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Point-of-care universal screening for meticillin-resistant *Staphylococcus aureus*: a cluster-randomized cross-over trial

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SUMMARY

Background: Meticillin-resistant *Staphylococcus aureus* (MRSA) is frequently endemic in healthcare settings and may be transmitted by person-to-person spread. Asymptomatic MRSA carriers are potential, unsuspected sources for transmission and some of them may be identified by admission screening.

Aim: To assess whether rapid point-of-care screening (POCS) for MRSA at hospital admission may be associated with a reduction in MRSA acquisition rates when compared with slower laboratory-based methods.

Methods: A cluster-randomized cross-over trial was conducted in four admission wards of an acute London tertiary care hospital. Polymerase chain reaction-based POCS screening was compared with conventional culture screening. Patients were screened on ward admission and discharge, and the MRSA acquisition rate on the admission wards was calculated as the primary outcome measure.

Results: In all, 10,017 patients were included; 4978 in the control arm, 5039 in the POCS arm. The MRSA carriage rate on admission was 1.7%. POCS reduced the median reporting time from 40.4 to 3.7 h ($P < 0.001$). MRSA was acquired on the admission wards by 23 (0.46%) patients in the control arm and by 24 (0.48%) in the intervention arm, acquisition rates of 5.39 and 4.60 per 1000 days respectively. After taking account of predefined confounding factors, the adjusted incidence rate ratio (IRR) for change in trend for MRSA acquisition was 0.961 (95% confidence interval: 0.766–1.206). The adjusted IRR for step change for MRSA acquisition was 0.98 (0.304–3.162).

Conclusion: POCS produces a significantly faster result but has no effect on MRSA acquisition on admission wards compared with culture screening. Where compliance with

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infection prevention and control is high and MRSA carriage is low, POCS has no additional impact on MRSA acquisition rates over the first one to four days of admission compared with conventional culture screening.

Introduction

Meticillin-resistant *Staphylococcus aureus* (MRSA) infections are associated with greater mortality, morbidity, and healthcare costs than are similar infections with meticillin-susceptible strains.[1] MRSA is frequently endemic in healthcare settings and may be transmitted by person-to-person spread. Asymptomatic MRSA carriers are potential, unsuspected sources for transmission and some of them may be identified by admission screening.[1]

In England and Wales, the Health Act (2008) Code of Practice for the prevention and control of healthcare-associated infections requires hospitals to have policies for MRSA admission screening and care pathways for the management of MRSA carriers.[2] The identification, isolation, and decontamination of patient carriers are associated with reduced MRSA transmission, although the evidence for this is limited and debated.[3–7]

Conventional laboratory-based culture screens (CS) take two or three days to report a result. More rapid detection of MRSA carriers theoretically should lead to faster implementation of control procedures and reduce the transmission of MRSA. Screening tests for MRSA using laboratory-based polymerase chain reaction (PCR) have significantly faster turnaround times to result, averaging 22 h.[8] However, although some studies comparing rapid and conventional screening at the same anatomical sites (the majority with nasal screens only) have shown an association between the use of laboratory-based PCR tests and a reduction in MRSA transmission and acquisition rates, others have not.[4,7–12] The lack of effect in some studies may be because of continuing cross-transmission of MRSA during the 22 h delay before receiving the result of the laboratory-based PCR test. Much of that delay is due to the transit of the specimen between the ward and the laboratory. Because of the conflicting outcome results and the greater expense compared with CS, laboratory-based PCR tests have not been recommended for routine adoption in English hospitals.[13]

Point-of-care MRSA PCR screening tests (POCS) can be performed on the ward, eliminating specimen transit times and allowing a truly rapid result within about 1 h. There have been no reports of controlled studies on this method. We therefore conducted a clinical trial — on hospital wards where a good standard of infection prevention and control was in place — to determine whether performing POCS is associated with a reduction in MRSA acquisition rates compared with CS.

For elective admissions, MRSA screening (and decontamination if necessary) is best done before hospital admission in outpatient clinics where rapid screening is unnecessary. Rapid screening is more appropriate for emergency admissions. In order to achieve better patient management, safety, and resource utilization, many hospitals, including our own, have introduced admission wards. Emergency patients are admitted to these wards for review, investigation, and stabilization before being transferred to general wards or discharged to outpatient care.[14] Stay on these wards is usually around 24–36 h. MRSA screening of emergency hospital admissions is therefore ideally done on the admission wards. Since POCS can produce results within 1 h, whereas CS takes two or three days, POCS will identify the MRSA status of patients before transfer or discharge and theoretically reduce transmission and acquisition within the general wards. Furthermore, since the postulated advantage of POCS is to reduce the 24–36 h delay of culture screening, POCS should theoretically reduce MRSA transmission/acquisition on the admission wards themselves.

The impact of admission ward screening on MRSA acquisition on general wards is dependent on numerous uncontrolled factors (including MRSA carriage by elective admissions and general ward transfers) and is difficult or impossible to measure with any accuracy. By contrast, the impact of rapid admission ward screening on MRSA acquisition within the admission wards themselves can be measured fairly accurately by screening at admission and on transfer/discharge and controlling for other variables by using a cross-over trial design. If POCS does have an impact on MRSA transmission compared with CS, then this should occur during the 22–36 h stay on the admission wards; if it has no effect during this period then it will have no advantage over culture- or laboratory-based PCR screening. We therefore performed a controlled cluster-randomized cross-over clinical trial of POCS compared with CS on the four admission wards in our hospital, with MRSA acquisition on the admission wards as the primary outcome.

Methods

Setting

The study was performed in a 900-bed, acute National Health Service (NHS) London teaching and tertiary care hospital between May 2011 and July 2012. Patients are admitted from the emergency department on to one of four admission units. After a period of assessment and treatment on these units, they are either discharged from the hospital or admitted to a general ward. For this study we screened patients on arrival at the admission wards, which were the two medical admissions units, the acute surgical unit, and a neurosurgical ward, the only study ward with a high dependency unit. The characteristics of the wards are shown in Table I.

A cluster-randomized, controlled cross-over trial design was used, with the four wards as clusters, randomized to control arm and intervention arm by a computer-generated randomization list. After the first phase of seven months, there was a washout period for one month, followed by a second phase of seven months, in which the wards were crossed over (Figure 1). Assuming a 3% MRSA carriage rate and a 0.3 transmission rate, we estimated that a sample size of 3840 patients per study arm would have an 80% power (at the