The intravenous cannula: more than just drug administration

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Introduction

Most blood stream infections are related to the use of intravascular devices [1] and, in Australia, serious morbidity and mortality associated with intravenous (IV) devices have been documented [2].

IV-related infection

In IV catheter-related infections, bacteria gain access to the bloodstream via the catheter/skin interface, over the external surface or down the internal surface of the catheter. Either way, the catheter becomes colonised and bacteria may subsequently begin to replicate within and on the fibrin sheath, eventually being released into the bloodstream. The external migration of bacteria is supported by many findings, and skin colonisation is a strong predictor of catheter-associated infection [3]. In fact, between 5 and 25 per cent of IV cannulae are colonised by skin organisms at the time of removal [4]. Internal migration, the less frequent cause, is most likely to occur from the cannula hub [5]. Some bacteria bind to the glycoprotein layer, which naturally coats the catheter quickly after insertion [6]. Fibronectin functions as an adherence receptor for *Staphylococcus aureus*, while coagulase-negative Staphylococci (CNS) are considered able to adhere directly to the catheter surface and protect themselves with 'slime' [6,7]. *S. aureus* and CNS are the most common causative organisms of catheter-associated infection.

Central venous catheters (CVCs) account for an estimated 90 per cent of all catheter-related bloodstream infections [8]. The risk of acquiring CVC-related bloodstream infection is 0.9 -8 per cent [9]. Among the factors influencing the risk of infection associated with the use of CVCs are the number of lumens and the site at which the catheter is inserted. Although patients with multilumen catheters tend to be more ill, the risk of infection with use of these catheters may be independent of the severity of the patient's underlying disease [5]. Other risk factors for CVC-related infections include repeated catheterisation, the presence of a septic focus elsewhere in the body, exposure of the catheter to bacteraemia, absence of systemic antimicrobial therapy, duration of catheterisation and type of dressing [10, 11]. In addition, the infection rate is reduced when catheters are inserted by skilled people using standard techniques; IV teams are an example of this.

Factors known to decrease the incidence of sepsis associated with peripheral intravenous cannulae include aseptic insertion, daily inspection and removal at 72 hours, or earlier in the presence of thrombophlebitis [2, 12]. Factors found to be strong predictors of phlebitis include intravenous antibiotics, female gender, poor operator skills, larger catheter bore size, anatomic site of cannulation and prolonged catheterisation [8]. Maki [8] quotes rates of phlebitis of up to 40 per cent in peripheral IV cannula sites. Phlebitis can be caused by a multitude of factors, only a small proportion of which may be attributable to infection, and fewer than half the patients with peripheral IV-related bloodstream infections show phlebitis [8].

Prevention of IV-related infection

Research indicates that non-adherence to policy can have a significant effect on the incidence of infection [4, 13]. The following techniques are important in the prevention of IV-related infection:

- wash hands and wear clean gloves prior to IV insertion;
- scrub the skin site well using an antiseptic solution;
- allow the antiseptic to dry before IV insertion;
- apply a transparent dressing so that the site can be observed;
- document the date and site of insertion on the drug chart, dressing and/or patient's notes, and
- change the peripheral cannula at day 3, or before if phlebitis occurs.

Diagnosis of catheter-related infection

The diagnosis of catheter-related infection is often difficult. Inflammation at the site of a peripheral cannula may indicate infection but is rare in CVC-related infections. Microbiological culture is necessary to confirm a clinically suspected diagnosis of catheter-related infection, while for peripheral cannulae the whole catheter should be sent for culture. However, it is important to culture the intracutaneous portion or tunnel of the CVC catheter; a correlation between the tunnel and blood culture is a good predictor, but a CVC tip culture is unreliable.

For the most accurate result, the patient's skin must first be cleaned with antiseptic, to prevent contamination of the catheter during its removal. The catheter is usually replaced over a guide wire. For these reasons, it is best that an experienced practitioner perform the procedure.

Positive cultures for CNS from the catheter and blood cultures are less conclusive than for *S. aureus*. While CNS are most commonly isolated from catheters, they are a less common cause of bacteraemia than *S. aureus*, positive cultures for which are strongly suggestive of catheter-associated infection in TPN administration. Furthermore, *S. aureus* catheter-associated bloodstream infection is more likely to be linked to complications such as endocarditis and osteomyelitis [9]. It is important to note that phlebitis and infection can develop even when the catheter has been removed.

Management of catheter-related infection

Infection of peripheral cannulae involving purulence or cellulitis of the surrounding tissue and bloodstream infection requires immediate removal of the cannula. For bloodstream infections related to CVC, the cannula may remain in place, provided there is no local infection or other signs of complications [14]. If the patient is unwell, the site inflamed and/or pus can be expressed, the catheter should be changed over a guide wire, using a strict aseptic procedure, by an experienced practitioner. Some local infections may resolve with removal of the cannula. However, systemic antibiotic treatment is required for more severe infections.

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Australian Standard: AS 4187

I recently received the final revision of AS 4187-1994. The format is the whole document, incorporating the two amendments. It will bring great joy to all our members to finally be able to buy a readable and entire version of the standard, which is as up to date as it could be. Voting on the final version closed on 31 October, so you can start looking for the publication some time very soon!

Jenny Tuffin FRCNA

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