

Surveillance and evidence of contamination in hospital environment from meticillin and vancomycin-resistant microbial agents

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Key words

Microbial resistance

Summary

Introduction. Direct contact is undoubtedly the main means of transmission of hospital infections. An investigative study was therefore conducted to assess workplace surfaces at risk from microbial contamination.

Methods. The study was conducted using swabs and contact slides placed on the palms of healthcare workers during their routine patient care and on workplace surfaces (e.g. telephones, computers, medication trolleys, taps) in treatment rooms, operating theatres and wards. Disposable swabs were used for rapid screening and read with a bioluminometer. At the same time, a sample was taken from those testing positive using a contact slide. The samples testing positive for *Staphylococci* underwent

identification to assess resistance to meticillin-resistant *Staphylococcus aureus* (MRS/MRSA) and to vancomycin (VISA/VRSA)

Results. Meticillin-resistant *Staphylococcus* strains were found on 14.7% (20/136) of samples taken from the hands of workers and 35.7% (15/42) of those from hospital surfaces. An even higher resistance to meticillin and/or vancomycin than that found for *S. aureus* was identified in nosocomial strains of coagulase negative staphylococci, including *S. epidermidis* and *S. haemolyticus*.

Conclusion. The study concludes that there is thus a need for greater care in complying with procedures designed and support for surveillance to reduce the risk of infection.

Introduction

Hospital infections continue to be a significant problem in public healthcare and often affect healthcare workers, hospital administrators and above all patients. The main means by which hospital infections are transmitted is through direct contact and thus suitable preventive measures with clearly defined rules are of great importance, in addition to improving systems of surveillance and monitoring. One of the most significant causes of infections in hospitals and communities the world over continues to be staphylococci [1-4]. Around 20% of community and hospital bacteraemia in the USA are caused by *Staphylococcus (S.) aureus* and a similar percentage by coagulase-negative staphylococci (CNS). In Italy, the most recent figures regarding *S. aureus* resistance come from a bacteraemia study coordinated by the Italian National Institute of Health under the AR-ISS project. The study conducted from June 2001-January 2002 reported an average rate of meticillin-resistant *Staphylococcus aureus* (MRS/MRSA) of 42.8% out of the 540 strains of *S. aureus* examined and afterwards during the period 2003-2005 the annual rates were (39%, 39.9%, 37.2%) [5, 6]. The rate of meticillin resistance in nosocomial strains of CNS, such as *Staphylococcus epidermidis* and *Staphylococcus haemolyticus*, is even higher than for *S. aureus* [7, 8].

Initially, MRSA strains were limited to large hospitals, in particular to wards with a high number of compro-

mised patients who more urgently required antibiotics and where an endemic situation with cross transmission between colonized and/or infected patients could occur. Currently, MRSA strains have also been isolated in smaller hospitals, and in hospital outpatients, and are even widespread in the community [9]. In light of this, and with a view to risk management, we decided to conduct an investigative study at the University Hospital of Messina (Italy). The aim of the study was to assess this phenomenon, to identify any shortcomings as regards compliance with prevention procedures so as to evaluate the extent of the risk and identify the key areas in which to intervene.

Methods

Points at risk from microbial contamination were screened using a quick qualitative on-site method. Disposable swabs and, subsequently, contact slides were placed on the palms of healthcare workers and/or on workplace surfaces (medication trolleys, hand/elbow-operated taps, door handles, telephones) situated in treatment rooms, operating theatres and on wards [2, 10, 11]. The disposable swabs were read using a bioluminometer to detect the presence of ATP, either of bacterial origin or from human cells. When the swabs gave a bioluminescence reading of > 300, the following contact slides were utilized: total bacterial count (Plate Count Agar),

Tab. I. Positive results for microbiological test on hands of healthcare workers.

| | Biolum. | PCA+ | S. species | Other CNSs- | S. Epid. | S. Aureus |
|---------------|---------|------|------------|-----------------|------------------|-----------------|
| OX resistance | - | - | - | - | 3/136 (2.2%) | 1/136 (0.7%) |
| CF resistance | - | - | - | - | 1/136 (0.7%) | - |
| MRS/MRSA | - | - | - | 6/136 (4.4%) | 13/136 (9.5%) | 1/136 (0.7%) |
| VISA/VRSA | - | - | - | 1/136 (0.7%) | 4/136 (2.9%) | - |

OX: Oxacillin; CF: Cefoxitin; MRS: Methicillin-resistant *Staphylococcus*; MRSA: Methicillin-resistant *Staphylococcus aureus*; VISA: Vancomycin-intermediate *Staphylococcus aureus*; VRSA: Vancomycin-resistant *Staphylococcus aureus*

Tab. II. Positive results for microbiological tests of hospital surfaces.

| | Biolum. | PCA+ | S. species | Other CNSs- | S. Epid. | S. Aureus |
|---------------|---------|------|--------------|--------------|---------------|--------------|
| OX resistance | - | - | 1/42 2.3% | - | 1/42 2.3% | - |
| CF resistance | - | - | - | - | - | - |
| MRS/MRSA | - | - | - | 4/42 9.5% | 9/42 21.4% | 2/42 4.7% |
| VISA/VRSA | - | - | - | 1/42 2.3% | 3/42 7.1% | 1/42 2.3% |

OX: Oxacillin; CF: Cefoxitin; MRS: Methicillin-resistant *Staphylococcus*; MRSA: Methicillin-resistant *Staphylococcus aureus*; VISA: Vancomycin-intermediate *Staphylococcus aureus*; VRSA: Vancomycin-resistant *Staphylococcus aureus*

Staphylococci (Vogel Johnson), *Pseudomonas* (Cetrimide), yeasts and moulds (Rose Bengal caf). These were placed directly onto the hands of workers or the hospital surfaces. The slides were incubated at 37°C, and readings taken after 24-48 hours for bacterial load and *Staphylococcus*, and up to 72 hours for yeasts, moulds and *Pseudomonas*. Samples testing positive for *Staphylococci* were differentiated between positive and negative Coagulase, and subsequently identified, in addition to testing for resistance to meticillin (MRS/MRSA) using oxacillin screen agar test and those strains confirmed to be positive were assayed for their resistance to vancomycin using the E-test, according to the national operative guide lines [12].

Results

Slides were examined during their routine patient care from the hands of a total of 235 workers. Overall, 65.1% (153/235) tested positive for total bacterial load a rate that was consistent with positive bioluminometer reading. The overall rate testing positive for *Staphylococci* spp was 57.8% (136/235) *S. aureus* accounted for 5.1% (12/235) of the samples and 52.7% (124/235) were CNS *Staphylococci*, this comprising 43.8% (103/235) *S. epidermidis* and 8.9% (21/235) other species. *Pseudomonas* were observed in 0.8% (2/235) of the samples examined and moulds in 1.6% (4/235). Meticillin resistance was found in 20/136

strains (14.7%) of positive samples. Table I provides a detailed breakdown of the metilicin and/or vanomycin resistant samples.

As regards the 102 workplace samples, the slides examined showed a total bacterial load of 55.8% (57/102) for positive samples overall, *S. aureus* was found in 4.9% (5/102) of cases, coagulase negative *Staphylococci* in 36.2% (37/102), which comprised 18.6% (19/102) *S. epidermidis* and 17.6% (18/102) other species. Also found were moulds in 8.8% (9/102) of cases. Metilicin resistance was detected in 35.7% of positive samples, and details are provided in Table II of all strains found to be resistant to metilicin and/or vanomycin.

Discussion

The results highlight the following concerns:

- Staphylococci was detected on the hands of a high percentage of medical and paramedical personnel, indicating a situation at risk for the transmission of infections, demonstrating that the prescribed procedures for careful hand washing were still not being followed adequately. The same problem emerged for the surfaces examined, thus the working environment was not being adequately sanitised.
- The prevalence of resistance to meticillin and/or vancomycin in nosocomial strains of coagulase negative staphylococci, such as *S. epidermidis* and *S. haemolyticus*, was even higher than that found for *S. aureus*.

- c) There is thus a need for greater care in complying with procedures designed to reduce the risk of infection. This applies to all healthcare workers.
- d) The quality of care requires improvement, including risk management, with systems of continual surveil-

lance in hospitals being based on proactive investigation into occurrences and the periodic testing of workers and the hospital environment.

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