Anatomy of the skin
The skin is composed of an outer epidermis consisting of stratified squamous epithelium and an inner dermis composed of connective tissue. Variations in feline cutaneous anatomy compared to other species may significantly impact wound healing and other considerations made in surgery. The epidermis of the cat is thinner than in the dog or humans. Similarly, the dermis as well as the subcutis, is also significantly thinner in the cat than in the dog. Another unique feature is that feline skin is pliable as well as very mobile over the majority of the body surface. Direct cutaneous arteries supply angiosomes which are composed of muscle, subcutaneous tissue and skin. Compared to other species, the cutaneous angiosomes of the cat has a lower density of tertiary vessels, particularly over the feline trunk. The subdermal plexus, which branches off the direct cutaneous arteries is the major route of the arterial blood supply to the skin.

Wound healing
Wound healing in the cat can be divided into first and second intention healing. Wound strength of first intention healing, or healing of clean, sutured skin wounds has been evaluated compared to dogs and found to be inferior. This difference has been correlated with a lower amount of collagen production in cat wounds and should be taken into consideration when evaluating a wound for suture removal.

Differences in second intention healing, or healing of open wounds, have also been identified. In cats, the inflammatory phase appears to follow a more chronic course and may be partially responsible for a delay in onset and progression of the proliferative phase. Compared to dogs, the observation as well as the production of granulation tissue is markedly slower in cats and often originates at the edges of the wound instead of the entire surface. Granulation tissue in cats also appears pale compared to other species in which the granulation tissue is often deep red in color. This delayed onset of granulation tissue production translates to a delay in contraction, epithelialization and ultimately complete wound healing in cats compared to other species.

Studies in cats have also identified that the subcutis in cats plays an important role in wound healing by providing an important source of precursor cells of granulation tissue. In patients that have had the subcutis extensively resected as in the case of major tumor resection, indolent pocket wounds have been identified and following suture removal, complete dehiscence has occurred. This is particularly a problem in areas of high motion such as the axilla and inguinal region. The use of a fasciotomy and fasciectiontomy have been shown to increase granulation tissue formation in these cases and help restore wound healing in these patients.

Potential benefits of the unique features of feline wound healing have been identified in cats undergoing radiation therapy as well as the successful engraftment of skin grafts. In patients undergoing radiation therapy, feline patients tend to recover more rapidly from the cutaneous side effects because of the less intense inflammatory response. Thinner skin and a weak inflammatory phase at the recipient site may result in superior “take” following skin graft procedures.
Wound assessment
A full history should be taken and a physical examination including an orthopedic and neurological examination performed. All patients showing signs of shock should be treated appropriately. Analgesics should also be administered. A complete blood count and chemistry panel are helpful in determining the general condition of the patient. Thoracic radiographs are recommended in cases of unknown trauma to rule out rib fractures, pulmonary contusions and diaphragmatic hernia. At initial assessment, a description of the wound as well as its location is recorded. Photographic documentation is also helpful to monitor wound progress and is recommended in cases of malicious acts. During patient stabilization, the wound is covered with a waterproof dressing to prevent contamination.

Once the cat is comfortable and can be safely sedated, the first aid dressing is removed and the wound is thoroughly assessed. Sterile aqueous jelly is placed in the wound and the fur is clipped away from the wound edges. Sterile instruments are used to probe any penetrating wounds and vascular perfusion is assessed by visual evaluation, feeling the tissue for warmth, palpating distal pulses and if necessary, using color flow ultrasound or Doppler to detect blood flow.

Initial wound management
Initial wound management involves lavage with a warm sterile isotonic fluid. Care must be taken to ensure the pressure of flushing does not drive foreign material into the wound. Contaminated and non-viable tissue is debrided; viable skin flaps should be retained for potential use later in wound closure. Following lavage, a swab is taken for culture and sensitivity to help guide future antibiotic therapy. If penetrating injuries are identified, surgical exploration should be performed once the patient is stable. The wound is then bandaged until the next assessment is performed.

Daily wound management
Bandages are changed daily initially and then as needed based on the degree of contamination and healing progression. Sedation or anesthesia is recommended to relieve stress and discomfort. Cats that require prolonged management may benefit from maintenance fluid therapy and a feeding tube to prevent dehydration from lack of water and food intake. Wounds should be assessed at each bandage change for the condition of the tissues, the presence of infection or inflammation, the level of moisture in the wound and the degree of epithelialization. The bandage is constructed of a primary layer which is in contact with the wound, and secondary and tertiary layers which allow for protection, absorption and support.

Options for wound closure for small wounds
Primary wound closure is reserved for simple, clean lacerations or surgical wounds. Delayed primary closure is used for wounds of unknown etiology or heavily contaminated wounds. The wound is managed as an open wound for 2-4 days to allow for appropriate debridement and drainage and to make sure that an appropriate blood supply exists. Secondary closure is reserved for patients that would benefit from a prolonged period of open wound management and includes patients with extensive tissue loss, contamination and infection. Second intention healing may be possible for some wounds, however the pros and cons of open wound management should be discussed in detail with the owner.

Bite wounds
Bite wounds from other cats occur most commonly and result in abscess formation secondary to the introduction of bacteria deep into the underlying tissues. *Pasteurella multocida* and obligate anaerobes are most commonly identified. Most patients respond to a 7-10 day course of amoxicillin, however some patients may need the abscess lanced and flushed. Cats should be
tested for FIV/FeLV approximately 6 months following the bite. Dog bites tend to result in crush injuries and tissue loss. These bites may result in continued tissue necrosis, bruising and hematoma formation which can provide an excellent medium for sepsis. Cats that have sustained dog bites should be carefully assessed for internal injuries in the thorax and abdomen since often times the degree of internal injury is much greater than suspected based on the cutaneous wound (iceberg affect).

**Burn wounds**
Burn wounds can occur from heating pad injuries, car engines, fires or malicious acts. The skin will often become hard to the touch, an eschar will form and discharge may be noted. The wound should be reassessed at 1 week since at this stage, further skin loss is unlikely and the eschar may be removed surgically.

**Non-healing wounds**
Some non-healing wounds in cats have been associated with infection, neoplasia, FIV/FeLV, foreign body sequestration, poor wound management and immunosuppressive therapy. Obtaining a thorough history is essential and helpful in understanding the cause of the non-healing wound. Further investigation including blood work, imaging, histopathological analysis and culture of abnormal tissue and culture may be recommended. Axillary wounds, which are most commonly caused by entrapment of a front leg in the collar, commonly form a non-healing wound despite aggressive treatment.

**Flaps and grafts**
In patients with large skin wounds, flaps and grafts provide the surgeon with further options with regards to closure of the wound. Although feline skin lends itself well to the use of axial pattern flaps even in the face of suboptimal wound beds, successful outcomes using skin grafts can be more challenging and require an optimal recipient bed as well as meticulous postoperative management.

**Subdermal plexus flaps**
Subdermal plexus flaps are a reliable method of reconstruction in the cat. Commonly used flaps include advancement flaps and rotation or transposition flaps. Less common are distant flaps used to reconstruct wounds at a remote site. Advancement flaps can be single pedicle or bipedicle flaps. These flaps are created parallel to lines of tension, rectangular in shape and have a skin attachment opposite the edge covering the wound. Paired advancement flaps can also be used. By design, a releasing incision is a bipedicle advancement flap. Advancement flaps are commonly used to close square or rectangular wounds. Transposition flap are used more commonly than rotation flaps. Transposition flaps are rectangular pedicle grafts that are rotated up to ninety degrees in order to cover the wound bed. Front and hind limb fold flaps are modifications of the transposition flap. Direct distant flaps are used for wound reconstruction of the middle or lower extremities. Flaps, which can be single or bipedicle, are raised on the flank and the affected limb is then sutured to the flap. The limb is then bandaged against the flank for 10-14 days while the flap attaches to the wound bed. To complete the transfer, the pedicle is divided in stages. Because there are many stages to this procedure, this technique can be time consuming and expensive.

**Free skin grafts**
In cats, free skin grafts are used primarily for reconstruction of large skin defects of the extremities when other options for closure do not exist. In cats, full thickness grafts are recommended for almost all procedures because they are more durable and robust and can tolerate considerable handling during preparation and placement. These grafts are also more
cosmetic in appearance than split thickness grafts. The donor skin used for free skin grafts is often taken from the flank area since this skin is of suitable thickness, durable and allows for primary closure of the donor site. Postoperative care of skin grafts is critically important to the success of the procedure.

Axial pattern flaps
Axial pattern flaps are pedicle grafts based primarily on the blood supply from a direct cutaneous artery and vein. Because of the elasticity of feline skin as well as the increase in body size to limb length, the use of axial pattern flaps can often facilitate more coverage of wounds on the distal limbs of cats. Regardless of flap performed, adequate planning is essential prior to undertaking a large reconstructive procedure.

The Thoracodorsal flap is based on the cutaneous branch of the thoracodorsal artery and vein. These flaps are used to reconstruct defects involving the shoulder, axilla, elbow and thorax. Depending on the conformation of the cat, this flap has been used successfully for wounds of the carpus. The Lateral thoracic flap is based on the lateral thoracic artery, which is a branch of the axillary artery. This flap is used for reconstruction of the thoracic limb and can be used to cover wounds extending distally to the carpus. The Omocervical flap, based on the superficial cervical branch of the omocervical artery, is a versatile flap and can be used for reconstruction of the head and neck. The Caudal superficial epigastric flap is based on the caudal superficial epigastric artery, a branch of the external pudendal artery. This flap can be used to close wounds of the flank, abdomen, inguinal region, perineum, thigh and hind limbs. Depending on the cat’s conformation, this flap can extend to the level of the feline tarsus and below.

Omental pedicle flap
The omentum has many properties that make it useful in augmenting wound closures that are complicated including a rich vascular and lymphatic network, humoral factors to help address infection, the ability to act as a natural drain and the ability to stimulate angiogenesis. With regards to wound management in cats, the omental pedicle flap has been used to augment closure of non-healing wounds and after thoracic wall resection.

Muscle flaps
An ideal muscle flap should be muscle that is easily accessible with minimal trauma to surrounding structures during dissection, have a consistent vascular supply, have an expendable function, and be of reasonable size and bulk. Muscle flaps used in the cat include the internal obturator transposition flap for perineal hernia closure, cranial sartorius flap for abdominal hernia repair or prepubic tendon avulsion, latissimus dorsi flap for thoracic wall reconstruction, semitendinosus flap for perineal hernia repair and the sternohyoid muscle for reconstruction of wounds in the cervical region.

Postoperative care
Depending on the procedure performed, postoperative care may involve the use active or passive drains to prevent seroma formation. Bandaging of the area is critically important to help decrease dead space, prevent seroma formation, protect the wound from contamination and protect from self-injury. For skin grafts, proper bandage placement is critical to immobilize the area. Dressings for free grafts should ideally not be changed for 72 hours to assure that the period of revascularization should not be disturbed. The frequency of bandage changes will vary with patient and graft technique used. Postoperative analgesia is very important and a multimodal approach is often recommended to keep patients comfortable and prevent self-trauma. Antimicrobial therapy is dictated by the underlying condition, patient and surgical procedure. Complications following flap procedures include seroma formation, edema, poor
wound drainage and dehiscence. Hematoma and seroma formation can predispose a patient to infection which can delay or prevent appropriate healing of the tissue to the wound bed. Wound dehiscence may occur secondary to excessive tension, poor circulation to the graft, infection, neoplasia, the presence of foreign material, lack of appropriate protection and support, or immune compromise secondary to underlying disease or medication administration.