



Methicillin resistant *Staphylococcus Aureus* (MRSA) is not always caught on the orthopaedic ward

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We report the prevalence and incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) colonisation during the patient journey for patients admitted to orthopaedic and trauma wards. Patients were swabbed for MRSA colonisation on admission, transfer, and discharge from hospital. Elective patients undergoing major joint surgery were also swabbed at a pre-operative assessment clinic. Of the 559 patients admitted, 323 (101 elective, 192 trauma and 30 non-orthopaedic) were included in the study. Of these, 27 elective (27%), 41 trauma (21%), and seven non-orthopaedic (23%) patients were colonised with MRSA at any time during the audit period. There is a high prevalence of MRSA colonisation in patients admitted to the orthopaedic and trauma wards in our setting. A policy of pre-admission screening, though able to identify MRSA carriage, does not guarantee that patients are not colonised in the period between screening and admission. We suggest to screen for MRSA all patients admitted to an orthopaedic ward.

Keywords : methicillin-resistant *Staphylococcus aureus* (MRSA) ; surgery ; colonisation ; infection ; complications.

INTRODUCTION

The most effective surveillance and infection control strategies of Methicillin-resistant *Staphylococcus aureus* (MRSA), a most important cause of nosocomial infections (13) remain controversial (11). MRSA colonisation does not seem to affect healthy individuals, and may be transient (25). MRSA infection, however, can be life threatening to patients in

hospital (8,10,15,22,27). Orthopaedic patients are a high-risk group (9) given the difficulty encountered in managing infections involving metalwork and prostheses (21). MRSA infections are associated with a substantial increase in morbidity, with prolonged hospital stay and high costs attributable to the infection and risk of cross infection (6,17,24). In our setting, rates of MRSA colonisation in patients admitted to the elective orthopaedic wards rose

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from 15 patients colonised in 1996 (1 of every 100 patients) to 50 patients (1 of every 19 patients) colonised in 2002 (unpublished data). We therefore set out to study the incidence and prevalence of MRSA colonisation at the time of admission and discharge for patients on elective orthopaedic and trauma wards.

PATIENTS AND METHODS

Setting

This work was undertaken in the trauma and elective orthopaedic departments of the University Hospital of North Staffordshire NHS Trust (UHNST) during the period of 1st March-31st May 2003. Data were collected for the three trauma wards (78 beds) and two elective orthopaedic wards (50 beds).

Inclusion and exclusion criteria

Patients admitted to the elective orthopaedic and trauma wards at the University Hospital of North Staffordshire NHS Trust (UHNST) between 1st March and 31st May 2003 whose expected stay was 48 hours or longer (including non-orthopaedic patients) were included in the study.

Method of screening for MRSA

Nursing staff in the outpatient department and on the wards screened patients for MRSA according to Trust policy. Briefly, swabs were taken from nose and perineum with cotton-tipped swabs (Medical Wire & Equipment Ltd) (25). The swabs were immersed into salt broth specimen bottles (Nutrient Broth and Salt, PHLS Media Production Services Ltd). Salt broths were incubated at 37°C in air for 18-24 hours, and sub-cultured on mannitol salt agar with oxacillin (2 mg/L), incubated at 37°C in air for 48 hours. Plates were read after 18-24 hours and at 48 hours. Plates showing suspect colonies had the presence of methicillin resistant *Staphylococcus aureus* confirmed by testing for catalase and DNA-se production.

Measurement Time Points

Pre-operative assessment patients

Since 2000, UHNST has had a policy of screening all patients scheduled for major joint surgery, e.g. knee and

hip replacement for MRSA at a pre-operative assessment clinic.

Elective orthopaedic patients

Patients admitted for elective orthopaedic surgery had been negative for MRSA at a prior pre-operative assessment clinic. They were swabbed again within 24-48 hours of admission, on transfer to another ward, and on discharge.

Trauma orthopaedic patients

Patients admitted to the trauma wards were swabbed on admission (within 24-48 hours), on transfer to another ward, and on discharge.

Non-orthopaedic patients

Non-orthopaedic patients admitted to the elective orthopaedic and trauma wards were swabbed on admission (within 24-48 hours), on transfer to another ward and discharge.

Data collection

Nursing staff recorded the following information on a standardised form after formal training: name, age, gender, consultant, ward, date of admission, date of discharge, source of admission, if transferred where transferred from, admitting specialty, diagnosis, MRSA status on admission, MRSA status on discharge, treatment for MRSA. Colonisation was defined as any swab culture result positive for MRSA. A new case of MRSA was defined as a patient who had a swab culture result positive for MRSA, and who had never been known to be positive for MRSA before. An old case of MRSA was defined as a patient who had a swab culture result positive for MRSA and who had been found positive for MRSA before. An MRSA infection was defined as any wound showing clinical signs of infection (7) and from which MRSA was isolated, or any other infection associated with a culture positive for MRSA.

Clinical management

We implemented a double notification system whereby, if a patient was identified as MRSA positive, the Clinical Nurse Specialist in Infection Control and the Research Nurse (GW) both contacted the ward to highlight the MRSA status of the patient to the nursing staff,

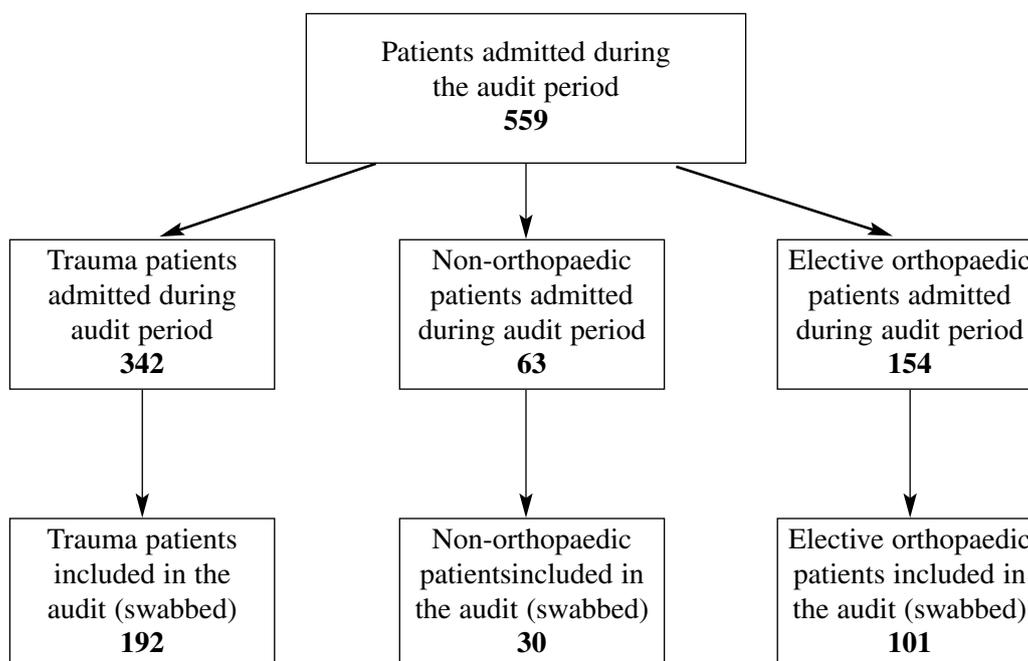


Fig. 1. — Patient flow

patient and clinician to ensure the adoption of appropriate precautions and management. Patients colonised with MRSA were treated according to the local policy. The decontamination protocol consisted of topical treatment with chlorhexidine washes for 5 days, and application of mupirocin 2% ointment (Bactroban® ointment) to the nose and cream to any open skin lesions, twice daily (8). These patients were then swabbed twice at 48 hours following the completion of the decontamination programme. If MRSA was still isolated after treatment, the five-day topical treatment was repeated up to three times. If MRSA was not isolated after treatment, weekly swabs were taken until three negative results were obtained.

RESULTS

There were 559 potentially eligible patients admitted to the trauma and orthopaedic wards between March and May 2003. The flow of patients in this study is summarised in figure 1.

Summary of main results

Five hundred and fifty-nine eligible patients (154 elective (71 years, (18-93)), 342 trauma

(71 years, (18-94)) and 63 non-orthopaedic (78 years, (59-90)) were admitted to hospital. Of these, 323 (101 elective, 192 trauma and 30 non-orthopaedic) patients were included in the study). Of the above patients, 28 of 101 elective patients (28%), 43 of 192 trauma patients (22%), and seven of 30 non-orthopaedic patients (23%) were colonised with MRSA at any time during the audit period. Of the 80 patients identified as negative for MRSA colonisation at pre-assessment screening and included in the audit, ten (9.5%) were found to be colonised on admission.

Pre-operative assessment patients

Pre-operative assessment patients were screened during the audit period prior to elective surgery as per protocol (fig 2).

MRSA colonisation

Elective patients were any patients admitted to the elective orthopaedic ward for elective orthopaedic surgery. Patients undergoing total hip, knee and shoulder joint replacement (80 patients

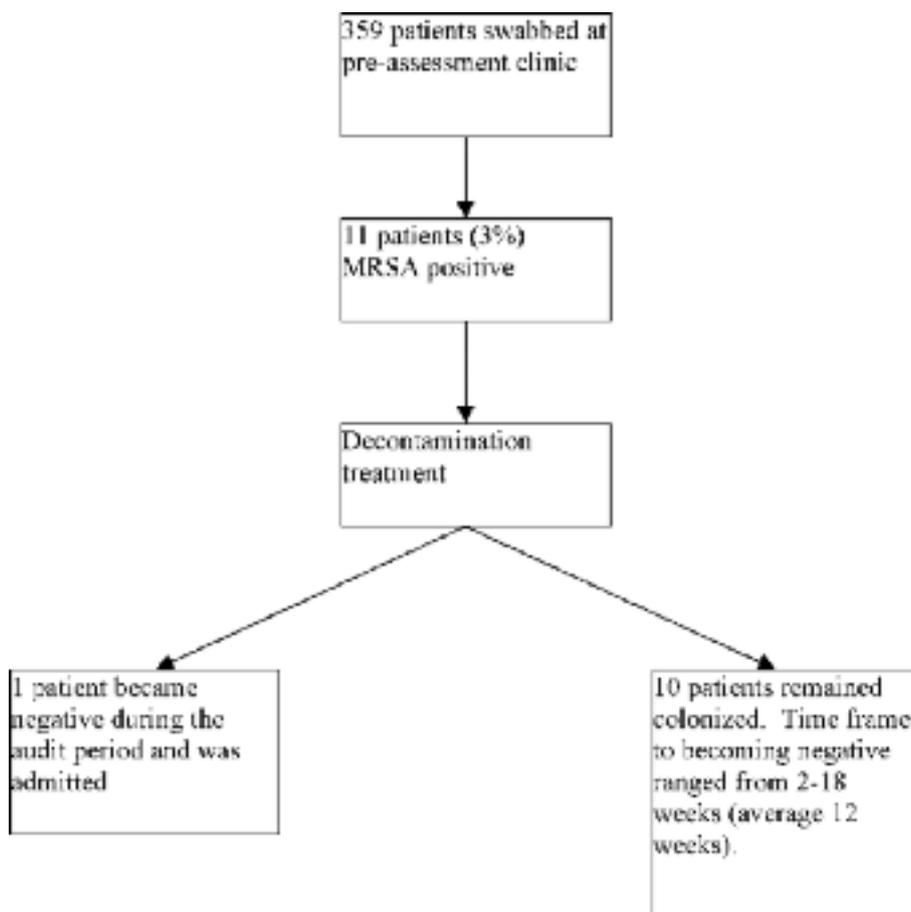


Fig. 2. — Pre-operative assessment patient flow

52%) were swabbed at the pre-assessment clinic. The other 74 (48%) elective orthopaedic patients admitted during the audit period were not swabbed at pre-operative assessment. Twenty-three percent of patients were positive on admission to the elective orthopaedic wards (table I). Of the 19 elective patients presenting as new MRSA colonisations, five had been previously admitted to our hospital in the preceding 24 months (average time since last admission : 54 weeks). Six (6%) orthopaedic patients were positive on discharge from the elective wards (table I). The results for trauma and non-orthopaedic patients are also shown in table I.

Of the 23 trauma patients colonised on admission and classified as new case MRSA, 12 (52%) had previously been admitted to our hospital in the preceding 24 months (average time since last admis-

sion : 14 weeks). Of the seven non-orthopaedic patients colonised on admission, three had been previously admitted to our hospital in the preceding 24 months (average time since last admission : 52 weeks). Twenty two patients (7%) positive on admission became negative on discharge without receiving any treatment.

MRSA infection

Of the orthopaedic patients colonised with MRSA on admission, four of 23 elective patients, and 12 of 32 trauma patients developed an MRSA infection. Four of these patients received intravenous vancomycin during the audit period and the other thirteen were managed on an individual risk basis. Sixteen of the 238 orthopaedic patients who

Table I. — MRSA colonisation status of elective, trauma orthopaedic and non-orthopaedic patients admitted to trauma and orthopaedic wards at the University Hospital of North Staffordshire NHS Trust, March to May 2003

Admitted	Elective 154	Trauma 342	Non-orthopaedic 63	Totals 559
Screened	101	192	30	323
MRSA negative on admission	78	160	23	261
MRSA +ve at anyone time during hospital admission	28 (28%)	43 (22%)	7 (23%)	75 (24%)
MRSA +ve on admission	23 (23%)	32 (17%)	7 (23%)	62 (19%)
New case MRSA	19	23	2	44
Old case MRSA	4	9	5	18
Previous UHNST admission	5	12	3	20
MRSA +ve on admission and negative on discharge	21 (21%)	20 (10%)	3 (10%)	44 (14%)
MRSA +ve on admission and discharge	2 (2%)	12 (6%)	4 (13%)	18 (6%)
MRSA +ve on discharge	6 (6%)	21 (11%)	4 (13%)	31 (10%)
New case MRSA	5	13	2	20 (6%)
Old case MRSA	1	8	2	11 (3%)
MRSA negative on admission and positive on discharge	4 (4%)	9 (5%)	0 (0%)	14 (4%)
MRSA negative on admission and positive at anytime during admission and negative on discharge	1 (1%)	2 (1%)	0 (0%)	3 (1%)

had a negative MRSA screen on admission developed a documented MRSA infection during the audit period (table II). Three of these patients were treated with intravenous vancomycin and became negative on discharge. The other 13 patients were treated on an individual risk basis.

DISCUSSION

The prevalence of MRSA carriage on admission in trauma and orthopaedic patients in our setting was 17% and 23% respectively, with a 15-fold increase over the previous seven years (unpublished data). Thirty-two (17%) trauma patients were MRSA positive on admission, at variance with the traditional view that trauma patients have a low colonisation rate on admission. Ten/80 (12%) pre-screened elective orthopaedic patients were positive on admission despite not being colonised at pre-assessment. In this study, 13 patients (4%) were identified as negative for MRSA on admission and positive on discharge, suggesting acquisition of MRSA during hospital admission.

The most common mechanism for the introduction of MRSA into the clinical arena is the admis-

sion of an infected or colonised patient who then serves as a reservoir (16). This study highlights the extent of the problem in our setting, with MRSA isolated from 78 patients (24%) admitted to the trauma/orthopaedic wards. Our prevalence of colonisation is higher than the 3% from Scandinavian and German hospitals (3), and the 6% to 10% prevalence reported in similar settings in the UK for patients admitted with femoral fractures (12,14). It is lower than that reported in Spain, France and Italy (greater than 30%) (4).

This study confirms the results of previous investigations that colonised patients are at a greater risk of developing deep wound infections compared with patients who are not colonised (14). In our subgroup of orthopaedic patients found colonised on admission, four elective (17%) and 12 trauma patients (37%) developed an infection with MRSA during the study period. Of these patients, one elective patient and two trauma patients received treatment with intravenous vancomycin. In contrast, only 16 of the 238 orthopaedic patients (7%) who were screened and found negative for MRSA on admission developed a documented MRSA infection during the audit period. In orthopaedic patients,

Table II. — MRSA colonisation on admission and MRSA infection during admission

	MRSA screen positive on admission	MRSA infection during admission (%)	MRSA screen negative on admission	MRSA infection during admission (%)
Elective	23	4 (17)	78	4 (5)
Trauma	32	12 (37)	160	12 (7.5)
All orthopaedic	55	16 (29)	238	16 (7)
Non-orthopaedic	7	1 (14)	23	0 (0)

this highlights the clinical relevance of MRSA colonisation on admission for the risk of subsequent MRSA infection.

Fifty-three elective patients (34%), 150 trauma patients (44%) and 33 non-orthopaedic patients (52%) admitted during the audit period were not swabbed. Patients were not swabbed on transfer as any patients transferred were transferred within the same unit. There is therefore the potential for selection bias. We do not believe that there was systematic selection of patients who were not swabbed. This resulted from the heavy workload in the orthopaedic department, and reflects the fact that swabbing for MRSA is not part of routine practice (2).

Ten of the elective orthopaedic patients who were positive on admission had been swabbed at the pre-operative clinics 2-6 weeks prior to admission, and found to be MRSA negative. This questions the present screening practice in our setting, and the variation in times between pre-assessment screening and admission: perhaps 6 weeks is too long. Perhaps obtaining a single set of screening swabs does not provide sufficient sensitivity. Another possible factor could be that the pre-assessment patients were mixing in the same clinic area as the post-operative patients. Among the non-orthopaedic patients admitted to the orthopaedic wards, the MRSA colonisation rate on admission (23%) was similar to that of the elective and trauma orthopaedic patients (23 and 17%, respectively).

Another limitation of the study was that not all patients colonised with MRSA were treated, since it depended on an individual risk assessment as to whether the MRSA decontamination regime was administered.

The major risk factor of MRSA colonisation is recent hospitalisation (26,20). Of the 62 patients

(19%) positive on admission 44 (71%) were new cases of MRSA with 20 (45%) of these patients having previous admissions to our hospital in the preceding 24 months (table I and II). However, previous admissions to other hospitals and healthcare settings were not recorded. The current prevalence of MRSA colonisation in our community is unknown.

Surveillance methods to identify and control MRSA are important. As no single model of infection control is universally applicable, all hospitals should develop their own MRSA infection-control principles based on best practice (1) and local prevalence of MRSA, and availability of isolation facilities. The re-implementation of simple but consistent infection control measures can have a dramatic effect in reducing infection rates (19). The introduction of a ringfenced elective orthopaedic ward and simple infection control measures significantly reduced the incidence of all postoperative infections and allowed 17% more patients to be treated (5). Tai *et al* (23) suggest that the low colonisation rate in the orthopaedic and trauma unit in their hospital (1.6%) in London may be due to the active infection-control program they have in place.

Enhanced training in basic principles of infection control, emphasizing correct and effective hand washing and adherence to evidence based guidelines (18) may be one way of tackling MRSA in our setting. Considering the high prevalence of MRSA colonisation on admission, prophylactic and empiric treatment regimes for orthopaedic surgery (23) should be taken into account. Given the high predictive value of MRSA carriage at the time of admission for the risk of subsequent MRSA infection, routine screening of orthopaedic patients on admission should be considered in areas with high

prevalence, as this would enable targeted intervention to prevent infection. Further studies are needed on the prevalence and risk factors for MRSA acquisition in the community.

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