

A 2-cycle prospective audit of the prevalence of methicillin-resistant *Staphylococcus aureus* in adult rhinology patients

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Purpose: To audit the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) carrier state in rhinology patients, secondary aims included looking at the compliance of a newly introduced hospital MRSA screening and eradication protocol.

Patients and methods: The first cycle included 113 rhinology patients and 62 otology patients. The second cycle included 123 consecutive rhinology patients attending the pre-assessment clinic (PAC).

Results: No rhinology patients in the first cycle appeared to be colonized with MRSA one otology patient was colonized with MRSA. The second cycle found that four rhinology patients (3.25%) should have been treated as colonized with MRSA according to protocol. Of these, two were newly colonized and two had a previous history of MRSA colonization. Only one of the latter was found to be positive. Three patients had eradication treatment. Re-swabbing was performed in three of the four patients and confirmed eradication of MRSA. The protocol was followed completely in one patient only.

Conclusion: The prevalence of MRSA appears to have increased over a two-year period. This may be due to increasing community-acquired MRSA. The overall prevalence is still low when compared to other specialties. MRSA does not appear to cause significant morbidity or mortality in rhinology patients. Protocol may need to be simplified if implementation is to be improved.

Keywords: audit, mupirocin, triclosan, otolaryngology, nasal, infection

Introduction

Staphylococcus aureus was discovered in 1881 by a surgeon named Sir Alexander Ogston.¹ It was later found to be responsible for a substantial amount of morbidity and mortality in hospitals around the world.² Studies show that in numerous institutional settings, autoinoculation by known nasal carriers causes infection, and that there is a correlation between reducing colonization and decreasing infection rate.³ Some 80 years after Sir Ogston's discovery, it was found that *S. aureus* had developed methicillin resistance.⁴ Currently, hospitals worldwide experience methicillin-resistant *S. aureus* (MRSA) as a major nosocomial pathogen.⁵

Studies have found that the anterior nares of the nose are the most frequent carriage site for *S. aureus*.⁶ Danbolt first reported the association between *S. aureus* nasal carriage and staphylococcal disease in 1931, and numerous studies have since confirmed this.⁷⁻¹² Decolonization of the nose and other body sites using antistaphylococcal drugs has been found to prevent infection and therefore morbidity.¹³

It is conceivable that rhinology patients have an increased rate of nose infections. Furthermore, patients who have repeated operations in their noses have a significant

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amount of raw mucosa that is exposed postoperatively, which may be more susceptible to bacterial infection and colonization by MRSA.¹⁴ This can be a root of MRSA sinusitis and can go on to develop chronic rhinosinusitis, a cause of morbidity amongst patients, this is becoming an increasing problem.^{15,16} Jiang et al found that untreated MRSA can cause mucopurulent crusting and discharge in patients, affecting postoperative outcomes in this group.¹⁷

Initially, patients who were admitted for elective surgery within the rhinology department were not routinely screened for MRSA unless they were undergoing major head and neck surgery or had been found positive in the past. However, other hospital departments (eg, Orthopedics) screen all patients who came for pre-assessment before elective surgery. This is followed by eradication of MRSA colonization found preoperatively. This is due to a risk of significant morbidity.

Prior to instigation of the first cycle of the audit, two episodes of postoperative MRSA infection were recorded in rhinology patients, raising a concern of increased risk in this patient group. Therefore, it was decided to study this patient group to establish whether this concern was warranted and, if so, was the current treatment effective?

Objectives

The aim of this audit was to determine the prevalence of MRSA in adult patients undergoing sino-nasal surgery, comparing it with otology patients. Our secondary aim looked at how successful the pre-assessment clinic (PAC) was at implementing the MRSA screening and eradication protocol.

Material and methods

The 2-cycle audit took place within the otorhinolaryngology department of Derriford Hospital, a tertiary referral teaching hospital in Plymouth, UK. The first cycle of the audit included 175 consecutive patients (113 rhinology and 62 otology patients) attending the otorhinolaryngology PAC prior to rhinological or otological surgery from March 2006 to July 2006. The second cycle included all 123 consecutive rhinology patients attending the PAC between February 2008 and July 2008. The inclusion criteria for the study specified that the patient must be 16 years old or above to be included. Ages ranged from 17–78 with mean ages of 47 and 44 in the study and control groups respectively. The distribution of patients' ages is shown in Table 1. The study group only included rhinology patients undergoing septoplasty, turbinate surgery, septorhinoplasty, endoscopic sinus surgery, dacryocystorhinostomy or medial maxillectomy. The control group included patients undergoing otological surgery. Patients who

Table 1 Ages of patients in study groups

	Rhinology patients	Otology patients
Age range	17–78	17–73
Mean age	47	44

Abbreviations: PAC, pre-assessment clinic; MRSA, methicillin-resistant *Staphylococcus aureus*.

were having their operation less than 5 days from the day they attended the PAC were excluded as there would have been inadequate time for the specimen to be processed and the results to be available before the time of surgery). Patients refusing to participate in the audit were excluded.

While attending the PAC, verbal consent was obtained and MRSA screening was performed according to the hospital protocol: swabs were taken from the nose, throat, and perineum. A protocol worksheet was then completed for each patient. Those that were found to be MRSA-positive in any of the swabbed sites were treated according to the hospital protocol (see Appendix 1). The protocol specifies that mupirocin nasal ointment (three times daily) and triclosan skin cleanser (once daily) should be commenced 48 hours prior to surgery and continued 72 hours after surgery, for a total of five days. Patients were then re-swabbed 72 hours after the end of treatment to determine whether MRSA had been eradicated prior to surgery. The operating surgeon was informed and further measures were taken if needed, according to the advice of microbiology (eg, a single dose of teicoplanin peri-operatively). Teicoplanin was given peri-operatively if the patient tested positive for MRSA colonization, as per standard protocol. According to the Scottish Intercollegiate Guidelines Network (SIGN), which develops evidence-based clinical guidelines for the National Health Service for Scotland, antibiotic prophylaxis is not indicated in routine nose, sinus and endoscopic sinus surgery.¹⁸ However, SIGN recommends that in complex septorhinoplasty, the duration of antibiotics should not be more than 24 hours.¹⁸

Laboratory procedures

Swabs were taken from each participant's nose, throat and perineum. Swabs were then processed at the Infection Control Bench in the Microbiology Department using mannitol salt + oxacillin agar (Msox) for screening and sensitivities. MRSA ID (bioMérieux, Marcy l'Etoile, France) agar was used for screening, which was selective for methicillin- and cefoxitin-resistant *S. aureus*. If positive, sensitivity testing of cefoxitin and mupirocin was undertaken using the Isosensitest (Oxoid, Basingstoke, UK) kit. Pastorex agglutination (Bio-Rad Laboratories, Inc, Marnes-la-Coquette, France)

was performed. To be confirmed as MRSA, isolates must have been pastorex-positive and be ceftaxime-resistant on disk testing. All of the MRSA plates were incubated aerobically at 37°C. Plates were examined at 18–24 hours and negative results were reincubated for a further 24 hours. Sensitivity testing then took place using oxacillin agar plates at 30°C.

Results

1st cycle

All 175 patients in the first cycle were screened and swabbed for MRSA according to protocol. MRSA colonization was not detectable in any of the rhinology patients (0 out of 113) of the rhinology patients were found to be colonized with MRSA (Figure 1). Only one otology patient (awaiting a stapedectomy) of the 62 was MRSA carrier status-positive, and only in one site (the perineum) (Figure 1).

2nd cycle

The second loop of the audit screened and swabbed all 123 consecutive rhinology patients attending the PAC between February 2008 and July 2008. Four rhinology patients (3.25%) should have been treated according to protocol “as colonized with MRSA” (Figure 2). Two were newly colonized and two had a previous history of MRSA colonization. Only one of the two patients with a previous history of MRSA was found to be still positive; the notes were unavailable for the other. Therefore, of the four patients who should have been treated as MRSA-colonized, three were actually treated, and re-swabbed. Subsequently, these three patients were found to be MRSA-negative post re-swabbing. Two of the patients had eradication treatment without peri-operative teicoplanin. The protocol was followed completely in one patient only.

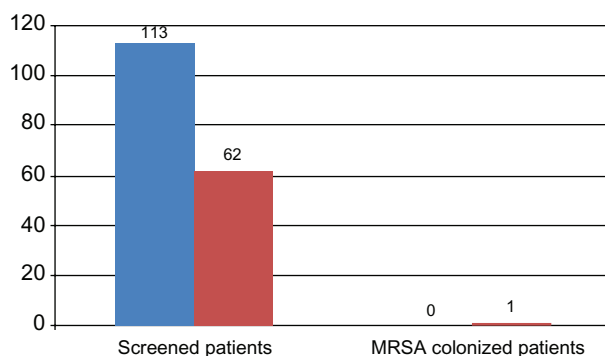


Figure 1 Prevalence of MRSA in rhinology patients compared against otology patients: 1st cycle.

Notes: Blue = Rhinology patients; Red = Otology patients. The graph shows that of the 113 rhinology patients screened in the 1st cycle of the audit, 0 were colonized by MRSA. It can be seen that of the 62 otology patients screened, however, one was colonized.

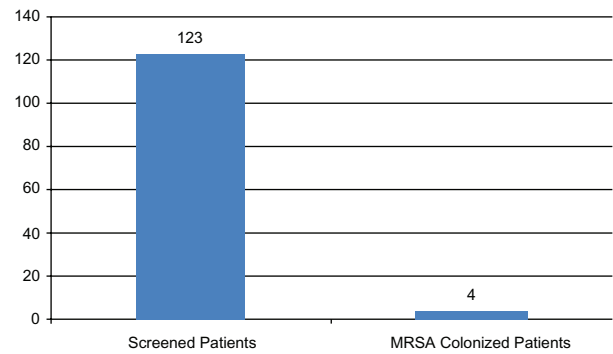


Figure 2 Prevalence of MRSA in rhinology patients: 2nd Cycle.

Notes: The graph shows that during the 2nd cycle, four of the 123 (3.25%) rhinology patients screened were colonized by MRSA.

In the second loop cycle of the audit, the incidence of MRSA in rhinology patients was 3.25% prior to surgery. After eradication therapy no reswabbed patients were found positive for MRSA colonization.

Discussion

Recent reports suggest that MRSA, once considered exclusively a nosocomial pathogen, may be emerging in community populations. It was first identified in non-hospitalized populations in the 1980s, initially among intravenous drug users.¹⁹ The difficulty with MRSA lies with the need to use expensive and potentially toxic antibiotics.²⁰ New, resistant strains and associated infections are becoming prevalent, such as vancomycin-resistant *S. aureus* (VRSA) and panton-valentine leukocidin (PVL).^{21,22}

With a significant risk of morbidity and mortality, it is important to have a firm grasp of MRSA. However, very little is available in the literature on the prevalence of MRSA carriers with regards to the rhinology patient group. With the hospital's implementation of a new eradication protocol, it was important to establish whether the screening and eradication therapy was having a desired effect.

We chose to audit MRSA carrier state in rhinology and otology patients as these patients tend to have similar characteristics. Most of them are generally healthy and attended the same ward. None of our patients had a recent admission to another hospital ward.

Prevalence

The first cycle did not demonstrate an increased prevalence of MRSA in the rhinology group. The overall low prevalence of MRSA within rhinology patients may possibly be due to the nature of the group. Most elective rhinology patients are relatively healthy, middle-aged people (the mean age of

our patients was 45), with few prior admissions to hospital. Their lack of significant contact with other hospital patients, healthcare workers, and members of residential homes (which is also a criterion for empirical treatment as part of the protocol) reduces the risk of likelihood of coming into contact with those colonized by MRSA. There may be a possibility that MRSA has a seasonal component, with a reduced prevalence during the spring period, as the study is limited to looking at a specific snapshot in time during the period of March to July. Equally likely is that the difference demonstrated between the first cycle and second cycle is due to a natural progression in increasing prevalence of MRSA. Alternatively, a lack of MRSA positive patients in the first cycles does not necessarily indicate an absence of MRSA, only that it may be below detectable thresholds, therefore, forming a residual pool.

The second cycle found a slight increase (3.25%) in the number of MRSA carriers awaiting sino-nasal surgery, this was better than the admission rates found in other studies (4.2%).²² This increase may be due to an increasing prevalence of MRSA within the community and hospitals, or due to a random cluster secondary to the small sample size and low prevalence. If previous eradication therapy proved ineffective, it would lead to a residual infection pool which would then be later picked up by hospital screening.

Protocol implementation

The second cycle demonstrated that if MRSA was detected eradication therapy was only partially followed. However, even with partial therapy, MRSA was eradicated from all previously colonized patients, and so was successful in this regard. Eradication treatment with or without teicoplanin may be effective in eradication of MRSA carrier state in these patients. However, the numbers are too limited to draw firm conclusions. Various reasons exist for a breach of protocol: eg, steps already taken were not fully documented in the patient's notes or lack of understanding of how to implement the protocol if patients proved MRSA-positive, especially with regards to peri-operative teicoplanin. Not only does the surgeon have to be aware of the patient's MRSA status, but the anesthetist who administers the teicoplanin must be aware, too, of the protocol, the patient's status, and the microbiology recommendation. This shows that the current hospital protocol may benefit from a simplified and streamlined protocol or re-training.

There are several limitations worthy of consideration. Firstly, our study is a snapshot in time, specifically February to July. A study looking over a longer period would give

a more comprehensive picture and also determine whether there is any seasonal variation in MRSA colonization, as with nonovirus which appears to have a seasonal component. Secondly, due to low numbers, it is difficult to determine how significantly treatment affected MRSA colonization. A Cochrane review in 2004 suggested that there was insufficient evidence for topical and systemic treatment of MRSA colonization. However, another study at a nursing home did not suggest this.²³ From the results of our audit, it would appear that treatment does have an effect on MRSA colonization, and that targeted treatment may be effective. All previously colonized patients were no longer colonized after treatment. However, the audit did demonstrate that MRSA is not a significant cause of morbidity and mortality in rhinology patients, due to a low prevalence of MRSA, and no reported complications or deaths.

Thirdly, due to the distinct geographical heterogeneity of the study, it may not be possible to extrapolate the findings to a global population. Therefore, there is a need for larger multi-center cross-sectional, studies. There are financial implications for blanket screening of patients, especially as there appears to be a low prevalence of MRSA in the specified study group and not a cause of significant morbidity or mortality.

There is some evidence that co-colonization by certain species of bacteria may preclude to some form of protection against other pathogens. Would this same mechanism offer protection against MRSA? If so could this potentially lead to the development of a bacteriophage type that could eliminate MRSA once and for all?

Conclusion

The prevalence of MRSA appears to have increased over a two-year period. This may be due to increasing community-acquired MRSA. The overall prevalence is still low when compared to other specialties, and it does not appear to cause significant morbidity or mortality in rhinology patients. Partial treatment of patients with mupirocin and triclosan before surgery appears to be successful in the eradication of MRSA. However, a larger multi-center, cross-sectional study is required. The available data does not support the use of routine MRSA screening in rhinology patients. However, it must be noted that the risk of acquiring MRSA infection may far outweigh any financial burden to the hospital or patient.

Since the publication of the 2-cycle audit, the protocol has been refined, with continuous treatment for five days and no follow-up screening, this procedure is likely to be easier to implement.

Acknowledgment/disclosure

The authors report no conflicts of interest in this work.

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Appendix

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PROTOCOL FOR ELECTIVE PRE-OPERATIVE SCREENING FOR MRSA

Patient categories

This protocol covers the MRSA screening of patients seen in the Pre-Operative Assessment Clinic. There are three main categories of patients:

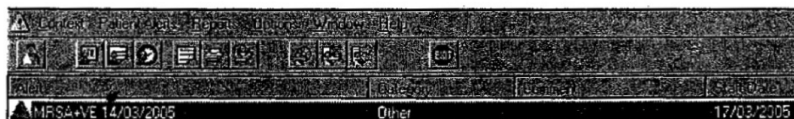
1. Patients already known to be MRSA-positive

Patients who are known to have been MRSA-positive at some point in the past **should be considered as colonised with MRSA**. These patients will have an 'Alert' sticker on their notes:



Multi resistant *Staphylococcus aureus*
isolated on _____
Notify infection control team or
microbiologist on or prior to admission.

and on their electronic record:



Patients admitted from nursing or residential homes are at high risk of being colonised with or acquiring MRSA between being screened and subsequently admitted for surgery. For the purposes of this protocol, these patients should be assumed to be colonised with MRSA and receive suppression therapy and appropriate prophylaxis (see below).

2. Patients of unknown MRSA status undergoing joint replacement and vascular graft surgery. Separate screening protocols for these patients should be followed.

3. All other patients of unknown MRSA status. These should be screened for MRSA using this protocol.

Screening method

Patients seen in the Pre-Operative Assessment Clinic **between 5 and 56 working days** before surgery should be screened by three-site (nose, throat and groin/perineum) broth enrichment culture.

Patients seen in the Pre-Operative Assessment Clinic **less than 5 working days** before surgery should be screened using the Polymerase Chain (PCR) Reaction method. A nose swab should be performed using the red-topped swabs. Swabs need to arrive in Microbiology no later than 13:00 for results to be available by the end of the same working day.

MRSA screening results

1. Negative

If the screening result is negative, give standard peri-operative antibiotic prophylaxis. If patients have previously been colonised or infected with MRSA, they should be treated as if they are still colonised with MRSA regardless of any subsequent screening results (see below).

2. Positive, unknown status or previously colonised with MRSA

This group include the following patients:

- a) Patients known to be currently colonised or infected with MRSA
- b) Patients previously known to have been colonised or infected with MRSA regardless of any subsequent screening results
- c) Patients of unknown MRSA status (e.g. those with results pending or who not been screened)
- d) Patients admitted from home for whom 58 days or more has elapsed since there they were last screened (even if this was negative)
- e) Patients admitted for a nursing or residential home or who have been hospitalised since they were last screened (even if this was negative)
- f) Patients who have been on the ward for more than 96 hours since their last screen (even if this was negative).

A clinical risk assessment should be undertaken as to the appropriateness of surgery in a patient identified as an MRSA carrier.

These patients should

- a) commence topical Mupirocin and Aquasept for 48 hours prior to surgery and continue until 72 hours after surgery (i.e. a total of 5 days):

Generic name	Propriety name	Usual dose	Notes
Triclosan	Aquasept	Daily for five days	Apply directly to skin as liquid soap on a sponge or flannel & lather well prior to rinsing
Triclosan	Aquasept	Shampoo on days one and five of treatment. Other bathing products may be used after triclosan	Rinse hair with normal shampoo after applying triclosan to scalp
Mupirocin	Bactroban nasal ointment	Apply thrice daily for five days	Place a pea-sized amount of ointment on the squamous portion of each nostril and massage gently upwards.

- b) receive a **single dose of Teicoplanin 400 mg** at induction if anti-staphylococcal prophylaxis is indicated. This should be in addition to **standard prophylaxis**.

In general operations where a cephalosporin or penicillin is usually indicated also require teicoplanin added if the above criteria are met. Procedures **NOT** requiring teicoplanin prophylaxis include:

- Operations for which prophylaxis is not usually indicated eg clean operations not involving an implant
- Per vaginal procedure where the normal prophylaxis (if indicated) is metronidazole and doxycycline
- Urological procedures that usually receive gentamicin prophylaxis
- ERCP

For further detail on which prophylaxis to use please see the Trust policy on Trustnet

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