IN-DEPTH REVIEW

Methicillin-resistant *Staphylococcus aureus* and multidrug resistant tuberculosis: part 1

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The first of these articles reviews the epidemiology of MRSA and its clinical importance in a healthcare setting. The methods of controlling the spread of hospital acquired MRSA are discussed with an emphasis on the role of screening staff for MRSA. Relevant papers for the review were identified by a systematic literature search on Medline.

The prevalence of MRSA is increasing in the United Kingdom, as is the prevalence of ‘epidemic’ MRSA strains. Several countries have recently reported cases of *Staphylococcus aureus* with intermediate-level resistance to vancomycin. The key measures to minimizing hospital-acquired MRSA are stringent infection control programmes and strict antibiotic policies. Staff screening should only be undertaken after a detailed risk assessment of the local situation has been made by the occupational health and infection control teams. Priority should be given to high-risk areas of a hospital where MRSA is endemic.

**Key words:** Carriage; colonization; infection control; methicillin-resistant *Staphylococcus aureus*; occupational health; risk assessment; screening.

INTRODUCTION

The increasing problem of bacterial resistance to antibiotic therapy, and the growing number of pathogens resistant to several classes of antimicrobial drugs (multi-resistant organisms) has resulted in mounting concern in the United Kingdom and worldwide.¹ UK occupational health departments are most likely to be concerned with methicillin-resistant *Staphylococcus aureus* (MRSA) and multidrug resistant tuberculosis (MDRTB). Part 1 of this review will discuss MRSA in detail, and part 2 will consider MDRTB.

This review is based on published information on MRSA from general and specialist journals. Relevant papers for this review were identified from a Medline literature search of all articles published from January 1994, using methicillin-resistant *Staphylococcus aureus* MRSA and antibiotic-resistant *Staphylococcus* as research terms.

Epidemiology of Methicillin-Resistant *Staphylococcus aureus*

*Staphylococcus aureus* is a pathogen capable of causing both trivial and deep-seated infections, and is carried as a skin commensal at any one time by approximately 30% of the population. Penicillinase stable β-lactams, such as methicillin, cloxacillin and fluocloxacillin, have been the mainstay of treatment of *S. aureus* infections for over 35 years. Strains resistant to these drugs are referred to as methicillin-resistant *Staphylococcus aureus* (MRSA),² and have been a cause of hospital acquired infections since their first detection in Europe in the early 1960s.¹

Worldwide MRSA rates are increasing, with the lowest rates generally in countries with strict infection control policies such as Scandinavia and the Netherlands, and the highest in those with more liberal policies such as Japan and Korea, where MRSA accounts for 70% of all *S. aureus* isolates.¹

In England and Wales, the prevalence of MRSA has steadily risen from 1.5% of blood and cerebrospinal fluid (CSF) *S. aureus* isolates in 1989–1991, to 22.1% in 1996, and 31.7% in 1997.¹ In 1998, the prevalence was 34% (Public Health Laboratory Service, London), indicating a decline in the rate of increase.

The overall rise is a reflection of the increasing prevalence of ‘epidemic’ MRSA strains (EMRSA),
specifically EMRSA-15 and EMRSA-16, with the former being responsible for 937 reported incidents in 167 hospitals and the latter for 856 reported incidents in 142 hospitals in 1996. EMRSA is defined as MRSA isolated from two or more patients in at least two hospitals.

Recent additional problems include the emergence of resistance to mupirocin, the mainstay of treatment of skin or nasal carriage, and case reports of intermediate-level resistance to vancomycin (VISA) in Japan, France, and the USA. In 1999, the Scottish MRSA Reference Laboratory reported two VISA isolates. These were the first to be reported in the UK. These isolates differ from previously reported VISA isolates in that they were identified as a result of routine screening of all MRSA isolates sent to the Scottish MRSA Reference Laboratory, rather than as a result of treatment failure.

PATHOGENESIS

In terms of pathogenicity, the virulence of MRSA compared to methicillin-susceptible Staphylococcus aureus (MSSA) has generated considerable controversy. Some would argue that there is no evidence that MRSA causes greater morbidity than MSSA and the latter is more prevalent. However, Cafferkey et al. found that the outcome of MRSA infections was at least similar to that of MSSA infections, when mortality was corrected for underlying disease, and possibly even worse. Other studies have revealed a higher overall mortality, longer duration of hospital stay, need for more antibiotics, and delay in initiation of appropriate therapy for MRSA infections when compared to MSSA.

CLINICAL IMPORTANCE OF MRSA

In clinical practice, MRSA poses an increasing threat, as not only can the organism survive for long periods in the environment, but also it can colonize the skin, nose, and throat of patients and healthcare staff, and is readily spread by direct contact. Risk factors for acquisition of MRSA include previous hospitalization, pressure sores, and recent treatment with antibiotics. Intensive care patients have a higher risk of developing MRSA infection compared to medical patients.

In order to assess the impact of MRSA in hospitals and the community, it is important to adhere to the agreed definitions of carriage, colonization and infection. A carrier of MRSA is a person who harbours MRSA with no overt expression of clinical disease, but who is a potential source of clinical infection. The carriage of MRSA can be transient, intermittent or chronic. Colonization by MRSA is the presence and multiplication of MRSA at a body site without tissue damage or invasion. Infection with MRSA indicates the entry and multiplication of MRSA in the tissues with associated tissue damage.

In light of the increasing prevalence of MRSA in the hospital environment, revised guidelines for the control of MRSA infection in hospitals were produced by a combined working party of the British Society of Antimicrobial Chemotherapy, the Hospital Infection Control Society and the Infection Control Nurses Association. The following section on the control of MRSA is based upon this report. These guidelines are intended to provide a more flexible and targeted approach to MRSA, based on assessment of risk.

CONTROL OF MRSA

The primary objectives of infection control are the prevention of acquisition and spread of infection by patients and staff. The experience of countries with low MRSA rates suggest that scrupulously applied infection control programmes and stringent antibiotic policies are key measures in minimizing hospital acquired MRSA.

Patients with large burns or eczema that is infected with MRSA are usually responsible for the spread of infection, as they are heavy dispersers of the organism. However, the introduction of MRSA into unaffected areas by colonized staff is well-documented, and the hands of staff are an important route of cross-infection. Infected patients, and where possible, in-patients who are carriers, should be isolated in a single room, or preferably in an isolation unit with designated staff. During outbreaks, staff should be reminded of the importance of hand-washing and of reporting any lesions to the occupational health department. Wherever possible, temporary staff should be deployed to care for non-MRSA patients. If the use of temporary staff on MRSA affected wards cannot be avoided, preference should be given to staff who can work for several days rather than one session.

STAFF SCREENING

The approach to screening of staff should be based on a risk assessment of the local situation made by the occupational health team and the infection control team. Priority should be given to high-risk areas of a hospital where MRSA is endemic.

An endemic situation occurs when there is the continuing presence of MRSA, with or without infection, in a given hospital or in a specific group of patients in the hospital, despite standard control procedures. Occupational health professionals working in an environment where MRSA is endemic are urged to seek detailed advice from the Combined Working Party report.

If a case of MRSA is detected in critical areas such as ITU, SCBU or cardiothoracic wards, it is recommended that staff are screened as soon as possible. If a case of MRSA is detected in other areas, standard infection control measures should be implemented. If MRSA is spreading despite the introduction of control measures, then the examination of lesions and staff screening is recommended.
Initially, staff screening should consist of nasal swabs and swabs of lesions. Staff should be examined for infected lesions and, if present, should be removed from high- or moderate-risk areas. They can continue to work in low- or moderate-risk areas provided that the lesion is covered with an impermeable dressing.

When screening staff it is important to avoid doing so at the end of a period of duty, as carriage of MRSA may be transient and will not necessarily be present before the next day's duty. There is little evidence that transient carriage of MRSA by staff is responsible for transmission of the organism.

Nasal carriers should be treated with mupirocin and antiseptic detergents. Staff should be excluded from work in high-risk wards for 48 h after commencing mupirocin treatment. They can work in other areas whilst on treatment providing that the strain is susceptible, or has a low-level of resistance, to mupirocin. Treated carriers should be followed up at weekly intervals and at least three negative swabs from previously positive sites should be obtained before accepting that MRSA has been cleared. Failure to eradicate MRSA after two courses of treatment should be reviewed by a consultant microbiologist.

It is important to remember that treatment of staff carriers of MRSA, who are essentially healthy, is not without risk. Topical treatment may cause side effects, in particular contact dermatitis. Furthermore, the costs of screening, treatment and possible locum cover are considerable. Therefore, it is imperative that the decision to screen is a multidisciplinary one, based on detailed risk assessment of the local situation.

REFERENCES