

Wound Closure, Tension-Relieving Techniques, and Local Flaps

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KEYWORDS

• Wound closure • Tension • Local flap • Subdermal plexus

KEY POINTS

- The simplest method of wound closure that is deemed to have the highest chance of success should be chosen.
- Simple tension-relieving techniques, such as undermining, strong subcutaneous sutures and walking sutures, are effective in facilitating primary wound closure in many cases.
- More advanced methods of relieving wound tension include the use of releasing incisions, skin stretchers, and tissue expanders.
- Local flaps are elevated adjacent to the recipient bed and rely on the subdermal plexus for their blood supply.
- The risk of necrosis of local flaps can be minimized with meticulous surgical technique; various modalities may be used to salvage a failing flap.

INTRODUCTION

Closure of traumatic wounds or planned surgical incisions is commonly performed in small animals. The use of local skin to cover a defect by direct apposition of the skin edges reduces the time and care otherwise required for a wound to heal by contraction and epithelialization. With direct apposition of the skin edges, cutaneous healing can proceed directly by reepithelialization.¹ The skin of dogs and cats is viscoelastic and present in abundance, meaning many wounds can be closed by adhering to basic surgical principles. The goal should be to obtain rapid wound closure using the simplest technique associated with the lowest morbidity and cost. Although the simplest technique should be chosen, this should not be at the expense of probable

Disclosure Statement: The author has nothing to disclose.

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Vet Clin Small Anim ■ (2017) ■–■
<http://dx.doi.org/10.1016/j.cvsm.2017.06.007>

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success because choosing an inappropriate technique will lead to more cost in the long term. A “reconstructive ladder” has been adapted for veterinary use to assist with decision making in wound closure.²

Before wound closure, the wound bed should be free of contamination and infection and have an adequate blood supply. If a wound is planned, for example a mass excision, then steps may be taken preoperatively to ensure there is adequate skin available for wound closure. Surgeons should have a reasonable knowledge of reconstructive techniques and multiple plans in mind when embarking on wound closure, because not every eventuality can be predicted preoperatively. Every effort should be taken to minimize wound tension; if tension is present on the wound edges, then dehiscence is likely to occur. Tension-relieving techniques act to reduce or redistribute tension from the skin edges. Recruiting neighboring skin in the form of local flaps is useful for more challenging defects where primary skin closure is not otherwise possible.

CATEGORIES OF WOUND CLOSURE

Primary Wound Closure (First-Intention Healing)

Primary closure is the immediate closure of viable tissue without tension, typically by suturing.¹ The decision as to whether a wound may be closed primarily depends on wound factors (time from wounding, manner in which wound was created, location, size, degree of contamination, availability of local tissue) and systemic factors (concurrent disease, age, malnutrition).^{1,3} In healthy patients, wounds less than 3 to 6 hours old with no visible devitalized tissue or debris after lavage are candidates for primary closure; if a wound contains more than 10^5 bacteria per gram of tissue, the risk of infection is markedly increased.^{1,4} Clean and clean contaminated wounds are eligible for primary closure; some contaminated wounds that can be converted to clean wounds by debridement and lavage may also be considered.⁴ Dirty or infected wounds may be closed primarily only if they are first completely excised.

Where possible, wounds should be closed in a linear or curvilinear fashion because wound dehiscence is most likely to occur where incisions intersect (T, X, or Y).⁵ Many wounds can be converted into fusiform defects to facilitate this closure.⁶ Wounds should be sutured accurately and atraumatically with swaged on fine suture material.² Using a toothed Adson tissue forceps to manipulate the skin provides a firm grip that requires less pressure and inflicts less crushing injury than the Adson-Brown tissue forceps, although both have been described as more traumatic than the DeBakey thumb forceps.^{6,7} Suture material should be chosen that approximates the normal strength of the tissue and loses its tensile strength concomitant to the rate of recovery of wound strength.¹ It is important to obliterate dead space; however, the number of sutures and suture size (and therefore total amount of suture material) should be kept to a minimum.⁴ Skin closure may be completed using intradermal or cutaneous sutures, skin staples, or tissue adhesives.¹ Skin sutures should be placed 3 to 5 mm from wound edges to avoid increased collagenases near the wound edge, and 5 mm apart.² The use of reverse cutting needles decreases the risk of skin sutures cutting out through the skin edge; the depth of suture bites can be adjusted to precisely appose the wound edges and avoid step defects. In the short term, increased swelling or erythema may be seen with intradermal patterns due to increased tissue handling.⁸

If there is a small discrepancy between the length of the apposing skin edges, “fudging” is a simple technique to minimize the development of dog-ears; tissue bites are taken closer together on the shorter skin edge and further apart on the longer skin

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