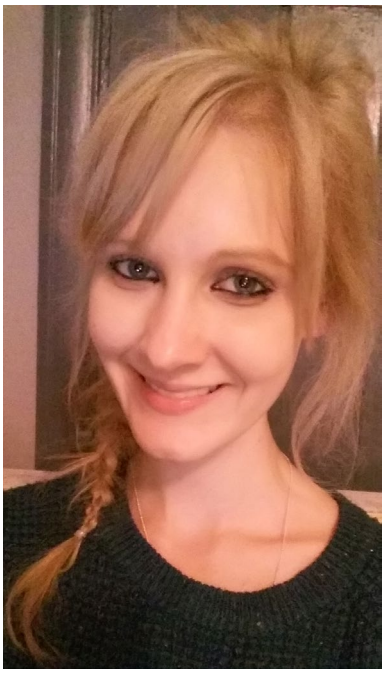

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Peripheral intravenous catheter care in hospitalised cats and dogs

Jess Ashby FdSc, RVN

Locum RVN for Medivet

Introduction

This literature review investigates the use of peripheral intravenous catheters in veterinary hospitals and their associated nursing care. Literature has been evaluated and critiqued to obtain the most relevant and reliable sources to inform the reader of the most current, up-to-date findings. Appropriate articles and books have been analysed, omitting unreliable sources to increase the reliability and accuracy of the information included.

The placement of intravenous catheters

Infections associated with intravenous catheters are reported to be one of the most frequent causes of nosocomial infection in hospitalised patients in both human and veterinary medicine (Jones, Case, Stevens, Boag, & Ryncroft, 2009). Particular attention should be focused on aseptic technique during placement which includes patient preparation and hand hygiene considerations.

Alcohol hand rub should be applied or hands thoroughly washed using the World Health Organisation (WHO) hand hygiene method prior to catheter placement (McMillan & Ackerman, 2016). Non-sterile gloves should be worn while preparing the catheter site and these can then be removed and alcohol hand gel applied again with the WHO method prior to catheter placement (McMillan & Ackerman, 2016).

Patient hair removal should occur prior to placing peripheral intravenous catheters (PIVCs) to help visualise the vein, promote asepsis and improve the security of the catheter (Goddard, 2013). Hair removal should be done using clippers because razors are associated with increased risk of infection (Tanner, Norrie, & Mellen, 2011). Research has previously suggested that povidone iodine should be used to prepare the skin site followed by the application of iodine and isopropyl alcohol (Tan, Dart, & Dowling, 2003). More recent research suggested that a 50% solution of 4% chlorhexidine gluconate (i.e. 2%) should be initially used followed by isopropyl alcohol, as this method has shown reduced skin infection rates compared to povidone–iodine (Scarlet, 2012). Despite this, Tan et al. (2003) reported that chlorhexidine has less residual antimicrobial activity, which would not support its claim of reducing infection rates. This research does not, however, cover a range of chlorhexidine preparations or its use with alcohol, which could account for this conflicting statement (Tan et al., 2003). Weil (2006) concluded in a study that 2% chlorhexidine results in reduced infection rates in comparison to povidone–iodine or 70% alcohol. More recent studies in human medicine advocate the use of chlorhexidine gluconate 2% with 70% isopropyl alcohol contained within a sterile applicator (Young et al., 2014). In conclusion, when given the option, it appears preferable to select a 2% chlorhexidine solution in combination with isopropyl alcohol for skin preparation.

Research suggests that nurses should carefully consider the choice of catheter connectors. Jones et al. (2009) published a study involving the comparison of Y- and T-connectors. Y-connectors are larger than T-connectors and situated further from the injection port and catheter insertion site. The study shows a reduced association with contaminated catheters when comparing Y- to T-connectors. If Y-connectors become

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Figure 1. Essential equipment for IV catheter placement
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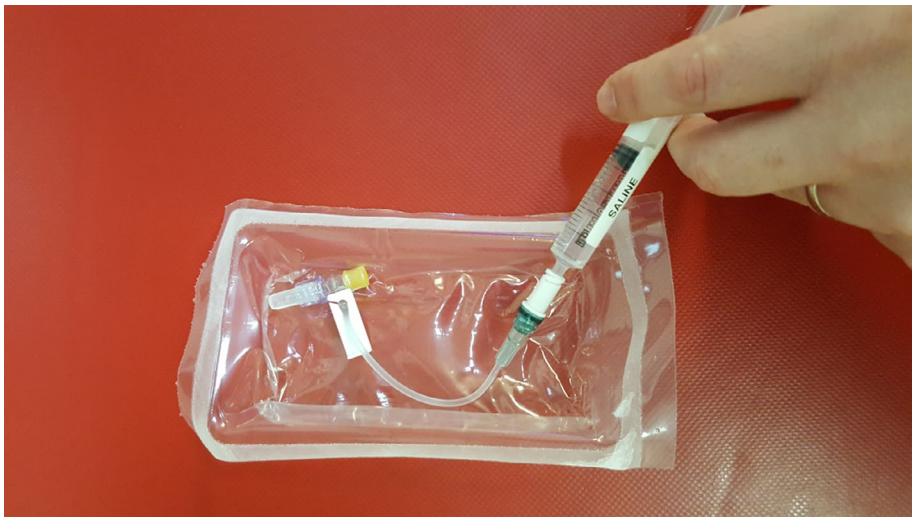

Figure 2. Saline or heparinised saline may be used to flush the T-connector
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Figure 3. Chloraprep™ being used as final skip preparation for the catheter site
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contaminated, bacteria have further to migrate to infect the catheter, which could explain this occurrence. However, a relatively small number of animals were used so a repeat study on a larger scale could help prove the significance of the results. Casey et al. (2002) studied two types of needleless connectors, finding that average internal bacterial contamination was significantly lower than with the open ports of a previous study, suggesting the potential for needleless connectors to reduce infection. To improve the study, an alternative connector type could have been investigated simultaneously alongside the needless versions.

PIVC size selection and length should be considered carefully. Fluid flow through the catheter is directly related to the length and radius of the catheter (McMillan & Ackerman, 2016). Catheter radius (r) has the greatest affect and according to Poiseuille's law flow is related to r^4; therefore, halving the diameter will result in a 16-fold decrease in flow (McMillan & Ackerman, 2016). Therefore, high fluid rates can be delivered faster using larger-diameter (small-gauge) catheters (Donohoe, 2012). It could be beneficial to place smaller-gauge catheters in patients which may require emergency fluids. A study conducted by Jayanthe and Dabke (2006) investigated the effects of shortening catheters upon flow rate. Results indicated that shortening the catheter length by 13 mm statistically increased the flow rate but not to the extent anticipated. There were queries about whether shortening catheter lengths would impact clinical practice. In order to address this concern, a study could be attempted in a veterinary environment rather than *in vitro*. This highlights the need for careful patient assessment and prior catheter preparation before placement.

How long should PIVCs be left *in situ*?

The length of time PIVCs should be left indwelling often causes debate within the veterinary practice. Past recommendations suggest removal after 3 days, whereas current recommendations support that without complications, they can be left longer (Taylor, Holmes, & Jasani, 2011). This current recommendation has been supported with articles indicating that there is no veterinary evidence to support the 3-day removal rule (Scarlet, 2012). There is also debate within human nursing, as nursing national guidelines suggest that the removal of PIVCs should be considered after 3 days due to the increased risk of associated complications. However, the Department of Health suggests it is acceptable to leave PIVCs

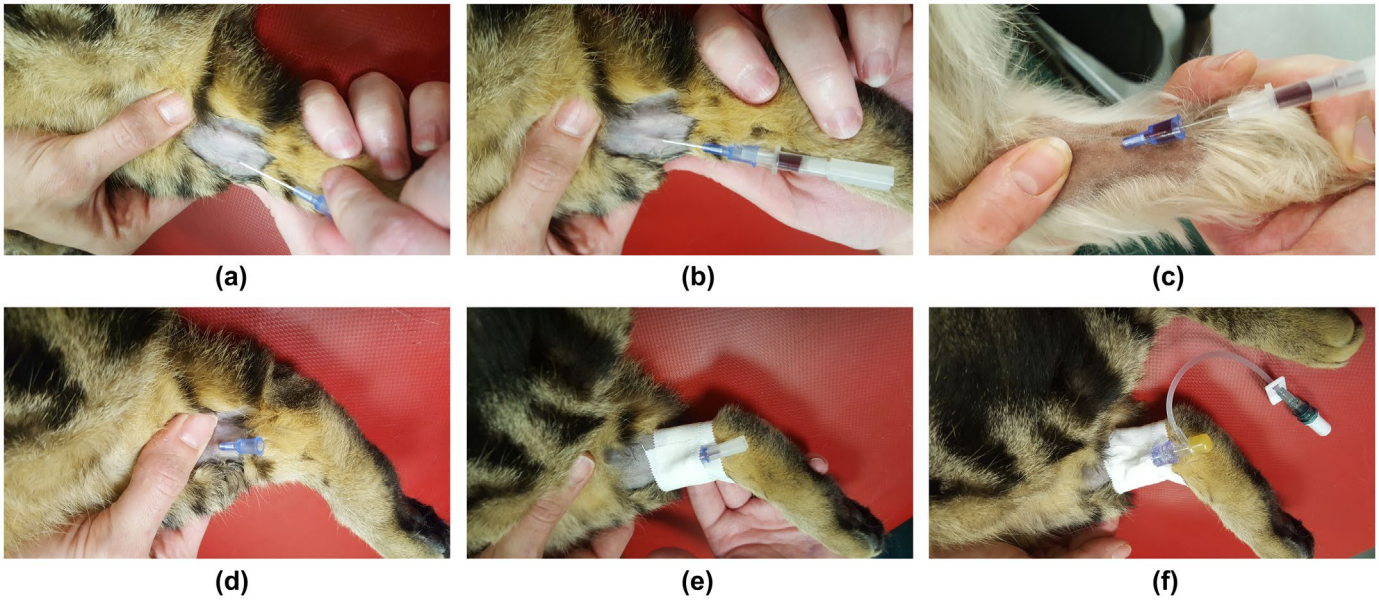

Figure 4. (a)–(f) Placement of an intravenous catheter in a saphenous vein
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indwelling for 96 hours (McCallum & Higgins, 2012). Davis (2015) suggests that PIVCs should only be removed if clinically indicated, so the removal rule does not apply to catheters functioning well. Mathews, Brooks and Valliant (1996) performed a study to investigate the link between increased indwelling time and infection. The outcome found that there was no significant difference between catheter contamination exceeding 72 hours compared to contamination rates occurring after less than 72 hours. However, unequal numbers of cats : dogs were sampled and the results generalised across the two species, so the results may not be representative. The study is quite dated, highlighting the need for more recent research.

Despite the general response that PIVCs can be left for longer than 3 days, Weil (2006) argues that studies have shown increased levels of bacteria after 24 hours due to the development of a fibrin sheath encouraging bacteria to attach. This suggests that although they can remain *in situ* for longer, bacteria are more likely to develop, causing subsequent infection. Overall, current recommendations are conflicting and it may be better to consider a specific protocol for individual practices to help overcome this.

Monitoring and checks

It is recommended that PIVCs are monitored frequently, which can coincide with other necessary daily patient assessments (Scarlet, 2012). This could help to improve nurse compliance checking PIVCs, incorporating checks into daily routines, saving valuable time. It is suggested that the insertion site and the blood vessel should be inspected for infection and inflammation daily, although more frequent monitoring is preferable (Goddard, 2013). This suggestion is supported by Taylor et al. (2011), who propose additionally checking the catheter for leaks and examining the securing dressing/tape. Additional considerations could include monitoring and recording the date, catheter type and site observations alongside daily comments (Scarlet, 2012). This could help to track the length of placement and allow other staff to easily visualise the catheter position and whether previous complications have occurred. This could be extremely beneficial during nurse hand-over periods.

Dressings and securing the PIVC

Dressing application helps to prevent site contamination and secures the catheter in place (Goddard, 2013). The dressing and tape tension must be checked because limb swelling can arise if the placement is too tight (Taylor et al., 2011). In addition, loose bandaging could lead to catheter dislodgement (Weil, 2006). It can therefore be assumed that nurses must closely monitor securing materials in order to maintain appropriate tension and avoid complications arising. Research from human nursing opposes the use of dressings, concerned that materials collect moisture and obstruct the observation site (Dougherty & Lister, 2008). It could be possible that this may also be the case for veterinary use. Scarlet (2012) suggests rewrapping the bandage every 12 hours and changing the material if it becomes wet or soiled, which could address the issue and reduce contamination. However, this would not address the visual obstruction of the site. Grint (2007) suggests that impermeable transparent dressings can improve visualisation. However, this could cause fluid accumulation, which would encourage bacterial growth, so perhaps a combination of both properties could be investigated.

Flushing

Patency of PIVCs must be checked by flushing the port with heparinised saline (Taylor et al., 2011). Scarlet (2012) suggests flushing every 2–6 hours, whereas Weil (2006) suggests this should occur every 2–4 hours using heparinised or physiologic saline. Heparinised saline may be favoured over sodium chloride as it could reduce the incidence of clots, hence reducing catheter malfunction. This has been proved by some studies but disproved in others, reducing the reliability of the suggestion (Weil, 2006). Alternatively, Davis (2015) conducted a veterinary study which concluded that "0.9% sodium chloride flushes were just as effective as 10 IU/ml heparinised saline". This study was

blind and randomised using a control group alongside two treatment groups, decreasing bias and improving research validity. Only one catheter size was investigated so it may be possible that alternate sizes could yield different results (Ueda, Odunayo, & Mann, 2013). Nurses should monitor for pain during flushing, which may indicate misplacement. If observed, the catheter should be thoroughly examined and removed if it is considered to be misplaced (Taylor et al., 2011).

Patient comfort

PIVC placement is often stressful and painful for the patient. To minimise this, good restraint with assistant help is necessary to allow the patient to feel secure, reducing the chance of self-injury (Aspinall & Aspinall, 2013). This should be incorporated with every PIVC placement in order to make the patient's experience as stress-free as possible.

A recent study by Chebroux, Leece and Brearley (2015) investigated the placement of a newly designed veterinary catheter in healthy cats and dogs which claimed to reduce tissue trauma and pain compared to a commonly used human brand. The study investigated whether student veterinarians could place the catheter more easily and whether this resulted in less insertion discomfort. Results indicated that the veterinary catheter did not improve incidences of successful placement or patient comfort. However, the study may be biased, as the person placing the catheter was aware of which design they were using, which may have influenced their perception of placement. The animals were sedated, which may have affected their comfort levels and would not be representative of ordinary catheter placement of non-sedated patients. In order to improve this study, experienced professionals could judge the catheter placement to improve the accuracy of the results alongside the use of debilitated animals and non-sedated animals. This research could help improve animal welfare, investigating how patient discomfort can be minimised and patient care improved.

The patient's comfort should also be considered as the catheter is left *in situ*. In order to increase comfort levels, the PIVC should be covered with a bandage and packed underneath with swabs. This would help to reduce self-mutilation and contamination that occurs as a result of discomfort (Aspinall & Aspinall, 2013).

Further research

Human research has suggested intravenous catheter care bundles could reduce infection rates. Boyd, Aggarwal, Davey, Logan and Nathwani (2011) initiated a study investigating whether peripheral intravenous catheter care bundles (PIVCCs) could improve nursing care and management, improve patient safety and reduce associated complications. Results showed an increased compliance level as nurses were obligated to provide daily assessments and feedback. It was assumed that improved nursing compliance was linked to reduced catheter complications and improved patient safety, but evidence was not provided for this. Alternatively, Hancill (2013) investigated PIVCCs in the veterinary environment and results showed reduced nurse compliance levels with the bundle. Hancill's study is likely to be more applicable for use as it was completed in the veterinary environment. However, it was carried out over a shorter time period than Boyd's longer study, reducing the accuracy of the results. As Boyd's PIVCCs were more successful over a longer time period, it could be possible to improve Hancill's experiment by investigating compliance over a longer time frame. Boyd's study incorporated a whole-team approach, whereas Hancill's approach was not as strict, with some staff not participating, affecting the overall accuracy. Repeating a similar veterinary study over a longer time period, incorporating more patients alongside a whole-team approach could improve the assessment of veterinary PIVCC bundles.

In order to reduce infection rates and minimise associated complications, antibiotic catheters could be used within the veterinary practice. Human studies have shown some positive results, but there is a lack of current evidence within the veterinary profession due to a lack of research and associated cost implications (Tan et al., 2003). It could be interesting to conduct more veterinary studies in order to assess their use within practice and whether they could be considered for future patients. Studies would need to be carefully considered and the issues concerning antibiotic resistance addressed.

Conclusion

There are many guidelines available advising veterinary nurses on how to ascertain the best PIVC care for their patients. Studies have been carried out to improve asepsis with the aim to reduce infection rates, encourage nurse compliance and improve patient comfort considering the best protocols for catheter placement. This research, although relatively new, can be incorporated for use within current veterinary practices in order to assess its success. However, there is much scope for further research to address the gaps of knowledge highlighted within this essay, which could further improve the nursing profession.

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Multiple Choice Questions

1. According to the article what are reported to be the most common causes of nosocomial infections?

(a) Urinary catheters
(b) Bandages
(c) Intravenous Catheters
(d) Kennels

2. What, according to the article, should be worn when placing an intravenous catheter?

(a) Mask
(b) Sterile gloves
(c) Non-Sterile Gloves
(d) Apron

3. PIVC stands for

(a) Percutaneous indwelling catheter
(b) Peripheral Intravenous catheter
(c) Permeate Intravenous catheter
(d) Placed intravenous catheter

4. What conclusion did the study, conducted in 2014 by Young et al., about skin preparation reach?

(a) Povodine Iodine works well
(b) 50% solution of 45 Chlorhexadine should be used
(c) Alcohol should be sprayed before placement
(d) The use of 2% Chlorhexadine Gluconate with 70% Isopropyl alcohol is advocated in human medicine.

5. The study by Casey at Al in 2002 suggested that?

(a) All catheters should be removed after 3 days
(b) Needless connectors could potentially reduce infection
(c) Chlorhexadine 2% is the best solution for a skin prep
(d) Dressing applications help reduce site contamination

6. Dougherty and Lister 2008 suggested that?

(a) Bandages are suitable to prevent patient interference
(b) Bandages reduce contamination
(c) PIVCs can be left for 5 days
(d) Within human medicine research opposes the use of bandages.

7. Who conducted the study that suggested flushing PIVCs with Saline 0.9% was just as effective as Heparinised saline?

(a) Casey et al 2002
(b) Ueda, Odunayo and Mann 2013
(c) Taylor et al 2011
(d) Davies 2015

8. Within human research what has been suggested to reduce infection rates?

(a) Care Bundles
(b) WHO hand washing after placement
(c) Clear Dressings
(d) SOPs

For the answers to the MCQs, please go to: http://www.bvna.org.uk/publications/veterinary-nursing-journal