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Equine intravenous catheters and thrombophlebitis

Intravenous catheters are commonly used in equine practice. However, this can lead to complications such as thrombus and thrombophlebitis. Registered veterinary nurses (RVNs) and nursing assistants should be vigilant when monitoring catheter sites so that complications are prevented. This article identifies effective monitoring techniques and preventive strategies to help minimise the occurrence of intravenous catheter site complications in equine patients.

The use of intravenous catheters has become routine in equine practice owing to the implementation of more intensive medical treatment over recent years (Traub-Dargatz, 1991). Catheter site complications, such as thrombophlebitis, can increase morbidity and recovery time for patients and this is an important concern for RVNs in practice.

In equine patients, it is the jugular vein that is most commonly catheterised (Figure 1). This can be limiting in practice – when complications occur in one jugular vein, catheterising the contralateral jugular vein is contraindicated because of concerns over disruption to venous drainage (Traub-

Dargatz, 1991). Swelling of the head and cervical region may then lead to a life-threatening airway obstruction (Dolente et al, 2005).

Other intravenous catheter sites used in the horse include the lateral thoracic and cephalic veins, but these sites are more prone to catheter complications (Traub-Dargatz, 1991).

Thrombophlebitis and its causes

Thrombophlebitis is one of the most frequently reported catheter site complications in horses and is recognised as thickening within or around the vein, together with pain, heat and swelling at the catheter site (Geraghty et al, 2009a).

Intravenous catheters activate the blood clotting cascade in horses, which results in the formation of a fibrin 'sleeve'; and if this reaction is extensive it can result in thrombus formation. Bacteria from the skin may colonise an existing thrombus and this can initiate thrombophlebitis – inflammation of the vein leading to infection (Geraghty et al, 2009b).

How can we prevent thrombophlebitis?

High risk patient identification

The risk of morbidity can be reduced with early detection and treatment of thrombophlebitis (Geraghty et al, 2009a). This is an important concept for RVNs to put into practice when monitoring equine intravenous catheter sites.

Lankveld et al (2001) found that the level of patient debilitation was an important risk factor in the development of thrombophlebitis and Dolente et al (2005) demonstrated that horses with intravenous catheters suffering from a condition that caused a generalised state of hypercoagulation were more likely to develop thrombophlebitis. The conditions identified included endotoxaemia, hypoproteinaemia, salmonellosis and large intestinal disease (Dolente et al, 2005). Geraghty et al (2009a) also found that debilitation and a rectal

temperature above 38.5°C were significant risk factors for developing thrombophlebitis.

The results of these studies suggest that patient risk factors are significant in the development of thrombophlebitis. So identification of high-risk patients – either by recognising a condition that causes abnormal coagulation or a significant clinical parameter, such as heart rate or rectal temperature – could guide veterinary professionals towards the implementation of enhanced intravenous catheter monitoring techniques in order to prevent thrombophlebitis.

Catheter site preparation – clipping

The correct method for preparing catheter sites has been investigated for humans and small animals, but very little research exists for the topic in equine patients (Geraghty et al, 2009b). Inadequate preparation of intravenous catheter insertion sites has been associated with increased rates of infection in cattle, dogs and humans.

There is some debate as to whether the catheter site should be clipped or the hair left in place. Many authors advocate clipping the area of catheter insertion (Traub-Dargatz, 1991), as it is believed that skin disinfectants do not always penetrate down to the underlying skin surface.

Some evidence suggests that clipping dislodges bacteria from hair follicles, increasing the bacterial colony forming units (CFUs) at the site and increasing the risk of infection (Zubrod et al, 2004). Geraghty et al (2009b) found that chlorhexidine was just as effective at disinfecting the intravenous catheter sites of horses when the hair was left long, clipped or shaved.

Geraghty et al (2009b), however, still advocated

that catheter sites should be clipped as this improves visualisation of the vein, and reduces the chance of introducing foreign material when inserting a catheter. This is a significant consideration because equine patients live in a particularly contaminated environment. Improving visualisation is also important as repeated venepunctures during the insertion of a catheter can lead to thrombus formation, which may then lead to thrombophlebitis (Lankveld et al, 2001).

Catheter site preparation – correct skin disinfection

There is much debate as to which skin disinfectant is most effective at reducing bacterial counts at proposed intravenous catheter sites. The two most commonly used skin disinfectants in veterinary practice are chlorhexidine and povidone-iodine.

Povidone-iodine is inactivated by organic material and this could be considered undesirable in horses that live in a heavily contaminated environment. Geraghty et al (2009b) found that the use of both chlorhexidine and povidone-iodine scrub solutions resulted in significant reductions in CFU counts on intravenous catheter sites in horses.

However, Geraghty et al (2009b) used chlorhexidine at a concentration of 2% which is less than the 4% concentration recommended by the manufacturers. This could have affected the results as a higher concentration might have enhanced the performance of chlorhexidine compared to povidone-iodine.

Chlorhexidine is believed to have a residual effect lasting up to six hours. This reported residual effect may be of particular use in the preparation of equine intravenous catheter sites giving the contaminated environment in which they live.



Figure 2. In veterinary medical research, 70 per cent of all intravenous catheter-related infections occurred through the catheter hub itself.

Osuna et al (1990) discovered that the residual activity of chlorhexidine was decreased by the use of alcohol after the surgical scrub. These authors recommended that chlorhexidine be used for the correct contact time and then rinsed with sterile saline to preserve the residual antimicrobial activity. Further research is required to fully validate these claims because the majority of the literature concerning the preparation of equine intravenous catheter sites advocated the use of alcohol after scrubbing with chlorhexidine or povidone-iodine (Geraghty et al, 2009a).

Osuna et al (1990) also found a significantly increased rate of skin reactions with the use of povidone-iodine, which is undesirable. This would support the use of chlorhexidine for the preparation of intravenous catheter sites in horses, where it is imperative to preserve one single jugular catheter site (Traub-Dargatz, 1991).

Disinfectant hubs

In human research, a disinfecting catheter 'hub' has been used and it reduced sepsis rates by 90 per cent. This represents a dramatic reduction and would be extremely valuable in high-risk equine patients (Sitges-Serra et al, 1997). In veterinary medical research, 70 per cent of all intravenous catheter-

related infections occurred through the catheter hub itself. This suggests that hub sepsis could, therefore, be reduced if a disinfecting catheter hub was adopted for use in veterinary practice (Figure 2).

In human and veterinary research, it has been suggested that environmental factors and poor management may influence catheter-related sepsis. Improving catheter management during insertion and post-catheterisation will help reduce thrombophlebitis in high-risk patients (Sitges-Serra et al, 1997).

Conducting regular catheter hub cultures, reducing the number of lumens a catheter may have and providing a high level of aseptic handling of catheter hubs will help to minimise sepsis too (Sitges-Serra et al, 1997). Routine catheter hub cultures should be performed, and if positive cultures are found, the catheter should be removed before the vein is affected.

According to Sitges-Serra et al (1997) the hub is the main portal for micro-organisms in human medicine; and by minimising the amount of hub manipulation and improving aseptic technique, sepsis was reduced from one episode every 49 'catheter days', to one episode every 375 'catheter days'. Improving practice

Figure 1. In equine patients, it is the jugular vein that is most commonly catheterised.



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cleaning standards and regular hand washing can reduce the spread of harmful bacteria too.

Performing regular hub cultures is not widely practised in veterinary medicine despite its having been recommended for humans (Sitges-Serra et al, 1997). There has been no research in veterinary medicine that has found it beneficial in equine patients; but it could help with intensive care patients because potentially harmful bacteria could be detected and prevented from colonising the catheter.

Monitoring catheter sites with ultrasound

Ultrasound scanning is a useful tool for the early detection of thrombophlebitis in equine patients with intravenous catheters (Geraghty et al, 2009a). Although it has been suggested that ultrasonographic examination of jugular veins is impractical because of the associated expense and the inconvenience of frequent examinations, these authors found them inexpensive and easy to perform; suggesting that regular ultrasound examinations of intravenous catheter sites would be practical to carry out in equine practice.

In one study, Geraghty et al (2009a) identified subclinical signs of thrombophlebitis in 27 per cent of horses – encouraging evidence for the use of regular ultrasound scanning of intravenous catheter sites to identify early signs of thrombophlebitis and facilitate early preventive treatment.

However, these authors stated that regular ultrasound examinations were only necessary in debilitated patients where the coagulation status may have been compromised. They did not use ultrasound to monitor intravenous catheter sites after the

catheters were removed. It has been recommended that ultrasound examinations – carried out after the removal of the catheter – could improve the quality of patient care by monitoring the progress of thrombophlebitis and assessing the response to treatment.

Regular ultrasound examinations of equine intravenous catheter sites could be carried out by RVNs as part of evidence-based nursing practice (Figure 3) and reducing the cost of the procedure. The images acquired could then be interpreted by a veterinary surgeon to ensure an accurate diagnosis and facilitate the correct treatment.

Figures 4 and 5 illustrate the differences between a normal and an abnormal IV catheter site scan in the horse.

Intravenous catheter care bundle

Prevention is better than cure. The development of an evidence-based intravenous catheter care 'bundle' for horses could help to reduce the incidence of thrombophlebitis.

The first part of the procedure would be to identify high-risk patients with hypercoagulation disorders. All patients having catheters inserted should have a full TPR examination performed prior to the procedure to aid the identification of debilitated patients.

Next, the catheter site would be prepared by clipping the area and scrubbing the site with 4% chlorhexidine solution for the recommended contact time – as discussed earlier, the concept of rinsing the area with saline rather than alcohol to preserve the residual activity of chlorhexidine warrants further study.

Long-stay catheters made from polyurethane or



Figure 3. Regular ultrasound examinations of equine intravenous catheter sites could be carried out by RVNs as part of evidence-based nursing practice.

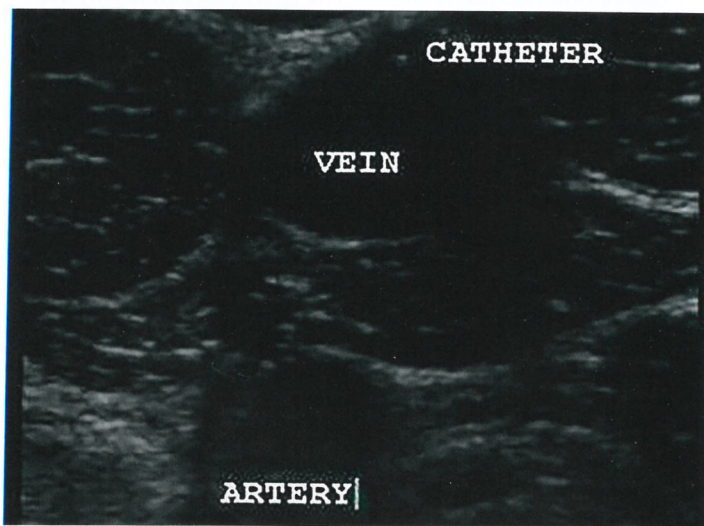


Figure 4. A normal IV catheter site scan.

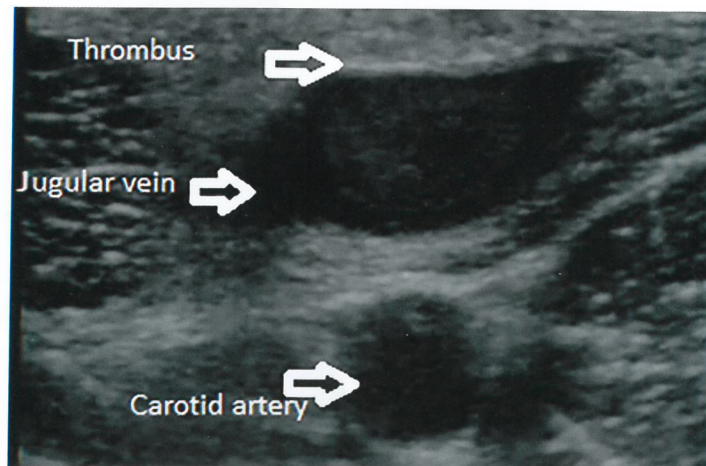


Figure 5. An abnormal IV catheter site scan.

silicone would be the most appropriate for use in debilitated patients because they are less thrombogenic than Teflon catheters. Catheters should be flushed regularly to maintain patency and reduce the incidence of phlebitis. Disinfecting catheter hubs should be used in debilitated patients – specifically those suffering from colic – as part of the care bundle: and swabs from catheters and hubs should be cultured to try to prevent complications before they occur.

As part of the care bundle all horses should have the left and right jugular veins assessed via ultrasound before insertion of a catheter. Measurements should be taken and these can be compared to scans taken once the catheter is in place. Debilitated patients should be scanned once daily to monitor for subclinical signs of thrombophlebitis; but in non-

high-risk patients this could be performed less frequently, as suggested by Geraghty et al (2009a).

Conclusion

Strict monitoring of catheter sites is essential in equine patients to try to reduce potential complications. The RVN is in an ideal position to do this and to implement preventive strategies.

The application of an equine intravenous catheter care bundle could facilitate evidence-based nursing practice and raise the standards of care for equine patients. This should, however, be implemented with caution because specific studies on the care of intravenous catheter sites in horses are lacking (Geraghty et al, 2009b). Clinical audit could also be used to provide an unbiased means of monitoring protocol changes and to ensure that patient welfare is not compromised. ■

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PPD Questions

1. Which vein is usually catheterised in the horse?
2. What strength of chlorhexidine solution should you use to prepare IV catheter site sites the horse?
3. Name three significant risk factors which make an equine patient more prone to developing thrombophlebitis.
4. Which skin disinfectant is believed to have a residual effect lasting up to six hours?
5. Which imaging modality can be used to help detect subclinical signs of thrombophlebitis in equine patients?

- Answers**
1. Jugular vein
 2. 4% chlorhexidine solution
 3. (i) a disorder causing a state of hypercoagulation (endotoxaemia, hypoproteinaemia, salmonellosis and large intestinal disease); (ii) debilitation; (iii) a temperature over 38.5°C.
 4. chlorhexidine
 5. ultrasonography