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MRSA in a hospitals-what can be done?

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Methicillin resistant *Staphylococcus aureus* (MRSA) is a variant of ordinary *Staphylococcus aureus* which is part of the normal body flora of up to 30% of the population. It is usually found in specific body sites such as the nose. MRSA comprises a variety of different strains with the common feature of resistance to methicillin (and by implication also to the commonly used anti-staphylococcal flucloxacillin). MRSAs are almost always resistant to most other commonly used antimicrobials. These organisms have become highly prevalent in many hospitals of most countries in the developed world in the past couple of decades. Various reasons are given for wishing to limit their spread, perhaps the most persuasive being that patients treated empirically with standard antibiotic regimes will be treated inadequately if their infection is due to an undiagnosed MRSA; there are also concerns that by forcing us to use our last reserve antibiotics for treatment, MRSAs effectively take us to only a step away from having a virulent common pathogen which is untreatable with antibiotics.

Whilst it may be questioned whether MRSAs warrant the degree of concern that they have excited compared with other hospital pathogens, it is certainly true that these organisms, being largely confined to hospitals and often representing a single strain spreading within a hospital, provide an easily identifiable marker of cross-contamination between patients and staff. In finding means of reducing the transmission of MRSAs, it can be assumed that the transmission of infectious agents in general within a hospital will also be reduced, as would the overall extent of hospital-acquired infection with antibiotic-resistant micro-organisms.

What should be done in order to control spread is clearly not known at present known since, were this the case, we would not be needing to discuss the matter. However a good case can be made that the traditional practices used in recent years to stem the spread of MRSAs have failed overall. These practices are based largely on common-sense approaches. Thus patients who are found to harbour an MRSA are screened at likely body carriage sites to determine the extent of their colonisation and are treated with appropriate antiseptic and antibiotic regimes to eliminate the organism; ideally being placed in isolation ('barrier') nursing where they are separate from other patients who may become colonised. Staff make use of protective clothing such as plastic aprons and disposable gloves so that they do not themselves acquire the organism or pass it on. Patients are screened to establish that they are negative following their treatment and the room they have occupied is thoroughly cleaned to eliminate the MRSA from the environment. In areas where outbreaks are thought to be occurring or where patients are considered to be at particular risk of acquiring, or suffering from, MRSA screening programmes are adopted to identify asymptomatic carriers among patients and staff. If found, these are treated similarly to the above.

The continual rise in reported cases of MRSAs shows that the above methods of control have been ineffective in limiting spread. Various reasons are readily apparent that might explain this. These include the admission of unrecognised MRSA carriers, the insensitivity of detection methods, the inability of overworked staff fully to comply with isolation protocols, and even the possibility that the seemingly sensible measures listed above are intrinsically

faulty. An examination of attempts at implementing attempts to control MRSA also highlights practical reasons for these measures not succeeding. For example MRSA screening programmes in practice fail to include large numbers of patients who should be screened; antiseptic decontamination regimes fail to eliminate carriage in a substantial number of cases; isolation facilities are generally insufficient where there is anything more than a small number of cases of MRSA, and a lack of staffing prevents effective barrier nursing.

Given that traditional control measures have, apparently, at best delayed the spread of MRSA, it is necessary to reconsider how we are approaching the matter. Fresh approaches are needed and ideas on how to proceed may be available from older research, analogous situations with other micro-organisms, and examination of practices in other countries where MRSAs are less common.

It seems reasonable to presume that MRSAs, like other *Staphylococcus aureus*, are spread by a limited number of means - direct physical contact, airborne spread from one person to another, and acquisition from the environment. That transmission occurs by direct physical contact is a fundamental premise of Infection Control, and thus that handwashing is of importance. It is surprisingly difficult to discover convincing scientific work to support this thesis, although to design definitive experiments to prove the point would clearly be unmanageably difficult. However there is a considerable amount of circumstantial evidence going back to the mid 19th century, when Semmelweis in Vienna demonstrated the dramatic effect of an antiseptic handwash on reducing maternal mortality following childbirth. More recent studies have made the point that a variety of bacteria can persist on the skin and are readily transmitted onwards. Handwashing also is central to elementary hygiene and it may reasonably be assumed that if hand hygiene is being neglected, then this is probably a reflection of poor hygienic practices overall

The transmission of staphylococci via the airborne route was examined in research undertaken 40-50 years ago. It is apparent that spread from the respiratory tract is unlikely to be important and that the simple carriage of *S. aureus* in the nose is unlikely in itself to be an infection risk. Unfortunately of course, people frequently touch their noses and so the nose becomes a source of staphylococci then spread by physical contact. A great deal research was also done in the past on the spread of infection via airborne particles such as skin squames carrying *S. aureus*. In the context of the operating theatre there is good evidence that reducing the number of bacteria-carrying particles in the air is associated with a reduced infection rate, as was shown convincingly by Charnley's studies of infection rates in replacement hip joints. This work does not seem to have been repeated in areas outside the closed confines of the operating theatre but clearly may warrant further investigation. Earlier workers also drew attention to the existence of the staphylococcal "shedder", i.e. the occasional individual who sheds vastly greater numbers of *Staph aureus* into the surrounding air than others do and so was presumed to be particularly likely to cause infection. This is an aspect which appears to have become neglected; we do not attempt to identify such shedders and MRSA screening programmes merely look for surface carriage, which may yield unreliable results since it has been demonstrated that staphylococcal carriage is intermittent in any given individual.

Antibiotic overuse is generally recognised as contributing to the spread of antibiotic resistant bacteria and there are reports of the restriction of use of certain antibiotics leading to a fall in the prevalence of particular antibiotic resistant organisms. This has not so far been reported for MRSAs but by analogy is clearly an approach worth investigating in an attempt to limit their spread.

The environment as a source of infection with staphylococci has never been properly studied. One can undoubtedly find MRSA surviving in the surrounds of a patient who has had a staphylococcal infection, but as to whether this simply represents a dead end for the staphylococcus, or whether subsequent patients are at risk of acquiring the organism from this source is unknown. A few publications have reported ventilation extract grilles colonised with MRSA and implicated them as a source of infection, usually when temporary reversal or shut down in air flow occurred. Another area and that may warrant study is the contribution of the general condition of buildings. It would be difficult to demonstrate that poorly maintained buildings promote the spread of infection, but it may equally be true that staff working in a badly maintained environment are more prone to gain the impression that basic hygiene is not considered a priority.

A curious feature of the epidemiology of MRSAs is their virtual absence from a small number of countries in the developed world, notably the Netherlands and Scandinavia. Although the rarity of MRSAs in these countries means that they are able to respond vigorously to control the spread of the small number of isolates they do encounter, the basic elements of the control measures then implemented are the same as those applied in the majority of the countries where MRSAs flourish. The failure of these organisms to spread in the low prevalence countries must thus reflect the presence of some other factors beyond the traditional control measures. It may be worth investigating staffing levels, hospital design, resourcing, etc. to discover what is exceptional about these countries. It should also be noted that Scandinavian countries generally have a much lower degree of antibiotic resistance overall than do most other developed countries.

In summary, current "blanket-approach" methods to controlling MRSA are expensive and unsuccessful. Greater success might be obtained by identifying specific individuals and specific circumstances in which the organisms are particularly likely to be transmitted.

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