

Multi-faceted interventions to prevent bloodstream MRSA infections

Peter Orsman¹ EN(G) RGN, Katherine Cheema² BSc PGDip, Luis Cotter³ MD, Iris Smith¹ RGN MSc and Armando Gonzalez-Ruiz³ MD MSc PhD

¹ Department of Infection Prevention and Control, Darent Valley Hospital, Dartford. Kent. UK

² Quality Observatory, NHS South East Coast, Horley. Surrey. UK

³ Microbiology Department, Darent Valley Hospital, Dartford. Kent. UK

Abstract

Issue:

From 1st January until 31st December 2007, there were 31 MRSA bacteraemias at our NHS trust. 22 were defined as Hospital Acquired Infections (HAI). It was discovered during Root Cause Analysis that the source of the MRSA bacteraemias in 12 (54%) of the patients was due to a PIVD (Peripheral Intravascular Device). These lines were not always inserted using full aseptic technique and their maintenance was poorly documented.

Project:

The introduction of a sequence of interventions targeted at reducing MRSA bacteraemias by a newly expanded infection control team, after analysis of existing policies and procedures:

- The use of MRSA antimicrobials in the Trust's formulary was optimised according to an assessment of published efficacy data. Teicoplanin was substituted with daptomycin in medical and surgical wards. In Intensive Care, vancomycin by continuous infusion was introduced.
- Introduction of MRSA screening of all emergency admissions to adult medical, surgical and orthopaedic wards and subsequent decolonisation of patients found to be positive.
- A new PIVD policy, insertion record and on-going care tool was launched. Skin preparation prior to cannulation was changed from a non-sterile 70% alcohol 0.5% chlorhexidine swab, to a sterile pre-packaged application device containing 70% alcohol and 2% chlorhexidine.

No other interventions likely to impact HAI MRSA bacteraemias were introduced during the period of study.

Results:

A statistically significant ($p < 0.01$) reduction in the number of MRSA infections was seen over the time period spanning the introduction of the three interventions, with maximal benefit achieved after all three interventions were introduced.

Monthly rates of HAI MRSA bacteraemias were relatively low and too variable, thus cumulative rates were calculated. The three interventions were successful in controlling the cumulative rates of MRSA bacteraemias

Lessons learned:

The expansion of the infection control team triggered a review of procedures in our Trust. Three interventions were implemented to comply with best practice. Each intervention could not be shown to be effective individually, partly because the monthly rates of bacteraemias were consistently low, and partly because each new intervention was introduced in quick succession. The cumulative MRSA bacteraemia data do, however, suggest the combined trio of interventions resulted in a reduction in the rate of MRSA bacteraemias.

Issue

Darent Valley Hospital (DVH) (a modern district general hospital with 461 beds), like every acute Trust in the United Kingdom, has a Government Department of Health (DoH) target for MRSA bacteraemia. During 2007-08 the number of MRSA bacteraemias considered to be permissible at DVH was 12. This figure includes infections both pre- (community-acquired) 48 hours of admission and post- (hospital-acquired) 48 hours after admission. From 1st January 2007 until 31st December 2007, DVH reported 31 cases of MRSA bacteraemia. 22 were defined as Hospital Acquired Infection (HAI) or post-48-hour from admission. Root Cause Analysis showed that the source of the MRSA bacteraemias in 12 (54%) of the patients was due to a PIVD (Peripheral Intravascular Device). Observational audits conducted in October 2007 by the Infection Control Team showed that these lines were not always inserted using aseptic technique and their maintenance was poorly documented.

Project

The DVH infection control team devised a strategy to combat this high MRSA bacteraemia rate. A three-pronged approach was employed:

MRSA SCREENING AND DECONTAMINATION

In July 2007, our screening programme was broadened to include elective patients attending the pre-assessment clinic for all surgical procedures (excluding minor procedures such as arthroscopy and skin biopsies) and all adult patients admitted as emergency cases, putting DVH 4 years ahead of DoH guidance. Patients found to be colonised with MRSA were then decolonised. Re-screening then occurred every 14 days throughout a patient's stay.

USE OF DAPTOMYCIN

In June 2007, teicoplanin was substituted with daptomycin in medical and surgical wards. Vancomycin was changed from an intermittent IV regime to a continuous infusion in the intensive care unit as this was considered optimal for severely ill patients. By treating MRSA infections effectively, the risk of relapse is reduced.¹

INTRAVENOUS CANNULATION

In December 2007, DVH implemented a new cannulation policy to reduce the number of PIVD-related MRSA bacteraemias. This was based on the "Peripheral intravenous cannula care bundle" from the DoH's "Saving Lives" programme.

Insertion stickers to add in hospital notes and an on-going care chart, incorporating a visual infusion phlebitis (VIP) score, were devised. Single patient use, sterile 70% alcohol and 2% chlorhexidine (ChloraPrep[®]) skin prep was purchased and used for both skin preparation and maintenance of all intravenous and intra-arterial lines in adult areas. It was also used prior to blood culture collection. In addition, a new needle free connection device, the BD Q-Syte, was introduced. One of the benefits of this product is that it is compatible with all syringe types, and is easy to access and connect. The split septum's surface is smooth to allow quick and easy cleaning.



Figure 1: The needle free connection device BD Q-Syte

Figure 2: 0.67ml ChloraPrep[®] SEPP

Results

MRSA case numbers were taken from the UK central Health Protection Agency MRSA surveillance database² and rates were calculated per 10,000 bed days.³ A statistical process control (SPC) approach was taken, in conjunction with one way analysis of variance, in the analysis of the impact of the three interventions on MRSA infections and bacteraemias. This SPC approach was included because of its well-evidenced applicability in quality improvement settings.³ Inherent in the analysis of our MRSA cases was the requirement to conduct these analyses using very small numbers. This would have impacted on the power of any inferential statistical test.

³Bed occupancy determined from Hospital Episode Statistics activity data extracts over the time period January 2006 to January 2009.

MRSA infection rates (not including bacteraemias)

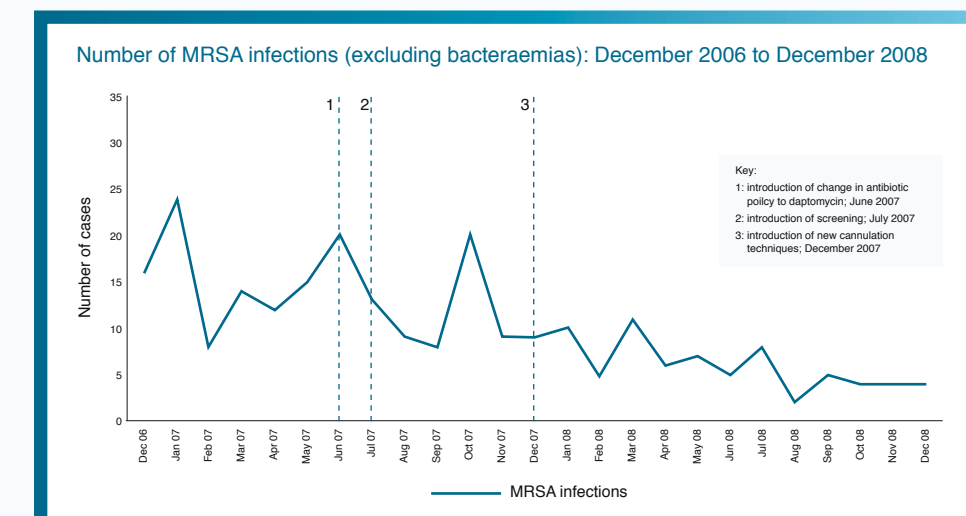


Figure 3: Shows a statistically significant ($p < 0.01$) reduction in the number of MRSA infections over the time period spanning the introduction of the three interventions, with maximal benefit seen after all three interventions were introduced

MRSA bacteraemia rates

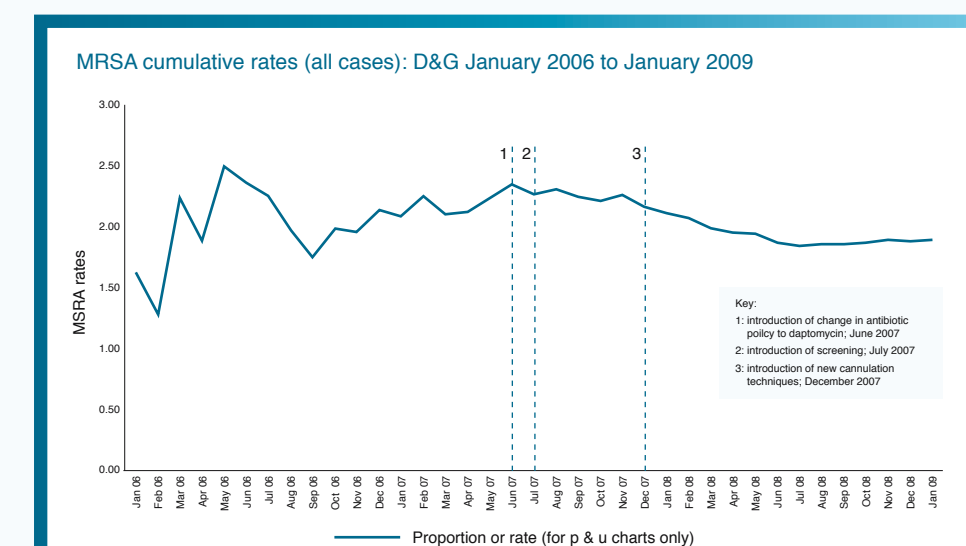


Figure 4: Clearly suggests that the three interventions were successful in controlling the cumulative rates of MRSA bacteraemias up till August 2008. Since this time, the rate has increased slightly

MRSA bacteraemia root cause analysis

Investigation of the root cause of the MRSA bacteraemias showed that:

- 50% of cases between August and December 2008 were pre-48 hour (i.e. acquired in the community, outside hospital)
- None was linked to PIVDs

There was a statistically significant reduction in PIVD-related MRSA bacteraemias over the whole study period

	Dec 2006 to Dec 2007	Jan 2008 to Dec 2008
Number of PIVD-related cases	12	1

$\chi^2 = 0.002, p < 0.05$

Lessons learned

- MRSA is a still an ongoing problem
- The three interventions were introduced over a short time period, making it difficult to assess the individual benefits of each intervention
- MRSA bacteraemias were controlled by all three interventions together
- PIVD-related MRSA bacteraemias were virtually eradicated
- Overall, MRSA infection (not including bacteraemias) were also reduced

It is not possible to say which intervention or combination has had the most impact. However, the three interventions appear to be having a significant impact not only on PIVD-related MRSA bacteraemias but also on our overall MRSA infection rates.

Our three interventions have not shown an impact on community acquired MRSA infections.

References

1. Gonzalez-Ruiz A., Richardson J. Are glycopeptides still appropriate and convenient for empiric use? Journal of Chemotherapy 2008; 20(5): 531-541.
2. Health Protection Agency, MRSA Surveillance System, <https://nww.hpanw.nhs.uk/mrsa/App/MRSASelectReport.aspx>, accessed 16th February 2009.
3. Thor J., Lundberg J., Ask J., Olsson J., Carl C., Pukk Härenstam K. and Brommels M. Application of statistical process control in healthcare improvement: systematic review. Quality and Safety in Healthcare 2007; 16: 387-399.

Enturia Limited provided an independent medical writer to assist with the production and design of this poster. Enturia Limited exerted no editorial control over the content of the poster and were not involved in the study conduct, design or data collection

Dartford and Gravesham 
NHS Trust