Sarah Holliday RQVN C&GCertens

Qualified in 2008 and is a proud member of the nursing team of Fitzpatrick Referrals. She is the Senior Medical Oncology Nurse at Fitzpatrick Referrals' Oncology and Soft Tissue hospital, a state-of-the-art veterinary oncology centre in Surrey. Sarah has a keen interest in oncology and palliative care. Email: sarahholliday24@gmail.com

The benefits and uses of Venous Access Ports (VAP) in chemotherapy and critical care patients

Sarah Holliday RQVN C&GCertens

Fitzpatrick Referrals' Oncology and Soft Tissue Hospital, 70 Priestley Road, Guildford, Surrey, GU2 7AJ

ABSTRACT: Commonly used in human oncology to administer chemotherapy, vascular access ports (VAPs) are becoming increasingly popular in veterinary medicine. VAPS are now frequently used in specialist hospitals when caring for critically ill patients or for those receiving frequent treatment, such as chemotherapy.

VAPs provide numerous benefits, such as reducing problems when administrating pharmaceuticals and drawing blood samples, preventing damage to the peripheral vessels and decreasing patient discomfort. This article outlines the nursing considerations when handling patients with access ports and the advantages and disadvantages of placing VAPs in patients undergoing chemotherapy and critical care.

Introduction

Originally introduced to human medicine in the 1980s, VAPs were used in patients for chemotherapy, transfusion, parenteral nutrition and blood sampling (Narducci et al., 2011). More commonly referred to as totally implantable vascular access ports (TIVAPs) in human medicine, VAPs are surgically inserted, semi-permanent devices placed under a patient's skin and attached to a catheter in the venous system. In veterinary medicine the subcutaneous port is positioned on the side of the patient's neck, and allows easy access into the intravenous system for similar treatments such as blood sampling and administering medication. These ports are discrete and simple to use, easily located subcutaneously under the skin. They require minimal maintenance and are relatively simple to place under a short surgical procedure.

Why choose a VAP?

The placement of a VAP enables veterinary professionals to take repeat blood samples with ease, including blood donation for emergency transfusion. They are routinely used for patients that need regular drug administration such as analgesia or sedation and port systems can greatly reduce the discomfort and stress of frequent intravenous therapy (Teichgräber Pfitzmann, & Hofmann, 2011).

The low level of discomfort and ease of use surrounding VAP use should be considered with patients that have a low tolerance to the veterinary treatments outlined. This includes those with anxious or aggressive tendencies, as restraint methods may precipitate further complications, where the use of a VAP allows medication administration to be performed with very low stress and pain. They also reduce overall procedure time with no need for intravenous catheterisation.

Other patients that would greatly benefit from these ports are those undergoing long-term treatment such as chemotherapy. Frequently used in medical oncology, these ports enable preservation of vascular quality and improve overall quality of life in these patients (Valentini , Fassone, Pozzebon, Gavazza, & Lubas, 2012).

DOI: 10.1080/17415349.2017.1303266

Access ports should also be considered for those receiving palliative care, to reduce stress when handling and enable ease of drug administration during end-of-life-stage nursing. Not only can bolus medications be administered, but intravenous fluid therapy can be given to critically ill patients with ease due to permanent access into the venous system.

Port placement

Port placement should be regarded as a surgical procedure and is therefore placed using aseptic technique while the patient is under anaesthesia (Phillips & Anderson, 2013). The frequency of patient anaesthetics can be reduced by placing the port following a surgical procedure such as a tumour excision or leg amputation, where chemotherapy will be part of the follow-up treatment plan (**Figure 1**).

The patient is placed under general anaesthetic and the area is surgically prepared by clipping the implantation site and surgically scrubbing the skin. This is important to remove skin flora and reduce the risk of post-placement complications such as infection.

The access ports come in a variety of sizes depending on the size of the patient. The size should be pre-selected and measured prior to placement. **Table 1** outlines the equipment needed.

The patient is placed in left lateral recumbency, and an incision is made in the skin over the jugular vein for the catheter placement and a second incision is made 10–15 cm dorsally to the jugular for port placement.

The port catheter will be placed directly into the jugular vein and be advanced down to where the vena cava enters the right atrium. The catheter is then secured to a rubber window within the subcutaneous skin at the dorsal location and the port is secured to the cervical muscle (Norfolk Vet Products). The surgeon is then able to determine patency by drawing blood back into a syringe and finishes placement by "locking" the port using heparinised saline to flush the port system (Phillips & Aronson, 2013).

Maintaining the ports

Initially following placement, the ports should be "locked" for a number of days. This is to reduce the risk of blockage and maintain patency. Locking the port means flushing the system with saline followed by a heparinised flush solution to fill the entire line. The literature varies, but

(a)

(b)

Figure 1. (a) Euradyce, a 3-year-old Great Dane, had her right forelimb amputated due to an osteosarcoma. Here she is awaiting her chemotherapy treatment doxorubicin via her VAP. (b) Euradyce and one of the Auxillaries, Victoria

Norfolk Vet Products provide guidelines to flush and lock the port every third to fourth day for the first two weeks following placement and then following each usage of the port. If not in constant use, the ports can be flushed every 10–14 days (Phillips & Aronson, 2013).

The handler must only use a specially designed needle when entering the port. Huber needles or deflected point needles are specially designed with a non-coring tip, which do not damage the silicone ports once withdrawn. This allows the silicone within the port to reseal itself and maintain sterility. The needles should never be twisted or put into the port at an angle (Norfolk Vet Products).

The skin should be aseptically prepared prior to each flush and the spongy centre felt in the centre of the port. When handling the port, the handler should aseptically prepare their hands and use sterile gloves. Once the skin is prepared for use, the port can be held firmly between the thumb and forefinger to keep it steady during use.

The Huber needle is then inserted at a 90 degree angle until the hard surface of the port can be felt. Heparinised saline should then be used to flush the port. The

Table 1. Equipment list for vascular access port placement.

Clippers	Huber point needle
Skin preparation	Huber infusion set
Sterile drape	Peel-away catheter introducer
Sterile suture kit	Round tip silicone catheter
Surgical blade	Titanium clear port
Suture material	Post-operative dressing

volume of heparinised flush used will vary depending on the size of the port in place.

It is advised not to use a syringe smaller than a 5 ml when performing any procedures via the VAP. A smaller syringe will cause high pressure and could rupture the catheter (Norfolk Vet products).

Blood sampling

Placement of a venous access port allows for easy blood sampling with minimal patient discomfort and distress. To prepare the patient for sampling, aseptic skin preparation and hand hygiene procedures are performed as previously described.

A Huber needle is placed into the port, a syringe with heparinised saline attached and the port flushed with the correct volume of flush as indicated. Once the port is patent, 5 ml of blood is drawn into the syringe and this is removed from the port. A sterile bung is placed onto the syringe and the syringe set aside. The Huber needle can remain in place during this procedure. A new syringe is now used to remove the blood sample and the blood is then placed into the correctly labelled blood tubes. The blood in the first syringe may then be replaced back into the port before locking the port with heparinised saline (**Figure 2**).

(a)

(b)

(c)

Figure 2. (a) Huber needle in port. (b) Flushing the port to check patency prior to sampling. (c) Blood sample being taken via the access port

The use of venous access ports in cancer patients

In medical oncology, VAPs are indicated for those receiving long-term treatment such as ongoing chemotherapy (Teichgräber et al., 2011). It is common to place a VAP in patients beginning a course of chemotherapy to eliminate potential peripheral venous access problems (Hsieh et al., 2009). Placement of VAPs for chemotherapy can be greatly beneficial for those receiving tissue-irritant chemotherapy, such as vincristine and doxorubicin, as these cytotoxic pharmaceuticals are vesicant when administered via the peripheral route (Hsieh et al., 2009). VAPs bypass these peripheral veins and help to avoid extravasation (Valentini et al., 2012).

The main benefit of placing TIVAPs in human breast cancer patients is that the ports greatly reduce the risk of extravasation of venous toxic chemotherapeutic agents (Ma et al., 2016). When peripheral veins are used so frequently, the vessels can become damaged or fragile and may blow or leak chemotherapy agents into the surrounding tissues, causing severe damage (Ma et al., 2016).

Mayer et al. (2008) outlines the successful use of VAPs in dogs receiving external radiation therapy for treatment of cancer. The results of their study conclude that the use of VAPs in these patients greatly reduces treatment time. Care should be taken with veterinary chemotherapy patients undergoing treatment, as neutropenia greatly increases the risk of complications post port placement (Seguela & Pages, 2011).

Access ports can also be used in managing chronic cavity effusions or to locate treatment of cavity tumours with treatment methods such as endo-cavitary chemotherapy (Romanelli et al., 2008).

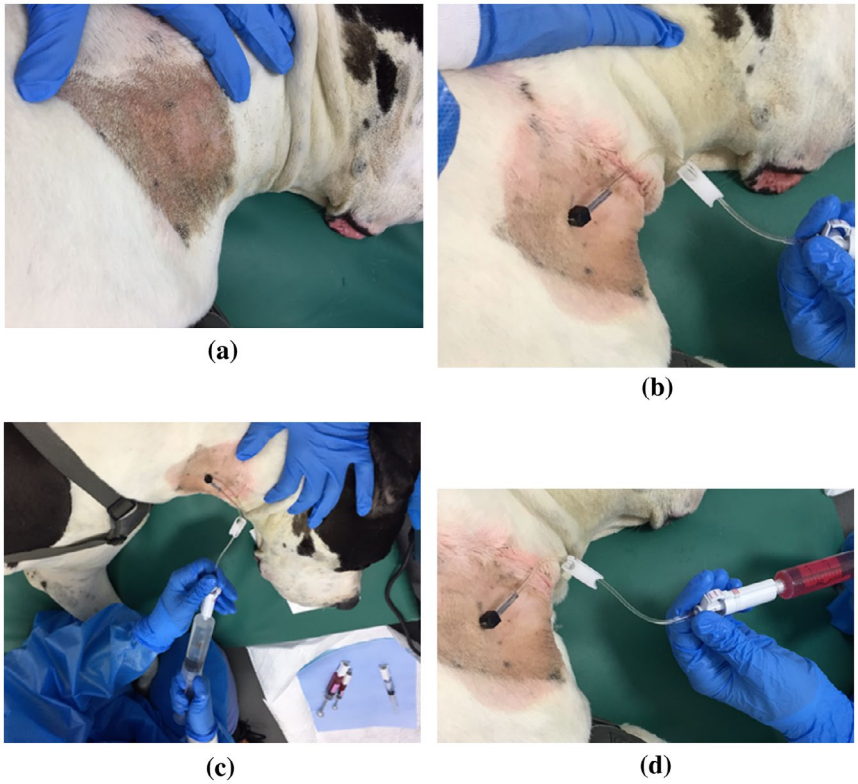

Figure 3. (a) Clipped and prepped site over an area stabilised by handler. (b) Right-angled Huber needle in centre of port. (c) Patient adequately restrained and both staff members wearing PPE. Flushing port prior to use. (d) Doxorubicin chemotherapy administration via Huber needle into VAP

VAP use in chemotherapy administration

Prior to chemotherapy administration, the skin over the area is clipped and surgically prepared. All staff members performing administration should be adequately trained and provided with personal protective equipment (**Figure 3**).

The Huber needle is inserted into the centre of the port and blood is drawn back into the line to ensure the port is patent. The port is flushed with heparinised saline and the chemotherapy is administered slowly. Care must be taken when flushing the port to ensure patency and reduce the risk of drug extravasation during administration.

The patient can be gently restrained to aid administration but is generally less anxious and more comfortable during treatment than with traditional peripheral catheter venous administration. Once complete, the port is locked with a heparin solution and the Huber needle is slowly removed and discarded in the cytotoxic waste container.

Complications

In one human study of 2996 breast cancer patients, Ma et al. (2016) conclude that the three most common complications seen in 5% of patients are fibrin formation, infection and deep vein thrombosis. Other common complications may include: loss of catheter patency (Culp et al., 2010), local swelling, infection, pain and bruising (Phillips & Aronson, 2013).

The need for anaesthesia to place the port may influence the decision to use a VAP in patients that are a high risk under anaesthesia. Once the port is placed, there is a risk of site infection and the possible need for repeat surgery due to complications such as dislodgement. Bloodstream infections are seen more frequently in veterinary oncology patients, with research suggesting this is due to higher levels of skin and hair bacterial populations (Seguela & Pages, 2011).

Conclusion

VAP placement is becoming more frequently used in referral veterinary practice in patients undergoing repeat treatments, such as chemotherapy. These ports may also be a consideration in first-opinion practice for critically ill patients. VAPs are extremely beneficial in patients receiving regular treatment such as fluid therapy, medication and even for euthanasia. Ports are discrete and are generally well-tolerated by patients. VAPs can facilitate repeat blood sampling and recurrent treatment administration with ease. Additionally, the placement of ports in aggressive or anxious patients may reduce the overall need for sedation or restraint, and allows for long-term venous access without damaging peripheral veins.

Costs of placement should be considered, along with the need for general anaesthesia and surgeon training for placement technique. Known complications should also be discussed with the owner as part of the informed consent process, such as risk of infection and drug extravasation, catheter migration and site pain and inflammation. All points for and against placement should be fully assessed, by the veterinary surgeon, on an individual patient basis prior to placement. Veterinary nurses and assistants handling the ports will also need adequate training and a good understanding of the importance of sterility, how to maintain patency, administer medication and successfully retrieve a blood sample.

References

Culp, W., Mayhew, P., Reese, M. S., Duda, L., Glassman, M. M., & Brown, D. C. (2010). Complications associated with use of subcutaneous vascular access ports in cats and dogs undergoing fractionated radiotherapy: 172 cases (1996–2007). *Journal of the American Veterinary Medical Association, 236*, 1322–1327. doi:10.2460/javma.236.12.132.

Hsieh, C.-C., Weng, H.-H., Huang, W.-S., Wang, W.-K., Kao, C.-L., Lu, M.-S. & Wang, C.-S. (2009). Analysis of risk factors for central venous port failure in cancer patients. *World Journal of Gastroenterology: WJG, 15*, 4709–4714. doi:10.3748/wjg.15.4709.

Ma, L., Liu, Y., Wang, J., Chang, Y., Yu, L., & Geng, C. (2016). Totally implantable venous access port systems and associated complications: A single-institution retrospective analysis of 2,996 breast cancer patients. *Molecular and Clinical Oncology, 4*, 456–460. doi:10.3892/mco.2016.726.

Mayer, M. N., Grier, C. K., Yoshikawa, H., & Ringwood, B. (2008). Complications associated with the use of vascular access ports in dogs receiving external beam radiation therapy. *Journal of the American Veterinary Medical Association, 233*, 96–103. doi:10.2460/javma.233.1.96.

Narducci, F., Jean-Laurent, M., Boulanger, L., El Bedoui, S., Mallet, Y., Houpeau, J.L. ... Fournier. C. (2011). Totally implantable venous access port systems and risk factors for complications: A one-year prospective study in a cancer centre. *European Journal of Surgical Oncology*. doi:10.1016/j.ejso.

Norfolk Vet Products Companion Port™ Huber needles Retrieved October 17, 2016, from www.norfolkvetproducts.com/huber%20needles.html

Norfolk Vet Products Companion Port™ Surgical Suggestions handout (online) Retrieved September 10, 2016, from www.norfolkvetproducts.com/PDF'S/CompanionPort%20Surgical%20Guide.pdf

Phillips, H., & Aronson, L. R. (2013). Vascular surgery. In K. M. Tobias & S. A. Johnston (Eds.), *Veterinary surgery: Small animal*, (Vol. 2, pp.1854–1870) . Elsevier Health Sciences.

Romanelli, G., Marconato, L., Olivero, D., Massari, F., & Zini, E. (2008). Analysis of prognostic factors associated with injection-site sarcomas in cats: 57 cases (2001–2007). *Journal of the American Veterinary Medical Association, 232*, 1193–1199. doi:10.2460/javma.232.8.1193.

Seguela, J., & Pages, J.-P. (2011). Bacterial and fungal colonisation of peripheral intravenous catheters in dogs and cats. *Journal of Small Animal Practice, 52*, 531–535. doi:10.1111/j.1748-5827.2011.01101.x.

Teichgräber, U. K., Pfitzmann, R., & Hofmann, H. A. (2011). Central venous port systems as an integral part of chemotherapy. *Deutsches Ärzteblatt International, 108*, 147–154. doi:10.3238/arztebl.2011.0147.

Valentini, F., Fassone, F., Pozzebon, A., Gavazza, A., & Lubas, G. (2012). Use of totally implantable vascular access port with mini-invasive Seldinger technique in 12 dogs undergoing chemotherapy. *Research in Veterinary Science*. doi:10.1016/j.rvsc.2012.07.023.