

Amputation Techniques in Small Animals- Anatomical Considerations and Surgical Approaches

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Introduction

Limb amputation is a routinely performed surgical intervention in small animal veterinary practice, involving the removal of limb from the body. Common indications for limb amputation in small animals include traumatic injuries that result in extensive soft tissue damage, irreparable fractures and significant neurologic injuries such as brachial plexus avulsion. Other reason for amputation includes tumors (Neoplasia), loss of blood supply to the limb (Ischemic necrosis), severe arthritis that cannot be controlled with treatment and serious birth defects that affect limb function. Preoperative evaluation of the patient's physiological status is essential prior to performing a major limb amputation. Because it involves the removal of significant volume of fluids, electrolytes and RBCs. Preoperative epidural anaesthesia is essential in patients for pain management. Forelimb amputation can be performed either by disarticulating the shoulder joint or by removing the scapula. Hindlimb amputation may involve either a midshaft femoral transection or disarticulating at the coxofemoral joint. Post operative monitoring is vital for early detection and management of complications.

Causes for Amputation

Amputation procedure is considered as a last resort measure in a variety of cases, which includes

- **Extreme trauma to the limb:** The most common cause, mostly as results of motor accidents, fall injuries, attack from other animals, mauling, etc.
- As an important tool in improving the quality of life of animals who have lost control over the limbs due to acquired

conditions such as spinal trauma or canine distemper.

- **Severe infections of the limb:** Amputation is done in case of extensive necrosis or due to infection, as a measure to curb the spread, thus saving its life. As in case of chronic Osteomyelitis or gangrene.
- **Congenital or developmental abnormalities** like Hemimelia (partial development Of the limb), Peromelia (malformation of, particularly the proximal extremity of limb).
- **Neoplasia of limb tissue:** Amputation is a vital treatment for aggressive bone cancers, such as osteosarcoma, and other extensive tumors of the soft tissues. Removing the entire tumor-bearing limb can prevent the spread of cancer (metastasis) and significantly extend the animal's life..
- **Infarction of limb tissues,** due to thromboembolism, trauma etc. which can cause severe pain, sepsis and accumulation of toxin in the system.

Site of Amputation

The site of amputation depends largely on the reason for the surgery and the location of the disease or injury.

Here are the common sites of amputation in small animals:

1. Thoracic limb (Forelimb) amputation
2. Pelvic limb (Hind limb) amputation
3. Digit / Toe amputation
4. Tail amputation

The two most common amputation techniques used on small animals are forelimb and hindlimb.

Forelimb Amputation

In dogs and cats, the forelimb is not connected to the axial skeleton by a clavicle, but rather by muscular attachments. This anatomical feature makes a complete **forequarter amputation** the most common and effective technique. In this procedure, the entire limb, including the scapula, is removed by disarticulating it from the chest wall. This method provides excellent long-term results by preventing the remaining limb bones (humerus, etc.) from interfering with a comfortable gait. Other less common techniques include:

- **Scapulohumeral Disarticulation:** Involves amputation at the shoulder joint, leaving the scapula attached.
- **Humeral Osteotomy:** The humerus bone is surgically cut, leaving a portion of the bone and scapula behind. This is less common due to a higher risk of complications and less cosmetic outcomes.

Hindlimb Amputation

Hindlimb amputations are also routine and life-saving procedures. The most common techniques are:

- **Coxofemoral Disarticulation:** This involves completely removing the entire limb by disarticulating it at the hip joint. It is often the preferred method for tumors or severe injuries affecting the upper femur.
- **Midshaft Femoral Amputation:** The femur is surgically cut through its shaft, leaving a small segment of bone. The remaining muscle bellies are then used to cover the stump. This technique is often used for injuries or diseases affecting the lower portion of the limb.

Other Amputations

While less common, veterinarians also perform **digit/toe amputation** for localized injuries or infections and **tail amputation (caudectomy)** for trauma, tumors, or chronic infections.

Impact of amputation in functional competency of small animals

Amputation is a surgical procedure that results in permanent anatomical alteration in the patient. Amputation in small animals, particularly

dogs and cats, generally has a remarkable impact on their functional competency.

The benefits of conducting amputation in small animals include:

- **Pain relief and improved quality of life**
Many conditions such as severe trauma, aggressive bone cancers (like osteosarcoma), severe arthritis etc., cause immense and ongoing pain. Amputation removes the source of this pain, leading to better life.
- **Disease control and prevention of spread**
In case of aggressive tumors, particularly bone cancer, amputation can be life-saving by completely removing the primary tumors. This prevents spread of cancer to other parts of body (metastasis) and extends animal's life. Several infections that are unresponsive to antibiotics or other treatment and that can cause extensive tissue damage or necrosis can be controlled by amputation of infected part.
- **Resolution of deformity (congenital defects)**
Some animals are born with limb deformities that hinder their mobility and cause discomfort. Amputation can remove the non-functional limb allowing them to move freely and comfortably.

Limitations of Amputation in Small Animals:

- **Potential complications**
After amputation, the occurrence of potential complications including seroma formation (accumulation of serous fluid in the space beneath the skin), bleeding, infection and suture line dehiscence, is one of the major setbacks.
- **Risk of blood loss**
During the surgical procedure, there is a high risk of blood loss. Proximal limb amputations carry a higher risk of bleeding due to the presence of major vessels like the femoral artery or the arteries associated with the brachial plexus.
- **Pain**
During the first year after amputation, phantom limb pain (PLP) is reported in animals too, since humans and animals share similar pain pathway.
- **Reduced endurance and strength**

Amputee animals may have decreased strength and endurance as compared to their four-limbed counterparts, especially for rigorous activities.

Physiological implications of amputation

The procedure has just as massive impact on the physiology, as it does on the anatomy of the animal.

- Post-operative pain management can be both acute and chronic. The acute pain after the surgery can be combatted by means of analgesia such as nerve block, NSAIDs, opioids etc. Their chronic counterparts, stump pain and PLP are trickier to resolve, characterized by modified behaviours such as spontaneous yelping, scratching the location of the limb etc.
- The increased load on the remaining limbs increases and thus, causes physiological changes such as muscle hypertrophy whereas stress on the joints may degenerate causing osteoarthritis, particularly on the opposing limb.
- The general disposition and gait of the animal is altered, to adapt to the tripod condition.
- Animals generally become more active than before to compensate for the missing limb – leading to increased metabolic demands.
- The brain begins to re-map neural network to adapt to the absence of the limb, allowing for the adaptation of life on a reduced number of limbs.

Psychological impact of amputation

Amputation can cause anxiety and stress in minds, which shows as increased aggression and loudness, self-mutilation and changed sleep patterns. They also may be clumsy and hesitant to move initially due to the disorientation following surgery.

However, they learn to adapt to their new lifestyle remarkably fast, since they have simpler thoughts than humans, who might brood over the loss of an appendage. They return to their normal lifestyles eventually, with increased adaptability.

Other animals may give a negative response to the patient upon reintroduction to their social groups initially, and the animal is more subdued and less playful. The psychological rehabilitation is largely helped by a supportive, calming influence from the owners and proper physiotherapy to help adjust the shift in weight distribution.

Conclusion

Amputation in small animals, while a significant surgical intervention, remains a vital and often life-saving procedure. Amputation should be performed only as a last resort when preserving normal function is no longer possible. A detailed evaluation of the patient's physical status is essential before performing major procedures like forelimb or hind limb amputation. The preoperative condition of animals is of great significance since a large amount of fluid, electrolytes, and blood is lost during the surgical procedure. Animal welfare laws generally aim to prevent cruelty and ensure humane treatment of animals. The Prevention of Cruelty to Animals Act, 1960 exclaims it is an offense to inflict unnecessary pain or suffering on any animal. In essence, amputation, when indicated and performed with meticulous technique and comprehensive perioperative care, is a highly successful and rewarding procedure in small animal veterinary medicine, allowing many pets to lead full, pain-free lives.

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