Amputation

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In 1780, Thomas Kirkland, a Scottish physician/obstetrician wrote, “Any blockhead can do an amputation. The skillful man is the one capable of curing without operations”.(2) Many serious injuries to the limbs causing severe bone and soft tissue damage will heal when treated wisely with current techniques. The indications for leg amputation are based on irreversible changes or a poor prognosis for a functional limb. The failure of infected fractures to heal after prolonged treatment and the prospect of prolonged morbidity may justify amputation. A chronic infectious process such as chronic osteomyelitis may produce glomerulonephritis, myocarditis, or other lifethreatening disease. An acute progressive osteomyelitis can cause systemic disease and produce septicemia. Draining tracts from an infected bone can be a management problem. Joint distraction or deformity may interfere with mobility or may be unsightly. A fracture that is unstable following multiple surgical stabilization procedures may require amputation. In veterinary patients, economic limitation may also dictate treatment choices.

Neurologic dysfunction such as sciatic neuropathy or brachial plexus paralysis is confirmed by physical examination, electromyograms, and evoked potential measurements. These tests will help localize the lesions and identify which lesions are amenable to corrective surgery such as the relocation of muscles, the transfer of muscles and tendons, and/or arthrodesis. The neurologic damage is not considered irreversible until 6 months after injury. Electromyograms can be used to assess renervation progress during that time. If an owner is unwilling or unable to provide the necessary physical therapy to maintain limb function during the recuperative period, earlier amputation is justified. When muscle and tendon contracture or mutilation of the foot occurs, amputation may be necessary even if neurologic function has returned.

The prognosis and management of soft tissue and bony tumors of the limbs are discussed in Chapters 74-79. Amputation is indicated for those tumors that are slow to metastasize. In animals whose tumors are of the type that treatment by excision does not prolong life (e.g., osteosarcoma), amputation may still be indicated as palliative therapy for a painful or infected limb.

Other indications for amputation include congenital limb deformities, vascular disease, and arteriovenous fistulas.

Prosthetic devices are rarely used in animals. To avoid trauma to the amputation stump, amputations are performed at the level of the scapulohumeral joint or proximal femoral shaft or higher. Prosthetic limbs may be attempted in a patient with bilateral disease.” In one survey it was shown that owners were reluctant initially to consider amputation for their pets, but after the surgery they were satisfied with the mobility and appearance of the animals.(3)
PREOPERATIVE EVALUATION

Although an amputation may be lifesaving, haste is rarely indicated. The patient should be in the best possible condition to withstand and survive the surgical trauma. A complete physical examination is given. Shock, dehydration, anemia, and infection are recognized and treated. The other legs are palpated and manipulated to assess pain and range of motion. An elective amputation may be postponed if there is extreme obesity or severe skin disease such as bacterial dermatitis. The extent of a tumor is palpated. Associated nodes are evaluated and if necessary aspirated or biopsied.

Packed red blood cell volume (PCV) and plasma protein concentration (PP) determinations are made. If the PCV is less than 20%, a blood transfusion is given. Serum creatinine or serum urea nitrogen measurements are made if the animal is older than 3 years. Additional blood chemistry tests, clotting profiles, or other laboratory tests are performed as needed.

Radiographic evaluation of the involved leg can help determine the extent of a neoplasm or an infection. Pelvic radiographs are indicated before rear leg amputation in dogs predisposed to hip dysplasia. The thorax is radiographed to rule out metastasis if a tumor is suspected.

Antibiotic administration is begun a sufficient time before surgery to establish antibiotic tissue levels in dogs with osteomyelitis or immunosuppression. An intravenous line is established, and balanced electrolyte solutions are administered during surgery.

GENERAL PRINCIPLES OF AMPUTATION TECHNIQUE

The surgical site is clipped widely. Fresh wounds are cleaned and debrided until the operative field is clean. Old wounds should display a cherry red granulating surface. After the leg is hung in a vertical position, the surgical site is prepped for aseptic surgery. The entire leg is draped to permit free manipulation. If there is an open infected wound distal to the amputation site, a water-impermeable wrap is used.

The skin incision is generous so that there will be no tension when closing. Excess skin can be trimmed later if necessary. The skin is not separated from tendon and muscle when the configuration of both is identical. This aids in grouping muscles about the side of the bone. Throughout the surgery there should be systematic and orderly dissection with good visualization and control of bleeding. The major arteries are doubly ligated and transfixed. The major veins are doubly ligated. The arteries and veins are not ligated together to prevent the development of an arteriovenous fistula. Vessel branches to remaining muscles are preserved. When the muscles are cut with a scalpel, hemostasis of the muscle belly is achieved with electrocautery or ligation. If the muscles are severed with electrocautery, the muscles contract as they are cut. Care must be taken not to remove too much muscle.

An adequate resection for tumors requires that normal tissue be excised with the tumor. It may be necessary to remove additional muscle mass with a soft tissue tumor. Veins should be ligated first to prevent possible spread of tumor cells during manipulation.

Nerves are gently pulled distally, severed, and allowed to retract into fascial planes. Extensive traction or crushing is avoided.

All metal is removed from a previously repaired fracture. A swab for bacterial culture is taken if indicated.

Before a bone is cut, the periosteum is excised circularly at the level of the amputation. The periosteum is scraped distally to avoid leaving detached periosteum in the bone stump, which may cause bone spur formation in immature animals. The bone is cut transversely with a saw, Gigli wire, or bone cutters. The end is smoothed and rounded with a file. Bone dust is irrigated away and all fragments are removed. After a disarticulation no special treatment is required for the cartilage of the glenoid fossa or the acetabulum.

The leg is removed from the operating table. If there is a question about complete removal of a soft tissue tumor, a biopsy is taken near the stump. The entire leg is submitted for histopathologic diagnosis so that skip metastases can be identified.

Muscles are apposed by inverting the cut edges and placing absorbable mattress sutures through the external fascia. Drains may be placed in dead space areas for 48 to 72 hours. The skin is sutured so that the incision line is not over pressure points.
such as the acromion or ischium. The skin flaps are approximated with interrupted skin sutures. There should be neither excessive skin tension nor redundant skin. Normal skin sensation and mobility and adequate subcutaneous fat provide protection against trauma. An elastic compression bandage is applied smoothly to minimize edema and eliminate dead space.

After surgery the patient is monitored for pain, hypothermia, and excessive bleeding. Initially assistance in standing and walking is provided to prevent bruising of the surgical site.

METHODS OF LIMB AMPUTATION

The techniques for thoracic limb amputation are illustrated in the following figures: Removal of the scapula (Forequarter amputation) in figures 48-1 to 48-7; scapulohumeral joint disarticulation in figures 48-8 to 48-15.

The techniques for pelvic limb amputation are illustrated in the following figures: Coxofemoral disarticulation in figures 48-16 to 48-23; osteotomy of the proximal one-third of the femur in figures 48-24 to 48-30.

FIG. 48-1 An inverted Y-shaped skin incision is made extending along the spine of the scapula to the greater tubercle and half way to the elbow. The incision is extended medially from the fold of the axilla to the greater tubercle.

FIG. 48-2 Lateral view. The axillobrachial and omobrachial veins are ligated and severed proximal to the greater tubercle. The cephalic vein is ligated and severed distal to the cleidobrachialis muscle. The location and size of these veins are variable. The brachiocephalicus muscle is transected through the clavicular tendon. The omotransversarius and trapezius muscles are severed along the cranial edge of the spine of the scapula.

FIG. 48-3 Lateral view. The latissimus dorsi muscle is separated from the teres major and severed close to its insertion on the humerus.

FIG. 48-4 Cranial-medial view. The cranial edge of the scapula is rotated externally. The insertions of the rhomboideus and serratus ventralis muscles are severed. The suprascapular artery and vein are ligated and severed. The suprascapular nerve is severed. The superficial and deep pectoral muscles are transected at their attachment on the humerus.

FIG. 48-5 Cranial-medial view. The subscapular nerve is severed. The nerves of the brachial plexus are severed. The axillary artery is doubly ligated, transfixed, and severed (see insert). The axillary vein is ligated and severed.
FIG. 48-6 Closure. The cut ends of the muscle bellies are turned inward.

FIG. 48-7 The lateral fascial sheaths of the latissimus dorsi muscle, omotransversarius muscle, and the trapezius muscle are sutured to the lateral fascial sheaths of the pectoral muscle.

FIG. 48-8 A lateral semilunar skin incision is made from the point of the shoulder to the caudal angle of the axilla. A straight medial skin incision connects the sides of the lateral incision.

FIG. 48-9 Lateral view. The axillobrachial and omobrachial veins are ligated and severed just proximal to the greater tubercle. The cephalic vein is ligated and severed distal to the cleidobrachialis muscle. The size and location of these veins are variable.

FIG. 48-10 Lateral view. (a) The cleidobrachialis muscle is transected distal to the clavicular tendon. (b) The deltoid is severed at its insertion on the deltoid tuberosity of the humerus. (c) The lateral and long heads of the triceps muscle are separated from the caudal border of the humerus and the brachialis muscle. (d) The tendon of insertion of the triceps muscle is severed at its insertion on the olecranon.

FIG. 48-11 Medial view. The scapula and humerus are elevated to expose the medial surface. The brachial artery is doubly ligated, transfixed, and severed. The median, ulnar, radial, and musculocutaneous nerves are severed.

FIG. 48-12 Cranial view. The pectoral muscles are transected through their insertions on the humerus. The supraspinatus tendon is severed at its insertion on the greater tubercle.
FIG. 48-13 Lateral view. The tendons of the biceps brachii, infraspinatus, and teres minor are severed.

FIG. 48-14 Disarticulation. Beginning cranially and proceeding caudolaterally, the joint capsule is incised. The medial joint capsule is incised and the coracobrachialis tendon is severed.

FIG. 48-15 Closure. The fascial sheaths of the triceps brachii and the deltoid muscles are sutured to the brachiocephalic and pectoral muscles.

FIG. 48-16 The lateral skin incision extends from the fold of the flank across the midshaft of the femur to the ischial tuberosity. The medial skin incision is made 1 cm distal to the inguinal crease.

FIG. 48-17 Medial view. The leg is elevated. The femoral artery is doubly ligated, transfixed, and severed proximal to the proximal caudal femoral artery. The femoral vein is ligated and severed at the same position. The sartorius, pectineus, and gracilis muscles are severed through their muscle bellies 2 cm from the inguinal crease.

FIG. 48-18 Medial view. The proximal part of the pectineus muscle is reflected proximally, exposing the medial circumflex femoral artery and vein. The vessels are ligated and severed. The iliopsoas and adductor muscles are transected.

FIG. 48-19 Lateral view. The tensor fascia lata and biceps femoris muscles are transected at the level of the midfemur.
FIG. 48-20 Lateral view. The biceps femoris muscle is reflected proximally to expose the sciatic nerve. The sciatic nerve is severed. The semimembranosus and the semitendinosus muscles are transected at the level of the proximal one-third of the femur. The vastus lateralis, medialis, and intermedius are not severed and are removed with the femur.

FIG. 48-21 Lateral view. The semimembranosus and semitendinosus are reflected proximally to reveal the gemelli, internal obturator, and quadratus femoris muscles. These muscles are transected at their insertions on the femur. The gluteal muscles are transected at their insertions on the femur. The rectus femoris muscle is transected at the level of the greater trochanter. The lateral joint capsule is incised cranially, dorsally, and caudally.

FIG. 48-22 Medial view. The leg is elevated. The pectineus and iliopsoas muscles are reflected proximally. The medial joint capsule is incised and the round ligament is severed.

FIG. 48-23 Closure. The biceps femoris muscle is sutured to the gracilis, semimembranosus, and semitendinosus muscles. The tensor fascia lata muscle is sutured to the sartorius muscle.

FIG. 48-24 The lateral skin incision extends from the fold of the flank across the junction between the proximal two-thirds and distal one-third of the femur. The medial skin incision is made 2 cm distal to the inguinal crease.

FIG. 48-25 Medial view. The femoral artery is doubly ligated, transfixed, and severed just proximal to the proximal caudal femoral artery. The vein is ligated and severed at the same position.

FIG. 48-26 Lateral view. The tensor fascia lata, cranial part of the sartorius, quadriceps, and biceps femoris muscles are transected at the level of the distal femur.
COMPLICATIONS
Immediate postoperative bleeding beneath the wound may develop very slowly as gradual oozing or may occur as sudden massive hemorrhage. If the amount of blood loss is minimal it is aspirated and a pressure bandage is applied. A large amount of hemorrhage indicates an openly bleeding vessel; in such a situation the operative wound should be opened, the vessel ligated, and the incision resutured. Accumulations of blood should be removed to prevent infection or excessive fibrous tissue production.

Superficial infections are treated with hot packs and antibiotic therapy. A localized, purulent infection should be drained. Skin ulceration may be caused by inaccurate skin approximation, hemorrhage, inappropriate drainage, or circulatory impairment due to a tight closure, edema of the stump, or excessive bandage compression. It is treated with hot packs, excision of ulcerated tissue, and wound closure without tension. It may be necessary to resect bone at a more proximal level.

DEWCLAW AMPUTATION
Dewclaws are removed from show dogs except in the Briard and Great Pyrenees breeds. They are also removed in hunting dogs to prevent their laceration during hunting. During the first few days of life, the dewclaws are amputated with scissors. An absorbable suture is placed to unite the skin.

In older dogs, a surgical incision is necessary prior to disarticulation of the carpometacarpal or tarsometatarsal joint (Fig. 48-31).
TAIL AMPUTATION
Amputation of the tail is performed for cosmetic purposes in some breeds and the length is determined by individual breed standards. Amputation is also indicated following severe trauma or denervation of the tail. A tourniquet applied to the base of the tail will reduce hemorrhage. The technique is illustrated in Figure 48-32.

FELINE ONYCHECTOMY
Feline onychectomy or declaw procedure is performed in cats to prevent scratching and damage to furniture and draperies. Usually, only the front claws are removed. It is very important to remove all of the germinal tissue contained in the ungual crest. The entire third phalanx can be dissected out and removed. A small part of the palmar surface of the third phalanx can be left without causing regrowth of the nail. Following the onychectomy the second phalanx should be examined. If any of the remaining third phalanx overlaps the second phalanx, the piece of third phalanx should be dissected out and removed. The technique is illustrated in figures 48-33 to 48-35.
REFERENCES


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