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Meticillin-resistant *Staphylococcus aureus* (MRSA): screening and decolonisation

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ABSTRACT

Meticillin-resistant *Staphylococcus aureus* (MRSA) infections are of increasing importance to clinicians, public health agencies and governments. Prevention and control strategies must address sources in healthcare settings, the community and livestock. This document presents the conclusions of a European Consensus Conference on the role of screening and decolonisation in the control of MRSA infection. The conference was held in Rome on 5–6 March 2010 and was organised jointly by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and the International Society of Chemotherapy (ISC). In an environment where MRSA is endemic, universal or targeted screening of patients to detect colonisation was considered to be an essential pillar of any MRSA control programme, along with the option of decolonising carriers dependent on relative risk of infection, either to self or others, in a specific setting. Staff screening may be useful but is problematic as it needs to distinguish between transient carriage and longer-term colonisation. The consequences of identification of MRSA-positive staff may have important effects on morale and the ability to maintain staffing levels. The role of environmental contamination in MRSA infection is unclear, but screening may be helpful as an audit of hygiene procedures. In all situations, screening procedures and decolonisation carry a significant cost burden, the clinical value of which requires careful evaluation. European initiatives designed to provide further information on the cost/benefit value of particular strategies in the control of infection, including those involving MRSA, are in progress.

1. Introduction

Whilst the problem of antimicrobial resistance is widespread amongst common bacterial pathogens, the particular health threat caused by meticillin-resistant *Staphylococcus aureus* (MRSA) is of increasing concern to clinicians, public health agencies, governments and, last but not least, the general public. This has brought critical attention to bear on the adequacy of current infection prevention and control strategies, which have had to take into account reservoirs of MRSA in healthcare delivery institutions [healthcare-associated MRSA (HCA-MRSA)] and, more recently, the community [community-acquired/associated MRSA (CA-MRSA)] and livestock [livestock-associated (LA-MRSA)] [1–6]. For these reasons, the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) and the International Society of Chemotherapy (ISC) organised a joint expert meeting to focus on the latest evidence for MRSA prevention and control measures and treatment in Rome, Italy, in March 2010. This review is based on the proceedings of that meeting.

In particular, this document outlines specifically the opinions expressed by experienced clinicians and scientists on the role of screening and decolonisation as useful tools in such management strategies. Low-prevalence countries were not considered a major issue: they have very similar screening policies. In our opinion, the target audience for this document should include health policy-makers, infection control teams, and clinicians working in hospitals with endemic MRSA, i.e. a situation where MRSA transmission rates are high and MRSA is constantly being circulated amongst the population present in the hospital and re-introduced by patients previously admitted to the same or other institutes in a locality/region where MRSA is endemic [7]. Indications for screening and decolonisation are not necessarily uniformly directed at every hospital within any given country. A recurrent and important feature since MRSA was first reported in the early 1960s has been that hospitals can vary in their MRSA rates, not just between countries but within a country or even in the same city [8,9].

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However, it is important to harmonise infection prevention and control measures between hospitals to limit MRSA spread between them, and a good example of such harmonisation is to ensure that hospitals inform one another when they transfer MRSA-affected patients between their institutions [10–12].

Screening involving the use of microbiological procedures to detect the carriage of MRSA by individuals without evidence of clinical infection is an essential 'pillar' of any MRSA control programme [13–15]. Since such procedures carry significant healthcare costs, it follows that any surveillance undertaken be of proven benefit to the overall strategies put in place for the prevention and control of MRSA infections. This is often difficult to ascertain, as such procedures are frequently multifaceted and analysing the contribution of any one component to observed outcomes can, in practice, be extremely difficult [16].

However, it was stressed that some sort of MRSA screening is essential in order to be successful in MRSA prevention and control. When considering the design of such a screening programme, it is essential to be aware of the context, specifically the MRSA occurrence levels nationally, regionally and locally. It is vital that nationally agreed guidance is incorporated into local policies and that relevant practices are audited regularly (this is also called process surveillance) to ensure that there is compliance. Policies may need to be modified locally based on the results of these audits so that they remain fit for purpose. This is especially pertinent given the changing landscape in Europe with the emergence of CA-MRSA and LA-MRSA.

2. Universal and targeted screening

'Who' should be screened for MRSA as well as 'where' and 'when' are still open questions. Several sites are recommended when screening patients. The anterior nares are the 'headquarters' of *S. aureus*/MRSA carriage and should always be included, although some data suggest that CA-MRSA may not be carried in the nose as frequently as other MRSA [4]. Data from community outbreaks suggest that skin-to-skin, and to a lesser extent skin-to-fomite, contacts represent common routes of transmission [17]. The throat is also important, especially where relapse following eradication therapy is to be explored (see below). Additional sites are often included but may have diminishing returns. The perineum is more frequently colonised by CA- than by HCA-MRSA strains [18]. Other sites include any lesions, manipulated sites (such as intravenous and urinary catheters), the axillae, the fingertips and the hairline. The latter two sites can provide clues that patients are dispersers with an increased risk of transmission to other patients, family members or the wider environment around patient areas or the home [19,20]. Pooling swabs from several sampling sites into a single broth culture has long been advocated as a cost-effective screening method where one just wants to know whether, rather than where, subjects are positive [21].

Both in primary detection and in screening following decolonisation, the use of selective or semiselective broth culture of individual swabs has been shown to increase the sensitivity of detection [21,22].

In hospitals with endemic MRSA, universal screening of all individuals admitted to the healthcare facility as well as isolation and/or decolonisation of patients screened MRSA-positive are indicated to be the most effective interventions in mathematical models [12] and, in support of this theoretical approach, have been associated with significant reductions in the incidence of MRSA infection in clinical studies [23,24]. However, the efficacy and cost effectiveness of universal screening, being strictly related to the local epidemiology of MRSA infections, continues to require clarification [25–28].

Screening can also enable closer monitoring of circulating bio/genotypes. Recording typical antimicrobial susceptibility patterns and variants of these can inform the utility for local 'antibiogram typing' and treatment options. Screening also produces alert organism data, raising possible issues of MRSA occurring in patients without previous hospitalisation, for example livestock exposure in MRSA-positive patients [29,30].

The study that best represents an example of the efficacy of universal screening is that performed by Robicsek et al. [23] at a three-hospital organisation in the USA with ca. 40,000 annual admissions. The authors performed an interventional study comparing rates of MRSA clinical disease during and after hospital admission in three consecutive periods: (i) baseline (12 months); (ii) MRSA screening of all admissions to the Intensive Care Unit (ICU) (12 months); and (iii) universal MRSA screening of all hospital admissions, with contact isolation and decolonisation of MRSA-positive cases (21 months). During the last universal screening period, the prevalence of MRSA infections decreased significantly compared with the baseline (−70%). However, some limitations of the study need to be emphasised: findings relied on observational data only; and MRSA isolation days and adherence and effectiveness of decolonisation were not monitored.

The alternative to active universal screening is selective (targeted) screening, which takes into account the relative risk to a patient, and others, on the basis of the individual's medical history, the procedure(s) to be undertaken during hospitalisation and the incidence of MRSA colonisation in the community of which they are part [31]. West et al. [32] performed a before-and-after study comparing the rate of MRSA infection before and after the initiation of expanded surveillance in a community hospital system in the USA. Patients considered to be at risk were those who were (a) transferred from another hospital, (b) admitted from long-term care facilities, (c) re-admitted within 30 days after discharge and (d) admitted to a nephrology service. Cost effectiveness was calculated as the difference between the cost savings associated with preventing nosocomial MRSA bacteraemia and surgical-site infections (SSIs) and the cost of MRSA cultures and contact isolation for patients colonised with MRSA. The mean rate of nosocomial MRSA infection decreased over the study period. Surveillance was cost effective, preventing 13 nosocomial MRSA bacteraemias and 9 SSIs, resulting in a saving of US$1 545 762 [32].

Table 1 summarises risk factors to be considered when planning a targeted screening programme. International transfers are becoming a higher priority in many countries with the presence of CA-MRSA and its spread within hospitals causing serious healthcare-associated infections. In some countries, exposure to LA-MRSA is a significant risk, whilst in others it has yet to be described. To improve compliance with MRSA screening policies, we recommended the flagging of MRSA-positive status in the patient's notes or the use of computerised systems that enable one to readily 'tag' MRSA-positive patients and follow these up accordingly. Such a system was described many years ago but may not be available in many hospitals [33].

This selective approach to screening has the undoubted advantage of reduced cost and workload but requires constant vigilance. Over time, changes in those considered to be in at-risk groups may be needed based on monitoring of the incidence of infection in a particular establishment or clinical unit. For example, the National Health Service (NHS) Quality Improvement Scotland Health Technology Assessment (HTA) on the clinical and cost effectiveness of MRSA screening originally recommended screening all overnight admissions [34]. When this strategy was tested, however, the Scottish recommendations were altered to include screening of the majority of elective admissions to acute specialties (excluding paediatrics, obstetrics and psychiatry) and elective admissions to only four specialties (nephrology, vascular surgery, dermatology and