Routine screening of women having caesarean section for MRSA: Ritual or rational?

Abstract

Meticillin-resistant *Staphylococcus aureus* (MRSA) is a significant global problem. One response to the growing threat of this organism has been the introduction of routine screening of patients before admission to hospital. In midwifery, this has been applied to those undergoing caesarean section, and although these women are at low-risk of hospital-associated MRSA, one rationale for continuing this policy could be that it identifies cases of community-associated MRSA. This audit was undertaken to determine local compliance with MRSA screening in the maternity setting, and the utility of routine screening in one London Hospital. The prevalence of MRSA was 2.8% in those having elective caesarean sections and 1.1% in emergency cases. Although staff generally understood the need for screening, significant barriers included consent, time and material constraints. Given the low prevalence and risk of severe infection in this generally healthy group; it is recommended that routine screening be stopped.

Keywords: Caesarean section, Infection control, MRSA, MRSA screening

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Meticillin-resistant *Staphylococcus aureus* (also known as methicillin-resistant *Staphylococcus aureus* or MRSA) is a growing problem throughout the world, and although originally associated with hospitals and other healthcare facilities, it also has occured more recently in the community. Although transmission of hospital-associated MRSA (HA-MRSA) in the community has been documented many times, these community strains (CA-MRSA) are distinct from their healthcare-associated equivalents, being genotypically different and consequently having different resistance profiles and pathogenic sequelae; one particularly important difference being that CA-MRSA has historically been susceptible to ciprofloxacin. Thus any discussion of MRSA transmission needs to take account of two different threats: those of HA- and CA-MRSA.

There have been a number of responses to the threat posed by MRSA, including an emphasis on hospital cleanliness and hygiene, reducing the use of antimicrobials that produce a selective environment for the development and spread of resistance, and the screening of people being admitted to hospital to identify those carrying MRSA so that they can be isolated and treated, if necessary. While MRSA has historically been seen as predominantly a hospital organism, the discovery of distinct CA-MRSA organisms complicated matters greatly, because the risk factors for carriage of these strains are very different. HA-MRSA usually affects patients who are in healthcare or institutional settings or those who have been in hospital recently, whereas CA-MRSA is often associated with younger and healthier people; transmission of CA-MRSA has, for example, been associated with activities that result in skin-to-skin contact such as contact sports (Cohen, 2007). Consequently, while previous hospital admission is a major risk factor for HA-MRSA, it is less significant for CA-MRSA, and MRSA screening programmes that focus on this and other HA-MRSA risk factors such as older age and admission to high-risk specialities may fail to identify CA-MRSA strains.

The Department of Health (DH) introduced targeted mandatory screening for all elective and emergency admissions in April 2009 and December 2010, respectively. Although elective caesarean sections were included in the mandatory screening; emergency caesarean sections were not included without any specific rationale being given (DH, 2008). In order to investigate this further, a literature review using the terms 'women', 'pregnancy', 'obstetric', 'caesarean', 'MRSA', 'methicillin/meticillin resistant *Staphylococcus aureus*' was carried. Medline, EMBASE amd Maternity and Infant were searched to identify literature that might explain this policy using the following dates: Medline—1946-August 2014, EMBASE—1980-August 2014 and Maternity and Infant—1971-August 2014; however, this search revealed no papers giving explicit evidence for this.

At some institutions, including this study site, MRSA screening for all emergency and elective admissions commenced in 2007 after a retrospective cohort study showed that 8.6% of admissions to hospital made through the accident

and emergency department were colonized with MRSA. The most common risk factors in this study were older age, previous hospital admission, previous MRSA colonisation, and residence at a care home (Rao et al, 2007). As with CA-MRSA, these risk factors associated with HA-MRSA are not usually present in pregnant women.

The local Trust policy states that any woman who is having a caesarean section must be screened for MRSA at 36 weeks of gestation; and for emergency caesarean sections as soon as it is practically possible. For elective caesarean sections, women are generally screened in the antenatal clinic or in antenatal inpatient ward, while emergency caesarean sections can be screened on the labour or postnatal ward. On rare occasions women are screened in the birth centre.

Aims and objectives

This audit was undertaken to determine local compliance with MRSA screening in the maternity setting, and the utility of routine screening of all women having a caesarean section. Detailed objectives were to examine knowledge of the policy among midwifery staff, reasons for compliance or non-compliance, and to make recommendations about this policy following examination of the prevalence of MRSA in different groups within the population.

Methods

Population and sampling strategy

For the purpose of this study, there were two populations of interest: women who have had caesarean sections between 28 February 2013 and 1 February 2014; and the midwives, midwife support workers or midwifery students who were likely to have cared for them during that time and therefore been responsible for MRSA screening. Midwifery staff in this study could have been working in any of the five maternity areas within a general district hospital in South East London. The hospital has 3883 births annually, of which during the study period 31% were caesarean sections.

Women who had caesarean sections were identified by a local maternity database and cross checked with Galaxy Theatre System (version 3.64). This system identifies patient details, month of operation, duration of operation, type of operation, and the staff involved. Date limits were applied to ensure data were retrieved from 28 February 2013 to 1 February 2014 only. Although it would be expected that all women undergoing caesarean sections would be on this system, if the OPCS code (a nationally recognised code to identify the type of surgery) was entered incorrectly, then patients may have been missed from the final sample, although the risk of this was thought to be low. Patient demographic data (date of birth, date of caesarean section, type of caesarean section) were retrieved prior to data anonymisation. Additionally, because women were potentially identifiable from these data even after anonymisation, all data were stored on an encrypted computer and only summary statistics reported.

Data collection tool

Two data collection tools were used, a questionnaire for staff, and a data extraction tool for collecting clinical data. The staff questionnaire consisted of 11 questions. As the aim was to audit practice and ascertain knowledge, most questions were closed, where the respondent answers a fixed set of responses such as yes, no or not sure. However, two questions were open-ended to allow for further elaboration.

Prior to their use, the validity of the tools were piloted through discussion with three infection control nurses, a clinical microbiologist and the clinical audit department to ensure that it collected the information they thought was necessary. Both data collection tools were piloted on 10 cases to ensure that the tool was collecting the correct information for the audit and was clear to potential participants. The pilot highlighted that not many midwives understood the word 'compliance'; therefore, this required the author to make minor changes to the wording of the questionnaire to say 'increase the number of screens'. No other significant changes were made.

Data collection

Data extraction from the clinical databases was carried out over 4 weeks in June 2014. Hospital numbers of women who had caesarean sections were used to access the microbiology laboratory results system to determine if an MRSA screen was done. This, and any positive or negative results were recorded directly onto the data collection tool. If it was highlighted from the microbiology system that the patient had a wound swab post-caesarean section, then the site of swab and result of swab was recorded. The questionnaire was administered over a 6 week period between June and July 2014. Eighty questionnaires were distributed to all staff in antenatal clinic, antenatal in patient ward, labour ward, postnatal ward and the birth centre.

Data analysis

Data were analysed using Epi Info version 7 (Dean et al, 2011).

Ethical considerations

Permission to use patient data and review their medical notes and to distribute questionnaires to staff was sought and granted from the Clinical Audit Department (study no. 3030). All data were handled in accordance with the NHS England Data Protection Policy; in particular that no sensitive identifiable data were collected, and in order to minimise any risk of identification through linking different items of data these were stored on an encrypted computer and destroyed after summary statistics were calculated (NHS England, 2014).

Results

MRSA prevalence

A total of 3883 women gave birth during the study period, of whom 1061 women had caesarean sections. Of the latter group, 367 had elective and 694 had emergency surgery. The proportion screened were 75.7% (*n*=278) and 25.8% (*n*=179), respectively. This difference was clinically and statistically significant (RR 0.34; CI 0.3-0.39, corrected $\chi 2$ =242.3, (df=1); *P*=<0.0001), meaning that women undergoing emergency surgery were 66% less likely to be screened than those undergoing elective surgery. MRSA was found prior to surgery in five elective cases and three emergency cases, giving a prevalence of 2.8% and 1.1% and a number needed to screen to identify one case of 55 and 59, respectively. There was no statistically significant difference in the proportion correctly identified as having MRSA between the groups (RR 0.93; CI 0.18-3.85; corrected $\chi 2$ =0.07, (df=1); *P*=0.61).

Table 1. Which patients do you routinely screen for MRSA?

Risk factors	Number (%) *n*=39
*All elective caesarean sections	22 (56.4)
*All previously MRSA positive patients	10 (25.6)
*All women whose babies are going to be admitted to NICU	9 (23.1)
All admissions	8 (20.5)
*All emergency caesarean sections	1 (2.6)
All of the above	10 (25.6)
None	1 (2.6)

(* indicates correct answers)
NICU—neonatal intensive care unit; MRSA—meticillin-resistant Staphylococcus aureus

Table 2. Which parts of the body do you swab when screening for MRSA?

Sites Screened for MRSA	Number (%) *n*=39
Nose	36 (92.3)
Axilla	31 (79.5)
Groin	30 (76.9)
Throat	24 (61.5)
Wounds	4 (10.3)
CSU	2 (5.1)

MRSA—meticillin-resistant Staphylococcus aureus; CSU—catheter stream urine

Staff compliance

Of the 80 questionnaires distributed to staff, 39 were returned, giving a response rate of 48.8%. When asked what patients they routinely screened for MRSA, the most common responses were: All elective caesareans only—56.4% (*n*=22); followed by all previously positive women and all women, both of which were given by 10 repsondents (25.6%) (*Table 1*).

When asked what site they used for screening swabs, most swabbed the nose, throat, axilla and groin. Only a small number of respondents (*n*=4) mentioned swabbing wounds (*Table 2*).

When asked about the importance of MRSA screening in this group, few respondents were able to provide a justification for the policy, the most common reason was to prevent cross-infection 12.8% (*n*=5). The other most common responses were to reduce infection generally, or to reduce risk of infection in the baby, both of which were given by 7.7% of respondents (*n*=3). Its importance in surveillance was given by 5.1% of respondents (*n*=2) and preventing wound infection by 2.6% of respondents (*n*=1).

The main barriers to MRSA screening cited were inability to get consent as stated by 33.3% (*n*=13), or time constraints and availability of materials 23.1% (*n*=9). The other reason given was lack of understanding among patients 5.1% (*n*=2). Suggestions for improving compliance were:

- Education 30.8% (*n*=12)
- Changing the policy 17.9% (*n*=7)
- Increased staffing and making the materials available 10.3% (*n*=4).

Discussion

The low MRSA prevalence seen in this study is not unexpected as this population is generally young and healthy, and they do not generally have commonly recognised risk factors for HA-MRSA carriage (Coia et al, 2006). This finding is similar to other UK studies (Gray and Suviste, 2013; Otter et al, 2014); and although the estimated UK prevalence of CA-MRSA is very low at 0.3%, there is evidence that this may be increasing gradually (Otter et al, 2014). The risk factors for CA-MRSA are different

to those of HA-MRSA, and they also differ from those identified by the operational guidance (DH, 2008), upon which the current screening policy is based. Thus this guidance predominantly focuses on HA-MRSA strains, which have little relevance in pregnant women because most pregnant women are healthy individuals who have infrequent healthcare exposure during their pregnancy.

To date, there has been no research conducted on the risk factors for CA-MRSA and its relationship with maternity patients, although it is known from previous studies that community strains of MRSA can affect healthy individuals of all ages (Zetola et al, 2005; Otter and French, 2010). The low prevalence of any identifiable MRSA in this group may, however, lead to a question as to the cost-effectiveness of routine screening; with the number needed to screen to identify one woman with MRSA being over 50, particularly as there appear to be both time and equipment constraints in the implementation of this policy. Furthermore, although eight MRSA carriers were identified throughout the study period, only one woman identified was found to have an infection, and this was a relatively minor superficial wound infection 5 days post-surgery. A full economic analysis was beyond the scope of this audit, but would be a useful exercise to inform future policy.

The results of this study also showed some uncertainty about both the Trust policy and how to apply it among midwives. This may, in part, be due to the recent merger with another NHS Trust and the fact that the MRSA screening policies are not yet unified across both hospitals. This is exacerbated in the midwifery workforce because midwives move units both within and across sites. Also within the study site, MRSA screening practices and policy varies from ward to ward: for example, babies in neonatal intensive care require MRSA screening weekly; women undergoing elective caesarean sections require screening at 36 weeks of gestation; and those having emergency caesarean sections should be screened 'as soon as practically possible'. This latter requirement, while meeting the need for flexibility, is very vague and open to interpretation, particularly as in an emergency situation MRSA screening is unlikely to be a priority, especially if the equipment is not to hand.

Most staff reported they did screen the anterior nares, throat axilla and groin for MRSA, which is in line with the Trust policy. The anterior nares are persistently or intermittently colonised with MRSA whereas other body sites have less frequent carriage (Sanford et al, 1994). MRSA carriage is also commonly persistent at sites where there is a breach in skin integrity (such as insertion of peripheral cannulas, urinary catheters or any wounds or lesions). The poor compliance of screening from wounds (10%) and catheter sites (7%) is of concern, as these are high risk sites, and if this were to be a more common practice then the prevalence of MRSA in pregnant women may be under-estimated in UK.

Although screening of pregnant women undergoing caesarean section is currently recommended, implementation of more recent guidance from the DH suggests a move away from a blanket approach towards a more risk-based one taking into account the risk from infection and the likely effect on clinical outcomes (DH, 2014). Thus while some clinical areas are inherently higher risk, such as orthopaedics and trauma and so might warrant routine screening of all patients; in lower-risk areas, of which these and other data suggest maternity might be one, specific risk factors for screening should be developed. While the guidance is clear, that previous colonisation with MRSA is one such indication; others are yet to be identified in this population. However, what is clear is that the low prevalence of MRSA, in this otherwise healthy population, does not appear to support the cost and time taken to routinely screen all women.

Although this study was conducted among midwives; there are implications of this for neonatal services, both because babies and their mothers may be transferred to these facilities, and because similar issues of compliance may arise in these areas; however, this was not the subject of this study and although a unified approach might be beneficial, it was not investigated here. The reluctance of some midwives to carry out screening may also reflect the desire to promote a normal birth rather than assume pathology until proven otherwise, although such beliefs were not investigated here.

Limitations

This sample is a relatively small subset of the obstetric population, and while it is believed to have captured a representative cohort of the study population, it is ultimately a convenience sample of women at one local Trust; thus any generalisation beyond this is not possible. The validity of the questionnaire in measuring practice may also be limited, as the results from questionnaires may measure knowledge that is not translated into practice or simply reflect what respondents consider to be socially acceptable answers. Additionally, there needed to be a balance between gaining sufficient information and not

Key points

- MRSA is a serious problem in healthcare, although primarily associated with hospitals it also occurs in the community
- Pregnant women are at a low risk of MRSA carriage, but risk factors should be considered
- Screening programmes for MRSA should be based on updated epidemiological and risk-based evidence, and may not currently be warranted

overburdening busy clinical staff; so while more open questions would have been useful, a closed-question approach was employed. The response rate, although reasonable for this type of research may also have led to a response bias, whereby those returning the questionnaire were a specific sub-group of midwives whose knowledge is not representative of the overall population.

Although there were eight positive cases identified, antibiotic or genetic profiling was not examined and this would have validated the study further by confirming ciprofloxacin susceptibility thus confirming CA-MRSA strains were present in this population. However, there was no apparent difference between positive and negative cases in terms of any demographic or clinical features which would suggest screening based on these criteria.

Conclusions

This study has demonstrated poor compliance with MRSA screening for caesarean sections; and limited knowledge; although this conclusion needs to be tempered by the response rate, which was only 48% and the risk that those completing the questionnaire differ in some way from those who did not. Additionally, as this study used a convenience sample of staff from one hospital, no claim for external validity can be made. Although the low prevalence of MRSA suggests that screening may not be cost-effective or clinically necessary in most cases, while it is policy it should be implemented, or the policy changed. One approach based on the findings from literature and findings from this in-depth analysis would be to develop a risk assessment tool which focuses on identifying and screening pregnant women who might be of higher risk, or who have babies at particularly high risk of invasive infection.

Although MRSA screening is taught during mandatory infection control teaching sessions, maternity staff may benefit from having bespoke sessions focussing on their specific MRSA screening practices and procedures. It may also be helpful to produce specific information for parents, both so that they can provide consent, and so that they understand the significance of specific risk factors. This information is given to the mother prior to the caesarean section at the study site. In a broader policy context, these results challenge the current MRSA current screening policy, instead suggesting a more targeted approach might be beneficial; although, the exact risk factors that might allow this are yet to be identified. Therefore, these data suggest that routine screening in maternity, in this specific clinical context does not add clinical value and may not be cost-effective. However, more research is required to establish the cost-effectiveness of more targeted MRSA screening for women having caesarean sections. **BJM**

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