 2008 and December 2012 11,567 patients were planned for surgery and were screened for MRSA. Of these 0.9% (99) were colonised with MRSA (Fig. 1).

3. Results

All patients were studied. In the MRSA colonised group, the mean age was 64 years (23–92) and the male to female ratio was 1:1.06. Eighty-eight (89%) of those patients colonised with MRSA subsequently underwent planned elective surgery. All MRSA-colonised patients had suppression therapy with the topical agents described above. In addition, all patients had intravenous Teicoplanin and Gentamycin at the time anaesthetic induction prior to the planned surgery.

Fig. 1 – The methicillin-resistant *Staphylococcus aureus* (MRSA) status of elective orthopaedic patients and subsequent surgical site infections (SSIs) (MSSA, methicillin-sensitive *Staph. aureus*).

Fig. 2 – Graph showing incidence of pre-operative MRSA positive cases and number of patients screened.

Overall, a downward trend in the incidence of pre-operative MRSA positive cases was noted during the course of the study (Fig. 2). This is in contrast to the trend seen in the number of patients screened.

Three patients (3.4%) developed post-operative superficial SSIs. Two of these were in patients who had primary total knee replacements (TKR). The third case was in a patient undergoing first tarsometatarsal joint (TMTJ) arthrodesis. MRSA was isolated from the surgical site in two cases with methicillin-sensitive *Staphylococcus aureus* (MSSA) cultured in the other (patient with TKR) (Table 1).

The mean age of patients with a post-operative SSI was 77 years (58–87). The rate of SSI in TKR was 11% (2 of 18 cases). There were no cases of deep infections. The patients with MRSA SSI were treated with doxycycline and erythromycin respectively, with flucloxacillin used to treat the patient with MSSA SSI. All infections settled with antibiotics, with vacuum-assisted closure (VAC) therapy additionally required for the MSSA SSI following TKR.

4. Discussion

Approximately 30% of the general population is colonized with *Staph. aureus*. As it is known that colonisation with *Staph. aureus* adds to the risk of SSI (by MSSA/MRSA), it is of paramount importance to reduce *Staph. aureus* colonization prior to elective orthopaedic procedures in order to decrease the risk of SSIs.

A review by Goyal et al⁴ demonstrated that the implementation of a screening and eradication programme for those patients undergoing elective orthopaedic surgery is effective in reducing the rate of SSIs caused by MRSA. The most effective treatment regimen consists of a combination of intranasal mupirocin and chlorhexidine body washes, with reductions in SSIs reported as high as 86% compared with control groups. Pofahl et al⁵ reported a reduction in MRSA SSI from 0.23% to 0.09% out of over five thousand patients, following an MRSA screening protocol. The reduction was most pronounced in

Table 1 – Patients with surgical site infections.

Age (yrs)	Gender	Procedure ^a	Site of colonisation	Prophylactic antibiotic	Infection type ^b
58	F	TKR	Nose/groin	Teicoplanin & Gentamycin	Superficial (MRSA)
85	F	TKR	Nose/groin	Teicoplanin & Gentamycin	Superficial (MSSA)
87	F	1st TMTJ arthrodesis	Nose	Teicoplanin & Gentamycin	Superficial (MRSA)

^a THR, total hip replacement; TKR, total knee replacement; TMTJ, tarsometatarsal joint.

^b MRSA, methicillin-resistant *Staph. aureus*; MSSA, methicillin-sensitive *Staph. aureus*.

joint-replacement procedures (0.30%–0%; $p = 0.04$). Patients with positive MRSA screens were treated before elective operation with 2% nasal mupirocin ointment twice daily for 5 days and with 4% chlorhexidine gluconate bathing in this study.

Following the use of our MRSA screening programme and subsequent topical suppression regime, the SSI rate for elective orthopaedic surgery in patients colonised with MRSA was 3.4%, with no deep infections. SSI rate in those undergoing total knee replacement was 11%, which is higher than national reported figures of 0.6%.⁶ The SSIs encountered in the TKRs were in 2008 and 2009, whereas that for the TMTJ arthrodesis occurred in 2010.

Murphy et al in 2011 reported an overall SSI rate in elective orthopaedic cases of 6.7% from ninety MRSA-colonised patients, with deep SSIs occurring in 4 cases (4.4%) and superficial SSIs in 2 (2.2%).⁷ The responsible organism was MRSA in four cases, with MSSA identified in the remaining 2 cases. MRSA eradication therapy consisted of nasal mupirocin and Clinisan advance bodywash (chlorhexidine and tea tree oil). It is worth noting however that in this study patients only proceeded to elective surgery after a repeat pre-operative MRSA screen after eradication therapy was negative. However, in our series, patients were prescribed suppression therapy 2 days prior to their elective surgery and did not have a repeat screen prior to surgery and our SSI rates were much lower at 3.4%.

The incidence of pre-operative MRSA positive patients displayed a downward trend throughout the course of our study, despite an upward trend in the number of cases screened per year and MRSA colonisation being relatively prevalent, with some studies reporting prevalence figures as high as 27%.⁸ Prevalence of pre-operative MRSA colonisation in patients planned for elective orthopaedic surgery, in our study group was 0.9%.

Yano et al⁹ reported that positive nasal culture of MRSA is a risk factor for SSI in elective orthopaedics. Of 2423 patients included in the study, 63 (2.6%) were nasal MRSA carriers. In total, fifteen (0.6%) developed an MRSA SSI, four (6.3%) of whom were nasal MRSA carriers, compared with 0.5% of non-nasal MRSA carriers ($p < 0.001$). All three patients in our study who developed an SSI were nasal MRSA carriers. In two of these three cases the responsible organism was MRSA.

Arguments can also be made for the use of polymerase-chain reaction (PCR) as opposed to traditional culture-based techniques for pre-operative MRSA detection. Sensitivity of PCR is 100%, compared with 90% for culture, with the specificity of PCR being 98%, compared with 100% for culture.¹⁰ The main advantage however, is the speed of the result, with PCR yielding a result within 24 hours whereas standard

cultures may take up to three to four days. The disadvantage, unsurprisingly, lies in the cost between the two methods, with the cost to run a PCR being €98.82, compared with routine cultures, which cost €17.30 for MRSA-negative cultures and €39.53 for MRSA-positive cultures.¹¹

Although this study lacks a control group, its strength is that it provides the reader with further evidence that those patients colonised pre-operatively with MRSA are at a higher risk of suffering from an MRSA SSI when undergoing elective orthopaedic surgery in spite of pre-operative MRSA suppression therapy. As such, it serves as a reminder for surgeons to be meticulous with regards to infection control, especially when dealing with this particular group of patients. Some important measures to remember are hand hygiene, restriction of antibiotics and the detection and appropriate isolation of infected or colonised patients.

We conclude that patients identified to be colonised with MRSA pre-operatively and undergoing elective orthopaedic surgery are at an increased risk of developing an SSI. As a result, patients should routinely be made aware of this increased infection risk.

Conflicts of interest

All authors have none to declare.

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