Volume 69 Number 3

The health professional's role in preventing nosocomial infections

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Abstract
Despite their best intentions, health professionals sometimes act as vectors of disease, disseminating new infections among their unsuspecting clients. Attention to simple preventive strategies may significantly reduce disease transmission rates. Frequent hand washing remains the single most important intervention in infection control. However, identifying mechanisms to ensure compliance by health professionals remains a perplexing problem. Gloves, gowns, and masks have a role in preventinginfections, but are often used inappropriately, increasing service costs unnecessarily. While virulent microorganisms can be cultured from stethoscopes and white coats, their role in disease transmission remains undefined. There is greater consensus about sterile insertion techniques for intravascularcatheters-a common source of infections-and their care. By following a few simple rules identified in this review, health professionals may prevent much unnecessary medical and financial distress to their patients.

Keywords: Prevention, nosocomial, infection

Introduction

There is increasing concern worldwide about the rising prevalence of Multiresistant, virulent bacteria. Indeed, in one South African neonatal unit multi-antibiotic resistant klebsiellae are now the commonest organisms cultured.[3] While this neonatal unit, like many others, has resorted to using more potent and expensive antibiotics to curb the threat these organisms pose to vulnerable infants, it is clear that the focus of any efforts has to be on the prevention of nosocomial infections [1].

Hospital infection prevention and control (IPC) programs are designed to minimise rates of preventable healthcare-associated infection (HAI) and acquisition of multidrug resistant organisms, which are among the commonest adverse effects of hospitalisation. This qualitative case study involved in-depth interviews with senior clinicians and clinician- managers/directors (16 doctors and 10 nurses) from a broad range of specialties, in a large Australian tertiary hospital, to explore their perceptions of professional and cultural factors that influence doctors' IPC practices, using thematic analysis of data. Result showed that Professional/clinical autonomy; leadership and role modelling; uncertainty about the importance of HAIs and doctors' responsibilities for preventing them; and lack of clarity about senior consultants' obligations emerged as major themes. Participants described marked variation in practices between individual doctors, influenced by, inter alia, doctors' own assessment of patients' infection risk and their beliefs about the efficacy of IPC policies.Participants believed that most doctors recognise the significance of HAIs and choose to [mostly] observe organizational IPC policies, but a minority show apparent contempt for accepted rules, disrespect for colleagues who adhere to, or are expected to enforce, them and indifference to patients whose care is compromised. Failure of healthcare and professional organisations to address doctors' poor IPC practices and unprofessional behaviour, more generally, threatens patient safety and staff morale and undermines efforts to minimise the risks of dangerous nosocomial infection [2].

Etiology of nosocomial infections

Intravascular device related infections and infections acquired through the respiratory tract are among the most common nosocomial infections in critically ill patients [4]. Among the numerous risk factors for acquiring a nosocomial infection, the length of hospital stay is the most important. Etiological agents vary and include antibiotic resistant bacteria, particularly *Staphylococcus aureus*, Gram negative bacilli and enterococci, viruses (which account for upto 20% of cases), and fungi.

Risk factors for nosocomial infection

- Duration of hospital stay
- Indwelling catheters
- Mechanical ventilation
- Use of total parenteral nutrition
- Antibiotic usage
- Use of histamine (H_2) receptor blockers (owing to relative bacterial overgrowth)
- Age-more common in neonates, infants, and the elderly
- Immune deficiency

Practical methods for preventing nosocomial infection

Hand washing

The hands of staff are the commonest vehicles by which microorganisms are transmitted between patients. Hand washing is accepted as the single most important measure in infection control. Not surprisingly, hospital staff believesthat they wash their hands more often than they actually do, and they also overestimate the duration of hand washing. In a study of nurses' practices, hands were only cleaned after 30% of patient contacts and after 50% of activities likely to result in heavy contamination. Poorer hand washing performance was related to increasing nursing workload andthe reduced availability of hand decontaminating agents. At many hospitals and clinics, particularly in developing countries, handwash basins are poorly accessible and the unavailability of soap, sprays, and hand towels is a regular, annoying occurrence.

Alcoholic hand disinfection is generally used in Europe,while hand washing with medicated soap is more commonly practised in the United States [10]. The superiority of one method over the other is a moot point. Voss and Widmer argue that alcoholic hand disinfection, with its rapid activity, superior efficacy, and minimal time commitment, allows easy and complete compliance without interfering with the quality of patient care [10]. They estimated that given 100% compliance, soap hand washing would consume 16 hours of nursing time for a 24 hour shift, whereas alcoholic hand disinfection from a bedside dispenser requires only three hours. Hand washing using a spray can be accomplished in 20 seconds, compared with 40–80 seconds for soap [2].

Gloves

Gloves are a useful additional means of reducing nosocomial infection, but they supplement rather than replace hand washing. Possible microbial contamination of hands and transmission of infection has been reported despite gloves being worn. Not surprisingly, health care workers who wash their hands more often are also more likely to wear gloves [5]. Single use gloves should never be washed, resterilised, or disinfected, and gloves must be changed after each patient encounter.

Sterile gloves are much more expensive than clean gloves and need only be used for certain procedures, such as when hands are going to make contact with normally sterile body areas or when inserting a central venous or urinary catheter. Clean gloves can be used at all other times, including duringwound dressings. For gloves to be used appropriately they must be readily available. Again, this is not always the case at many clinics and hospitals in poorer settings.

Gowning

Gowns help keep infectious materials off clothing, although in some centres they are used more as reminders that the patient is isolated. Two recent studies confirm that staff gowning in the neonatal intensive care unit is an unnecessary custom. Wearing gowns did not reduce neonatal colonization, infection, or mortality rates. There was no change in traffic patterns in the unit or in handwashing behaviour and it was not cost-effective. The universal use of gloves and gowns was found to be no betterthan the use of gloves alone in preventing rectal colonization by vancomycin resistant enterococci in a medical intensive care unit [3].

Masks

It has never been shown that wearing surgical facemasks decreases postoperative wound infections. When originally introduced, the primary function of the surgical mask was to prevent the migration of microorganisms residing in thenose and mouth of members of the operating team to the open wound of the patient. However, it is now recognized that most bacteria dispersed by talking and sneezing areharmless to wounds. The prevailing opinion that masks are useful in preventing surgical site infection has been challenged. Orr reported a 50% decrease in wound infections when masks were not worn, but the study was criticized for lack of proper controls. Tunevall, using better controls, confirmed the earlier findings of lack of clear benefit from wearing masks after 1537 operations performed with face masks, 73 wound infections were recorded (4.7%), while following 1551 operations performed without face masks, 55 infections occurred (3.5%). The difference was not significant. Thus while masks may be used to protect the operating team from dropsof infected blood and from airborne infections, they havenot been proven to protect the patient [4].

Stethoscopes

Some health personnel have difficulty in accepting that the stethoscope, the symbol of their professional status, may actually be a vector of disease. In a study of 150 health care workers (50 paramedics, 50 nurses, and 50 doctors), staphylococcus species (mostly coagulase negative) were cultured from 89% of the participants' stethoscopes, the mean number of colony forming units increasing the longer stethoscopes were not cleaned. Overall, 48% of health care providers cleaned their stethoscopes daily or weekly, 37% monthly, 7% yearly, and 7% had never cleaned them. Cleaning the stethoscope's diaphragm resulted in an immediate reduction in the bacterial count-by 94% with alcohol swabs, 90% with a non-ionic detergent, and 75% with antiseptic soap.

There are no studies on the beneficial effect of regularly cleaning stethoscopes on nosocomial infection rates. Nevertheless, we suggest that regular disinfection should be carried out (at least once daily), as the level of contamination rises from 0% to 69% after more than oneday without cleaning of the stethoscope. Isopropyl alcohol isan effective cleaning agent, but may dry out thestethoscope's rubber seals and damage the tubing if used routinely.

White coats

Like the stethoscope, the white coat has long been a symbol of the medical professional. Many institutions insist that junior doctors, in particular, wear a white coat as part of a mandatory dress code. About half of all patients still prefer their doctor to wear one. However, they may be less enthusiastic about this if they realised that white coats harbour potential pathogens and are thereby a source ofcross infection, particularly in surgical areas. The cuffs and pockets of the coats are the most highly contaminated areas. The

recommendation that the coat is removed and a plastic apron is donned before wound examination is rarelyfollowed in practice. While few would challenge the sartorial elegance of the white coat, clearly its value needs to be critically assessed. There is little microbiological evidence for recommending changing white coats more often than once a week, or for excluding the wearing of white coats in non-clinical areas [29].

Intravenous catheters

In critically ill patients, intravenous lines are responsible for at least one quarter of all nosocomial blood streaminfections, with a 25% reported mortality. Most causative organisms originate from the skin: staphylococci cause two thirds of the infections, with *S aureus* accounting for 5–15%of these. The insertion of an intravenous needle or cannula results in a break in the body's natural defences. Organisms can enter the circulation from contaminated fluid or a givingset, or can grow along the outer surface of the cannula.

Prevention of complications requires careful insertion practice and optimal catheter care. Inserting a peripheral catheter demands the same precautions as for any surgical procedure. The hands should be disinfected with alcohol and gloves should be worn. The skin of the insertion site mustbe thoroughly disinfected with alcoholic chlorhexidine or 70% isopropyl alcohol for at least 30 seconds and allowed to dry before inserting the cannula. The insertion site shouldnot be touched after disinfection. When 2% chlorhexidine, 10% povidone-iodine, and 70% alcohol were compared as skin disinfectants, the rate of catheter associated bacteraemia was almost fourfold lower in the patients who received chlorhexidine than in the two other groups.

Routine replacement of the intravenous line every three to five days is common practice in the USA but not in Europe. Guidelines developed by the Centers for Disease Control and Prevention recommend that peripheral intravenous catheters be changed every three days. However, routinereplacement of central venous catheters was no longer supported in their latest update. A recent Swiss study was unable to show an increased risk of catheter related complications-phlebitis, infections, and mechanical complications-during prolonged peripheral catheterisation.Peripheral catheters can be safely maintained with adequate monitoring for up to 144 hours (six days) in critically ill children.

Containers of intravenous fluids are usually changed before significant growth occurs, but the giving set does not need to be replaced more often than every 72 hours. “Flagging” each set with a sticker displaying the time it had to bereplaced resulted in a significant reduction in the incidence of klebsiellae in a busy neonatal unit. There is no difference in the incidence of septicaemia in children who have in-line bacterial filters fitted compared with those who do not [5].

Conclusions

Methods for preventing nosocomial infections are summarized in box 2. Nosocomial infections are worth preventing in terms of benefits in morbidity, mortality, duration of hospital stay, and cost. Educational interventions promoting good hygiene and aseptic techniques have generally proved to be successful, but these practices are often not sustainable. Greater efforts are being made in some countries to ensure the application of the infection control evidence base into practice. In the end, constant vigilance and attention by the individual to what are rather simple measures is demanded.

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