Journal of Hospital Infection (2009) **71**, 29–35

Available online at www.sciencedirect.com

ScienceDirect

www.elsevierhealth.com/journals/jhin

# Utility of *spa* typing for investigating the local epidemiology of MRSA on a UK intensive care ward

**S. Khandavilli [a], P. Wilson [b], B. Cookson [c], J. Cepeda [c], G. Bellingan [a], J. Brown [a,*]**

[a] *Centre for Respiratory Research, Department of Medicine, Royal Free and University College Medical School, Rayne Institute, London, UK*
[b] *Department of Clinical Microbiology, University College London Hospitals, London, UK*
[c] *Specialist and Reference Microbiology Division, Health Protection Agency, London, UK*

Received 18 April 2008; accepted 12 September 2008
Available online 17 November 2008

**KEYWORDS**
Multilocus sequence typing; Meticillin-resistant *Staphylococcus aureus*; *spa* typing

**Summary** In the UK, meticillin-resistant *Staphylococcus aureus* (MRSA) is frequently endemic on intensive care units (ICUs), yet our understanding of the local epidemiology of MRSA within the ICU is poor and the best methods for preventing MRSA acquisition remain controversial. Newer molecular typing methods may aid epidemiological investigation of local MRSA strains. We applied Staphylococcal Protein A (*spa*) typing to MRSA strains collected from patients in a UK ICU. *spa* typing allowed better discrimination than multilocus sequence typing (MLST) but 73% of strains were either *spa* type t032 or t018 (associated with the prevalent UK MRSA strains, EMRSA-15 and EMRSA-16). MRSA infections were preceded by MRSA colonisation in 72% of patients, and in 88% of these, both commensal and disease-causing strains had identical MLST and *spa* types. *spa* typing helped elucidate the transmission of MRSA between patients for 19 strains with unusual *spa* types, although the high incidence of EMRSA-15 and -16 types t032 and t018 prevented its use for the majority of strains. Surprisingly, only four (9%) of 45 new MRSA isolates occurring within 28 days of isolation of an unusual *spa* type could have been due to cross-contamination. These results suggest that prompt transmission of MRSA between patients is rare in our ICU, at least for those strains with unusual *spa* types.


* Corresponding author. Address: Centre for Respiratory Research, Department of Medicine, Royal Free and University College Medical School, Rayne Institute, 5 University Street, London WC1E 6JJ, UK. Tel.: +44 20 7679 6008; fax: +44 20 7679 6973.
*E-mail address:* jeremy.brown@ucl.ac.uk

0195-6701/$ - see front matter 
doi:10.1016/j.jhin.2008.09.011

## Introduction

Meticillin-resistant *Staphylococcus aureus* (MRSA) has attracted attention as a nosocomial pathogen causing considerable morbidity and mortality on a global scale.[1] It causes one-fifth of nosocomial infections in the UK and up to one in six patients in UK intensive care unit (ICU) wards are colonised or infected with MRSA. These strains are usually EMRSA-15 and -16, the most prevalent epidemic MRSA strains in the UK.[2–5] MRSA is thought to be transmitted from patient to patient via the hospital staff or environment but there is surprisingly little published detailed data on the spread of particular MRSA strains from patient to patient. How readily MRSA are disseminated from an index case to other patients on an ICU ward is not known, and at present the most effective method to prevent MRSA infection is controversial.[6] Isolation of patients, when part of a larger package of control measures, is associated with reduced transmission of MRSA, but isolation of MRSA-positive patients in single rooms is not standard policy for 24% of English ICUs.[3,7] Furthermore, a prospective study from our centre has shown that isolating or cohort nursing MRSA patients in an ICU with endemic MRSA infection does not reduce cross-infections, although hand hygiene practices were less than optimal.[8]

Studies on local transmission requires good clinical data, local surveillance of MRSA, and a method of typing different MRSA strains with adequate discrimination. Several typing methods have been developed to aid investigation of MRSA epidemiology. Discrimination between strains by phage typing is very strain dependent and lacks reproducibility, making the identification of clonal relationships between strains difficult without confirmation by molecular techniques.[9] Pulsed-field gel electrophoresis (PFGE) is an effective method for investigating the local epidemiology of MRSA strains, but is labour intensive and, in common with phage typing, the results are difficult to standardise between laboratories.[9] Multilocus sequence typing (MLST), a molecular technique based on DNA sequencing of housekeeping genes, allows more precise identification of a particular strain and ready comparison of results between different laboratories.[10] MLST has provided valuable insights into the national and international epidemiology of MRSA but lacks the discriminatory power for investigating local epidemiology when there is a high prevalence of epidemic strains such as EMRSA-15 or -16. Staphylococcal Protein A (*spa*) typing requires the sequencing of only one locus, the short sequence repeat region of the gene that encodes Protein A, and has a greater discriminatory power than MLST. *spa* typing can define the local epidemiology of MRSA infection in various settings, but whether it has the discriminatory power to investigate cross-infection in a hospital environment dominated by EMRSA-15 and -16 has not been assessed.[11–17] In addition, although a substantial proportion of all *Staphylococcus aureus* strains isolated from the blood have identical PFGE patterns to nasal isolates from the same patient, we are not aware of studies specifically investigating whether MRSA infections are caused by strains already colonising the patient or by strains acquired from exogenous sources. In the ICU, exogenous acquisition of MRSA may be more prevalent than in a general hospital population due to high levels of environmental contamination and staff carriage.[18,19]

This study assesses whether *spa* typing can be used to investigate the epidemiology of MRSA within a UK ICU, using microbiological and clinical data obtained during a clinical trial of different methods of controlling MRSA infection among ICU patients.[8] In addition, we investigated whether the colonising strain is the same as the strain causing infection for patients with invasive MRSA infection, as well as the degree of spread between patients.

## Methods

### Bacterial isolates and culture

The MRSA strains used for this study were isolated from patients during a 12 month clinical study on the effectiveness of case isolation for controlling MRSA infection of patients in a London-based ICU.[8] The infection control procedures used during this study included disposable aprons, gloves for patient contact, and for half the study period only, isolation of MRSA-positive patients in single rooms or in an open bay of other patients who were MRSA positive.[8] Strains were stored on beads at −70 °C (Microbank system, Pro Lab Diagnostics, Neston, UK). Patients were screened (nasal/perineal swabs, NPS) for MRSA within 24 h of admission to the ICU, weekly thereafter and at discharge. Clinical samples (wound swabs and blood cultures) were obtained when clinically indicated. During the trial period, 746 MRSA isolates were obtained from our hospital, phage typing of which suggested 219 (29%) were EMRSA-15 and 271 (36%) were EMRSA-16.[8] For this study, a total of 115 of the