

## Hospital Practice

# A descriptive survey of uncontrolled methicillin-resistant *Staphylococcus aureus* in a twin site general hospital

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**Summary:** Over a five year period beginning in 1981, during which control measures were applied intermittently, the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) isolates increased steadily within a twin site general hospital. A retrospective chart review of 154 patients identified in 1984-1985 showed that the MRSA 'definitely' contributed to three deaths (2%) and 'probably' contributed to a further 15 (10%). The prolonged median duration of hospital admission (22 days) before first isolation of MRSA, together with the clustering of cases in time on certain wards, suggested that most, if not all, affected patients acquired the MRSA in hospital. As the virulence of MRSA in our outbreak appeared the same as that reported from teaching hospitals, MRSA control measures need to be comprehensively applied in general hospitals.

## Introduction

The spread of methicillin-resistant *Staphylococcus aureus* (MRSA) is an international problem and in the United Kingdom is particularly severe in hospitals in London and South East England.<sup>1</sup> Many reports from large teaching hospitals have described MRSA outbreaks,<sup>2-4</sup> but there are few reports from non-teaching districts. The following recounts the MRSA experience of a health district without regional tertiary referral units.

The district has a population of 320,000 of which a higher than average proportion are aged 65 years or over. Acute hospital services are on two sites; hospital A (424 beds) has all specialties except maternity and hospital B (527 beds) provides for maternity, most medical and surgical specialties, and a greater part of geriatric inpatient services. In 1981 MRSA first appeared in the district. Until early 1986 affected patients were rarely transferred to either isolation wards or single cubicles and contacts, including staff, were screened only occasionally. As a first step towards controlling the problem a study was undertaken to estimate infection rates and the proportion of cases with recognized risk factors, to look for clustering in time and by specialty, to describe the associated mortality

and morbidity, and to measure the point prevalence of MRSA among patients.

## Methods

Patients from whom MRSA was isolated during 1984 and 1985 were identified from infection control records and from staphylococcal phage typing results. Before 1984 complete information was unobtainable. A new patient isolate was defined as isolation of MRSA on at least a single occasion from a patient, whether clinically affected or not, who was not previously known to harbour the organism. The study was confined to strains characterized as 'Epidemic-MRSA',<sup>5</sup> since these strains accounted for all but six new patient isolates during the two year period. Methicillin resistance of all isolates was confirmed at the reference laboratory where phage typing was undertaken.

Case notes of affected patients were obtained and descriptive information extracted. The length of admission prior to first MRSA isolate was recorded, and whether the patient had received antibiotics during the previous 4 weeks. Rates of MRSA isolation were adjusted to allow for the varying intensity of specimen submission from patient care areas. Excepting those collected as

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MRSA contact 'screens', for 4 months in 1986 information was collected prospectively on the ward or unit of origin of all microbiology specimens tested on the wound bench for *Staphylococcus aureus*. After assuming that the number of specimens per patient remained unchanged from 1984, the rate of new patient isolates annually per 100 specimens submitted was calculated for each ward and unit.

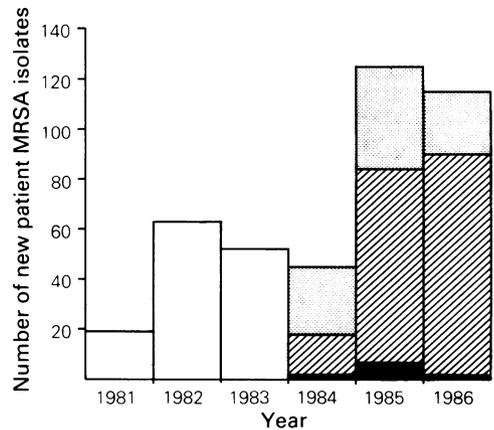
If patients had died, a detailed retrospective assessment was made of the contribution of MRSA to their deaths; this was considered 'definite' when MRSA was isolated from blood culture or a deep seated lesion in a patient without another obvious cause of death; the contribution was assigned as 'likely' in those patients in whom significant MRSA-related sepsis within 4 weeks of death was recorded in their charts. All other deceased MRSA patients were placed in the 'uncertain' category. As another measure of virulence the proportion of all isolates which came from blood cultures were compared for both MRSA and methicillin-sensitive *Staphylococcus aureus* (MSSA).

A point prevalence survey of MRSA amongst patients thought to be at particular risk of acquiring the organism was conducted. The survey was limited to 15 wards or units in hospital A where MRSA had previously been isolated. Wound swabs, catheter urine specimens and sputum samples from those with productive cough were collected and nose, throat and axilla swabs were obtained from any patient receiving antibiotics.

## Results

The increase of new patient MRSA isolates in the district from the beginning of 1981 is shown in Figure 1. Before 1984, it was not always possible to specify to which hospital each patient had been admitted. Complete records were available for 154 (96%) of the 161 patients identified in 1984-1985 and who were admitted to either hospital A or B; two-thirds of them were male, their average age was 72 years and four-fifths had received antibiotics in hospital during the 4 weeks preceding first MRSA isolate. The average admission period before first MRSA isolate was 47 days (median 22 days); for 35% the organism was not detected until more than 4 weeks had elapsed; only 6 (4%) yielded their first isolate within 2 days of admission and 5 of these had been admitted to hospital within the previous 4 months.

The wound bench of the laboratory processed approximately 16,000 specimens during the 2 years, four-fifths from inpatients and the remainder submitted by general practitioners; 100 MRSA strains



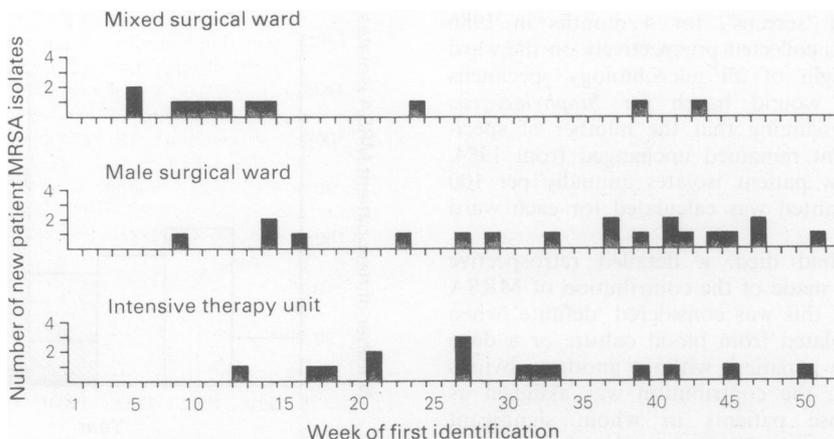
**Figure 1** Annual new patient MRSA isolates in the district. □, Hospital B; ▨, hospital A; ■, minor hospitals; □, not specified (prior to 1984).

were isolated from inpatients while only three were recovered from community patients and these three had been recently in hospital.

The 1984 and 1985 incidence of new patient MRSA isolates in particular wards within the two hospitals is presented in Figure 1. During this period the incidence increased in all affected units except geriatrics. Adjustment of isolation rates for variation in specimen submission suggested that the greatest problem was in the surgical unit of hospital A. Although the intensive therapy unit showed the greatest proportionate incidence increase between the two years, the large number of patients discovered may have resulted from the more intense microbiological surveillance of that unit. Temporal clustering of new MRSA patients was readily apparent on the three most severely affected wards in 1985 (Figure 2).

By the end of 1985, 62 (40%) of the 154 patients were dead, 50 having died during the admission when MRSA was first isolated. MRSA 'definitely' contributed to three (2%) of these 62 deaths and 'probably' contributed to a further 15 (10%). Compared with the over 2000 MSSA isolates in the same period, the proportion of total isolates which was made from blood was the same for MRSA (3.5%) and MSSA (3.5%).

The prevalence study in hospital A found that 160 of a total of 334 patients in the selected wards were considered at particular risk of acquiring MRSA, 66 because they were receiving antibiotics and the remaining 94 because they had a variety of lesions. From the 321 specimens collected, three new patient isolates were discovered; one from a wound swab, one from a sputum specimen and the other from the nasal swab of a patient receiving



**Figure 2** Selected examples of clustering in time and place of new patient MRSA isolates: Hospital A 1985. The 45 new patient isolates depicted represent 58% of the total (77) in hospital A in 1985.

antibiotics. Therefore, together with another three MRSA affected patients, already identified, the point prevalence of inpatients at particular risk on these wards was 4% (6 of 160).

## Discussion

The prolonged average duration of admission of patients prior to their first MRSA isolate, coupled with clustering in time on certain wards, strongly suggests that most, if not all, acquired MRSA in hospital. Apart from a study of intravenous drug abusers in the United States<sup>6</sup> there is no convincing evidence of significant transmission outside hospital. When affected patients are recognized within 24 hours of hospital admission or within the community it is usual to find that most have had relatively recent exposure to a hospital.<sup>2</sup> Eight of nine such patients in our series had been admitted to hospital within the previous 4 months.

Although an uncontrolled observation, 80% of our patients had received antibiotics during the 4 weeks before initial MRSA isolation. Therefore widespread use of antibiotics in hospital, an established risk factor for MRSA acquisition, may have played a major role in establishing the MRSA reservoir in our two hospitals.

The apparent prominence of the intensive therapy unit became far less pronounced when allowance was made for the much larger number of

specimens submitted per patient. Therefore, in our experience, the special problem of intensive care units reported in other MRSA outbreaks<sup>9,10</sup> was not seen. This observation needs to be confirmed for our findings suggest that the different surveillance threshold causes these units to be falsely incriminated in the spread of MRSA.

The mortality and morbidity associated with MRSA in our district must be interpreted cautiously because both were assessed retrospectively and indirectly. Nevertheless there was no suggestion that the organism was any less virulent compared with reports from teaching hospitals<sup>11</sup> and it might be argued that our retrospective chart review technique tended to underestimate the true incidence of complications. Some workers<sup>12</sup> have argued that MRSA are less virulent than MSSA. Our finding that the proportions of MRSA and MSSA recovered from blood were the same suggests equal virulence.

Our experience of an inexorable increase in MRSA incidence over a 5 year period in the absence of strict control measures and the inevitable associated morbidity, mortality and increased treatment costs, must serve as a warning to other hospitals.

## Acknowledgements

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## References

1. Cooke, E.M. & Marples, R.R. Outbreaks of staphylococcal infection. *PHLS Microbiology Digest* 1985, **2**: 62-64.
2. McNeil, J.J., Proudfoot, A.D., Tosolini, F.A. *et al.*

Methicillin-resistant *Staphylococcus aureus* in an Australian teaching hospital. *J Hosp Inf* 1984, **5**: 18-28.

3. Bradley, J.M., Noone, P., Townsend, D.E. & Grubb, W.B. Methicillin-resistant *Staphylococcus aureus* in a London hospital. *Lancet* 1985, **i**: 1493–1495.
4. Cafferkey, M.T., Hone, R., Coleman, D. *et al.* Methicillin-resistant *Staphylococcus aureus* in Dublin 1971–84. *Lancet* 1985, **ii**: 705–708.
5. Marples, R.R. & Cooke, E.M. Workshop on methicillin-resistant *Staphylococcus aureus* held at the headquarters of the Public Health Laboratory Service on 8 January 1985. *J Hosp Inf* 1985, **6**: 342–348.
6. Levine, D.P., Cushing, R.D., Jui, J. & Brown, W.J. Community acquired methicillin-resistant *Staphylococcus aureus* endocarditis in the Detroit Medical Center. *Ann Int Med* 1982, **97**, 330–338.
7. Crossley, K., Loesch, D., Landesman, B., Mead, K., Chern, M. & Strate, R. An outbreak of infections caused by strains of *Staphylococcus aureus* resistant to methicillin and aminoglycosides. I. Clinical studies. *J Inf Dis* 1979, **139**: 273–279.
8. Boyce, J.M., Landry, M., Deetz, T.R. & DuPont, H.L. Epidemiologic studies of an outbreak of nosocomial methicillin-resistant *Staphylococcus aureus* infections. *Infection Control* 1981, **2**: 110–116.
9. Casewell, M.W., Epidemiology and control of the 'modern' methicillin-resistant *Staphylococcus aureus*. *J Hosp Inf* 1986, **7**: (suppl. A) 1–11.
10. Thompson, R.L., Cabezudo, I. & Wenzel, R.P. Epidemiology of nosocomial infections caused by methicillin-resistant *Staphylococcus aureus*. *Ann Int Med* 1982, **97**: 309–317.
11. Haley, R.W., Hightower, A.W., Khabbaz, R.F. *et al.* The emergence of methicillin-resistant *Staphylococcus aureus* infections in United States hospitals. *Ann Int Med* 1982, **97**: 297–308.
12. Lacey, R.W. Multi-resistant *Staphylococcus aureus* – a suitable case for inactivity? *J Hosp Inf* 1987, **9**: 103–105.