Check for updates

Zoe Jane Curtis BSc (Hons) CertVN ECC RVN

Zoe qualified from Middlesex University in 2015. She worked as Head RVN for four years and completed her ECC certificate with VetsNow in 2018. Zoe started as a Theatre RVN at the Queen Mother Hospital for Animals in 2019 and has developed an interest in ophthalmic surgery.
Email: zcurtis@rvc.ac.uk

The role of the theatre veterinary nurse: surgical site preparation

Zoe Jane Curtis **BSc (Hons) CertVN ECC RVN**

Queen Mother Hospital for Animals, Royal Veterinary College, Hatfield, Hertfordshire, UK

ABSTRACT: Surgical site preparation involves removing debris and microorganisms from the dermal surface and reducing the risk of surgical site infection occurring. It has been noted in many studies that most veterinary practices could improve their skin preparation protocols prior to surgery. This article will discuss the protocols of best practice in carrying out surgical site preparation, including the removal of hair, the surgical preparation solutions and their dilution rates, the initial scrub and final skin preparation once the patient has been transported to the operating theatre. It will also outline surgical site preparation for more delicate mucous-membrane areas; such as ocular and oral surgeries.

Keywords: surgical site infection (SSI); surgical preparation solution; surgical skin preparation; cross-contamination; chlorhexidine gluconate; povidone-iodine

Introduction

When it comes to surgical skin preparation protocols, a large amount of veterinary practices are using techniques which are not supported by evidenced-based nursing standards (Phillips, 2018). In a study carried out by Evans et al. (2009), 75% of 105 veterinary practices were unaware of the concentration of surgical site preparation used or contact times used when preparing patients for surgery. Therefore, there is room for improvement in practice protocols for surgical site preparation.

Bacterial colonies on the skin surface can originate from the patients residual flora, or a transient skin contaminant from an exogenous source such as the environment (Kerrigan, 2018). Using appropriate surgical skin preparation techniques is essential in order to ensure the risk of the patient developing a surgical site infection (SSI) is lowered as much as physically possible (Phillips, 2018).

Prior to carrying out any surgical skin preparation, personal protective equipment (PPE) should be implemented, including non-sterile gloves and an apron. This is to prevent any cross-contamination of bacteria from the user's transient skin contaminants onto the surgical site (Kerrigan, 2018).

Removal of hair

Patient hair can act as a significant reservoir for organic debris and microbes, and can act as a foreign body if it gains access to the surgical incision (Bowers, 2012). Clipping of the surgical site should be carried out in a separate area from the operating theatre, in order to minimise hair contamination of the surgical environment.

Clipper blades should be visually inspected for cleanliness and damage prior to use, as damaged clipper blades are more likely to cause trauma to the skin, therefore increasing the risk of SSI (Lane, 2016). They can also become too hot during usage, therefore regular temperature checks can prevent further skin irritation and post-operative patient wound interference (McHugh et al., 2011). This can be achieved by placing the clipper blade on the user's un-gloved skin to assess the temperature in order to determine if a change of clipper blade is required (Zeltzman, 2018). If clipping around open wounds, applying a sterile water-soluble gel into the wound can reduce hair contamination (Figure 1). The use of a hoover and lint roller is also essential for removal of

DOI: 10.1080/17415349.2021.1931604

© 2021 British Veterinary Nursing Association (BVNA)

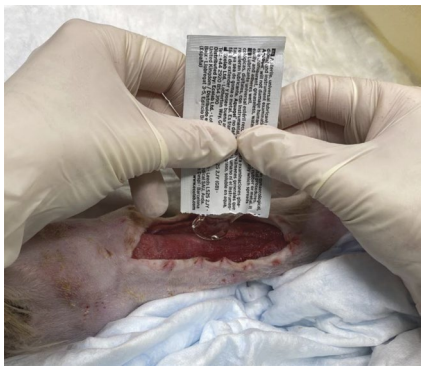

Figure 1. Sterile water-soluble gel being applied to a wound prior to clipping.

debris and hair from the surgical site prior to the initial skin preparation stage (Bowers, 2012).

Initial skin preparation

The choice of surgical preparation solution used is one of the main factors that significantly reduce microbial skin count immediately before and during surgery. An agent with a good residual activity, such as chlorhexidine gluconate, is desired to prevent re-growth of resident bacterial flora after skin preparation (Kerrigan, 2018).

Chlorhexidine gluconate has been considered the more superior surgical preparation solution, in comparison with povidone-iodine, due to its longer residual action (Phillips, 2018) and its efficacy in the presence of organic material (McHugh et al., 2011). A study carried out by Rutter and Macinga (2013) found the residual action of chlorhexidine gluconate can be up to 15 minutes in a moist environment. It contains a detergent base, therefore producing a lathering effect which also removes dirt and grease (Bowers, 2012). Chlorhexidine gluconate is a cationic solution and povidone-iodine is an anionic solution. They are chemically unsuitable for usage together as the molecules react with each other and drop out of the solution, therefore only one should be used on the same surgical site (Phillips, 2018).

In order to achieve the maximum antimicrobial effects of a surgical preparation solution, appropriate dilution rate and contact times should be adhered to. According to the manufacturers guidelines, chlorhexidine gluconate 4% should be used undiluted but with a small amount of water to aid the lathering action (Phillips, 2018). Evans et al. (2009) found that in 50 canine neutering procedures where chlorhexidine gluconate was used at varying concentrations between 2-4%, there was a lack of difference in efficacy in surgical site preparation, but more evidence is needed to support these findings. Chlorhexidine gluconate 4% diluted with an equal part of water to a 2% solution is most commonly used in veterinary practice (Reynolds & Nichols, 2019).

A contact time of five minutes with the skin is a general protocol used in veterinary medicine (Zeltzman, 2015). A study carried out by Davids et al. (2015) found that pre-surgical skin preparation with chlorhexidine gluconate 4% is effective in reducing bacterial counts after 225 seconds.

Surgical preparation solutions should be dispensed and reconstituted fresh for each patient, as it has been found that some gram-negative bacteria can multiply in dilute antiseptic solutions (Bowers, 2012). A technique using sterile items including a kidney dish, saline and swabs is highly desired to further reduce bacterial cross-contamination (Baines et al., 2012). The use of lint-free non-woven swabs is recommended in comparison with cotton wool, as they produce minimal residual particles on the surgical site and skin abrasions (Phillips, 2018) **(**Figure 2**).** Care should be taken to wring out any excess solution from the swabs before scrubbing as pooling on the skin and fur can lead to peri-operative hypothermia and oral ulceration, if ingested by the patient.

Arguably, the surgical site preparation technique used is more important than the skin preparation solution and dilution rate used (Kerrigan, 2018; Stonecypher, 2009). Reports from National Health Service human literature suggests that the backwards-and-forwards motion is just as effective as concentric circle motions in surgical skin preparation (Bowers, 2012). A back-and-forth motion technique has been found more effective at removing any embedded debris within the top layers of the dermis, compared to using the original concentric circles method as it provides more friction (Kerrigan, 2018). Swales and Cogan (2017) found no significant difference in the two methods used during their study of collecting samples from skin flora from the midline prior to abdominal surgery in 25 dogs.

The initial skin preparation should start at the proposed incision site and working outwards in a back and forth motion until the clipped edges are reached. This swab should then be discarded and a new swab used, and this process repeated until the surgical site is visibly clean and there is no discolouration or debris present on the swab (McHugh et al., 2011). It is important that soiled swabs are not placed back in the surgical preparation solution, causing possible cross-contamination (Phillips, 2018).

For patients with open wounds, irrigation with an isotonic electrolyte solution such as sodium chloride 0.9% is recommended to remove any surface bacteria or foreign material present within the wound bed (Bell, 2018). This is easiest achieved with a fluid bag, giving set, three way tap, 20 ml syringe and a suitable gauge needle **(**Figure 3**).** Irrigation with high pressures may cause damage to the epithelial cells and drive bacteria into the deeper layers of the tissue planes. The pressure recommended to flush wounds varies though out the literature. Commonly, an 18 gauge needle is used to create a pressure of 7-8 pound per square inch to non-selectively debride the wound (Davidson, 2015). Any clipped skin remaining around the wound should be initially prepared with chlorhexidine gluconate 2% with the technique described previously. Care should be taken to prevent any of the

Figure 2. Initial surgical skin preparation on a patient undergoing bilateral elbow arthroscopy, using a back-and-forth technique with lint-free non-woven swabs.

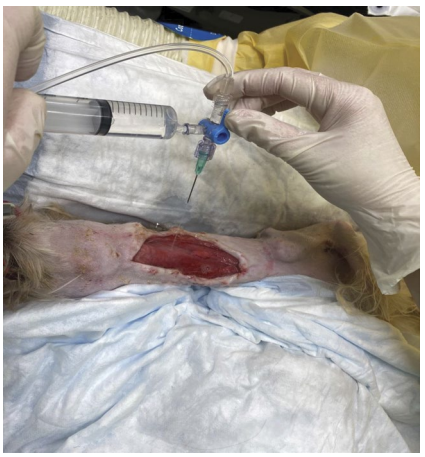

Figure 3. Flushing open wounds with saline using a three-way tap system during the initial preparation stage.

© 2021 British Veterinary Nursing Association (BVNA)

surgical preparation solution from coming into contact with the wound tissues as chlorhexidine gluconate can delay granulation tissue formation due to its cytotoxic nature (Bell, 2018).

In limb surgery, the hair remaining on the foot should be covered with a water-resistant bandage material such as Co-flex, to prevent bacterial strike-through (Bowers, 2012). For male canine patients undergoing abdominal surgery, the prepuce should be flushed prior to the initial skin preparation using either sterile saline or a 0.05% solution of chlorhexidine solution to remove any contaminants and reduce any bacterial culture present (Zeltzman, 2015).

An anal purse string suture can be placed in patients requiring perianal surgery to prevent faecal contamination of the surgical site (Figure 4).

Final skin preparation

Prior to the final skin preparation, the patient should be moved to the operating theatre and positioned appropriately for the surgical procedure. It is likely there will be some contact when transporting the patient from one area to another, therefore providing difficulty to maintain asepsis (Bowers, 2012). Wearing sterile gloves and using sterile materials is highly desirable to further decrease the risk of contamination of the surgical site from the operator's hands (Kerrigan, 2018).

Many practices have implemented the use of a sterile surgical preparation system such as Chloraprep™, a single use sterile instrument containing 2% chlorhexidine gluconate and 70% isopropyl alcohol. It is recommended for use with a back-and-forth technique with friction, focusing on the proposed surgical incision site for the first 30 seconds, then moving outwards until reaching the surgical site edges (Figure 5). The Chloraprep™ also comes available with an orange tint, providing a marker to show what skin areas have already been covered within the surgical site. Another benefit of using this system is there is no requirement for the user to physically touch the surgical site during usage, therefore reducing the risk of cross-contamination in the final skin preparation stage (Kerrigan, 2018).

If a disposable sterile scrubbing device is not available, then chlorhexidine gluconate 4% diluted to a 1:1 solution with sterile saline in a sterile bowl, using a one-swipe technique with sterile lint-free swabs is a suitable alternative. The final step should be with a rinsing agent spray, commonly used is 70% an isopropyl alcohol such as surgical spirit, reported to enhance the residual microbial effect of the chlorhexidine gluconate (Bowers, 2012; Phillips, 2018).

However, it has been noted that alcohol-based sprays can potentially remove surgical preparation solution from the skin surface, therefore reducing the agent's residual action (Zeltzman, 2015). The use of alcohol is contraindicated in open wounds and mucous membranes as it coagulates proteins therefore care needs to be taken in these areas.

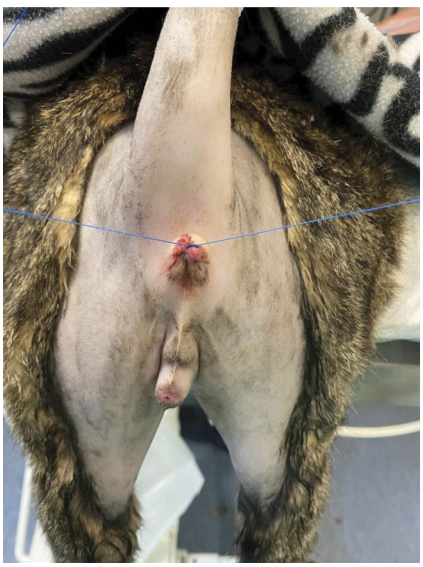

Figure 4. Anal purse string suture in a cat undergoing a perineal urethrostomy procedure.

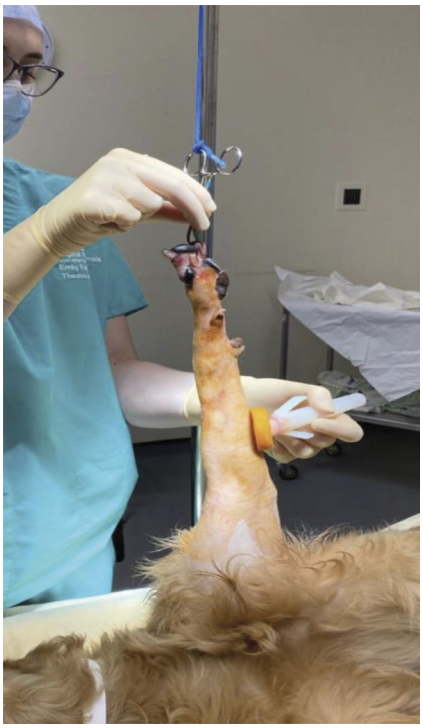

Figure 5. Patient hanging limb final preparation using a Chloraprep.

When using an alcohol spray bottle, the first spray should be carried out in a kick bowl to remove any microorganisms or debris from the nozzle (Phillips, 2018). These spray bottles should be replaced regularly due to the possibility that they harbour bacteria in the nozzle to reduce surgical site contamination.

Consideration should be given to the drying time of the agents of the final skin preparation prior to sterile draping taking place. Alcohol-based agents can become flammable, especially when diathermy is being used during the procedure too. Therefore it is particularly important to ensure adequate drying time is given prior to surgery (Hemani & Lepor, 2009). Veterinary practices still using traditional fabric drapes also need to take note, as any moisture present could assist bacterial strike-through from above and below the drape (Bowers, 2012).

Preparation of mucous membranous areas: Ophthalmic surgery

An assessment of the globes fragility should be carried out by the veterinary surgeon prior to any surgical site preparation taking place. If there is any suspicion of corneal perforation then a sterile saline solution should be the only preparation used, as surgical preparation agents can cause damage to the underlying intra-ocular structures (Adshead, 2012).

If the patient is having adnexal surgery, removal of hair on the eyelids surrounding the globe is required. Similarly to surgical skin preparation, this clipping should be carried out in an area separate to the operating theatre to maintain the sterile environment for surgery.

Prior to clipping, the eye should be heavily lubricated with sterile water-soluble gel to keep the cornea moist and protect the eye from hair and skin (Zeltzman, 2015). **(Top tip! - Longer eyelashes can be trimmed with small sharp scissors covered in sterile water soluble gel to catch the hairs to prevent them falling into the eye.)** If available, using a narrow fine clipper blade is will significantly reduce the chances of clipper lacerations to the fragile eyelid tissue. For intra-ocular surgery, the hair does not need to be clipped; however it should be short enough to maintain surgical asepsis and post-operative cleanliness (Woodham-Davies, 2019).

Once clipped, the globe should be flushed out with saline to remove remaining hair or

© 2021 British Veterinary Nursing Association (BVNA)

ocular discharge. Any organic matter present can inactivate any surgical preparation solutions used.

Povidone-iodine 10%, without detergent, is the agent of choice as it has a low pH of 3-5 and is tolerated well by epithelial cells (Bowers, 2012). A solution of povidone-iodine 10% diluted to 1:50 with sterile saline is a suitable strength for use on the conjunctiva and corneal surfaces (Gould & McLellan, 2014) (see Table 1). A sterile syringe filled with the solution can be implemented to flush out the globe and then sterile cotton buds to gently clean the conjunctival surfaces, including under the third eyelid membrane if the globe is stable (Figure 6). Then, if required, a 1:10 solution can be used to surgically prepare the clipped area on the external eyelids with lint-free non-woven swabs. Folding the swab in all four corners creates a smaller contact area, therefore making it easier to manoeuvre and reducing the chances of contact with the corneal surface (Foote, 2020).

Once the final preparation has been completed and contact time of two minutes reached, the globe should be flushed with sterile saline (Hayton-Lee, 2015). If the patient is requiring bilateral ophthalmic surgery then the globe should be surgically prepared immediately prior to the first incision as povidone-iodine has low residual action compared with other surgical preparation solutions (Bowers, 2012).

Oral surgery

Minimal surgical preparation is required for the oral cavity as surgical procedures within this area of the body are classified as clean-contaminated procedures. One of the most common oral cavity surgeries we see in veterinary medicine to date is brachycephalic obstructive airway syndrome (BOAS) correction surgery, which involves correction of multiple anatomical problems including a laryngeal sacculectomy, staphylectomy and rhinoplasty procedure.

Similar to ocular tissue, surgical preparation solutions commonly used for skin preparation are an irritant and potentially damaging to the mucous membranes (McHugh et al., 2011). Once the patient is suitably positioned for the surgery, an oral mouth rinse or a 1:50 solution of povidone-iodine 10% can be used to reduce the bacterial levels on the oral mucous membrane layer.

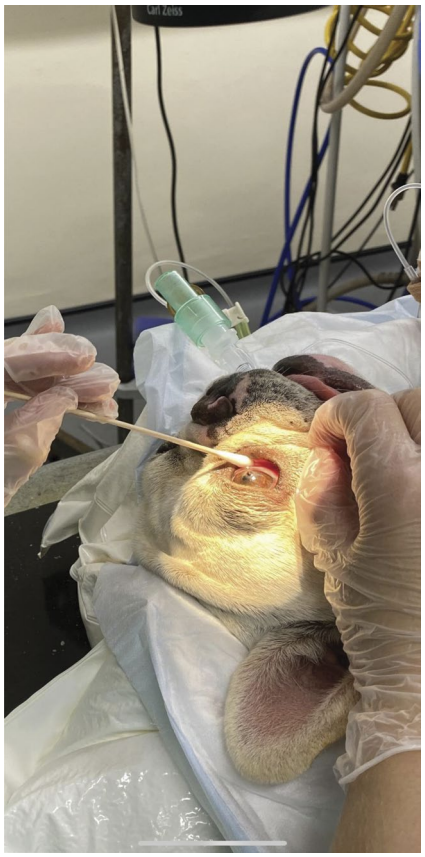

Figure 6. Sterile saline preparation of a perforated globe undergoing a corneal graft surgery.

This can be carried out with sterile lint-free non-woven swabs, and cotton buds to reach the laryngeal saccules (Figure 7). Care should be taken to ensure the patient's endotracheal tube is cuffed appropriately to prevent any excess fluid from the surgical preparation solution or regurgitation from entering the respiratory tract (Woodlands, 2018). If a rhinoplasty is also required, the povidone-iodine surgical preparation solution can also be used to remove debris from the nares and nasal folds.

Conclusion

Appropriate surgical skin preparation is proven to be a fundamental component of patient infection control (Kerrigan, 2018). When playing the theatre veterinary nurse role, it is important to be able to identify and recognise risks of contamination to our patients having surgical procedures and reduce them as much as physically possible. The use of evidence-based protocols in veterinary practice is critical in reducing microbial levels on surgical sites and therefore the prevalence of SSI's (Bowers, 2012).

Table 1. Making up different concentrations of povidone-iodine 10%.

1:50 povidone-iodine		1:10 povidone-iodine
Add 2mls of povidone iodine 10% to 100ml of sterile saline		Add 1 ml of povidone-iodine 10% to 10mls of sterile saline

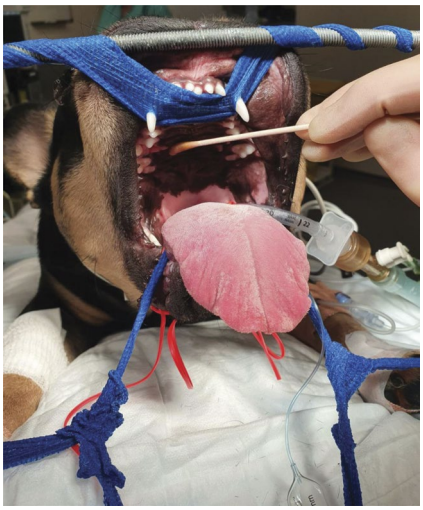

Figure 7. Final preparation of a patient undergoing BOAS corrective surgery using povidone-iodine surgical preparation solution.

Acknowledgements

Thank you to Courtney Scales for your guidance with my first submission.

Disclosure statement

No potential conflict of interest was reported by the author.

References

Adshead, S. (2012). Anaesthesia and nursing considerations of the SA ophthalmic patient – part 1. *VN Times*, *12*(11), 18–20.

Baines, S., & Lipscombe, V., & Hutchinson, T. (2012). *BSAVA manual of canine and feline surgical principles: A foundation manual* (1st ed.). British Small Animal Veterinary Association.

Bell, S. (2018). An overview of debridement techniques. *The Veterinary Nurse*, *9*(6), 294–301. https://doi.org/10.12968/vetn.2018.9.6.294

Bowers, L. (2012). Aseptic skin preparation: Reducing the risk of surgical site infection. *The Veterinary Nurse*, *3*(9), 544–551. https://doi.org/10.12968/vetn.2012.3.9.544

Davids, B., Davidson, M. J., TenBroeck, S. H., Colahan, P. T., & Oli, M. W. (2015). Efficacy of mechanical versus non-mechanical sterile preoperative skin preparation with chlorhexidine gluconate 4% solution. *Veterinary Surgery*, *44*(5), 648–652. https://doi.org/10.1111/vsu.12335

Davidson, J. R. (2015). Current concepts in wound management and wound healing products. *Veterinary Clinics of North America: Small Animal Practice*, *45*(3), 537–564. https://doi.org/10.1016/j.cvsm.2015.01.009

Evans, L. K., Knowles, T. G., Werrett, G., & Holt, P. E. (2009). The efficacy of chlorhexidine gluconate in canine skin preparation – practice survey and clinical trials. *Journal of Small Animal Practice*, *50*(9), 458–465. https://doi.org/10.1111/j.1748-5827.2009.00773.x

Foote, A. (2020). Nursing considerations for brachycephalic ocular syndrome. *Veterinary Nursing Journal*, *35*(7), 192–196. https://doi.org/10.1080/17415349.2020.1795024

Gould, D., & McLellan, G. (2014). *BSAVA manual of canine and feline ophthalmology* (3rd ed.). British Small Animal Veterinary Association.

© 2021 British Veterinary Nursing Association (BVNA)

Hayton-Lee, E. (2015). How to provide nursing care to the surgical ophthalmic patient. *The Veterinary Nurse*, *6*(1), 41–45. https://doi.org/10.12968/vetn.2015.6.1.41

Hemani, M. L., & Lepor, H. (2009). Skin preparation for the prevention of surgical site infection: which agent is best? *Reviews in rology*, *11*(4), 190–195.

Kerrigan, L. (2018). Surgical skin preparation – are we just going around in circles? *The Veterinary Nurse*, *9*(1), 20–25. https://doi.org/10.12968/vetn.2018.9.1.20

Lane, C. (2016). Preventing surgical site infection: equine surgical site preparation. *The Veterinary Nurse*, *7*(3), 151–155. https://doi.org/10.12968/vetn.2016.7.3.151

McHugh, D., Young, A., & Johnson, J. (2011). Theatre practice. In B. Cooper, E. Mullineaux, & L. Turner (Eds.), *BSAVA textbook of veterinary nursing* (5th ed., pp. 817–818). Aberystwyth: BSAVA.

Phillips, H. (2018). *Surgical skin preparation – best practice protocol for veterinary nurses*. [online]. https://vetnurse.com.au/2018/03/07/surgical-skin-preparation/

Reynolds, H., & Nichols, A. (2019). Which skin preparation technique is most effective to minimise bacterial contamination? *The Veterinary Nurse*, *10*(3), 162–166. https://doi.org/10.12968/vetn.2019.10.3.162

Rutter, J., & Macinga, D. R. (2013). Investigation into the residual activity of chlorhexidine gluconate using a novel method to simulate real-world conditions. *American Journal of Infection Control*, *41*(6) p, S39. https://doi.org/10.1016/j.ajic.2013.03.082

Stonecypher, K. (2009). Going around in circles: Is this the best practice for preparing the skin? *Critical Care Nursing Quarterly*, *32*(2), 94–98. https://doi.org/10.1097/CNQ.0b013e3181a27b86

Swales, N., & Cogan, T. (2017). Failure to achieve asepsis following surgical skin preparation is influenced by bacterial resistance to chlorhexidine, but not skin preparation technique. *Veterinary Nursing Journal*, *32*(8), 224–227. https://doi.org/10.1080/17415349.2017.1328994

Woodham-Davies, S. (2019). Cataract surgery in dogs. *Veterinary Nursing Journal*, *34*(1), 12–17. https://doi.org/10.1080/17415349.2018.1526658

Woodlands, C. (2018). Perioperative care of the brachycephalic patient and surgical management of brachycephalic obstructive upper airway syndrome. *The Veterinary Nurse*, *9*(10), 532–538. https://doi.org/10.12968/vetn.2018.9.10.532

Zeltzman, P. (2015). The pros and cons for scrubbing with Betadine and Chlorhexidine. *Veterinary Practice News*. https://www.veterinarypracticenews.com/the-pros-and-cons-of-scrubbing-with-betadine-chlorhexidine/

Zeltzman, P. (2018). *Tips and tricks to clip like a pro: 10 tips every veterinary surgeon should know*. https://www.veterinarypracticenews.com/tips-and-tricks-to-clip-like-a-pro/

© 2021 British Veterinary Nursing Association (BVNA)