47.5%; Gram-negative bacilli, 25%; *Candida* spp., 22.5%; *Enterococcus faecalis*, 5%. No significant differences in the time-related incidence of the micro-organisms were found.

Duration of catheterization, second episode of catheterization, skin colonization at the insertion site and hub colonization are risk factors for catheter-related bacteraemia.[2] Routine changes do not appear to lower the risk of infection, and CVC exchange over a guidewire as a preventive procedure is of questionable benefit. The use of a new site avoids the risk of guidewire contamination but the technical complications of new catheter placement are greater.[5–7] This study suggests and supports previous findings: guidewire exchange and second episodes of catheterization were not related to increased infection risk, and the daily risk of infection remained constant. It is impossible to eliminate the catheter infection risk; skin and hub colonization are the two major determinants for catheter-related infections, but haematogenous seeding of catheter tips from a distant focus of infection or administration of contaminated infusate may also cause catheter-related infections. Essential to the catheter-related infection and bacteraemia rate is the efficacy of specialized dedicated teams of physicians and nurses with established protocols for catheter insertion and care, as well as solution preparation and delivery. Such management is associated, particularly in critically ill patients, with reduced infection rates and costs.[8,9]

References

1. National Nosocomial Infection Surveillance (NNIS) System Report. Data summary from January 1992–June 2001. *Am J Infect Control* 2001; **6**:404—421.
2. Moro ML, Vigano EF, Cozzi Lepri A. The Central Venous Catheter-Related Infections Study Group. Risk factor for central venous catheter-related infections in surgical and intensive care units. *Infect Control Hosp Epidemiol* 1994;**15**: 253—264.
3. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections. *Am J Infect Control* 1988;**16**:128—140.
4. Cleri DJ, Corrado ML, Seligman SJ. Quantitative culture of intravenous catheters and other intravascular inserts. *J Infect Dis* 1980;**141**:781—786.
5. Richet H, Hubert G, Nitemberg A. Prospective multicenter study of vascular catheter-related complications and risk factors for positive central catheter cultures in intensive care unit patients. *J Clin Microbiol* 1990;**28**:2520—2525.
6. Cobb DK, High KP, Sawyer RG, *et al*. A controlled trial of scheduled replacement of central venous and pulmonary-artery catheters. *N Engl J Med* 1992;**327**:1062—1068.
7. Mermel LA, Farr BM, Sherertz RJ, *et al*. Guideline of the management of intravascular catheter-related infections. *Clin Infect Dis* 2001;**32**:1249—1272.
8. Polderman KH, Girbes ARJ. Central venous catheter use. Part 2: infectious complications. *Intensive Care Med* 2002;**28**: 18—28.
9. Coopersmith CM, Rebmann TL, Zack JE, *et al*. Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit. *Crit Care Med* 2002;**30**:59—64.

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Decrease in *Staphylococcus aureus* surgical site infections following cardiovascular surgery

Sir,

We previously reported a decrease in *Staphylococcus aureus* surgical site infections (SSIs) after orthopaedic surgery following intranasal application of mupirocin ointment.[1] Pre-operative nasal carriage of *S. aureus* by patients is an independent risk factor for *S. aureus* SSIs, and antibiotic ointment has been proposed to decrease the risk.[2,3] About 2000 cardiovascular operations are performed per year in the Florence Nightingale Hospital, Istanbul, Turkey. An infection control committee was instituted in January 1998. A prospective and laboratory-based surveillance programme has been in place since January 1999 and a quality assurance programme since June 2001.

Prevention of *S. aureus* infections is an important part of our work.

Since January 2001, all patients undergoing cardiovascular surgery have been treated with intranasal mupirocin ointment three times a day for three days before surgery, without screening for carrier status. At the same time, a survey was carried out to find nasal *S. aureus* carriers among the hospital staff, and these were also treated with intranasal mupirocin ointment two times a day for five days. The survey was repeated every eight months.

After completing 70 months of surveillance and 46 months of use of intranasal mupirocin ointment in cardiovascular surgery, we evaluated the annual rates of SSIs, *S. aureus* SSIs and methicillin-resistant *S. aureus* (MRSA) SSIs in all the patients who had cardiovascular surgery between January 1999 and November 2004.

Patients were hospitalized one day before surgery and had a pre-operative infectious disease consultation. Patients had pre-operative antibacterial soap showers and skin preparation with povidone–iodine. Hair removal was performed with a disposable razor the night before operation. Cephazolin or cefuroxime was given as perioperative antibiotic prophylaxis, according to the current guidelines of the hospital: cefazolin, 1 g 30 min before surgery followed by 1 g 6-hourly thereafter; or cefuroxime, 1.5 g 30 min before surgery followed by 1.5 g 12-hourly thereafter for a maximum of 48 h, until all chest and mediastinal drain tubes were removed. All sternotomies were performed by one of three surgeons, and all saphenous vein harvests were performed by one of the specially trained physician assistants. Entrance to the operation room was restricted.

Centers for Disease Control and Prevention definitions were used in the diagnosis of SSIs.[4] Conventional methods were used in the isolation of micro-organisms. Methicillin resistance of staphylococci was tested using oxacillin disks on plates containing Mueller–Hinton agar with 4% NaCl.

All patients with a nosocomial infection (NI) were followed-up. The rates of SSIs were calculated as follows: number of patients with SSI following cardiovascular surgery/number of patients operated. Chi-squared test was used for statistical analysis.

Annual rates of SSIs are shown in Table I. The decreases in SSIs, *S. aureus* SSIs and MRSA SSIs in recent years were statistically significant ($P < 0.001$).

The rates in 1999 were lower than those in the years 2000–2002. 1999 was the first year of surveillance, and relative inexperience may have led to some cases being missed. However, all SSI rates were highest in 2001, the first year of intranasal mupirocin ointment. In fact, there was a general increase in all NIs in 2001 and this was mainly attributed to the change of hospital staff, especially nurses, and to employing new, inexperienced staff. Although the rate of NIs and SSIs increased in 2001, the proportion of *S. aureus* and MRSA in SSIs decreased after intranasal mupirocin ointment. Education of all new staff began after June 2001 as part of a quality assurance programme. We observed a decreasing trend in SSIs, *S. aureus* SSIs and MRSA SSIs after 2001 and the rates were very low in 2003 and 2004; only three isolates of *S. aureus* and one isolate of MRSA in 2003 and 2004 to date. We also began isolating all patients coming from other settings, until nasal culture results became available, in September 2003, and since December 2003, we have not allowed any new staff to begin working before their nasal culture results are known.

We conclude that intranasal mupirocin ointment three times a day for three days before surgery, and surveillance and treatment of nasal carriers among hospital staff is useful in decreasing *S. aureus* SSIs and MRSA SSIs following cardiovascular surgery, but other NI preventive measures must not be neglected.

Decreasing *S. aureus* SSIs not only reduces morbidity and mortality, but also reduces the extra

Table I Annual rates of surgical site infections (SSI), *Staphylococcus aureus* SSIs and *methicillin-resistant S. aureus* (MRSA) SSIs from January 1999 to November 2004 in cardiovascular surgery

	1999	2000	2001[a]	2002[a]	2003[a]	2004[b]
No of surgeries	2150	2361	1713	2174	1981	1687
SSIs, *N* (%)	31 (1.4)	36 (1.5)	50 (2.9)	40 (1.8)	9 (0.4)	14 (0.8)
S. aureus SSIs, *N* (%)	7 (0.3)	20 (0.8)	15 (0.9)	9 (0.4)	1 (0.05)	2 (0.1)
MRSA SSIs, *N* (%)	2 (0.1)	12 (0.5)	11 (0.6)	4 (0.2)	1 (0.05)	0 (0)

[a] Intranasal mupirocin ointment years.
[b] Intranasal mupirocin ointment year (first 10 months).

expenditures for NIs in cardiovascular surgery. Therefore, maintanence of *S. aureus* control strategies is essential in combination with other NI preventive measures. As *S. aureus* is the leading cause of SSIs in most surgery, the effect of intranasal mupirocin ointment in other types of surgical procedures also needs to be evaluated.

References

1. Coskun D, Aytac J. Decrease in *Staphylococcus aureus* surgical-site infection rates after orthopaedic surgery after intranasal mupirocin ointment. *J Hosp Infect* 2004;**58**:90—91.
2. Kluytmans JA, Mouton JW, Ijzerman EP, *et al*. Nasal carriage of *Staphylococcus aureus* as a major risk factor for wound infections after cardiac surgery. *J Infect Dis* 1995;**171**: 216—219.
3. Wong ES. The price of a surgical-site infection: more than just excess length of stay. *Infect Control Hosp Epidemiol* 1999;**20**: 722—724.
4. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Am J Infect Control* 1992;**20**:271—274.

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Does adherence to universal precautions correlate with the prevalence of blood-borne infections?

Sir,

Universal precautions (UPs), including double gloving, waterproof gowns and eye protection, are recommended for all surgical procedures to reduce the likelihood of infection with blood-borne viruses (BBVs).[1] Our data suggest that adherence to these is unrelated to the actual risk of infection. Percutaneous exposure to infectious body fluids is reported to occur in 50% of healthcare workers (HCWs) annually, with 25% experiencing repeated contact.[2] The risk of acquiring human immunodeficiency virus (HIV) from an inoculation of infected blood is estimated at 0.3%. HCWs in countries where the prevalence of HIV is high may be at 1000 times greater risk of acquiring infection than those in countries where HIV is less prevalent. We evaluated the knowledge and adherence to UPs in three different hospitals with varying prevalence of HIV.

The study was carried out in a London teaching hospital (LTH), a London district general hospital (LDGH) and a South African district hospital (SADH). The prevalence of HIV in anonymized antenatal sera was 0.18% and 0.53%, respectively, in the two London hospitals, and the patient HIV prevalence was 20–30% in the SADH. One of us (MS) was present at 30 operations (SADH, 11; LDGH, 9; LTH, 10). Of these, 17 involved the surgeon performing invasive procedures where the hands could not always be visualized, known as exposure-prone procedures (EPPs).[1] At each operation, details of UPs taken by the lead surgeon, including the wearing of gloves (single/double), masks, eyewear and gowns, were recorded. The existence of a written hospital policy describing the management of inoculation injuries and its availability and accessibility to theatre staff was also noted. Testing for BBVs is not performed routinely in any of the hospitals. However, six of the 30 patients, all from the SADH, were known to be infected with one or more BBVs (HIV, 6; hepatitis B, 2; hepatitis C, 2).

All lead surgeons wore sterile waterproof gowns and gloves. Double gloving was used in five (SADH, 3; LDGH, 2) of the 18 operations involving EPPs, including two of the four HIV-positive patients who had invasive procedures. On three occasions (SADH, 2; LTH, 1), patient blood entered a torn glove but no wound was sustained. Each surgeon changed his gloves but none re-washed their hands, even when the patient was known to be HIV positive (SADH, 1). Two SADH surgeons operating on HIV-positive patients wore protective eyewear.

Both London hospitals had a written inoculation injury policy, but this was only readily available in theatres at the LTH. The SADH had a written policy but no theatre staff knew of its existence. A 24-h service for managing inoculation injuries was available at the London hospitals, and postexposure prophylaxis was administered according to a risk