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Julian's main interests are soft tissue and orthopaedic surgery and he has lectured extensively to vets and veterinary nurses about surgery, pain management and ultrasound. Julian lives in West Sussex with his wife and two daughters, and whenever he gets any time off he is usually to be found on a rock face somewhere.

Surgery of the forelimb

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ABSTRACT: Whilst the range of surgical procedures which may be performed on the forelimb is very diverse, there are various considerations which are held in common. These include pre-anaesthetic assessment, surgical preparation, analgesia and postoperative physiotherapy. This article discusses these considerations and offers suggestions for improving standards of care to maximise the surgical benefits to patient, practice team and client.

Although the principles of surgery are the same for the forelimb as for other tissues and regions of the body, it is often helpful to consider forelimb surgery as a separate entity, in much the same way as we would consider an exploratory coeliotomy (or 'laparotomy') as a type of surgical procedure.

Doing so allows us to formulate a much better plan for the surgical procedure – for example, if we schedule an exploratory laparotomy, we know there will be certain items of equipment we need to have on hand, such as a suction unit, laparotomy swabs, Doyen bowel clamps and so forth. There will be standard patient pre- and postoperative considerations (such as monitoring albumin and total protein levels and placement of a feeding tube).

By accepting that certain considerations will apply in any surgical approach to the forelimb, we can develop a practice protocol for the procedure. This should result in a much more holistic approach to the patient, hopefully improving the level of care and reducing the chance of forgetting any aspect of the procedure, such as options for analgesia, best ways of surgically prepping the site and post-operative rehabilitation.

This article proposes some of the considerations that may be borne in mind when surgery to the forelimb is contemplated. It is hoped that it will help provide a formula for a standard operating procedure for practices.

Surgical conditions of the forelimb

There are many reasons why a surgical approach to the forelimb may be required. These are summarised in **Table 1**.

Patient preparation

Pre-surgical considerations will depend on the nature of the surgery, patient signalment and health. Most cases require no special pre-op preparation, other than a thorough health check to assess safety for anaesthesia.

Patients with suspected or confirmed underlying disease (for example renal failure) may benefit from pre-operative blood and urine analysis and blood pressure assessment.

Trauma cases should be stabilised prior to general anaesthesia.

Table 1. Surgical conditions of the forelimb

Orthopaedic trauma: fracture/dislocation/congenital deformities
Osteoarthritis (e.g. OCD, UAP, FMCP)
Soft tissue trauma: skin, muscle trauma
Neoplasia: excision, biopsy (e.g. osteosarcoma, MCT, Spindle cell tumours, lipomas, melanomas)
Neurological disease: e.g. brachial plexus or radial nerve damage requiring amputation or arthrodesis, or nerve biopsy
Removal of foreign bodies (e.g. grass awns)
Dermatologic disorders: biopsy, excision (e.g. acral lick granuloma, pemphigus biopsy)
Nail and nail bed diseases (biopsy, amputation)

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Life-threatening conditions, such as haemorrhage and thoracic trauma, should be attended to prior to orthopaedic repair. However, if surgery is to be delayed, the patient should be made comfortable with dressings, analgesia and so forth.

Pre-operative pain scoring and lameness scoring (if lameness is present) should be carried out – this is useful not only for planning analgesia, but also to provide a baseline for comparison postoperatively. Several pain-scoring algorithms have been devised; the author's preference is the Colorado State University canine and feline acute pain scale which may be downloaded from www.vasg.org/pdfs/CSU_Acute_Pain_Scale_Canine.pdf or www.vasg.org/pdfs/CSU_Acute_Pain_Scale_Feline.pdf.

If the proposed surgical procedure is removal of a skin mass, a biopsy should be obtained prior to definitive removal (Liptak, 2013). Biopsy results will dictate the required excisional margins for the mass.

For most malignant masses, complete surgical excision (with an appropriate margin) will offer the best chance of a cure. If, however, an insufficient margin is achieved, neoplastic cells may remain. Removal of these remaining cells necessitates a relatively much larger excision if an adequate new margin is to be achieved (Figure 1[a, b & c]).

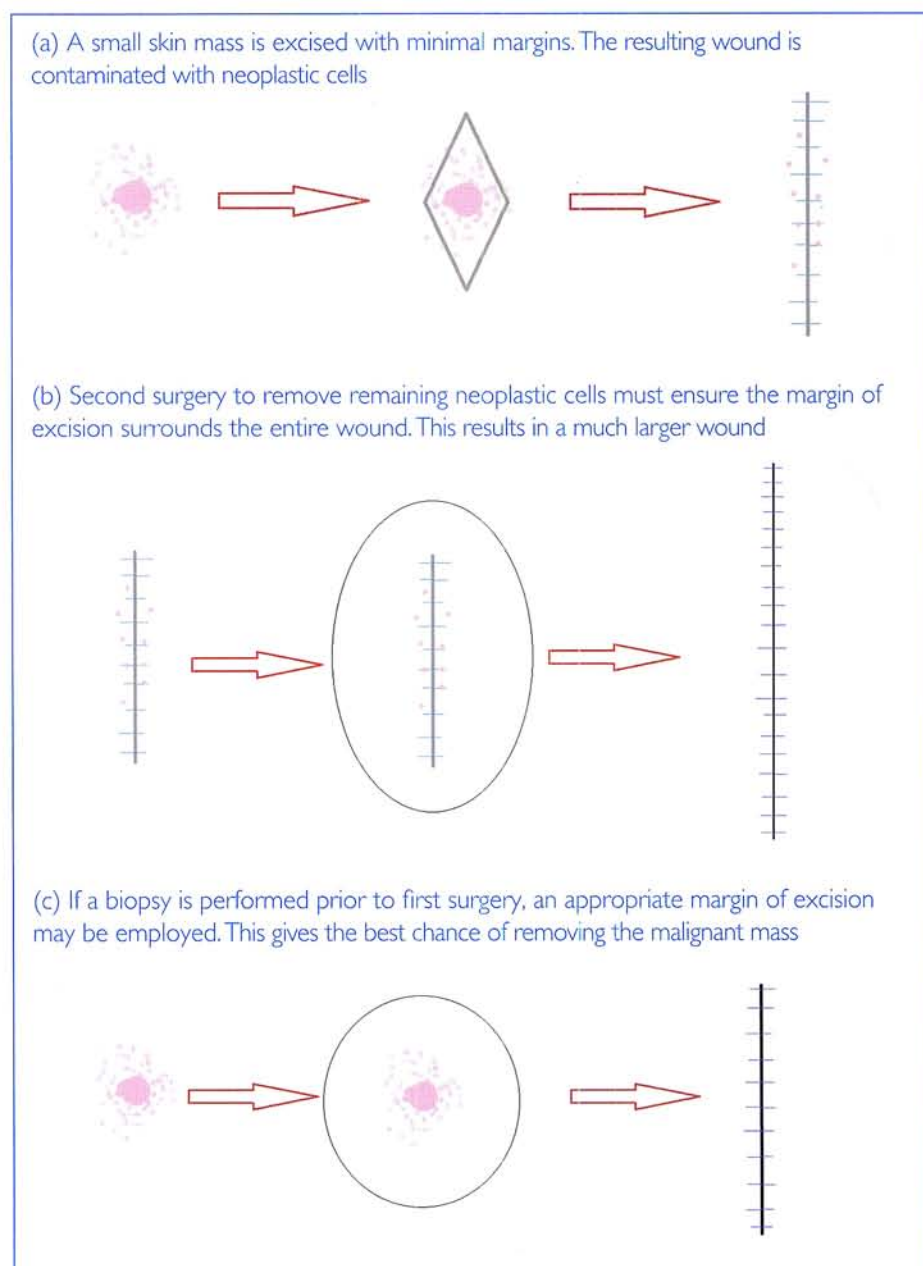
Other than causing the patient more suffering and reducing the chance for a complete cure, a larger excision may cause difficulties, especially on the limb, where spare skin is limited, and removal of tissue from deep under the mass may result in loss of limb function. Removal of a large area of skin is almost certain to require reconstructive surgery (skin flap or grafting), which will further add to patient suffering and may reduce postoperative appearance and limb function.

Biopsy of the mass prior to initial surgery, on the other hand, will improve the chances of a successful outcome. A fine needle aspirate (FNA) biopsy is recommended, as it is simple, quick and diagnostic in most cases.

Analgesia/anaesthesia

Choice of analgesia is very much dependant on the nature of the surgery

Figure 1[a, b & c]. Consequences of removing an insufficient margin of excision



and the degree of pain anticipated. As a matter of routine, the 'pre-med' should include an opioid (e.g. buprenorphine) and NSAID (if appropriate), an α_2 -agonist (unless contraindicated by co-existing disease) and an anxiolytic (e.g. midazolam).

For painful surgery, consideration should be given to a stronger opioid, such as morphine or fentanyl and ketamine, either as a bolus or as continuous rate infusion (CRI). Local anaesthetics are extremely useful in forelimb surgery and are discussed later.

Surgical preparation

A generous clip should be performed – it is much easier to manage sterile drapes and aseptic prep when the skin is clipped to a reasonable distance from the surgical site. A larger clipped area also facilitates

any change in surgical plan, should unforeseen events occur.

Meticulous clipper care is warranted, to avoid broken or blunt blades which may cause trauma to the sensitive interdigital skin, or may remove insufficient hair. If the foot is not required to be in the surgical site, it may be covered with a sterile bandage or sterile surgical glove.

An Esmarch bandage may be employed to provide a bloodless surgical field. This involves the tight wrapping of the bandage around the limb, starting at the foot and progressing proximally up the limb.

Once the bandage has been placed, the distal portion can be unwrapped, leaving an exsanguinated distal limb. Ideally, a rubber or latex purpose-made Esmarch bandage should be used: conforming



Figure 2. Using a disposable glove to clean the foot

bandage does a reasonable job, but there is an increased risk of creases forming during the wrapping process that may cause neuropraxic injury.

A correctly placed Esmarch bandage may be left in place for up to two hours and provides the surgeon with better visualisation of the surgical site owing to the bloodless field. This differs from the principles of tourniquet application if used in a first aid scenario as this should only be left in place for a maximum of 20 minutes because it is more prone to causing localised tissue and nerve trauma at the site of application.

Care must be taken, however, to ligate any cut vessels before closure as this could result in brisk haemorrhage once the Esmarch bandage is removed.

The interdigital area is 'fiddly' to clean and disinfect. A disposable glove filled with dilute chlorhexidine greatly facilitates the cleaning process. The surgical scrub can be kneaded into the crevices through the glove (Figure 2).

The limb may be elevated with a tie to allow surgical prep of the whole limb – the 'hanging limb' technique (Figure 3).

Local anaesthetics

Local anaesthetics may be employed in several ways to provide analgesia for forelimb surgery:

- a brachial plexus nerve block may be used to produce analgesia of the whole forelimb
- infiltration of local anaesthetic by direct injection into the surgical site
- placement of a 'soaker drain' or fenestrated local anaesthesia catheter (Hoad 2013)
- Bier's block (intravenous regional anaesthesia)

A Bier's block involves placing a tourniquet around the upper forelimb and injecting local anaesthetic (e.g. lidocaine) intravenously. It may be combined with an Esmarch bandage; but if this is done, the intravenous catheter needs to be placed prior to exsanguination of the limb!

The local anaesthetic diffuses slowly through the vein walls and provides a very good level of analgesia throughout the limb distal to the tourniquet.

Figure 3. Hanging limb technique for surgical preparation of the forelimb. The limb is suspended using a tie. Once the rest of the limb has been aseptically prepared, the surgeon or scrub nurse can wrap the foot in a sterile bandage, or place it in a sterile glove



Obviously, great care must be taken to ensure the tourniquet is dependable and remains in place, because if it loosens then lidocaine will be carried to the heart and may cause death. The tourniquet must stay in place for a minimum of 20 minutes – after this time the lidocaine will have diffused through the vein walls and out of the circulatory system.

The interested reader is directed to Lumb and Jones' *Veterinary Anesthesia and Analgesia* in which chapter 20 gives a detailed account of local anaesthetic techniques.

Draping the foot

Once the limb has been prepped, providing the foot does not need to be exposed for surgery, a suitable sterile cover must be used. Drapes (flat, or else custom tailored), sterile gloves or sterile bandages may all be used (Figure 4).

Figure 4. A sterile bandage being used to cover a foot prior to surgery of the distal radius



However, if sterile bandages are contemplated it is vital that the practice autoclave is 'up to the job': a class B (vacuum) is required – a class N (displacement) autoclave will not allow steam under pressure to infiltrate the tight weave of a bandage and will, therefore, not sterilise.

Postoperative care

After surgery, a wound dressing, bandage or splint may be placed, depending on the nature of the surgery. Regular pain scoring should be carried out to maintain a good level of analgesia.

Cryotherapy, or cold therapy, may be helpful for some surgical patients. This involves placing a (wrapped) cold pack over the surgical site for five to 10 minutes every four to six hours for the first 24-48 hours (Figure 5).



Figure 5. Applying a cold pack to the surgical site postoperatively

Cold therapy provides many benefits, including pain relief and the reduction of blood flow and haemorrhage as well as post operative swelling. Physiotherapy (e.g. passive range of movement 'pROM') and massage are also very useful.

Before the patient is discharged, a detailed rest/exercise regimen should be prepared, so that the owner is able to continue postoperative rehabilitation. The *BSAVA Manual of Canine and Feline Rehabilitation* (Lindley and Watson, 2010) is a very useful source book for postoperative care. [vni](#)

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NEWS REVIEW by Jean Turner

'Know your Code' competition winner

Over 100 vets and veterinary nurses tested their knowledge of the RCVS *Code of Professional Conduct* by taking part in a competition at the London Vet Show 2013 on 21 - 22 November.

The competition, which was held on the RCVS stand, consisted of three true or false questions about the Code, covering the topics of delegating Schedule 3 tasks to veterinary nurses, disclosing information about clients and the Practice Standards Scheme.

A quarter of those who took part answered all three questions correctly and, out of those, the winner was Jessie Hetherington, a veterinary surgeon at the PDSA PetAid Hospital in Sunderland. For answering all three questions correctly Jessie wins a £50 App Store voucher.

The RCVS will be looking at the questions which those who took part in the competition got wrong and will seek to improve knowledge in these areas through the *Know your Code* section of *RCVS News*.

Vets and veterinary nurses who want the *Code of Professional Conduct* and all 27 chapters of supporting guidance close to hand during practice can download the new and free RCVS Code app to their Apple and Android tablets and smartphones.

The mobile-friendly app has a keyword search tool, links to other sources of information and contains contact details for further information. Whenever the Code is updated the latest version will be available to download the next time the device is online.

To download the app for free please visit www.rcvs.org.uk/coderefresh

Jessie Hetherington



Are you a rabbit friendly practice?

The Rabbit Welfare Association & Fund (RWF) is creating a 'rabbit friendly vet' page on its website (which gets around 20,000 hits per day). Members on its rabbit friendly vet list will have a link to their practice's website.

Only practices who are members of the RWF can apply to be on the 'rabbit friendly vet list', but membership is a reasonable £45 per year and the benefits include:

- 75 free comprehensive rabbit care guides 'Hop to it'
- a £50 discount for all clinical practice members at the RWF annual conference
- a poster and sticker for your waiting room
- free e-mail advice service from RWF veterinary expert, Richard Saunders and access to his quarterly update
- a quarterly e-newsletter written by VN, Claire King, that you can send to your clients
- quarterly issues of the RWF magazine, *Rabbiting On*.

For full information, www.rabbitwelfare.co.uk/pdfs/RWAVETMEMBERSHIPINFO.pdf

Progress at cancer centre

The Kennel Club Cancer Centre opened at the Animal Health Trust (AHT) in January 2013 and has already treated over 45 dogs with a variety of cancers. The facility has a linear accelerator, thus enabling the AHT to offer radiotherapy, complementing existing surgery and chemotherapy treatments.

Sue Murphy, head of clinics at the AHT, states: "Every cancer case we treat at the AHT contributes towards clinical and genetic research projects, helping us to better understand the disease and find ways to more accurately diagnose and treat it in the future."