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Claire qualified as an RVN in 2011 and works at Willow Veterinary Clinic Ltd. She enjoys the challenge and variety of emergency cases and therefore chose to embark upon the Nurses Certificate in Emergency and Critical Care, which she thoroughly enjoyed and passed in 2015. In 2019, Claire studied for the BSAVA Merit Award in Wound Management. Outside of work, Claire has a daughter and a mischievous basset hound called Sidney. Email: claire.tomkinson.88@googlemail.com

Evaluating the healing process and the need for a 'wound nurse' in the veterinary clinic using a case study reflection

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ABSTRACT: This case study examines the wound management of a large traumatic avulsed wound to the torso of a healthy adult dog. The evaluation of this case supports the concept of a "Wound nurse" within the veterinary practice to oversee wound cases, ensure continuity of care, identify key healing stages and to ensure that wound management standards are high.

Keywords: wound management; wound nurse; avulsion; dehiscence

Introduction

Managing wounds in the veterinary field requires sound knowledge of the physiology of healing, the appropriate application of that knowledge to get the best result for the patient, alongside constant evaluation of progress and adjusting the current plan. The following challenging case study provided key learning experience for our clinical team, and it encouraged me to undertake the BSAVA Merit Award in Wound Management (VNMA). This case study showcases the efficiency of the healing process, despite a very large and traumatic injury.

The Patient Signalment:

Species	Canine
Breed	Lurcher (greyhound crossbreed)
Age	3 years old
Sex	Male (neutered)

The Wound Assessment:

Wound age	Less than one hour of wound assessment
Wound location	Left side of thorax
Wound size	50 cm × 50 cm
Tissue status	No active bleeding, so haemostasis had occurred, and the tissue was in the early stages of the inflammatory process
Recent patient history	The patient was clinically well with no recent illnesses or medications administered

Wound history

The injury occurred when the patient was running through the woods and impaled himself on a branch. The branch made a stab injury which penetrated the skin through to the latissimus dorsi muscle. The whole dermis and some of the subcutis was avulsed, leaving a large triangular flap which was still attached at the base (Figure 1).

Stabilisation

A major body systems assessment was performed, and the patient's cardiovascular system, respiratory system and central nervous system all appeared to be functioning normally. The patient was given analgesia in the form of methadone (Synthadon- Animalcare Ltd) and ketamine (Narketan- Vetoquinol UK) prior to any wound management intervention. The sedative, medetomidine (Domitor-Vetoquinol UK) was also administered to



Figure 1. Presentation of injury.

allow assessment of the wound fully without causing any distress to the patient (Table 1).

Initial interventions to assist healing

Preparation

The patient underwent a general anaesthetic and the wound was flushed, clipped and prepared for closure. The exposed tissue was covered in hydrogel (Intrasite- Smith & Nephew) to prevent any hairs becoming lodged in the wound, and an extensive clip of the surrounding area was performed. The surrounding intact skin was moistened and then prepared with undiluted chlorhexidine scrub (Hibiscrub® Molnlycke Health Care Ltd) which was then removed with swabs soaked in sterile saline. The skin flap was kept clean using a sterile drape.

Wound lavage was then commenced with three litres of warm Hartmann's solution delivered using a giving set, a 3-way-tap, a 20ml syringe and a 19G needle. This enabled the solution to be delivered at an appropriate pressure. As stated by Aldridge and O'Dwyer (2013), the suggested force is 5-10psi, which would allow removal of contaminants without pushing them further into the tissue as applied. There was minimal visible environmental contamination, as the client had been quick to cover the wound at the time of injury (Figure 2).

A broad-spectrum intravenous antibiotic (Co-amoxiclav, Augmentin – Glaxosmithkline) was administered prophylactically, and tranexamic acid (Double E Pharma Ltd) was utilised as greyhounds are prone to delayed postoperative bleeding, and bruising. The aetiology of this is likely to be related to enhanced fibrinolysis, as well as weaker clot strength. Pre-emptive administration of antifibrinolytic medications (tranexamic acid) can reduce patient morbidity, length of hospitalisation and cost of treatment (Yap & Aertsens, 2016).

Surgery

The surgical plan was to replace the degloved flap of tissue, with the understanding that a portion of the tissue may be damaged and

dehiscence would occur. Due to such a large area of the patient's torso being affected, it was possible that the direct cutaneous blood supply via the thoracodorsal artery had been severed at the cranial portion of the flap.

In the interest of eliminating dead space, the veterinary surgeon placed subcutaneous walking sutures (Figure 3) and placed a Penrose drain to prevent the accumulation of serous fluid under the skin flap. The damaged edges of the skin were surgically debrided, before suturing the skin with a non-absorbable monofilament nylon suture material (Monosof – Covidien).

Protection

A Primapore® dressing (Smith & Nephew) was placed over the surgical site post-operatively, to protect from environmental contamination, and also to provide absorption for some mild post-operative haemorrhage (Figure 4). The patient had an uneventful recovery from general anaesthetic, and was managed post-operatively with regular pain scoring assessments and analgesia as required.

Management

Follow ups:

A wound care plan was created and evaluated each day. It is important to adjust the management of the wound at each phase as the wound healing progresses.

Day one: 24 hours post injury, the dressings were removed to allow for the wound to be assessed and cleaned with saline. It was apparent at this point that the cranial portion of the flap was discoloured and



Figure 2. Wound following cleaning.

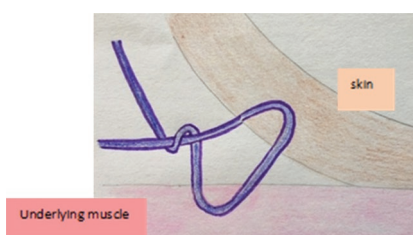


Figure 3. Subcutaneous walking sutures.



Figure 4. Protective dressing applied.

was cooler to the touch than the surrounding tissue. This was due to local ischaemia and the start of tissue necrosis (Figure 5). Otherwise the patient was doing well, and therefore he was able to go home and be managed as an outpatient with daily visits to the practice for assessments, laser therapy sessions and cleaning around the Penrose drain exit points. The patient was discharged with antibiotics in the form of amoxicillin and clavulanic acid -Synulox® (Zoetis), as well as meloxicam- Metacam® (Boehringer Ingelheim) and paracetamol and codeine- Pardale® (Dechra) to provide pain relief.

Day two: The devitalised portion had increased in size. The veterinary surgeons decided to wait until all non-viable tissue had declared, and then to perform debridement.

Day three: The Penrose drain was removed, and the wound irrigated daily with saline. The torso was covered by a medical pet t-shirt when the patient was at home. This helped protect the area from patient interference and keep the wound clean. No dressings were used at this point.

Days four-ten: The dog was examined every two days. On day ten, the devitalised area had become necrotic and was retreating from the edges of the healthy tissue (Figure 6).



Figure 5. Evidence of tissue necrosis 24 hours post injury.

Table 1. Patient medication.

Medication	Dose
Methadone (Synthadon- Animalcare Ltd)	0.5 mg/kg
Ketamine (Narketan- Vetoquinol UK)	1 mg/kg
Medetomidine (Domitor- Vetoquinol UK)	20 µg/kg

Day ten: The patient was sedated, to allow for surgical debridement to take place, and the tissue underneath was flushed with saline. A portion of the wound bed appeared to be unhealthy, and possibly in need of further debriding, but as a large portion of tissue had already been lost, the veterinary team opted for autolytic debridement (Figure 7). A wound dressings plan was created for the following five days after surgical debridement, whereby manuka honey (Manuka G- Kruise) was utilised with a large adhesive edged foam dressing (Allevyn-Smith & Nephew). Manuka honey is antimicrobial with a wound debriding action. The cleansing effect of honey is due to its high osmotic pressure which draws in fluid from the tissues (O'Dwyer, 2007).

Day 15. The decision was made to stop using manuka honey due to the presence of healthy granulation tissue across the majority of the wound bed, alongside visible marginal epithelialisation (Figure 8). At this point, a hydrogel (Intrasite-Smith & Nephew) was more appropriate to support the proliferation phase due to its ability to provide a moist healing

environment without debriding. Due to the small area of slough at the top right aspect of the wound, a dressing containing the antimicrobial agent polyhexamethylene biguanide (PHMB), known as Suprasorb X+PHMB (Lohmann & Rauscher) was used. This dressing was selected due to its ability to provide a moist wound environment and to also provide antimicrobial properties for up to seven days.

Day 28. The wound bed appeared healthy with ongoing marginal epithelialisation, and the wound was contracting quite rapidly (Figure 9). The wound was supported with hydrogel (Intrasite-Smith & Nephew) and a foam dressing (Activheal-AMS), and a medical pet t-shirt, with dressing changes every 3–4 days. Following a discussion regarding surgical repair of the tissue deficit with the patient's owners and the veterinary surgeon, it was decided that the patient would likely make a good recovery with a functional and cosmetically acceptable outcome within the next six weeks with the continuation of second intention healing. The owners were made aware that the patient would be left with non-haired scar tissue.

Day 49. The wound was almost completely healed and the wound care plan was handed over to the owners after the appropriate demonstration and instruction (Figure 10).

Day 60. The wound was completely healed and the owners were advised on scar tissue care, to include UV protection, and massage to encourage the collagen remodelling process (Figure 11), which was taken on day 90 post injury.

Economics and continuity of care

The cost of long-term wound management can be extensive and if the patient is not insured, can be prohibitive (Table 2). Working with the client is also essential, if they are not adhering to the wound care plan, the healing process may be extended and the outcome not so positive.

Evaluation

Client compliance and financial challenges

As an RVN with an interest in wound management, I became the main source of support and information for the owners of this patient. The majority of the support



Figure 6. Necrotic area.



Figure 8. Presence of healthy granulation tissue.



Figure 10. Wound almost completely healed.



Figure 7. Wound bed requiring further debridement.



Figure 9. Healthy wound bed with ongoing epithelialisation.



Figure 11. 90 days post injury.

Table 2. Summary of treatment.

Time to heal in days	60
Number of visits to the practice	25
Number of dressing changes	22
Total cost of management to include dressings, anaesthesia and clinical management	£2,600; £1,400 is attributed to the initial stabilisation, anaesthesia, surgery and 24 hours of hospital care including out of hours costs, and the remaining £1,200 represents ongoing management.
Number of clinicians involved in managing this wound	Vets = 3 Nurses = 6

provided was verbal, during wound management clinics and over the telephone. It would have been beneficial to be able to provide some written guidance about the care of the wound should a problem with the dressings arise. Unfortunately, at present, our practice only provides written guidance to owners when a bandage is involved and this is an area I would like to improve. In this case, there were no issues with client compliance and the patient was cared for very diligently when at home with his owners. This patient was insured; however, it would be beneficial to review the cost implications of our dressing selection for future cases, especially where there are likely to be numerous dressing changes required.

Outcome

The outcome for this patient was very positive, providing him with a rapid return to normal function, with minimal cosmetic effects. There are numerous instances in which large skin wounds in the dog and the cat heal with surprisingly small epithelialised scars compared with the magnitude of the original deficit (Pavletic, 1999).

The final part of the wound healing journey was largely monitored by the owners who updated the practice with regular photographs. This was because the owners were struggling to attend the practice on a twice weekly basis due to work and family commitments, and the patient was becoming increasingly anxious with each visit to the practice. They were provided with gloves to maintain asepsis, and the appropriate equipment for flushing and dressing the wound. Ideally, the wound would have been continually assessed until the maturation stage, but there were no problems or delays in the healing process, and I feel that allowing some flexibility in the treatment plan was important to care for the patient's wellbeing as well as the wound (Zachary & McGavin, 2016).

The patient's scar is now largely protected by fur from the peripheral normal skin, but will require UV protection long term (Borena et al., 2015). The tensile strength of the tissue

will only ever be 70–80% of that of normal skin, therefore another trauma to this area would be problematic (Theoret, 2017).

I feel that within the role of the “wound nurse,” and with the further knowledge and understanding gained by my recent studies, I will be more confident to voice my opinions on the best options for our future wound management cases. I would also be happy to accept the responsibility of wound referrals from my colleagues in situations where they feel my input would be helpful. The reflection section of this case study discusses several areas where the management of this wound could have been improved.

Reflection

Once a healthy bed of granulation tissue had been achieved in this wound, the epithelialisation of the skin edges happened remarkably quickly, and the wound contracted very well. We ensured the epithelialisation process was not disturbed with too many dressing changes or toxic substances such as chlorhexidine, and simply supported the tissue with a moist, clean environment (Salami et al., 2006). The area in which the wound was located meant that the dressings could be easily protected with a medical pet t-shirt, and we therefore avoided any complications associated with long term bandaging. Movement was also not a factor, as the patient was rested appropriately, and the owners were exceptionally diligent at preventing interference.

The recommended volume of solution for effective wound lavage is 100 ml per cm of wound. This patient's wound measured approximately 50 cm, and therefore five litres would have been the correct volume, rather than the three litres that was used. Thankfully, there were no detrimental effects caused by inadequate lavage. In heavily contaminated wounds it is deemed acceptable to use tap water lavage followed by sterile lactated ringer's solution (Aldridge & O'Dwyer, 2013). This option may have been both time and cost effective in this

patient's case, whilst ensuring adequate removal of bioburden.

The Penrose drain placed in this case was placed with two exit holes; one at the most dorsal aspect of the wound, and one at the most ventral aspect which is not ideal. As described by Pavletic (1999), the proximal portion of a Penrose drain should be buried and secured with a single skin suture. Penrose drains are used frequently to help drain excess fluid from large areas of dead space, resulting from trauma or surgical procedures (Dycus & Wardlaw, 2013). The exit point at the top of the wound would not serve this purpose, as the fluid will gravitate towards the ventral exit hole. This additional exit point could have also been an entry point for bacteria, and therefore increased the infection risk (Barnes, 2012).

The surgical debridement of the necrosed portion of the flap occurred ten days after the initial injury, at the point where the tissue had gone black and was a hard crust on the surface of the wound. Staged debridement may have been a better option for this case, to allow for the removal of any necrotic tissue, whilst preserving the maximum amount of healthy viable tissue. Leaving the necrotic slab of tissue in situ for this length of time meant it took longer for a bed of healthy granulation tissue to form. Granulation tissue typically appears by day 3–6 after wounding (O'Dwyer, 2007), and this wound was still in the inflammatory phase at day ten due to the presence of necrotic tissue. As seen in Figure 7, there is an area of potentially necrotic tissue left behind, and it may have been quicker to perform a more aggressive surgical debridement. Using mechanical debridement such as a wet to dry dressing, rather than opting for autolytic debridement with the use of manuka honey may have been more beneficial. However, the overall result was positive for both the patient, and the veterinary team.

As a profession, we face a battle against antibiotic resistance, and responsible antibiotic stewardship is imperative (EMA, 2018). However, the appropriate use of antimicrobials is not as readily considered. An antimicrobial in the form of PHMB dressings was selected during the healing process for this patient, despite no active infection being present. Prior to this dressing being used, the wound was managed with manuka honey, which also has antimicrobial properties. The small area of sloughy tissue may well have debrided with just the use of hydrogel and

foam via the autolytic method. It is often easy to assume that a wound is infected when there is simply some further debridement required. The role of the 'wound nurse' could include evaluating any delay in healing in each case, as infection is one of many possible causes of healing delay.

This case was seen by a number of veterinary professionals in the first two weeks post injury, all with differing ideas and approaches to wound management. Some members of the veterinary team are not experienced at deciphering the different stages of wound healing, and assessing the health of tissue. Some clinicians would have preferred to terminate the use of dressings earlier in the healing process, which can cause conflict within the veterinary team. Continuity of care is key in ensuring wound management cases are monitored accurately, correctly dressed and that the owners are kept well informed of ongoing care and the costs involved. The creation of the 'wound nurse' role is pivotal, not only to ensure excellent patient care, but to increase confidence and knowledge of best practice throughout the whole team when it comes to cases such as this one.

Conclusion

Wound management is an area within the veterinary practice whereby RVN's can be utilised to their full potential. Having a designated "wound nurse," who has completed further study in this field, would undoubtedly improve the standard of wound care provided to patients. The BSAVA VNMA in wound management course aims to develop a nurse's skills and knowledge in this area through ten online sessions and extra online resources. The practical sessions allows hands on experience to try out new methods and discuss cases with colleagues.

The evaluation of a complex case such as this one has allowed the author to identify key areas which are in need of improvement such as wound irrigation, dressing selection, and continuity of care and also to demonstrate the healing process at its best, when supported appropriately.

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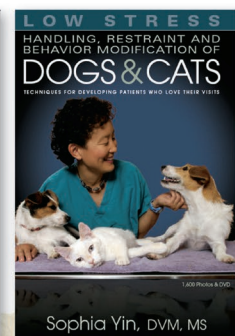
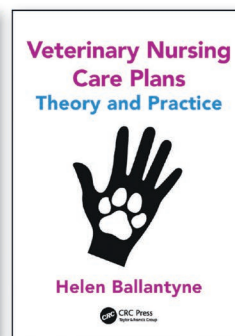
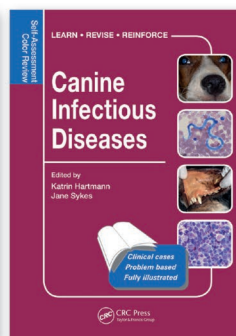
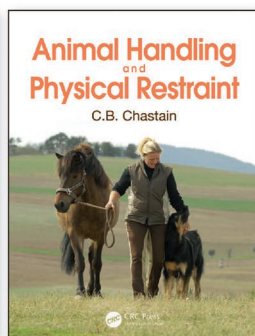
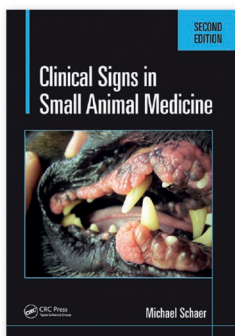
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