EDITORIAL

MRSA: major problem or minor threat?

Staphylococcus aureus strains that are resistant to methicillin (MRSA) and, often, other antistaphylococcal agents, provide a considerable challenge to infection control teams throughout the world, and several control guidelines have been published.^{1,2} However, there are many unresolved questions, not least the feasibility or sense in attempting to control MRSA.

S. aureus has always been a versatile pathogen³ with an irritating tendency to disprove many generalisations. The prevalence of MRSA characteristically varies in different countries, cities and even within a hospital.⁴ It is probable that there is similar variation in the community and other institutions, such as homes for the elderly, although information is lacking. International transfer of MRSA carried on patients and staff is well recognised^{4,5} and opportunities are likely to increase as patients travel to other countries for treatment, or develop infections whilst on business or vacation. Moreover, European Community (EC) regulations that enable staff to work abroad more easily and the disappearance of national barriers, particularly in Eastern and Western Europe, may ease the spread of resistant micro-organisms.

Typing of MRSA plays an important part in clarifying the suspected epidemiology of outbreaks, and in evaluating the success or failure of control measures. Although some of the genes involved in methicillin resistance are probably on transposons, evolutionary diversity seems to be uncommon among MRSA, at least in those strains causing epidemics of infection.⁴ Such strains pose a severe test for any typing system, and simple systems often produce as much information as modern molecular techniques.^{6,7} The key point is whether the requirement is to type isolates and build up a large data base suitable for inter-laboratory comparisons, or merely to distinguish between a relatively small number of local isolates. Much work is required to standardise the more recent typing methods, and objective analysis of the gels is also required, as has been achieved with SDS-PAGE of proteins.⁸

There are some who feel that the virulence of MRSA has been greatly exaggerated. We do not fully understand the nature of virulence in *S. aureus*. It is likely to be an interaction of many seed factors within a soil of varying susceptibility and exposed to different or changing climatic conditions. Lacey and co-workers⁹ discussed their experience with an MRSA of low virulence on a burns unit. That strain was unusual in that it lacked lipase and was a weak producer of clumping (slide coagulase) factor and protein A, all

purported virulence factors. Virulence factors linked with phage¹⁰ have been found in a strain circulating in the UK (the so-called “EMRSA-1”) and in epidemic MRSA from eastern Australia¹¹ and may thus be expected to vary between, or even during, MRSA outbreaks. However, we cannot provide reliable predictors of virulence in the laboratory. Although several units have experienced outbreaks similar to that described by Lacey *et al.*, on other occasions MRSA has caused considerable morbidity and mortality.⁴ Nevertheless, it is interesting that MRSA rarely cause the primary sepsis in healthy staff seen with the infamous 80/81 strain of *S. aureus* of the 1950s.

Clearly, certain MRSA express epidemic potential, but the identification of reliable laboratory markers has eluded research efforts. Experience would suggest that the answer to this question also lies in the interaction between the seed, the soil and the climate. EMRSA-1 (perhaps the archetypal epidemic MRSA) does not necessarily spread when introduced into a hospital setting.¹² We need to know more about the reasons for failure and success of MRSA control.^{5,12,13}

The introduction of new therapeutic agents to treat infections or eradicate carriage of MRSA has resulted, as might have been predicted, in the emergence of resistance. This has occurred with a frightening rapidity in the case of the quinolones and mupirocin. There are clues that some of the resistance genes originated in other bacterial species.^{14,15} Glycopeptides remain effective, but the spectre of vancomycin resistance looms large; proposed benefits of using this agent prophylactically must be examined very critically.¹⁶ We may be able to draw some comfort from the fact that transfer of *vanA* produced an unstable transconjugant.¹⁷ Some have criticised this kind of experimentation but, provided it is performed in carefully controlled conditions and with appropriate recipients, it provides important information for infection control teams and clinicians of the potential dynamics and control measures which might prevent the emergence of resistance *in vivo*.

The rationale for control of MRSA has been discussed in several recent articles and guidelines.^{1,2,18} There are differences of opinion about the advisability of attempting to eradicate MRSA with topical or systemic therapy. Several workers have used mupirocin to eradicate MRSA from nasal and wound sites and, in theory, this should reduce MRSA transmission to staff and then to other patients.¹⁹ However, the prophylactic use of mupirocin²⁰ must increase the chance of resistance emerging and, indeed, mupirocin resistance in MRSA, though still rare, has been

reported from several centres in the UK.²¹ Low level triclosan resistance has also been described,²² as with chlorhexidine "resistance" this may not be relevant *in vivo*.²³

Boyce recently reviewed 46 published outbreaks of MRSA.¹⁸ Rapid implementation of control measures seemed to be important: all 11 hospitals with ≤ 20 cases were successful in eradicating MRSA compared to 71% with 20–39 cases and 10% with ≥ 40 cases. The extent of the control measures depends on the morbidity and mortality caused by the MRSA, the consequences of infection in different patient groups, and the comparative cost of ignoring the MRSA or trying to contain it. It is best to avoid a prescriptive or dogmatic approach; requests for additional infection control resources should be balanced with other

factors, such as staffing shortages and the type of patient at risk. The antibiogram of the MRSA (and thus the availability of alternative therapies) and the success or failure of cohort or targeted nursing policies are among other factors that need to be taken into account.

It is evident that, in certain parts of the world, rates of colonisation with MRSA are so high and resources so scarce that elimination is impossible. Damage limitation policies, such as an increased emphasis on the importance of handwashing and the control of antibiotic prescribing are the sensible way forward.

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References

1. Working Party report. Revised guidelines for the control of epidemic methicillin-resistant *Staphylococcus aureus*. Report of a combined working party of the Hospital Infection Society and the British Society of Antimicrobial Chemotherapy. *J Hosp Infect* 1991; **16**: 351–377.
2. Bennett ME, Thurn JR, Klicker R, Williams CO, Weiler M. Recommendations from a Minnesota task force for the management of persons with methicillin-resistant *Staphylococcus aureus*. *Am J Infect Control* 1992; **20**: 42–48.
3. Altemeier WA, Lewis S, Brackett K. The versatile *Staphylococcus*. In: Macdonald A, Smith G. (eds) The staphylococci. Proceedings of the Alexander Ogston Centennial Conference, Aberdeen, University Press. 1981: 125–148.
4. Cookson BD, Phillips I. Methicillin-resistant staphylococci. *Soc Appl Bacteriol Symp Ser* 1990; Suppl 19: 55–70.
5. Aparicio P, Vindel A, Alarcon T, Richardson JF, Marples RR, Cookson BD. *Staphylococcus aureus* resistant to methicillin. *BMJ* 1991; **302**: 1080.
6. Cookson B, Talsania H, Reith S, Vickery A. Strategies for typing epidemic MRSA (EMRSA). Abstracts of the VIIth International Symposium on Staphylococci and Staphylococcal infections, Stockholm June 1992. Abstract 175.
7. Richardson JF, Chittasobhon N, Marples RR. Supplementary phages for the investigation of strains of methicillin-resistant *Staphylococcus aureus*. *J Med Microbiol* 1988; **25**: 67–74.
8. Costas M, Cookson BD, Talsania HG, Owen RJ. Numerical analysis of electrophoretic protein patterns of methicillin-resistant strains of *Staphylococcus aureus*. *J Clin Microbiol* 1989; **27**: 2574–2581.
9. Lacey RW, Barr KW, Barr VE, Inglis TJ. Properties of methicillin-resistant *Staphylococcus aureus* colonizing patients in a burns unit. *J Hosp Infect* 1986; **7**: 137–148.
10. Winkler KC, Waart J de, Grooten C, Zegers BJM, Tellier NF, Vertregt CD. Lysogenic conversion of staphylococci to loss of Beta-toxin. *J Gen Microbiol* 1965; **39**: 321–333.
11. Cookson B, Richardson J, Wieneke A. Studies of an epidemic MRSA (EMRSA) in the UK and Australia. Abstracts of the VIIth International Symposium on Staphylococci and Staphylococcal Infections, Stockholm, June 1992. Abstract 14.
12. Cookson BD, Phillips I. Epidemic methicillin-resistant *Staphylococcus aureus*. *J Antimicrob Chemother* 1988; **21** Suppl C: 57–65.
13. Farrington M, Brenwald N, Haines D, Walpole E. Resistance to desiccation and skin fatty acids in outbreak strains of methicillin-resistant *Staphylococcus aureus*. *J Med Microbiol* 1992; **36**: 56–60.
14. Engel HWB, Soedirman N, Rost JA, Van Leeuwen WJ, Van Embden JDA. Transferability of macrolide, lincomycin, and streptogramin resistances between group A, B, and D streptococci, *Streptococcus pneumoniae*, and *Staphylococcus aureus*. *J Bacteriol* 1980; **142**: 407–413.
15. Dyke KGH, Curnock SP, Golding M, Noble WC. Cloning of the gene conferring resistance to mupirocin in *Staphylococcus aureus*. *FEMS Microbiol Lett* 1991; **77**: 195–8.
16. Möller JC, Nachtrodt G, Richter A, Tegtmeier FK. Prophylactic vancomycin to prevent staphylococcal septicemia in very-low-birth-weight infants. *Lancet* 1992; **340**: 424.
17. Noble WC, Virani Z, Cree RGA. Co-transfer of vancomycin and other resistance genes from *Enterococcus faecalis* NCTC 12201 to *Staphylococcus aureus*. *FEMS Microbiol Lett* 1992; **93**: 195–8.
18. Boyce JM. Should we vigorously try to contain and control methicillin-resistant *Staphylococcus aureus*? *Infect Control Hosp Epidemiol* 1991; **12**: 46–54.
19. Cookson BD, Peters B, Webster M, Phillips I, Rahman M, Noble W. Staff carriage of epidemic methicillin-resistant *Staphylococcus aureus*. *J Clin Microbiol* 1989; **27**: 1471–1476.
20. Hill RLR, Casewell MW. Reduction in the colonization of central venous cannulae by mupirocin. *J Hosp Infect* 1991; **19** Suppl B: 47–57.
21. Cookson BD. Antiseptic resistance in methicillin-resistant *Staphylococcus aureus*: an emerging problem? Abstracts of the VIIth International Symposium on Staphylococci and Staphylococcal infections, Stockholm, June 1992. Abstract 46.
22. Cookson BD, Farrelly H, Stapleton P, Garvey RPJ, Price MR. Transferable resistance to triclosan in MRSA. *Lancet* 1991; **337**: 1548–9.
23. Cookson BD, Bolton MC, Platt JH. Chlorhexidine resistance in methicillin-resistant *Staphylococcus aureus* or just an elevated MIC? An *in vitro* and *in vivo* assessment. *Antimicrob Agents Chemother* 1991; **35**: 1997–2002.