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# Final year project

In partial fulfillment of the requirements for the degree of **Doctor of Veterinary Medicine**

**Field:** Nature and life science

**Program :** Veterinary sciences

**TOPIC**

# Surgery of the external and middle ear in domestic carnivores: Surgical techniques and illustration through case studies

**Presented by:**

**Miss GASMI Marwa Anfal**

**Mr SIAD Abdelmalek**

Publicly defended on 02/July/2025 before a jury composed of:

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**Honor statement:**

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Accordingly, we commit to properly citing all the sources we have used in the writing of this thesis.

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**Acknowledgement**

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## Dedication

It is an emotional moment for me to write these words. Reaching this point standing here with this accomplishment in hand was far from easy. The road was full of challenges, moments of doubt, and quiet perseverance. But none of it would have been possible without God's guidance, which I place above all else.

To my **dearest parents**, the pillars of my life thank you for your endless love, sacrifices, and prayers. Your unwavering belief in me gave me the strength to push forward even in the hardest moments.

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*Anfal*

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This work is a labor of love, dedicated to all of you who've made me who I am today.

*Abdelmalek*

**ABSTRACT:**

The ear is a complex organ essential for hearing and balance, composed of the external, middle, and inner parts. In small animals, the external and middle ear are commonly affected by conditions such as otitis externa, otitis media, aural hematomas, neoplasms, and trauma. These disorders, particularly frequent in dogs, often present with similar clinical signs, making accurate diagnosis crucial for effective treatment. When medical management fails, surgical intervention becomes necessary to relieve pain, resolve infection, or restore function. This work reviews the relevant surgical anatomy, describes common ear disorders requiring surgery, and outlines therapeutic and cosmetic techniques. It is supported by clinical case studies from veterinary clinics in Algiers to illustrate practical surgical approaches in dogs and cats.

**Keywords:** Ear, surgery, hematoma, dogs, cats.

**RESUME:**

L'oreille est un organe complexe, essentiel à l'audition et à l'équilibre, composée de trois parties : l'oreille externe, moyenne et interne. Chez les petits animaux, l'oreille externe et moyenne sont fréquemment touchées par des affections telles que l'otite externe, l'otite moyenne, les hématomes auriculaires, les néoplasmes et les traumatismes. Ces troubles présentent souvent des signes cliniques similaires, rendant le diagnostic précis indispensable pour un traitement efficace. Lorsque le traitement médical échoue, une intervention chirurgicale devient nécessaire pour soulager la douleur, traiter l'infection ou restaurer la fonction. Ce travail passe en revue l'anatomie chirurgicale pertinente, décrit les principales affections auriculaires nécessitant une chirurgie, et expose les techniques chirurgicales à visée thérapeutique ou esthétique. Il est appuyé par des cas cliniques issus de cliniques vétérinaires de la région d'Alger, illustrant des approches chirurgicales pratiques chez le chien et le chat.

**Mots clés:** Oreille, chirurgie, hématome, chien, chat.

**ملخص:**

الأذن عضو معقد وأساسي لحاستي السمع والتوازن، وتتكوّن من ثلاثة أجزاء: الأذن الخارجية، الوسطى، والداخلية. في الحيوانات الصغيرة، غالبًا ما تتعرض الأذنان الخارجية والوسطى لأمراض مثل التهاب الأذن الخارجية، التهاب الأذن الوسطى، الورم الدموي الصيواني، الأورام، والإصابات الرضحية. غالبًا ما تتشابه الأعراض السريرية لهذه الحالات، مما يجعل التشخيص الدقيق ضروريًا للعلاج الفعّال. وعندما يفشل العلاج الطبي، تصبح التدخلات الجراحية ضرورية لتخفيف الألم، ومعالجة العدوى، أو استعادة الوظيفة. يستعرض هذا العمل التشريح الجراحي ذي الصلة، ويصف أبرز أمراض الأذن التي تتطلب تدخلاً جراحياً، ويعرض تقنيات جراحية علاجية وتجميلية. كما يستند إلى حالات سريرية من عيادات بيطرية في منطقة الجزائر العاصمة، لتوضيح النهج الجراحي العملي لدى الكلاب والقطط.

**كلمات مفتاحية:** الأذن، جراحة، ورم دموي، قطط، كلاب.

**SUMMARY:**

**SECOND PART: PRACTICAL PART**

**TABLE OF FIGURES:**

## GLOSSARY

- **Transcanal endoscopic polypectomy:** A minimally invasive surgical technique used to remove aural polyps by introducing an endoscope through the external auditory canal, providing direct visualization and access to the lesion without external incisions.
- **Heterogeneous contrast enhancement:** an irregular or non-uniform uptake of contrast medium within the ear structures observed on imaging, typically indicating the presence of abnormal tissue such as inflammation, infection, neoplasia, or granulation tissue.

# INTRODUCTION:

The ear is a critical organ responsible for both auditory function and equilibrium. It is anatomically divided into three regions: the external ear (comprising the pinna and external auditory canal), the middle ear (including the tympanic cavity, the tympanic membrane, and ossicles), and the inner ear (which handles sensory functions) **(Evans and De Lahunta, 2013).**

Among these, the external and middle ear are particularly relevant in clinical surgery due to their frequent involvement in pathological processes that may require operative interventions. Conditions such as chronic otitis externa, otitis media, aural hematomas, polyps, neoplasms and traumatic injuries are commonly encountered in small animal practice, and when medical therapy fails or proves to be insufficient, surgical treatment becomes necessary **(Fossum, 2019).**

Auricular disorders represent a frequent reason for consultation especially in dogs and to a lesser extent in cats. These conditions can cause considerable discomfort, chronic pain, and in some cases, serious complications. Clinical signs such as head shaking, scratching, ear discharge, odor, and pain are frequently observed, yet they are often similar across different pathologies, making accurate diagnosis a challenge. This overlap in clinical presentation demands a rigorous and precise diagnosis approach from the veterinary practitioner to distinguish between underlying causes and to guide affective treatment **(Maginn, 2016; Jacobson, 2002).**

The objective of this document was to provide a practical understanding for the surgical anatomy relevant to auricular interventions, to identify and describe ear disorders requiring surgery, and to explore and highlight the different surgical approaches and techniques, whether therapeutic (aimed at treating pathology) or cosmetic (aimed at improving appearance).

This study is limited to the external and middle ear. the inner ear is excluded from the scope, although it is mentioned briefly for anatomical context. Several techniques are presented in detail, including the widely accepted incisional method of treating aural haematomas, as well as the lateral ear canal resection technique, total and partial ear canal removal and others. The present study is structured into two main parts. The first part is dedicated to bibliographic review (anatomical reminders, external and middle ear disorders that requires surgical treatment, surgeries for therapeutic purposes and surgeries for cosmetic or aesthetic purposes).

The second part is dedicated to some clinical cases studies involving domestic carnivores, specifically dogs and cats, which were treated in veterinary clinics within the province of Algiers.

# FIRST PART :
# BIBLIOGRAPHIC PART

# I CHAPTER I: ANATOMICAL REMINDERS

The ear is divided into three main parts: the external ear, the middle ear, and the inner ear. The external ear includes the auricle (or pinna) and the external auditory canal. The middle ear contains the tympanic cavity, which connects to the throat via the Eustachian tube, and the inner ear, ~~is~~ made up of structures that are essential for hearing and balance. The tympanic membrane separates the external and middle ear, and the auditory canal leads into the middle ear. Tiny bones called the auditory ossicles connect the eardrum to the inner ear. This study will highlight the fundamental anatomical elements necessary for comprehending the different affections and surgical treatments of the external and middle ear. ***(*Lanz and Wood, 2004).**

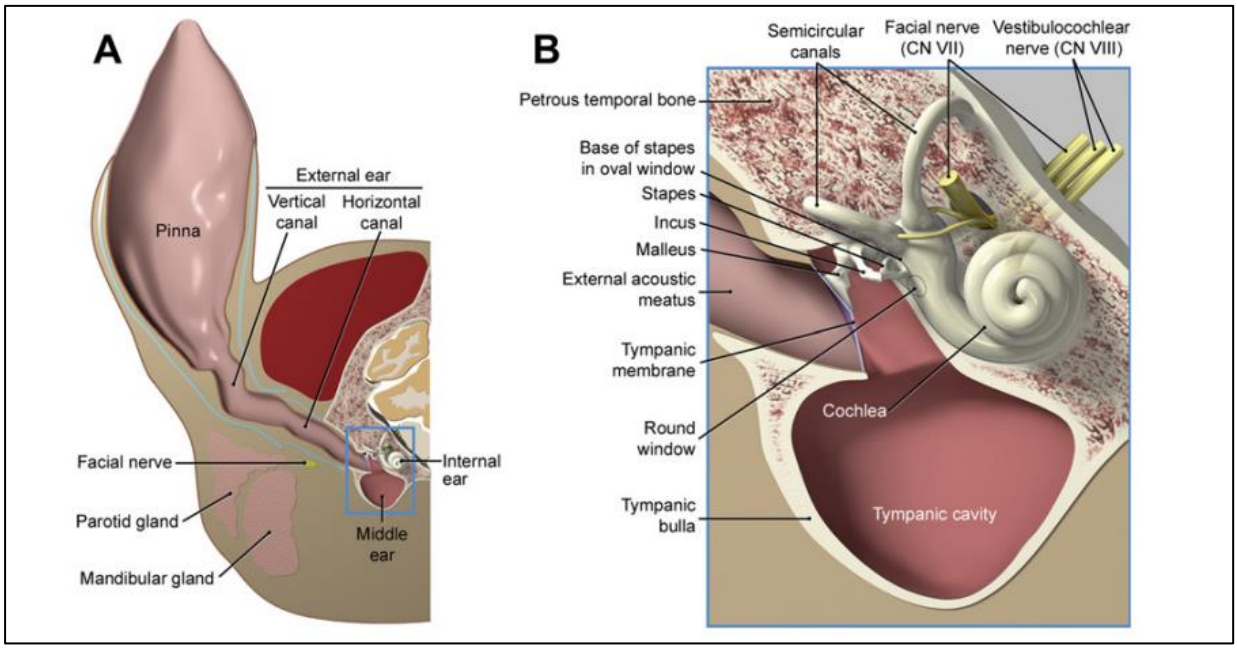


**Figure 1:** Schematic diagram of the external, middle, and internal ear, dog. (A) Cross-section through the skull. (B) Close up view of the middle and internal ear outlined in the blue square (Njaa et al, 2012).

## I.1 External ear:

Dog breeds differ significantly in the size and form of their external ears. The auricular cartilage, through which numerous blood vessels pierce, shapes the pinna. Along with the medially neighboring annular cartilage, it develops many folds at its base before taking on a tubular shape to form the external ear canal **(Schwarz and Saunders, 2011).**

### I.1.1 Ear pinna:

The pinna, or auricle, is the prominent outer ear structure. Its positioning varies by dog breed, while it generally stands upright in cats. It functions to focus and gather sound waves, transmitting them to the eardrum. Three muscle groups (rostral, ventral, and caudal), controlled by branches of the facial nerve (cranial nerve VII), enable ear movement. The leaf-shaped pinna of the external ear is broad, with distinct rostral (medial) and caudal (lateral) margins. A small skin pouch, called the marginal pouch, is found along the caudal edge, though it serves no clear function **(Venier, 1992).** The anthelix is the medial ridge characterized by a prominent tubercle, located on the inner side of the entrance to the vertical ear canal as shown in **Figure 2 (Harvey *et al*, 2001).** The skin on the concave side is tightly bound to the auricular cartilage, highlighting its shape. The pinna's size and form differ across dog breeds, due to the auricular cartilage, which contains blood vessels from the caudal auricular artery. The cartilage is the largest component of the external ear structure containing the conchal cartilage (an elastic plate that supports the pinna from base to the apex) **(Venier, 1992).**


**Figure 3** :The prominent tubercle of the anthelix (arrow) is clearly visible on the inner (medial) side at the entrance of this dog's external ear canal (Harvey *et al*, 2001).

**Figure 2:** Pinna of a German Shepherd (Harvey and Paterson, 2014).

It is also important to mention that the ear pinna has generally more delicate and less robust structure in cats compared to dogs **(Griffin, 2010).**

### I.1.2 External ear canal or external acoustic meatus:

In dogs, the external ear canal measures 5 to 10 cm in length and 4 to 5 mm in width. It has two parts: an initial vertical section, which may extend up to 2,5 cm, running ventrally and slightly rostrally, followed by a shorter horizontal section that runs medially. This horizontal portion completes the external ear canal. The canal is flexible due to the elasticity of the external ear, allowing it to be

straightened for otoscopic examination. Most of the canal, including the vertical and a significant portion of the horizontal sections, is cartilaginous, while the deepest part is osseous. The canal is lined with skin containing sebaceous and ceruminous glands, as well as hair follicles. The ceruminous glands, which are modified apocrine tubular sweat glands, combine with sebaceous glands to produce earwax (cerumen). Cerumen serves to protect the external ear canal by trapping foreign particles and keeping the tympanic membrane moist and pliable. The external ear canal is separated from the middle ear by the semitransparent tympanic membrane **(Cole, 2009).**

## I.2 Middle ear:

### I.2.1 Tympanic cavity:

The tympanic cavity can be divided into three parts: a dorsal part, or epitympanic, a middle part, or mesotympanic, and a ventral part, or hypotympanic as shown in **Figure 4.**

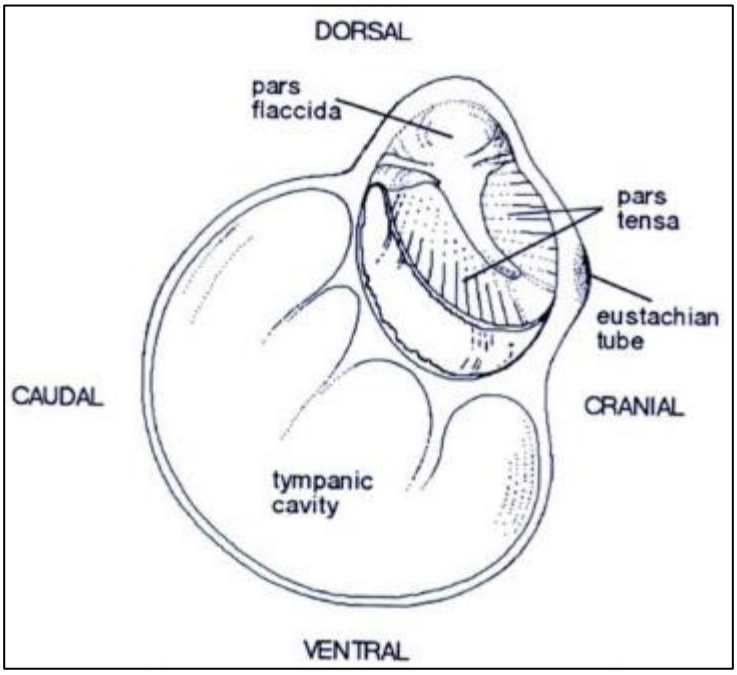


**Figure 4:** Interconnected Anatomy of the Tympanic Membrane, Tympanic Cavity, and Osseous Bulla (Slatter, 2003).

The auditory ossicles are located in the dorsal part, while the auditory tube opens ventrally and medially, establishing a connection with the nasopharynx.

The most ventral part is formed by the tympanic bulla, which serves as the resonating chamber of the middle ear. In most techniques, its bony structure provides access to the middle ear. On the medial surface of the wall, there is a bony prominence called the promontory, which houses the cochlea.

The vestibular window, also known as the oval window, is connected to the base of the stapes and is located dorso-laterally on the surface of the promontory. In cats, the tympanic bulla is the most important landmark on the ventral surface of the skull. The middle ear cavity is divided into two sections by a bony septum that runs along the wall of the tympanic bulla, connecting the rostral half to the lateral half. This septum is incomplete dorsally, resulting in two unequal compartments: the larger one extends ventrally, medially, and caudally relative to the smaller one. These characteristics are clearly visible on an 'open-mouth' radiograph of the tympanic bullae in cats **(Delahaye, 1993).**

### I.2.2 Auditory ossicles:

The middle ear contains three small bones that transmit sound vibrations to the inner ear. The malleus, which is the largest and located furthest outward, connects to the tympanic membrane. The stapes, the smallest and innermost bone, passes the vibrations to the inner ear. Positioned between them is the incus, which links the two bones and completes the chain **(Delahaye, 1993).**

**The malleus**, the largest auditory ossicle, features a long extension with its head articulating dorsally with the incus, forming the incudo-malleolar joint. This joint is stabilized in the epitympanic recess by ligaments. The chorda tympani, a branch of the facial nerve, exits the facial canal beneath the malleus and medial to the pars flaccida before leaving the middle ear. **The incus**, smaller than the malleus, has two crura; the short crus is anchored in the epitympanic recess, while the long crus extends medially and caudally, connecting to the stapes via the lenticular process, forming the incudo-stapedial joint. **The stapes**, the smallest ossicle, is anchored to the oval window by the annular ligament and transmits sound vibrations from the tympanic membrane into fluid waves in the inner ear's perilymph **(Njaa and Cole, 2012).**

### I.2.3 Tympanic membrane:

The tympanic membrane, commonly known as the eardrum, is easily examined during clinical evaluations with an otoscope. Its external surface is lined with stratified squamous epithelium, while the internal surface is covered with simple squamous epithelium. Sandwiched between these layers is fibrous connective tissue. The membrane is circular or oval in shape and consists of two main regions: the pars flaccida and the pars tensa. Additional notable structures include the umbo, which marks the point of attachment of the malleus to the tympanic membrane, and the stria mallearis, a visible ridge formed by the handle of the malleus as shown in **Figure 5 (Paterson and Tobias, 2012)**. The pars flaccida, located on the dorsorostral aspect, is a small triangular area with sparse collagen fibers. In contrast, the pars tensa makes up the majority of the tympanic membrane **(Heine, 2004).**

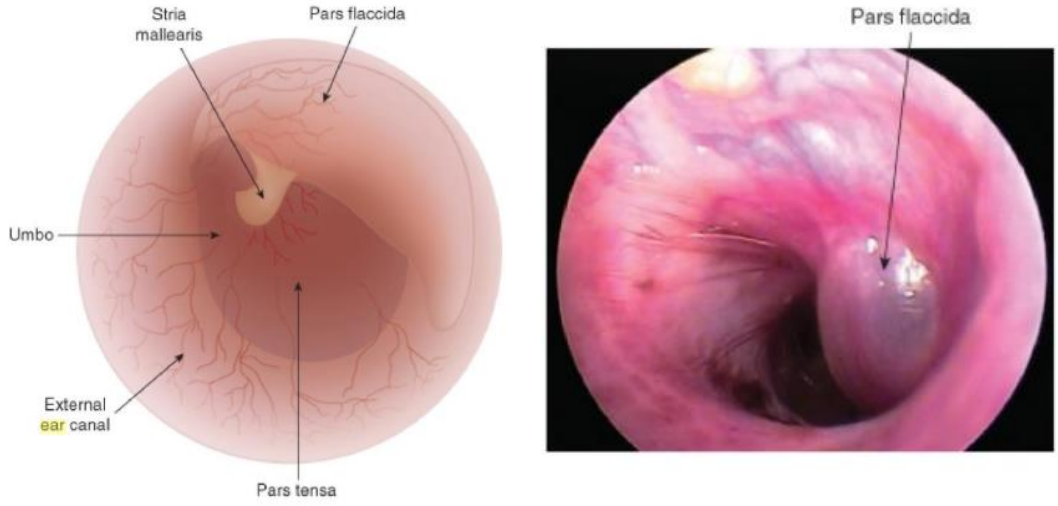


**Figure 5:(**A) diagram that illustrates the key anatomical features of the tympanic membrane, including the pars tensa, pars flaccida, umbo, stria mallearis, and the opening of the external ear canal. (B) Prominent Pars Flaccida potentially misinterpreted as a mass (Paterson and Tobias, 2012)

## I.3 Inner ear:

The inner ear contains the sensory organs for hearing and balance. It resides within the petrous part of the temporal bone and consists of a membranous labyrinth enclosed within a bony labyrinth **(Tobias,2015).**

This part of the ear falls outside the scope of our project and will therefore not be addressed in the present study.

## I.4 Angiology:

The external carotid artery gives rise to the caudal auricular artery, followed by the superficial temporal artery, which supplies most of the pinna as shown in **Figure 6(B).** The caudal auricular artery branches into lateral, intermediate, deep, and medial auricular arteries, supplying the caudal half of the pinna.

Small foramina allow blood vessels to pass between the outer (convex) and inner (concave) surfaces. The superficial temporal artery supplies the rostral half of the pinna. The vertebral artery supplies the basilar artery and the bony labyrinth via the labyrinthine artery. The tympanum is vascularized by the deep auricular and anterior tympanic branches of the maxillary artery and the stylomastoid branch of the posterior auricular artery (**Monnet,2023).**

## I.5 Myology:

There are a large groups of ear muscles that play a major role in terms of mobility; Cranial, dorsal, caudal and ventral. The ventral muscles are the parotido-auricular muscle (abductor of the concha), the stylo-auricular muscle (shortens the cartilaginous external acoustic meatus).

These muscles facilitate the concha's ability to retain its natural position or adapt to diverse orientation and rotations, playing a crucial role in the facial expressions and mimicry of small carnivores **(Venier,1992).**

The ventral muscles represent the primary muscle group involved in the surgical techniques that will be addressed subsequently

## I.6 Innervation:

In dogs, the facial nerve exits the skull through the stylomastoid foramen, located ventral to the jugular process and caudal to the external acoustic meatus. The nerve runs ventral to the horizontal ear canal before moving rostrally toward the face, where it divides into the buccal, palpebral, and aural branches **Figure 6(A).** Sensory innervation of the ear is provided by the trigeminal, facial, vagus, and second cervical nerves. In cats, the facial nerve is positioned more superficially, making it more susceptible to injury during middle ear surgeries **(Monnet,2023).**

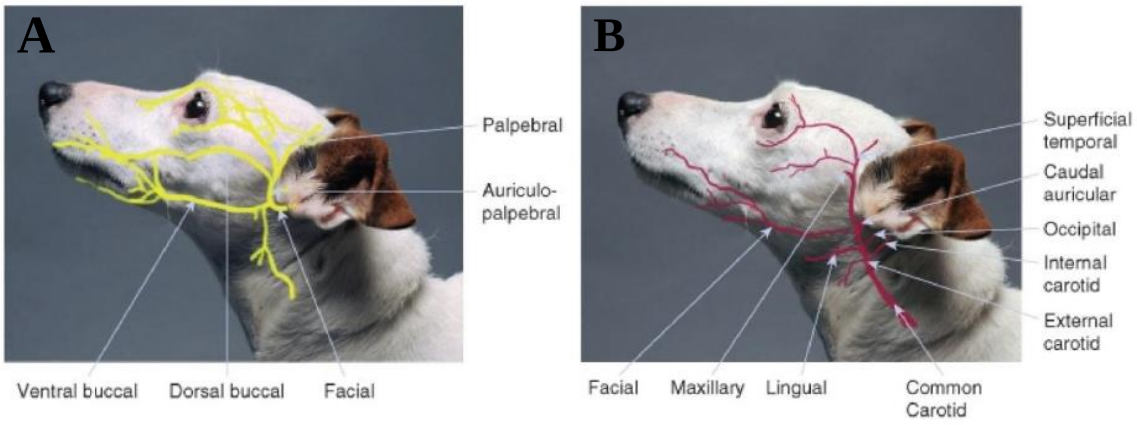


**Figure 6:** (A)Facial nerve branches around the ear in the dog (B) Arterial supply around the ear in dog (Paterson and Tobias, 2012).

# II CHAPTER II: EAR DISORDERS AND THEIR DIAGNOSIS

The disorders mentioned in this part of the study refer solely to those requiring surgical treatment, and do not include all possible external and middle ear disorders.

## II.1 External ear disorders:

### II.1.1 Otitis externa:

#### II.1.1.1 Definition :

Otitis externa is an inflammation of the external auditory canal, which extends from the pinna to the tympanic membrane that may be acute or chronic. The external ear canal is a specialized area of the skin. As a result, otitis externa often manifests as a clinical sign of dermatological conditions **(Carlotti, 1991).** According to **Ettinger *et al.* (2010),** Otitis is estimated to affect 4% to 20% of dogs and 2% to 6.6% of cats.

#### II.1.1.2 Etiology:

A retrospective study of 100 cases of canine otitis externa shows that predisposing factors includes pendulous ear pinnae, hair in the ear canal, water entry, and congenital stenosis or obstruction. Allergic dermatitis was the most common primary cause (43/100 cases), while some cases had multiple causes or remained undiagnosed. Secondary infections involved Malassezia spp. (66/100), cocci (38/100), and rods (22/100), often coexisting. Perpetuating factors included ear canal stenosis, cartilage mineralization, and tympanic membrane rupture. Parasitic causes (otodectic (mostly o*todectes cynotis*), demodectic, and sarcoptic mange) were diagnosed in 13 cases, while grass awns were responsible for 12 cases **(Saridomichelakis *et al* ,2007).**

#### II.1.1.3 Clinical signs and diagnosis:

Clinical signs vary depending on the etiology. Among them we mention head shaking and scratching around the ear. These are early signs of otitis externa, often leading to self-trauma with pinnal or auricular alopecia and excoriations, sometimes pyotraumatic dermatitis. Secondary bacterial or fungal infections, as well as keratinization disorders, can cause foul-smelling exudates. As inflammation worsens, affected animals may experience pain or moan when the ear is palpated **(August, 1988).**
Otitis externa may be suspected based on visible signs such as erythema of the auricular pinnae, malodorous discharge, alopecia, crusting, hyperpigmentation, or changes in skin texture and ear conformation. Close examination begins with careful inspection of the external ear canal, including

removal of obstructive hair and assessment of the cartilage folds and canal patency. if needed, gentle cleaning is performed to enhance visualization using appropriate antiseptic, detergent and moderately cerumenolytic agents such as chlorehexidine, povidone iodine or even acetic acid **(Harvey and Paterson, 2014; Carlotti, 1991)**. However, if infection is suspected, a sample must be collected prior to cleaning, using a sterile swab for cytological evaluation. An accurate diagnosis also relies on thorough anamnesis, including bathing habits, exposure to drafts (e.g., car rides with open windows), swimming, contact with other animals, and excessive or improper ear cleaning **(Harvey and Paterson, 2014).** A quality otoscope and sedation, if needed, facilitate examination **(Carlotti, 1991).** Ear cytology is also found to be very useful in practice **(Chickering, 1988).**

#### II.1.1.4 Medical treatment:

The veterinarian must first initiate and evaluate the response to medical treatment before considering surgical intervention. Surgery should only be pursued if medical management proves ineffective or if complications arise. The treatment combines both local and systemic therapies, regardless of the type of otitis. Systemic treatment includes a combination of antibiotics (such as polymyxin, gentamicin, or marbofloxacin), corticosteroids (like dexamethasone or betamethasone), and antifungals (such as miconazole or clotrimazole). The effectiveness of the therapy relies on proper application of the active ingredients deep into the ear canal and strict control of the administered doses. Regular ear cleaning is also essential to remove excessive secretions and support treatment success **(Coudert and Donas, 2013).**

### II.1.2 Aural hematomas:

#### II.1.2.1 Definition:

An aural hematoma is a blood-filled purplish rounded subcutaneous swelling on the pinna caused by capillary rupture and skin-cartilage separation. It may be unilateral or bilateral, often due to head shaking or scratching. It is more common in dogs than cats **(Hewitt and Bajwa, 2020).**

#### II.1.2.2 Etiology:

Aural hematomas are more common in larger dogs (>20 kg, 61.7%) according to **Mikawa *et al*. (2005),** especially Golden and Labrador Retrievers (55.1%). Most cases (88.1%) occur in dogs over 5 years old, and almost 80% are associated with otitis externa. This study shows that there are several risk factors. In addition to breed and otitis externa, they found that age and self-trauma which leads later to cartilage damage may also contributes to the condition. Autoimmunity has been considered a possible cause in some cases; however, a study found no evidence linking autoimmune pathogenesis to aural

hematomas in dogs. Instead, this study suggested that an early immune response may contribute to the cartilage erosion frequently observed in affected dogs **(Joyce and Day, 1997).**

#### II.1.2.3 Clinical signs and diagnosis:

Clinically, aural hematomas present as fluctuant swellings of varying sizes, typically affecting a large portion of the ear pinna above the anthelix (Figure 7). In the first few days, the swelling feels warm to hot to the touch, and the overlying skin appears erythematous. The animal is often troubled by the increased weight of the ear and may sometimes exhibit signs of pain **(Parker, 2000).** The diagnosis is guided primarily by the anamnesis, and when this proved insufficient, a fine-needle aspiration of the mass is performed. The aspirated fluid is a serous hemorrhagic exudate with low cellularity; cytological examination reveals red blood cells, occasional neutrophils, and fibrin strands **(Hedlund and Merchant, 2002)**. It resorbs later during normal healing, leading to fibrosis and pinna deformation **(Hewitt and Bajwa , 2020).**


**Figure 7:** Aural hematoma on the pinna of a dog (Harvey *et al*, 2001).

### II.1.3 Foreign bodies:

Otic foreign body penetration shows no sex predisposition, but young dogs are more prone to grass awn infiltration **(Harvey, 2005)**. Spaniel breeds and Golden Retrievers are the most commonly affected, while German Shepherds, Miniature Poodles, and Dachshunds are less frequently impacted. Grass awns are the most common foreign bodies in the external ear canal of dogs and cats. Their barbed structure prevents backward movement, pushing them deeper into the canal **(Brennan and Ihrke, 1983).** Other potential foreign bodies include hair shafts (especially when touching the tympanum), plant debris, toys, and accumulations of non-veterinary powders or ointments mixed with cerumen.
Penetration of a foreign body typically causes acute pain, head shaking, and attempts to remove the object with a paw. As it moves deeper, it may cause irritation, ulceration, otic discharge, and secondary

bacterial infections. If embedded in the ear canal lining, it can form a pyogranuloma. In some cases, tympanic membrane rupture occurs, increasing the risk of otitis media. Diagnosis relies on direct examination of the ear canal, as described above (otitis externa), to visualize and locate the foreign body **(Harvey, 2005).**

### II.1.4 External ear tumors:

#### II.1.4.1 Pinna tumors:

##### II.1.4.1.1 Squamous cell carcinoma:

Squamous Cell Carcinoma (SCC**)** is a malignant tumor arising from the squamous epithelium, commonly affecting lightly pigmented or white-skinned areas exposed to sunlight. In cats, particularly white cats, SCC frequently occurs on the ear tips, nose, and eyelids. Clinically, it presents as poorly circumscribed to diffuse lesions that may ulcerate or crust. Diagnosis typically involves a stepwise approach beginning with clinical inspection, followed by cytologic sampling such as superficial scraping of ear lesions—and ultimately confirmed by histopathologic examination. This process helps differentiate SCC from other neoplasms such as melanoma, spindle cell tumors, or mast cell tumors. In advanced cases, surgical removal of affected tissue, such as bilateral penectomy, may be necessary **(Kiehl and Mays,2016).**

*SCC may also arise in the middle ear, a consideration that will be addressed in detail later in the course of this study.*

##### II.1.4.1.2 Hemangioma **and hemangiosarcoma:**

Hemangiomas are benign vascular tumors commonly found in dogs, typically affecting cutaneous or subcutaneous tissues anywhere on the body, and often associated with chronic UV exposure. In contrast, hemangiosarcomas are malignant vascular tumors more frequently observed in cats, with a predilection for the head, especially the ear tips, in light-colored individuals exposed to chronic UV radiation. While cutaneous hemangiosarcomas in cats rarely metastasize distantly, they often recur after excision. In dogs, these malignant tumors may arise in UV-exposed areas or represent metastatic lesions from primary visceral hemangiosarcomas **(Sula, 2012).**

##### II.1.4.1.3 Basal Cell Carcinoma:

The most common cutaneous tumor in cats. It typically presents as a slow-growing, raised, white or hyperpigmented mass and may be confused with melanoma. While many cases are curable with excision, a more aggressive variant has been described that can invade surrounding tissues and vascular structures. Siamese, Himalayan, and Persian cats may be predisposed.

#### II.1.4.1.4 Mast Cell Tumors :

Mast cell tumors are common cutaneous neoplasms in both cats and dogs but differ in behavior. In cats, particularly Siamese, they are usually solitary, often located on the pinna (59% of cases on the head), and respond well to surgical excision with narrow margins. In contrast, mast cell tumors in dogs tend to be more aggressive and higher-grade, frequently involving multiple body sites and capable of metastasizing to regional lymph nodes, even when not enlarged. Treatment in dogs requires wide surgical margins (>2 cm and one fascial plane), with possible adjunct therapies like radiation or re-excision if margins are incomplete.

#### II.1.4.1.5 Sebaceous Adenoma and adenocarcinoma:

Sebaceous adenomas are benign tumors of the sebaceous glands, commonly found on the head, neck, pinna, and limbs of older dogs. They typically present as raised, pedunculated, white to yellow growths with a cauliflower-like appearance, and surgical excision is usually curative. In contrast, sebaceous adenocarcinomas are the malignant form, exhibiting invasive behavior and potential for metastasis. Their management requires wider surgical excision and may involve additional treatments depending on disease severity **(Coleman, 2024).**

### II.1.4.2 Ear canal tumors:

The ear canal is lined with an epidermal layer containing sebaceous and ceruminous glands. Besides that, various tissues and cell types within the ear canal can give rise to tumors. While tumors of the ear canal are uncommon, they account for 1% to 2% of all tumors in cats and 2% to 6% of those in dogs requiring ear surgery.

Benign ear canal tumors in dogs and cats include inflammatory polyps, ceruminous gland adenomas, basal cell tumors, and papillomas. Inflammatory polyps are the most common ear tumors in cats, primarily affecting young cats (3 months to 5 years). These polyps originate from the epithelial lining of the external or middle ear canal, leading to otitis media and, in some cases, Horner's syndrome (a condition characterized by enophthalmos, ptosis, third eyelid protrusion, and miosis due to the loss of sympathetic innervation to the eye and surrounding structures **(Maggs *et al,* 2013).**

Some researchers suggest that ceruminous gland adenomas may develop as a secondary response to chronic inflammation.

Malignant tumors of the ear canal include ceruminous gland adenocarcinoma, carcinoma of undetermined origin, and squamous cell carcinoma. In dogs, additional malignant tumors such as sarcoma, hemangiosarcoma, and malignant melanoma have also been reported **(Morrison, 2002).**

#### II.1.4.3 Differential tumor diagnosis:

The diagnosis of ear tumors in dogs and cats is based on a stepwise, multimodal approach combining patient history, clinical signs, imaging modalities, cytologic evaluation, and confirmatory histopathology **(LaFond *et al,* 2002).**

A detailed medical history is crucial to identify predisposing factors such as chronic otitis, UV exposure (particularly in light-skinned animals), or progressive behavioral changes like head shaking, ear scratching, or head tilt **(Rodríguez *et al,* 2021).** In cases of squamous cell carcinoma or hemangiosarcoma, prolonged sun exposure in light-colored cats is often reported **(Harvey *et al,* 2001).** Clinical examination typically reveals non-specific signs such as aural discharge, visible mass lesions, ulceration, or pain on palpation. Tumors like mast cell tumors or basal cell carcinomas may appear as solitary, raised, firm nodules, often on the pinna **(Fossum, 2019).** Ear canal tumors may cause otitis externa or media, accompanied by head tilt, facial nerve paralysis, or Horner's syndrome in severe cases **(Maggs et al., 2013).**

Imaging techniques, including radiography, CT, or MRI, are helpful to assess tumor size, location, bone involvement, and potential extension into adjacent structures. CT is especially valuable for evaluating bony destruction in cases of aggressive malignancies like ceruminous gland adenocarcinoma or carcinoma of undetermined origin **(LaFond *et al,* 2002; Monnet, 2023).**

Cytology, obtained by fine needle aspiration (FNA) or impression smears, can aid in preliminary diagnosis. It helps distinguish between epithelial, mesenchymal, and round cell tumors. For instance, mast cell tumors show granulated round cells, whereas SCCs display large, irregular epithelial cells with keratinization **(Rodríguez et al., 2021).**

However, definitive diagnosis relies on histopathologic examination of biopsy or excised tissue. Excisional biopsies are preferred, when possible, especially in small or accessible lesions. Histopathology confirms tumor type, degree of malignancy, and helps guide prognosis and further treatment **(Harvey & Paterson, 2014; Morrison, 2002).**

A proper combination of clinical evaluation, imaging, cytology, and histology not only ensures accurate diagnosis but also supports effective treatment planning, especially when surgical excision is considered.

### II.1.5 Lacerations and wounds:

Trauma to the pinna, particularly in cats, is relatively common. Bite wounds from fights can lead to lacerations with significant bleeding. However, abscess formation following a bite to the pinna appears to be uncommon.

In dogs, pinnal trauma is more often caused by head shaking rather than fighting. Various factors, such as otodectic mange, foreign bodies in the ear, otitis media, and facial pruritus, can result in damage to the pinna, typically affecting its periphery.

Additionally, overt or subclinical bleeding disorders (e.g., von Willebrand factor deficiency in Doberman Pinschers) may present as marginal wounds on the pinna that bleed persistently and heal slowly **(Harvey and Ter Haar, 2016).**

Small lacerations affecting only one surface of the ear can often be left to heal by second intention, provided the wound has been thoroughly cleaned, debrided, and assessed. However, primary closure is recommended when the laceration forms two- or three-sided flaps, as healing by second intention in these cases often leads to ear deformities or misalignment, depending on the initial damage. Peripheral ear lacerations may subsequently widen if left untreated due to contracture and epithelialization. When closed primarily, these wounds may lead to cupping or folding of the pinna caused by tissue contraction. In cases of small, peripheral injuries, a good cosmetic outcome can be achieved through partial pinnectomy (This technique will be discussed at a later point in this survey) **(Land and Wood, 2004).**

## II.2 Middle ear disorders:

Middle ear disorders include various conditions that can affect hearing and balance in cats and dogs:

### II.2.1 Otitis media:

#### II.2.1.1 Definition:

Otitis media, or inflammation of the middle ear structures, is typically brought on by an infection spreading from the external ear canal or by a foreign object penetrating the eardrum. Although it is uncommon, infection can also potentially spread to these areas via the bloodstream. These cases are referred to as secondary otitis media, which represent the most frequently encountered form. In contrast, primary otitis media is less common and occurs without an identifiable external or systemic source of infection.

#### II.2.1.2 Etiology:

In cats, the most common cause of secondary otitis media is the presence of nasopharyngeal polyps, which can obstruct the auditory tube and predispose to infection. Otitis interna, or inflammation of the inner ear structures, may result as a complication of middle ear inflammation **(Gotthelf, 2004).**

#### II.2.1.3 Clinical signs and Diagnosis:

The ear hurts, and the ear canal becomes inflamed and discharges which may cause deafness and lack of balance. Another indication could be recurrent outer ear inflammation. The paralysis of the facial nerve, narrowing of the pupil of the eye, drooping of the eyelid, sinking of the eyeball into the orbital cavity, and protrusion of the third eyelid may all occur on the same side as the damaged ear since the middle ear is where the sympathetic and facial nerves pass. Sneezing, ocular discharge, and/or nasal discharge may be indicators of otitis media in cats, which typically develops as a sequela to respiratory conditions. After the ear is cleared of the mucus and dried exudates, some cats with otitis media also have a visible polyp in the ear canal. A black, crumbly, dried exudate that resembles an ear mite infestation is seen in the ear canal of many feline otitis media cases **(Gotthelf, 2004).** In cases of primary otitis media, the retained purulent collections give it a convex shape. Due to their comparatively tiny ear canals, cats may be easier to diagnose using an otoscope when they have otitis media. When a patient exhibits any neurologic condition affecting the head, such as vestibular disease, Horner's syndrome, or injury to the facial nerves, the practitioner should take otitis media into consideration **(Bichot, 1982).**

The distinctive, elongated, and conical structure of the canine ear canal makes it difficult to see the tympanic membrane (TM), making the diagnosis of otitis media in dogs extremely difficult. Additionally, a lot of dogs with otitis media keep their TM intact, giving the appearance that their middle ear is normal. Many dogs with otitis media also suffer from chronic otitis externa, which is characterised by degenerative changes to the ear canal that result in stenosis, making it impossible to visually evaluate the TM. According to a widely accepted view, otitis externa that is left untreated, poorly managed, or resistant to treatment frequently progresses to otitis media, which causes cumulative harm and slow eardrum deterioration over time **(Rana,2025).**

### II.2.2 Cholesteatoma:

#### II.2.2.1 Definition:

A cholesteatoma is a keratinized epithelial-lined epidermoid cyst in the middle ear. It is characterised by its gradual growth that destroys nearby tissue, including bone, and contains keratin debris. There are two types of cholesteatomas: primary and secondary. Epithelial cysts develop inside the middle ear beneath an intact tympanic membrane in the congenital type (primary). Through an existing tympanic rupture brought on by a previous chronic inflammation (otitis), squamous epithelium migrates into the middle ear, resulting in acquired cholesteatoma (secondary). If the stratified squamous epithelium is not eliminated after a complete ear canal ablation, it may also be secondary **(Rodríguez *et al*, 2021).** Cholesteatoma comes from the invagination of the tympanic membrane into the epitympanic recess **(Paterson and Tobias, 2012).**

#### II.2.2.2 **Clinical sign** and **Diagnosis:**

Clinical manifestations of cholesteatoma include unilateral facial palsy, ataxia, nystagmus, circling, unilateral atrophy of the temporalis and masseter muscles, pain when opening the mouth, difficulty opening the mouth completely, and symptoms of chronic otitis externa (discharge, swelling, redness, and/or pain) **(Little *et al.* 1991; Hardie *et al.* 2008).**

Collaboration between the pathologist and the surgeon is necessary for a definitive diagnosis. The surgeon must carefully indicate that the origin of the tissue is the middle ear. The pathologist then looks for the presence of ciliated epithelium (to confirm that the origin of the tissue is the middle ear), presence of metaplastic epithelium, presence of cornification, and accumulation of keratin-rich cornified material (ideally lamination is observed) **(Monnet, 2003).**

During surgery, keratin debris within a cystic structure can be directly observed or typical imaging changes can be observed as part of the presumptive diagnosis of cholesteatoma **(Little *et al.* 1991; Hardie *et al.* 2008).** The presence of opacities within the bulla, osteo-proliferation, bulla lysis, bulla expansion, bone lysis within the squamous or petrosal portions of the temporal bone, and enlargement of associated lymph nodes are among the changes seen on CT(Computed Tomography). Middle ear tissue frequently exhibits heterogeneous contrast medium(contrast) substance enhancement (Check glossary) **(Monnet., 2003).**

### II.2.3 Squamous cell carcinoma "SCC":

#### II.2.3.1 Definition:

SCC can also be present in the middle ear. Both cats and dogs frequently develop it,and due to its aggressive nature the squamous cell carcinoma particularly when located in areas like the middle ear, commonly invades and destroys surrounding bone tissue.that frequently affects the skin. Skin that is nonpigmented or has light pigmentation is typically where SCCs are discovered **(Schaer, 2009).**

#### II.2.3.2 Clinical signs and Diagnosis:

One of the most important clinical indicators of SCC in the middle ear typically include pain when opening the mouth, in addition to the usual symptoms of middle ear illness and this pain is the result of the destruction of local tissues **(Njaa and Cole, 2012).**

Because benign lumps and inflammatory lesions can appear to be malignant tumors on the surface, a biopsy is usually necessary **(Henry and Higginbotham, 2009).** Frequently, these lesions are too thin or tiny for needle core biopsy or fine-needle aspiration (FNA) procedures, therefore, these diagnosis techniques are used for larger lesions followed by cytological evaluation, and the most appropriate and effective tool of diagnosis for this type of lesions is the excisional biopsy (**August, 2009).**

### II.2.4 Feline nasopharyngeal polyps "FNP's":

#### II.2.4.1 Definition:

Pedunculated, benign masses that usually originate in the middle ear. An epithelial layer that ranges from stratified squamous to ciliated columnar epithelium covers a core of loosely arranged fibrovascular tissue. Plasma cells, lymphocytes, and occasionally neutrophils are dispersed throughout the core. Just below the surface, which is frequently ulcerated, there are occasionally a few mucous-secreting cells **(Lappin, 2001).**

#### II.2.4.2 Clinical signs and Diagnosis:

Weight loss, sneezing, nasal discharge, stertor, dysphagia, gagging, otorrhea, and head shaking are among the clinical symptoms linked to nasopharyngeal polyps. Horner's syndrome or facial nerve paralysis are symptoms of middle ear involvement, while nystagmus, ataxia, and head tilt are indicators of inner ear involvement. Although polyps in older cats (mean age 6.1 years) have also been reported, the disease primarily affects young cats (mean age range 13.6 months to 3 years). There is no known breed or sex predisposition. The FNP is diagnosed through multiple examinations starting by performing a deep otoscopic examination for the presence of otitis externa and aural polyps (which

can occur exclusively in association with nasopharyngeal polyps) **(Kudnig,2002),** using a rigid fiberoptic scope. A radiographic and CT (Computed Tomography) examination is realized for tympanic bullae (observation of a thickening bone and an increase of fluid density) **(Hedlund & Merchant,2002),** The tissue usually obtained during a surgical excision and used for a histopathologic analysis comes to be the most effective way to provide a definitive diagnosis **(Nelson & al,2019).**

# III CHAPTER III: SURGERIES FOR THERAPEUTIC PURPOSES

Therapeutic otologic surgery encompasses a broad spectrum of surgical interventions on the ear, with the primary objectives of eradicating external and middle ear diseases and restoring auditory function **(Laury and Mattox, 2013).** In this chapter**,** we will present a detailed description of the surgical techniques, their clinical indications and the materials and the methods employed.

## III.1 External ear surgical treatments:

### III.1.1 Common materials and steps:

Across the described surgical techniques for ear procedures in small animals, several materials and steps are commonly utilized. The surgical area is clipped and aseptically prepared using a topical cleanser, followed by sterile saline lavage. A scalpel is used for initial skin and cartilage incisions, and dissection tools such as Mayo scissors, blunt/sharp dissectors, or curettes assist in tissue separation. Hemostasis is managed with ligation, cauterization, bipolar or monopolar electrosurgery depending on the approach. Closure typically involves absorbable or nonabsorbable monofilament sutures (ranging from 2-0 to 5-0), with subcutaneous layers often closed separately. Postoperative care frequently includes the application of an Elizabethan collar to prevent self-trauma. In many techniques, the ear canal is flushed with saline, and tissue or fluid samples are collected for cytology, culture, and sensitivity testing. **(Yool, 2012; Fossum, 2012; Holzman and Kleist, 2023; Coleman, 2024; Cole and Nuttall, 2021).**

We should also point to the importance of preoperative administration of vagolytic agents such as atropine which helps to minimize respiratory and salivary secretions and to prevent vagally mediated bradycardia during anesthesia **(PetPlace.com, 2025).**

Additional, technique-specific materials and instruments will be detailed in each corresponding procedure described below.

### III.1.2 Preparation of the patient:

In all surgical techniques that will be addressed later on this chapter, lateral recumbency is the most common patient positioning, with the head slightly elevated using a towel or aligned parallel to the chest wall **(Bojrab *et al,* 2014; Birchard and Sherding, 2006; Monnet, 2023).** The pinna, ear canal, and surrounding skin are systematically clipped and aseptically prepared. Draping is typically done with a fenestrated drape through which the affected ear is exteriorized to facilitate surgical access . Protection of the ear canal using a cotton ball is also a shared step **(Tear, 2021).** Antiseptics containing chlorhexidine are used cautiously, especially in cats, due to their ototoxic potential. A sterile marker may be employed to define the surgical margins, and laser or electrocautery is commonly used for hemostasis during the procedure **(Séguin et al, 2022; Monnet, 2023).** Despite these shared

preparations, there are specific differences depending on the surgical objective: in tumor surgeries, surgical margins vary depending on the tumor type and location, and patient positioning may alternate between lateral and sternal recumbency according to surgeon preference **(Séguin *et al,* 2022)**; and in cases of otitis externa, early canal opening is emphasized to alter the ear's microenvironment, thereby enhancing drainage and aeration **(Patel *et al,* 2008).**

### III.1.3 Surgical treatment of aural hematomas (othematoma):

#### III.1.3.1 Indications:

Aural hematomas in small animals, particularly dogs and cats, manifest as a soft, fluctuant, blood-filled swelling on the concave surface of the ear flap (pinna), often accompanied by pain, warmth, and erythema. Affected animals typically exhibit vigorous head shaking, ear scratching, or head tilting due to discomfort, with large hematomas potentially obstructing the ear canal **(Côté, 2019)**. If untreated, chronic cases may lead to fibrosis, resulting in a thickened, deformed "cauliflower ear'" appearance. The condition is secondary to trauma from underlying causes, including otitis externa (bacterial or yeast infections), ear mites(ectoparasites) like Otodectes cynotis in cats), foreign bodies, or direct trauma **(Harari *et al,* 2001)**. Breeds with pendulous ears, such as Cocker Spaniels or Retrievers, are predisposed due to increased trauma from ear flapping. Bilateral hematomas are more common in cats with severe mite infestations. Thorough investigation of underlying conditions is essential to prevent recurrence **(Aiello *et al,* 2016).**

#### III.1.3.2 Techniques and materials:

To treat aural hematomas in small animals like dogs and cats, several materials and techniques may be chosen:

**Fenestrated silastic tubing:** fenestrated silastic tubing is one of the procedures for aural hematomas drainage which consist of creating small stab incisions at both the apex and the base of the hematoma, through which the drain is then carefully guided. To ensure the drain remains stable, fine sutures are used to secure it to the skin **(Figure 9(B))**. Ongoing care involves periodically cleaning the drain's external openings with saline and a cotton-tipped swab.

**Penrose drain:** Alternatively, a Penrose drain can be placed with the same steps as the previous technique with the placement of the drain (tube) being the major deference (Penrose drain is generally placed to exit from one dependent incision at the most ventral aspect of the hematoma), to allow fluid to escape passively **(Figure 8)**. For more controlled suction, a butterfly catheter may be used as a closed-suction drainage system **(MacPhail, 2016).** The butterfly catheter needle is inserted into a

vacuum blood tube. The vacuum tube is replaced periodically and the ear and tube are bandaged over the head to protect the system and the ear.

**Figure 8:** Drainage of an haematoma in a left cats ear with a Penrose drain tube (Chadzimisios *et al*, 2019).

**Teat cannula:** another less common technique known as teat cannula is commonly used to provide continuous drainage based on placing the teat cannula through a small incision into the cavity, positioned either on the dorsal or ventral aspect. A small vacuum drain is inserted into the hematoma and secured with a fine pursestring suture (stitches are placed in a circular pattern around an opening or incision). A standard incision and suturing technique is shown with sutures placed parallel to the vasculature **(Figure 9(A))**.

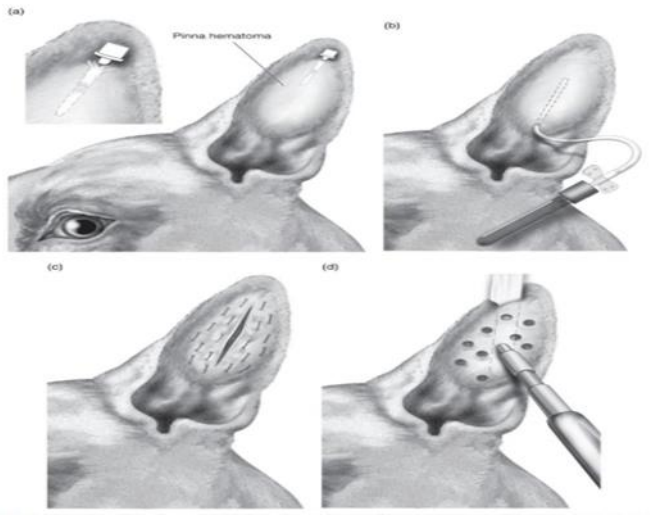


**Figure 9:** (A), a teat cannula is placed through a small incision into the cavity of the aural hematoma. In (B) a small vacuum drain is inserted into the hematoma and secured with a fine pursestring suture. (C) Shows a standard incision and suturing technique, with sutures placed parallel to the vasculature. (D) aural hematoma treated by using a dermal punch (Monnet,2012).

**Dermal punch:** An aural hematoma can be also treated by using a dermal punch to create small holes in the convex margin of the pinna **(Figure 9(D))(Monnet,2012).**

According to **Mikawa *et al*, (2005)**, **needle aspiration** is also practiced in the treatment of aural hematomas in dogs, but it is associated with a high recurrence rate. All cases treated with aspiration alone experienced relapse, and none healed through repeated aspirations. However, when aspiration was followed by local corticosteroid injection, healing was achieved within four weeks in several cases, suggesting improved outcomes with combined therapy.

The previously described methods represent simple techniques; however, to achieve a more aesthetically satisfactory outcome and to minimize skin retraction and promote better healing **(Gotthelf, 2004)**, we now present the most commonly employed approach: the incisional technique.

#### III.1.3.3 Incisional technique:

##### III.1.3.3.1 Surgical procedure:

On the concave surface of the ear, a longitudinal or S-shaped incision is made over the entire hematoma **(Figure 10(B)).** Any blood or fibrin clots are removed**,** and the cavity is flushed with sterile saline. Sutures are used to hold the cartilage in place while scar tissue is allowed to develop**.** Two to five rows of sutures are placed in the cavity, depending on its size. Stenting rows of sutures are spaced parallel to the main branches of the caudal auricular artery, with bites that are made between 0.5 and 1 cm long, penetrating the skin on the concave surface and the cartilage, then engaging the dermis on the convex surface but not necessarily being penetrated**.** Space is left between the borders of the incised skin. After surgery, the ear is protected and immobilized with an Elizabethan collar and bandage to limit head shaking, rubbing, and scratching. At 14 to 21 days, the sutures are removed**,** the bandage **is** replaced at least once a week and is kept on for another week **(Hamaide and Griffon, 2016). *(*Demetriou*&al,2013)*.**

According to **Mikawa *et al,* (2005)**, short plastic tubes can be sutured across the pinna after hematoma evacuation to act as mechanical supports. While they do not function as drainage systems, they help preserve the ear's shape, reduce dead space, and lower the risk of recurrence by maintaining close contact between the skin and cartilage.

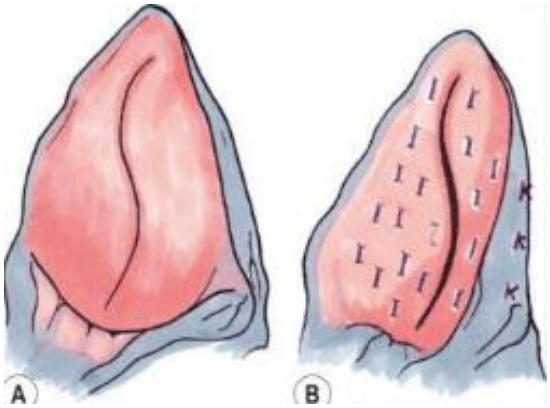


**Figure 10:** (A) Aural hematoma bulging on the concave inner pinna. (B) An S-shaped or sinusoidal incision is made along the length of the hematoma to drain the contents. The cavity is then closed off with multiple through-and-through mattress sutures placed parallel to blood vessels to avoid vascular compromise (Demetriou *et al*, 2013).

There have been reports of aural haematomas being treated with carbon dioxide lasers. After an incision is made into the haematoma with the laser to enable blood evacuation, several tiny incisions are created across the hematoma's surface to promote the creation of adhesions. No sutures are used **(Fossum, 2012).**

### III.1.4 Pinnectomy:

#### III.1.4.1 Indications:

Pinnectomy is primarily indicated in cases of severe trauma or lacerations that cannot be resolved with conservative management. It may also be necessary in cases of neoplasia involving the pinna. Actinic lesions caused by UVB (ultraviolet Blight) exposure can progress to malignancy and may require surgical removal. Squamous cell carcinoma, Hemangiomas and hemangiosarcomas may require excision if invasive. Basal cell carcinomas are usually managed with surgery if locally aggressive. Mast cell tumors, especially high-grade or extensive ones in dogs, may require pinnectomy when they affect the pinna and cannot be controlled with local excision alone. Histiocytomas are typically benign and self-limiting, but persistent lesions causing discomfort may warrant partial resection. Sebaceous adenomas may be excised easily, but their malignant counterparts might require a more extensive surgical approach, including pinnectomy. Finally, severe or refractory infectious or inflammatory conditions of the pinna may justify palliative pinnectomy when other treatments fail **(Aroson, 2022).**

**Figure 11:** Pinnectomy in a cat with multifocal head and neck SCC (Séguin and Kuding, 2013).

### III.1.4.2 Subtotal and total pinnectomy:

Subtotal and total pinnectomy are straightforward surgical procedures primarily indicated for excision of diseased or severely damaged pinna tissue. The procedure typically involves amputating the pinna using scissors or a scalpel, ensuring a safety margin of at least 1–2 cm beyond any visible ulceration or crusting **(Johnston and Tobias, 2017; Yool, 2012)**. Hemostasis is achieved with cauterization or ligation tools, and bleeding is generally minimal. The skin from the convex surface of the ear is carefully mobilized and draped over the cut edge of the auricular cartilage, then sutured to the concave skin using a simple continuous pattern with fine, nonabsorbable monofilament suture. Importantly, the cartilage itself is not directly sutured. Postoperative care includes placing an Elizabethan collar to prevent self-trauma and wound contamination, which is especially critical in the recovery phase **(Yool, 2012).** In cases complicated by local cellulitis or peri-aural abscessation, it may be necessary to insert a drain or opt for open wound management followed by delayed primary closure to promote optimal healing **(Johnston and Tobias, 2017).**

Pinna reconstruction following partial pinnectomy for tumors involving the medial or lateral borders of the helix of the pinna can be inventive.

### III.1.5 Total ear canal ablation TECA:

In dogs with end-stage otitis externa, secondary middle ear infections are common. Performing a Total Ear Canal Ablation (TECA) without also accessing and cleaning the middle ear (via lateral bulla osteotomy and curettage) often leads to poor outcomes and a high rate of complications. Since TECA removes the main drainage route, failure to thoroughly debride the middle ear can result in chronic infections, abscesses, and persistent fistulas due to retained secretory epithelium. Therefore, most

surgeons routinely combine TECA with lateral bulla osteotomy (LBO) using the same surgical approach (LBO will be addressed in detail in a subsequent section of this chapter) **(Bojrab *et al,* 2014).**

### III.1.5.1 Indication for TECA:

The whole vertical and horizontal ear canal cartilage and epithelium are removed during a salvage surgical technique called total ear canal ablation. Severe ear trauma, irreversible hyperplastic horizontal ear canal disease, horizontal ear canal neoplasia, and chronic otitis externa after lateral ear resection are among the conditions that can be treated with TECA **(Smeak and Dehoff, 1986).**

### III.1.5.2 Surgical procedure of TECA:

The TECA-LBO procedure requires specific surgical instruments such as Kerrison or Lempert rongeurs and Freer elevators to remove the ear canal cartilage and access the tympanic bulla. Once the canal is dissected, the bony ostium is enlarged using a high-speed burr while ensuring the facial nerve is carefully identified and retracted throughout the procedure to prevent iatrogenic injury. The bulla is thoroughly debrided to remove any exudate or tumor material, with ossicles being preserved unless they are diseased. In feline cases, the bony septum must be breached to ensure full access to the tympanic cavity **(Coleman, 2024; Holzman and Kleist, 2023).** Various skin incisions have been described for this procedure. In dogs, either a T-shaped or a circumferential incision around the external auditory meatus is commonly used, with the latter favored for its simplicity and sufficient exposure. In cats, a U-shaped incision is sometimes recommended for cosmetic reasons, but a circumferential approach is also considered effective. After the skin incision, auricular muscles are transected circumferentially using sharp dissection, blunt dissection, or monopolar electrosurgery. Monopolar cautery is particularly useful in chronically inflamed or neoplastic ears due to the increased vascularity, though it should be discontinued near the transition from auricular to annular cartilage to prevent facial nerve damage. For retraction and visualization, Allis tissue forceps or manual assistance may be employed depending on the surgeon's preference. Further dissection proceeds sharply along the plane between the cartilage and its muscular attachments, with bipolar cautery used to control bleeding. The facial nerve, which exits the stylomastoid foramen near the junction of the vertical and horizontal ear canals, must be carefully located and preserved, especially in cases of chronic otitis or neoplasia where tissue adhesions may obscure key anatomical landmarks. Once the bulla is reached, the external canal is transected at the level of the external acoustic meatus, typically using curved Mayo scissors and protecting the nerve with a Freer elevator. If the canal is mineralized, a scalpel or bone forceps may be necessary. The excised canal should always be submitted for histopathological evaluation **(Demetriou *et al*, 2013; Coleman, 2024).** Closure is performed in three layers, and the

decision to place passive or suction drains depends on the clinical context such drains are generally avoided in neoplastic cases to reduce risk of tumor spread **(Holzman and Kleist, 2023).**

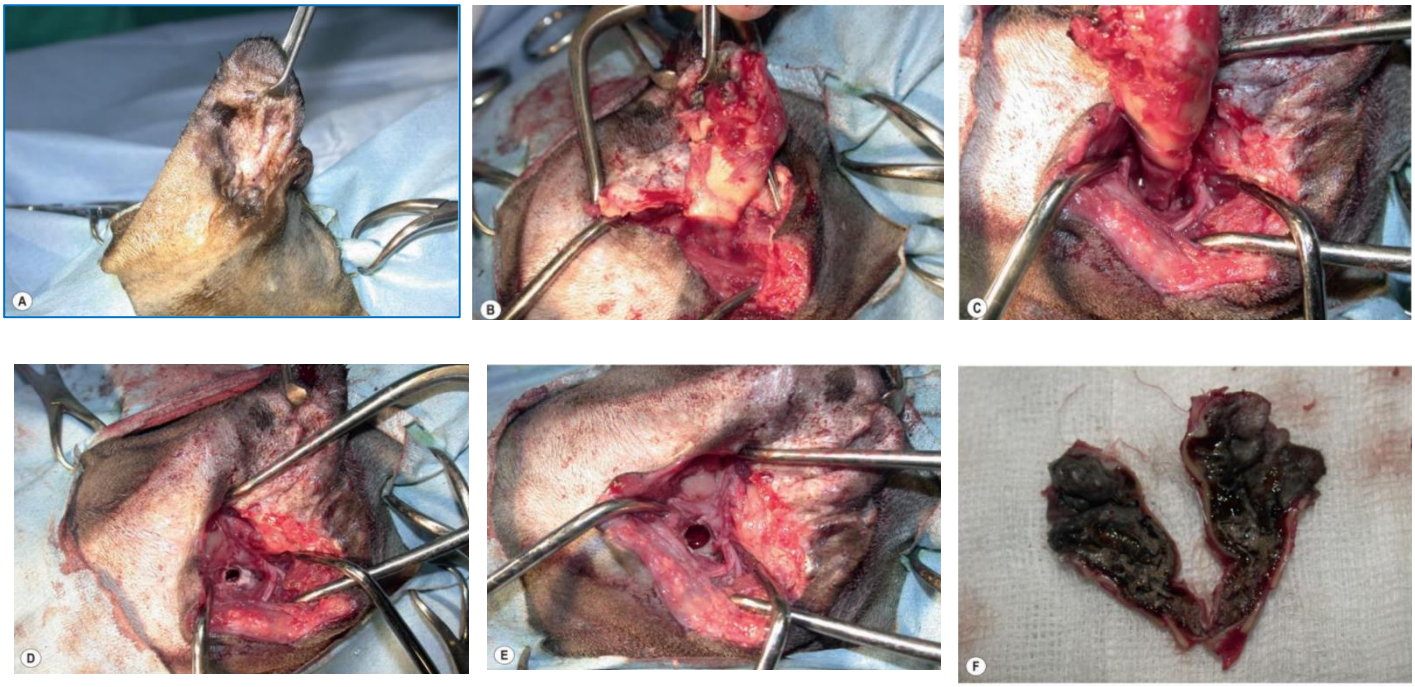

**Figure 12:** TECA-LBO technique ;(A): The ear is clipped and prepared for surgery. (B): The external ear canal is dissected out. (C): The junction of the external ear canal and osseous external acoustic meatus and facial nerve are identified. (D): The external ear canal is amputated from the osseous external acoustic meatus. (E): A lateral bulla osteotomy is performed(F): The excised external ear canal is shown after bisection; there are chronic proliferative changes in the integument and intraluminal discharge and debris (Demetriou *et al*, 2013).

### III.1.6 Lateral wall resection LWR:

#### III.1.6.1 Indications:

Lateral wall resection is primarily indicated for the correction of congenital stenosis of the external ear canal, allowing for improved drainage and ventilation. It is also employed to excise laterally located masses within the vertical ear canal or to enhance surgical access to deeper lesions, particularly when video otoscopic equipment is not available. Although not curative for chronic otitis externa especially in cases where the canal is proliferative or calcified, it may help improve local environmental conditions and facilitate the application of topical treatments **(Paterson and Tobias, 2012).** This technique could be recommended for the treatment of otitis externa and, on occasion, to obtain access to a neoplastic lesion in the distal horizontal ear canal or on the medial aspect of the vertical ear canal **(Patel *et al*, 2008).**

### III.1.6.2 Surgical procedure of LWR: (Yool,2012).

Lateral wall resection is a surgical technique aimed at improving drainage and ventilation of the horizontal ear canal, particularly useful in early or moderate stages of otitis externa. A key distinguishing feature of this procedure is the use of forceps to determine the ventral extent of the vertical ear canal prior to making the incision **(Fossum, 2012).** The surgical approach involves creating two parallel skin incisions along the rostral and caudal borders of the vertical canal, extending ventrally beyond the horizontal canal. The skin flap created by these incisions is reflected laterally to expose the vertical canal wall. The dorsal and ventral ends of the incisions are then connected, allowing removal of the skin overlying the canal **(Yool, 2012).** Using cartilage scissors, the rostral and caudal walls of the vertical canal are incised to access the underlying annular cartilage, with at least 50% of the vertical canal's circumference excised. The lateral segment of the vertical canal is then resected in a ventral direction. A drain board, fashioned from the distal portion of the excised canal, is attached to the ventral skin margin using nonabsorbable sutures on a cutting needle, beginning with cartilage penetration followed by skin anchoring **(Fossum, 2012; Lanz and Wood, 2004).** During closure, particular care is taken at the hinge point of the skin flap to suture the rostral and caudal margins in a way that ensures maximal opening of the horizontal ear canal. The dorsal closure of the flap involves apposing the canal remnants to the adjacent skin to maintain patency and facilitate drainage **(Lanz and Wood, 2004).**

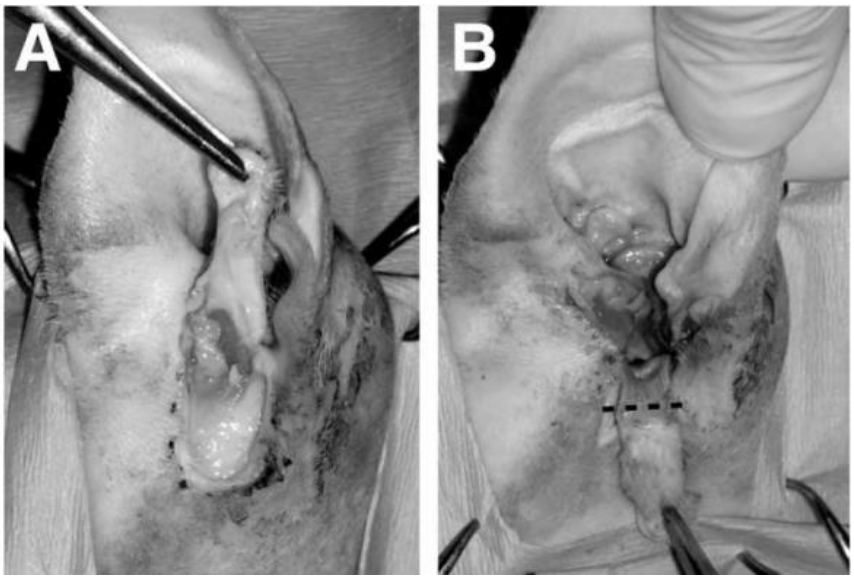


**Figure 13:** (A) Elevate the skin flap from the perichondrium to expose the lateral wall of the vertical. (B) Incise the cartilage and reflect the flap ventrally. Dashed line indicates site of cartilage resection (Yool, 2013)

## III.1.7 Vertical canal ablation VCA:

### III.1.7.1 Indications:

When a disease exclusively affects the vertical part of the ear canal, the entire vertical segment of the canal is removed. Polyps or tumors that solely impact the vertical canal, severe hyperplasia or

constriction that is limited to the vertical canal, and trauma-induced damage to the vertical canal are a few disorders that may be addressed by vertical canal ablation **(Campbell, 2006).**

#### III.1.7.2 Surgical procedure:

Vertical canal resection is indicated in cases of otitis externa confined to the vertical canal or in localized neoplastic conditions. The procedure begins similarly to a lateral wall resection, with patient positioning, ear canal exposure, and skin preparation performed as in LECR protocols. A T-shaped skin incision is made, followed by careful dissection around the vertical ear canal using curved Mayo scissors, taking care to preserve the facial nerve **(Fossum, 2012).** Once the vertical canal has been fully isolated, resection is performed lateral to the annular cartilage. The remaining canal tissue is incised to create dorsal and ventral skin flaps, which are then gently repositioned and pressed against the ear epithelium to create a T-shaped closure **(Birchard and Sherding, 2006).** The closure is executed in layers, with subcutaneous tissues sutured using absorbable suture material, and the skin closed with nonabsorbable sutures of appropriate sizes depending on tissue thickness **(Fossum, 2012).**

## III.2 Middle ear surgical treatments:

### III.2.1 Bulla osteotomy:

This surgical technique based on creating an opening in the bulla and can be done through two types of approaches, either lateral or ventral.

#### III.2.1.1 By lateral approach LBO:

The lateral approach is the most commonly employed technique for tympanic bulla osteotomy, particularly when performed in continuity with external ear canal ablation. This method provides direct access to the bulla while preserving major anatomical structures such as the parotid gland, the horizontal ear canal (if not involved in the pathology), and the facial nerve **(Delahaye,1993).**

##### III.2.1.1.1 Indications:

The primary indication for tympanic bulla osteotomy is the management of chronic or refractory otitis media. In dogs, the procedure is most frequently performed in conjunction with total ear canal ablation, utilizing a lateral approach to the bulla.Less frequently, bulla osteotomy may be indicated for the excision of neoplastic lesions or the surgical management of cholesteatomas **(Harvey *et al,* 2005).**

#### III.2.1.1.2 Surgical procedure:

Following total ear canal ablation, remnants of the external ear canal cartilage surrounding the tympanic bulla ostium are identified and removed using rongeurs (e.g., Lempert or double-action) and a Freer elevator, to facilitate dissection and minimize excessive head movement during surgical manipulation. Once these remnants are cleared, the bony ostium is enlarged using rongeurs or a high-speed, air-driven burr, which also allows access through the honeycomb-like bone of the ventral bulla during lateral bulla osteotomy (LBO) **(Sumner *et al,* 2011).** Care is taken to avoid the petrous temporal bone defect, which becomes evident once the external acoustic meatus is sufficiently enlarged. The facial nerve is identified and carefully retracted throughout the procedure to avoid iatrogenic trauma.

The tympanic bulla is typically filled with exudate, necrotic debris, or neoplastic tissue, which are extracted using gentle traction, curettage, or biopsy forceps. While ossicles may be inadvertently removed if found to be diseased or friable, intact and healthy ossicles are preserved whenever possible. Debridement of the mesotympanum and epitympanum is performed cautiously to prevent injury to the round window and vestibular structures, while the hypotympanum is more safely curetted. In feline patients, a bony septum separating the hypotympanum from the rostral compartments (mesotympanum and epitympanum) is consistently encountered and must be breached using a curette or hemostats to enable thorough evacuation and cleaning of the tympanic cavity. The epithelium and lamina propria lining the tympanic cavity are also excised using a high-speed burr for complete decontamination **(Silva *et al,* 2008).**

After debridement, the bulla is lavaged and suctioned multiple times to eliminate residual debris and pathogens (Sumner et al., 2011). Samples are then obtained and submitted for bacterial and fungal culture with susceptibility testing, as results post-lavage are more representative of persistent infections. A Penrose drain (0.25-inch diameter) is placed into the tympanic bulla, exiting through a separate 1-cm skin incision located ventrally to the primary surgical site, and is secured with two simple interrupted sutures using 2–0 nylon **(Sumner et al, 2011).** The use of passive or suction drains remains debated. While one study found no significant difference in complication rates with or without drainage, their use may be justified in cases involving infection, significant tissue trauma, or pharyngeal edema. When employed, drains should be secured under sterile conditions, often with a stockinette for stabilization. However, their placement is generally avoided in oncologic cases unless clinically warranted **(Coleman, 2024).**

Closure is conducted in three layers. Auricular musculature is apposed routinely, avoiding deep manipulation to limit the risk of facial nerve trauma. Skin closure is considered technically delicate due to the thin and fragile nature of the overlying tissue; interrupted sutures are preferred, although

absorbable monofilament sutures (e.g., 5-0 Monocryl) may be utilized in uncooperative or fractious patients **(Coleman, 2024; Sumner *et al*, 2011; Silva *et al*, 2008).**

Systemic antibiotic therapy is initiated and later adjusted based on culture and sensitivity results **(Delahaye, 1993).**

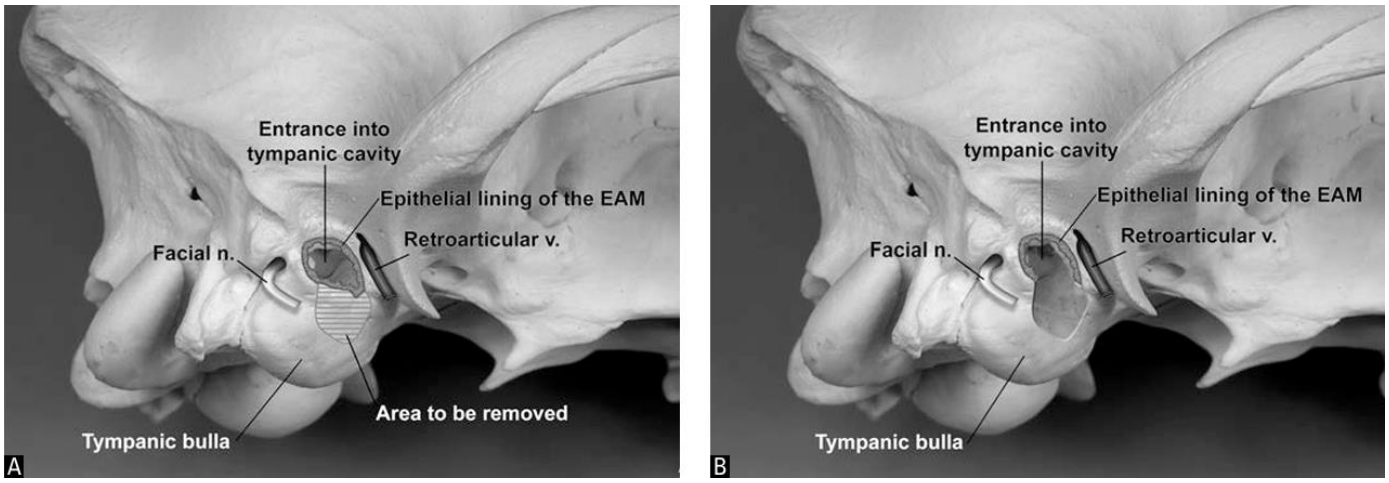


**Figure 14:** (A) Lateral view of the skull showing the notch created in the ventral floor of the osseous external auditory meatus (EAM) and its epithelial lining (B) Elevation of epithelial cuff from the osseous ear canal exposing underlying bone (Bojrab, 2014).

#### III.2.1.2 By ventral approach VBO:

##### III.2.1.2.1Indications:

Ventral bulla osteotomy (VBO) is a commonly performed and effective surgical procedure in cats for the treatment of middle ear disease, particularly in cases associated with inflammatory polyps that do not respond to conservative management. Unlike lateral bulla osteotomy, the ventral approach does not allow access to the external acoustic meatus and is therefore reserved for conditions limited to the middle ear.

In dogs, VBO is rarely indicated and generally unsuccessful for the treatment of otitis media, especially when secondary to otitis externa. The failure to address underlying disease in the external ear canal significantly limits the effectiveness of this technique. As such, ventral osteotomy alone is generally not recommended in canine cases without concurrent surgical management of the external ear canal **(Slatter, 2003).**

### III.2.1.2.2Surgical procedure:

Ventral Bulla Osteotomy (VBO) is a surgical procedure performed with the patient in dorsal recumbency, with cervical extension supported to optimize access to the tympanic bulla. The choice of surgical approach paramedian or midline depends on the species involved, with a paramedian approach commonly used in cats and a midline approach in dogs **(Slatter, 2003; Sharp, 1990).** The cervical, intermandibular, and facial regions are aseptically prepared, and a skin incision (3 to 10.5 cm) is made accordingly. Dissection proceeds through the platysma and sphincter colli muscles, and deeper structures including the mandibular salivary gland and external maxillary vein formed by the convergence of the facial and lingual veins are identified and retracted. The digastric and mylohyoid muscles are separated bluntly, and deeper muscles such as the hyoglossus and styloglossus are retracted using small Weitlaner or Gelpi retractors. Particular attention is paid to preserving the hypoglossal nerve, which lies near the lingual artery and enters the base of the tongue. Repeated digital palpation assists in localizing the domed ventral surface of the tympanic bulla **(Slatter, 2003).**

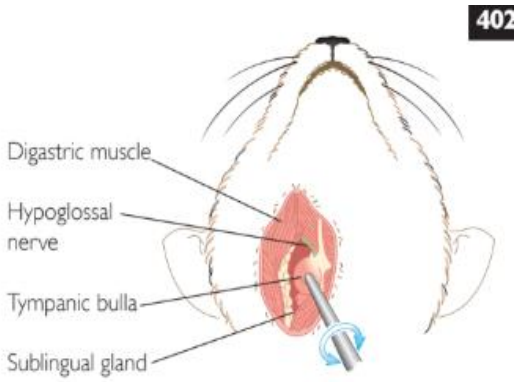


**Figure 15:** Surgical site of feline ventrall bulla osteotomy (Harvey *et al,* 2005)

Once the bulla is located, the periosteum is elevated and osteotomy is initiated using either Steinmann pins or a surgical burr. The osteotomy site is carefully enlarged with rongeurs or a high-speed burr, with precautions taken to avoid damaging the promontory or entrapping adjacent soft tissues especially in patients with chronic middle ear disease that may weaken bony structures. In cats, the hypotympanic cavity is often filled with sterile mucus, which is suctioned prior to breaching the septum between the hypotympanum and mesotympanum. This allows for gentle curettage of polyps from the mesotympanum using a small curette, taking care to avoid trauma to the tympanic plexus or vestibular structures. In cases with active infection or chronic disease, postoperative lavage or drainage may be implemented **(Slatter, 2003).**

Species differences are significant: in cats, the approach requires navigating around delicate neurovascular structures and breaching a bony septum for full access. In dogs, however, VBO is

usually performed after total or subtotal ear canal ablation and involves a direct midline ventral approach. The parotid salivary gland and facial nerve are identified and gently retracted, and the tympanic bulla is accessed with osteotomy tools without encountering the internal septation present in felines **(Sharp, 1990).**

### III.2.2 Myringotomy:

#### III.2.2.1 Indications:

Myringotomy is a surgical incision of the intact tympanic membrane. It is indicated for both diagnostic and therapeutic purposes. It allows for the collection of middle ear effusion for microbial culture and sensitivity testing in cases of suspected otitis media. Additionally, it provides access for the drainage of accumulated fluid, facilitates middle ear flushing, the instillation of topical medications, and the insertion of transtympanic ventilation tubes. The procedure must be performed under direct visualization after thorough cleaning and drying of the external ear canal **(Harvey *et al*, 2005).**

#### III.2.2.2 Surgical procedure:

Myringotomy is a minimally invasive technique performed under direct visualization, ideally using a video otoscope, to access the middle ear cavity through a controlled incision in the tympanic membrane (TM). The external ear canal is first thoroughly cleaned and dried to reduce the risk of contamination. If the TM is intact, an incision is made in the caudoventral quadrant of the pars tensa using a 5 French polypropylene catheter passed through the instrument channel of the otoscope. The catheter is gently advanced into the middle ear cavity, avoiding contact with delicate middle ear structures by maintaining a position along the ventral floor of the ear canal. Middle ear fluid is then aspirated for cytology and microbial culture, and the cavity is gently flushed with sterile saline to remove debris, pus, and mucus. If the TM is not intact, samples can be directly collected without incision. The procedure allows for effective diagnostic sampling and therapeutic lavage of the middle ear.

Care is taken to avoid over-flushing through a small incision, which could cause pressure-related trauma. In select cases, topical treatment can be instilled into the middle ear post-procedure. With proper technique, the TM typically heals within 3 to 5 weeks **(Cole and Nuttall, 2021).**

### III.2.1 Tympanostomy tube placement:

Tympanostomy tubes have been proposed as a treatment option for primary secretory otitis media (PSOM), an uncommon condition predominantly affecting Cavalier King Charles Spaniels. Traditionally, management has relied on repeated manual removal of mucoid effusion through a

myringotomy incision and administration of topical or systemic corticosteroids. However, these approaches often offer only temporary relief, requiring multiple interventions. Tympanostomy tube placement through the pars tensa under microscopic guidance provides continuous tympanic cavity ventilation and drainage, reducing the need for repeated myringotomies.

This technique is particularly indicated in cases with recurrent or chronic effusion, poor response to conservative treatments, or viscous mucus accumulation similar to human otitis media with effusion (OME). Previous reports and case series indicate that tympanostomy tubes are well tolerated, and complications are minimal, making them a viable and durable alternative for managing PSOM **(Corfield *et al*, 2008).**

### III.2.2 Middle ear polypectomy:

Effective management of inflammatory polyps hinges on their complete removal to minimize the risk of recurrence. While simple methods such as traction-avulsion**,** carbon dioxide laser ablation are often sufficient for pedunculated polyps, more extensive or recurrent lesions may necessitate advanced surgical techniques **(Greci and Mortellaro, 2016).** Beyond conventional procedures like ventral bulla osteotomy (VBO) and total ear canal ablation with lateral bulla osteotomy (TECA-LBO), several alternative methods such as transcanal endoscopic polypectomy (TEP) offer varying levels of invasiveness, accessibility, and effectiveness depending on polyp morphology and available equipment **(Hoshino *et al*, 2022).** The following sections outline these techniques, highlighting their procedural features, benefits, and limitations

#### III.2.2.1 Traction/avulsion of polyps:

Traction or avulsion represents the most straightforward method for aural and nasopharyngeal polyp removal, requiring no specialized instrumentation. The procedure involves grasping the polyp with toothed forceps and applying firm, rotational traction to detach it from its stalk **(Figure 16).** Although effective, this technique may be complicated in cases of multilobulated polyps, which are prone to rupture and bleeding, sometimes necessitating repeated traction and increasing the risk of stalk remnants and recurrence. For nasopharyngeal polyps, visualization is typically achieved by manipulating the soft palate, with or without a midline incision (staphylotomy) to improve access. Hemorrhage is usually mild to moderate and self-limiting. While generally successful, incomplete removal remains a concern, particularly when visualization or access is limited **(Greci and Mortellaro, 2016).**

However, some say that although traction is a simple and less invasive technique, it may not always ensure complete resolution. A study performed on 37 cats demonstrated that in 30 of them, the aural polyp was initially removed by **traction** alone. Among the 22 cats with available follow-up information, nine (41%) experienced a recurrence of the polyp, therefore careful post-treatment monitoring is essential **(Anderson *et al*, 2000).**

**Figure 16:** The forceps is gently rotated while grasping the aural polyp to make sure no other tissue has been grasped (Janssens *et al*, 2017).

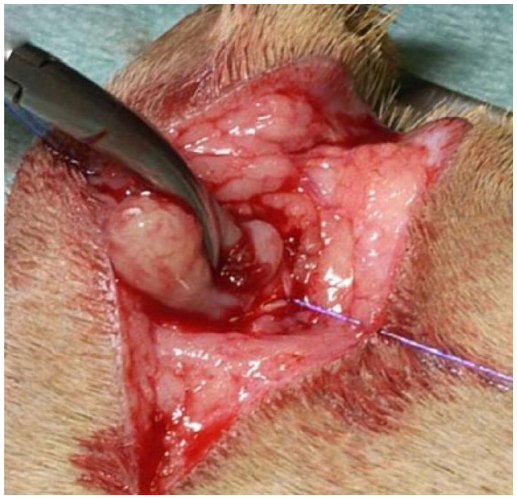

**Figure 17 :**Traction is applied until the polyp avulses (Janssens *et al*, 2017).

### III.2.2.2 Laser ablation of polyps:

Carbon dioxide laser ablation represents a minimally invasive and effective technique for the removal of aural polyps, particularly under video-otoscopic guidance. Using a rigid 120 mm laser tip inserted through a 2-mm working channel of a dedicated video-otoscope, smaller polyps can be vaporized directly, with charred debris subsequently removed by irrigation. In the case of larger polyps, the laser is directed along the floor of the horizontal ear canal into the tympanic cavity, enabling complete or partial vaporization of the mass to facilitate traction-based removal. Final ablation of the residual stalk is achieved by directing laser energy into the tympanic bulla until the stalk is no longer visible, reducing the likelihood of recurrence **(Greci and Mortellaro, 2016).**

### III.2.2.3 Transcanal endoscopic polypectomy TEP:

A new traction-torsion technique combined with diode laser ablation was recently employed via transcanal endoscopic polypectomy (Check glossary) to remove an aural polyp under general anesthesia in one dog. The polyp was initially extracted using 9 cm-long aural forceps, followed by endoscopic visualization of the suspected base in the upper tympanic cavity using a rigid scope. Complete vaporization of the residual stalk was achieved with a diode laser, and the ear canal was flushed with neutral electrolysed water. Postoperative care included oral administration of

prednisolone to control inflammation and cephalexin to prevent secondary infections. Two follow-up middle ear flushings were conducted at weekly intervals without anesthesia. Long-term monitoring over 3 years and 8 months revealed no recurrence of the polyp or associated otitis, indicating the effectiveness and durability of this minimally invasive approach **(Hoshino *et al*, 2022)**.

# IV CHAPTER VI: SURGERIES FOR AESTHETIC PURPOSES

## IV.1 Legal and ethical perspectives on ear Cropping in dogs:

Ear cropping is a surgical procedure involving the partial or complete removal of the auricular pinna. It is essentially practiced in dogs for aesthetic or breed-standard purposes, whereas in cats, it is never performed for cosmetic reasons and is limited strictly to medical or identification interventions. Historically, it was practiced in Shepherds, and in fighting breeds to reduce the risk of injury, as the external ear structures were vulnerable targets during combat.

In modern times, ear cropping is still performed in certain non-fighting breeds such as *Schnauzers*, *Great Danes*, *Boxers*, and *Boston Terriers*, primarily for cosmetic reasons and to meet conformation standards set by breed registries particularly in the United States. This practice continues despite the absence of functional or medical benefit and often results in prolonged postoperative discomfort. **(Sinmez *et al*, 2017)**

According to **Packová *et al* (2021)**, elective ear cropping is illegal under all circumstances in the UK and Slovakia, while legislation across the EU varies: some countries have entirely banned the procedure, whereas others still permit it without a centralized certification system.

In regions such as Australia, where dog fighting is illegal, the rationale for ear cropping is considered obsolete. The procedure is increasingly viewed as an unnecessary and painful cosmetic intervention **(Duckworth, 2009).**

In Algeria, ear cropping is not explicitly prohibited due to the absence of specific animal welfare legislation, placing the practice in a legal gray area.

## IV.2 Surgical procedure:

### IV.2.1 Age:

Otectomy, or ear cropping, is typically performed between 8 and 16 weeks of age, depending on the breed **(Bonnefous and Peker, 1986).** In small dog breeds such as the *Miniature Schnauzer*, *Pinscher*, *Brussels Griffon*, and *Petit Brabançon*, ear cropping may be performed after three months of age due to a lower risk of postoperative ear drooping. In contrast, for medium to large breeds including the *Boxer*, *Doberman*, *Briard*, *Beauceron*, *Bouvier des Flandres*, *Pyrenean Shepherd*, and *Standard and Giant Schnauzers*, the procedure is recommended before three months to optimize cartilage support and healing outcomes **(Maschke, 1980).**

### IV.2.2 Anesthesia:

Several anesthesia methods are used in ear surgeries. Local anesthesia with procaine injections at three specific ear points exists but is rarely used alone. It is commonly combined with sedation using agents like acepromazine, levopromazine, or chlorpromazine (Maschke, 1980). Alternatively, a full anesthesia protocol may be used, involving premedication with acepromazine (VETRANQUIL®), induction with thiopental sodium (NESDONAL®), and maintenance with oxygen, nitrous oxide, and fluothane. This approach provides effective sedation, smooth induction, and stable anesthesia (Vilain, 1981).

### IV.2.3 Surgical procedure:

The surgical technique is initiated by demarking the line of the incision through three reference points as shown in **Figure 18:** point C (established at the confluence of the ear and the cheek), point B (identified as the anterior limit of the caudal fold of the ear), and point A (the highest point of the ear according to the breed standard). This will be the line you draw with a permanent marker. A PINCEMIN-type clamp is then positioned as close as possible to point A to guide the cut. The excision is performed in a single smooth motion from the top to the bottom of the ear, using either scissors or a scalpel, to ensure a clean, even cut. Hemostasis is achieved by twisting the arterioles, and the section is then refined with scissors to maintain regularity and symmetry between both ears. For the second ear, the flap from the first ear is used to accurately replicate the cutting line. Finally, suturing is performed with a non-absorbable thread in a continuous pattern, making sure not to involve the cartilage, as this could cause a notched appearance at each stitch mark **(Venier,1992).**

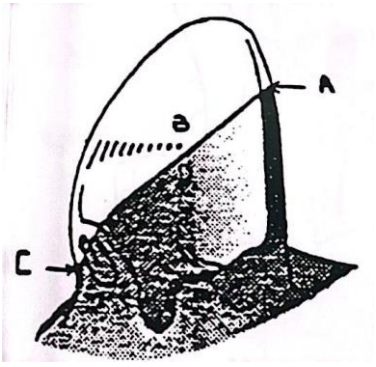


**Figure 18:** Demarking the line of the incision through three reference points (A,B,C) (Venier, 1992)

# SECOND PART :
# PRACTICAL PART

## I. Objective:

The objective of this study was to describe and compare several surgical cases of aural surgery encountered in Algiers province, in some veterinary practices, in order to better understand the indications, the surgical techniques used, the post operative outcomes, and the clinical results.

The results will be discussed and compared with the existing literature to identify similarities, differences, and potential areas for improvement.

## II. Case presentation:

### II.1 Case number 01 : Surgical treatment of aural hematomas (othematoma)

#### II.1.1 Case presentation:

A 3-month-old Tabby cat named “Kakashi” was presented to the HB clinic following the recent appearance of a swelling in one of the ears. According to the owner, the swelling was first noticed a few days after the cat had fallen from the sixth floor. The owner reported a progressive increase in the volume of the affected pinna, which appeared to be directly related to the trauma caused by the fall.

Upon clinical examination, a soft, fluctuant swelling consistent with an aural hematoma was observed on the concave surface of the pinna. Apart from the localized lesion, the general physical examination did not reveal any abnormalities. The cat was alert, responsive, and in overall good general health.

**Figure 19:** Kakashi’s pinna when he was presented at the clinic
(Courtesy of HB VET clinic, 2025)

### II.1.2 Surgical procedure:

#### II.1.2.1 Preoperative time :

“Kakashi” was placed in lateral recumbency and was put under general anesthesia using Zoletile® 100.

#### II.1.2.2 Operative time :

The surgeon used a blade to make a longitudinal incision through the pinna to drain the ear hematoma, as seen in Figure 20, with sterile gauze placed to prevent blood from entering the ear canal. In Figure 21, the surgeon squeezed the blood out of the pinna using their index and thumb, using another sterile gauze to clean the blood coming out. During the compression, the surgeon noted that the auricular cartilage appeared slightly damaged and showed signs of erosion, likely due to the pressure and chronic nature of the hematoma. Finally, as shown in the third image, the surgeon began executing sutures to

**Figure 23 :** Longitudinal incision through the pinna to drain the hematoma (Courtesy of HB VET clinic, 2025)

**Figure 23:** The blood is squeezed out of the pinna (Courtesy of HB VET clinic, 2025)

**Figure 23:** Suturing the rubber feeding tubes using simple interrupted sutures (Courtesy of HB VET clinic, 2025)

**Figure 23:** Final result of the suture (Courtesy of HB VET clinic, 2025)

attach the trimmed infusion tubes, their main role being to keep the ear from retracting and prevent recurrence of the aural hematoma.

#### II.1.2.3 Postoperative time :

Postoperative dressing began with the removal of the sterile cotton previously placed in the external portion of the pinna. Shotapen® was administered for infection control, Melovem® for pain relief, and Vitamin B12 to support recovery

#### II.1.2.4 Outcome:

The recovery progressed well, with no signs of infection, inflammation, or other complications reported by the owner during follow-up.

## II.2 Case number 02: Surgical treatment of aural hematomas (othematoma)

### II.2.1 Case presentation:

The 2-year-old Persian mix cat named “Mingo” underwent an anamnesis and general examination at Cheragas clinic for a swelling of the right pinna that had been evolving for approximately 10 days. According to the owner, the cat had been excessively scratching at its ear during this period. There was no clear history of ear mites (otodectic mange) or otitis externa, and the underlying cause of the pruritus remained unknown.

**Figure 24:** Mingo’s pinna before surgery (Courtesy of Cheraga veterinary clinic, 2025)

Upon clinical examination, the pinna appeared swollen and fluctuant, consistent with an aural hematoma. The rest of the physical examination was unremarkable. Mingo’s body temperature was 38.5°C and heart rate was 160 beats per minute, both within normal physiological limits for a cat. No other systemic abnormalities were detected, and the cat was otherwise in good general health.

### II.2.2 Surgical procedure:

#### II.2.2.1 Preoperative time:

Mingo was placed in lateral recumbency with the owner of the cat responsible for holding the cat and there was no anesthesia administration.

#### II.2.2.2 Operative time:

The surgeon used a needle to aspirate blood through the pinna in order to drain the ear hematoma, as seen in **Figure 25**, with cotton swab placed to prevent blood from entering the ear canal., the surgeon aspirated the blood using a needle . Finally, as shown in the **Figure 26**, the surgeon began executing sutures to stitch the wound using suture thread (Dec 3) and complete with the placement of a trimmed infusion tubes.

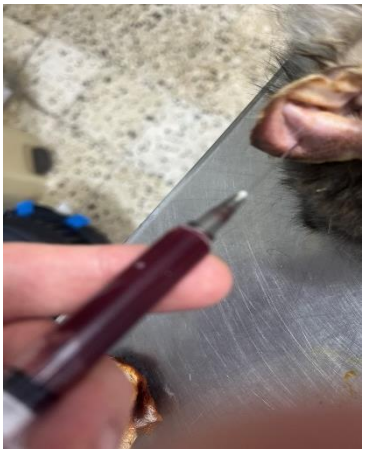

**Figure 25:** Aspirating blood using a syringue (Courtesy of Cheraga veterinary clinic, 2025)

**Figure 26:** Segments of IV infusion tubing attached to prevent the recurrence of the aural hematoma (Courtesy of Cheraga veterinary clinic, 2025)

#### II.2.2.3 Postoperative time:

Surgeon starts with the removal of the cotton swab previously placed in the external portion of the pinna. Antibiotic spray (Teramycine) was then applied directly to the surgical wounds followed by Aluspray (wound spray) to reduce the risk of postoperative infection. Additionally, a Vitamin B12 injection was administered for improving the general health.

#### II.2.2.4 Outcome:

The outcome was favorable, and the owner reported no signs of infection, recurrence, or other complications during the postoperative period.

## II.3 Case number 03: Surgical treatment of aural hematomas (othematoma)

### II.3.1 Case presentation:

A 3-year-old German Shepherd was presented to the veterinary school ENSV for evaluation of a swelling affecting one of the ears. According to the owner, the swelling appeared progressively, but there was no clear indication of excessive scratching, head shaking, or previous ear infections. The anamnesis did not reveal a confirmed history of otitis externa or trauma, and the underlying cause of the aural hematoma remained undetermined.

During the general clinical examination, the dog was alert and in good overall condition. The affected pinna exhibited a soft, fluctuant swelling consistent with an aural hematoma. Vital parameters, including temperature and heart rate, were within normal limits for the species.

Given the diagnosis, the patient was placed under general anesthesia to proceed with the appropriate surgical treatment.

### II.3.2 Surgical procedure:

#### II.3.2.1 Preoperative and operative time:

The German Shepherd was placed in lateral recumbency. The surgeon used a blade to make an "S"shaped incision through the pinna to drain the ear hematoma, reaching the distal end of the swelling, as seen in the first image **(Figure 27).** In the second image, the surgeon squeezed the blood out of the pinna using their index and thumb, using another sterile gauze to clean the blood coming out. Fibrine cloths and debris where identified and removed by gentle traction using blunt forceps. Finally, the surgeon placed multiple 1cm long sections of infusion tubing ,on both the inner surface (**Figure 29)** and the outer surface of the pinna **(Figure 28),** securing them with perforating U-stiches, the thread

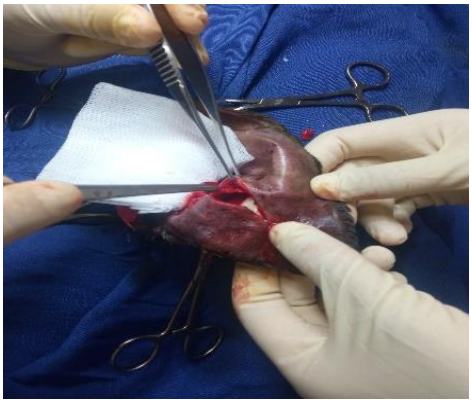

**Figure 27:** Longitudinal incision through the pinna (Courtesy of Dr rebouh (ENSV surgery department, 2025))

passing into their lumens.  their main role being to keep the ear from retracting and prevent recurrence of an aural hematoma.

**Figure 29:** Rubber feeding tubes (Lateral view) (Courtesy of Dr rebouh (ENSV surgery department, 2025))

**Figure 28:** Rubber feeding tubes (Medial view) (Courtesy of Dr rebouh (ENSV surgery department, 2025))

### II.3.2.2 Postoperative time:

Postoperative management included bandaging for a few days and the use of an Elizabethan collar to be maintained until suture removal. However, according to the owner, the collar was not consistently respected. The follow-up consultation occurred after a slight delay, although the exact number of days remains uncertain. Sutures were removed without complications.

**Figure 30:** image shows the post operative status of the patient with the wound wrapped around with a bandage (Courtesy of Dr rebouh (ENSV surgery department, 2025))

#### II.3.2.3 Outcome:

The postoperative outcome was favorable. No signs of infection or other complications were noted. The ear was not retracted but remained slightly thickened, giving it a heavier appearance and a mildly drooping aspect.

## II.4 Case number 04: Cosmetic ear cropping

### II.4.1 Case presentation:

Lucy, a 3-month-old female Doberman, was presented to OASIS clinic for an elective cosmetic otectomy. At the time of presentation, the patient was in good overall health, with all vaccinations and deworming protocols up to date.

### II.4.2 Surgical procedure:

**Figure 31:** Lucy's pinna before surgery (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

#### II.4.2.1 Preoperative time:

The patient was placed under general anesthesia using a combination of ketamine and acepromazine. An intravenous catheter was inserted into the right forelimb, and the surgical assistant administered atropine intravenously to prevent vagal reflexes, as well as Dicynone® to reduce intraoperative bleeding. The animal was positioned in sternal recumbency, and the assistant carried out aseptic preparation of both ears using multiple cycles of hydrogen peroxide, followed by alcohol and iodine-alcohol. A piece of cotton was placed in each external ear canal to protect the auditory passage. After aseptic preparation, four sterile surgical drapes were placed and secured using four towel clamps with care taken to avoid full coverage of the head, ensuring that both ears remained fully exposed and accessible within the sterile field.

### II.4.2.2 Operative time:

The surgeon began by assessing the desired length of the auricles, using the medial canthus of the eye as an anatomical reference point **(Figure 32).** The target length was initially marked on one ear by making a skin incision with surgical scissors. Both ears were then placed together with their external surfaces in contact to ensure symmetry, and a corresponding notch was made on the second ear at the same level as shown in **Figure 33.**

**Figure 32:** assessing the auricular length in relation to the the medial canthus of the eye (arrow) (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

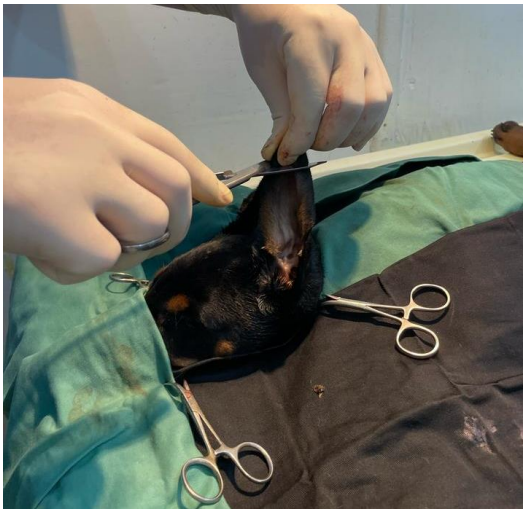

**Figure 33**: Symmetrical Notch Placement Achieved by Positioning Both Ears with External Surfaces in Contact (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

A limiting (otectomy) clamp was applied to one ear at the level of the anterior notch and secured at the base of the auricle, just posterior to the helix, with care taken to avoid the formation of folds within the ear **(Figure 34)**. A clean, continuous incision was made using a scalpel blade, ensuring a smooth cut and avoiding jagged or fragmented sections of cartilage. The clamp was removed immediately following the incision **(Figure 35).**

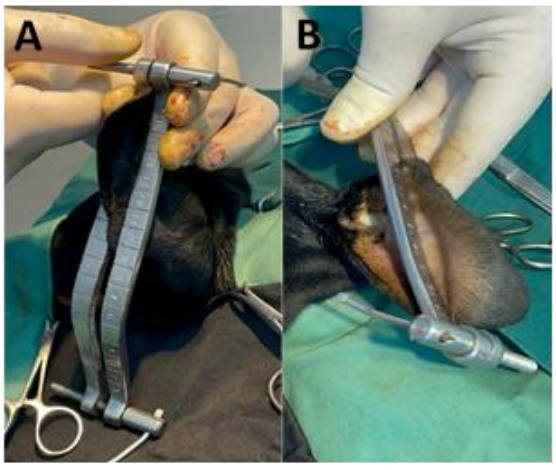


**Figure 34:** Placement of the limitative clamp (A) Lateral view; (B) Medial view (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

**Figure 35:** Clean and continuous skin Incision at the surgical site (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

Hemostasis of any bleeding vessels was achieved by applying a sterile gauze pad over the hemorrhagic area using a hemostatic forceps, allowing adequate time for coagulation **(Figure 36).** The same surgical procedure was then performed on the contralateral ear. Once both auricles had been trimmed, symmetry was carefully evaluated, and minor corrections were made if necessary to achieve a balanced and aesthetically acceptable result **(Figure 37).**

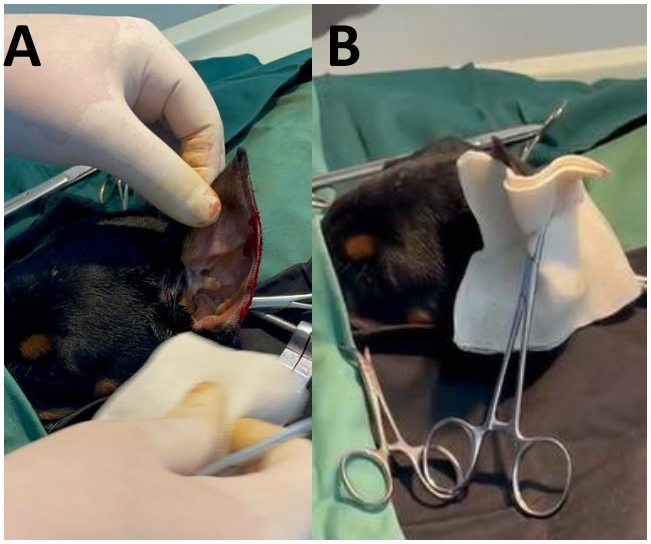


**Figure 36:** (A) bleeding in the surgical site (B) hemostasis with hemostatic forceps (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

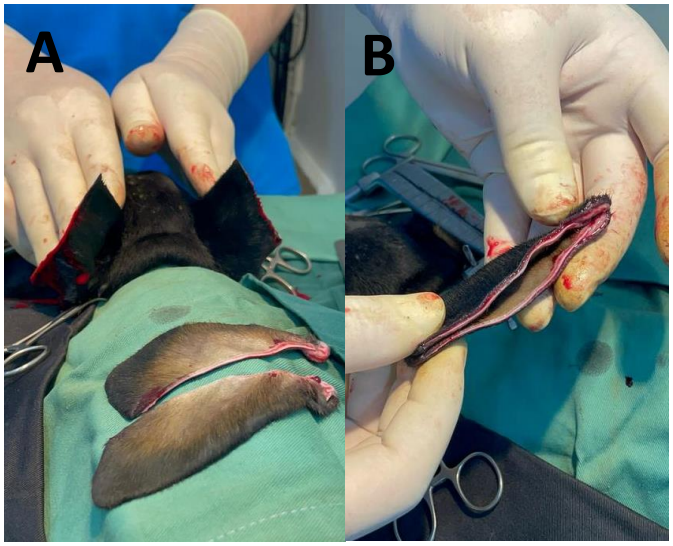


**Figure 37:**(A) Symmetry evaluation of both auricles (B) Comparison of the two cut auricular parts placed in parallel to verify symmetry and shape alignment (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

Closure was performed using absorbable suture material (2/0). The surgeon placed interrupted sutures, beginning on the medial (inner) aspect of the ear. Each stitch involved first piercing the skin of the internal surface, then bringing the needle out between the skin and the cartilage, taking care never to perforate the cartilage itself. The needle was then passed through the skin of the external surface, ensuring the cartilage was properly sandwiched between skin layers for optimal healing and protection. Each suture was secured with a surgeon's knot, and care was taken not to overtighten the sutures to avoid tissue ischemia. This process was repeated along the entire length of the incision on both ears **(Figure 38).**

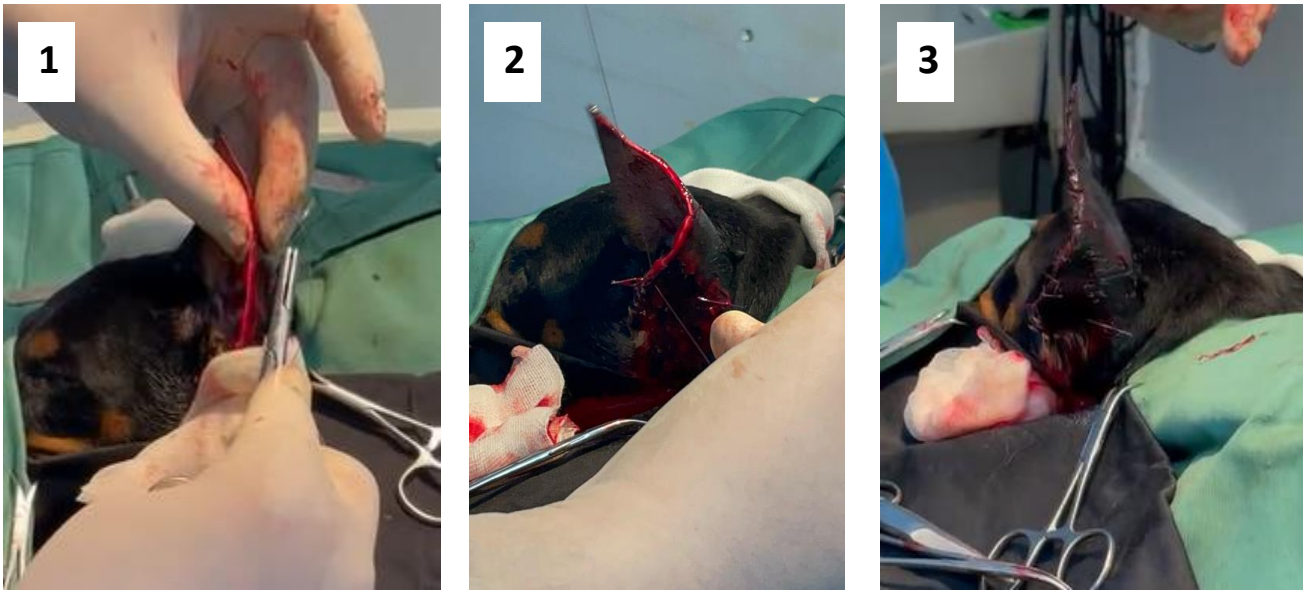


**Figure 38:** Suturing process of the left auricle (1) Initial Suture is placed at Mid-auricle (2) Downward Progression of the Suture Line (3) Final Appearance of the Left Ear (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

### II.4.2.3 Postoperative time:

Postoperative dressing began with the removal of the sterile cotton previously placed in the external auditory canals. A topical antibiotic spray (Oxytetracycline) was then applied directly to the surgical wounds to reduce the risk of postoperative infection **Figure 39(1).** Sterile gauze was subsequently placed over the incised margins **Figure 39(2),** and both ears were brought together in a flat, aligned position **Figure 39(3)** and **Figure 39(4).** The auricles were then wrapped and secured using a sterile gauze bandage **Figure 39(5).** It was kept in place for 24 hours only, after which it was removed to allow proper ventilation and monitoring of wound healing.

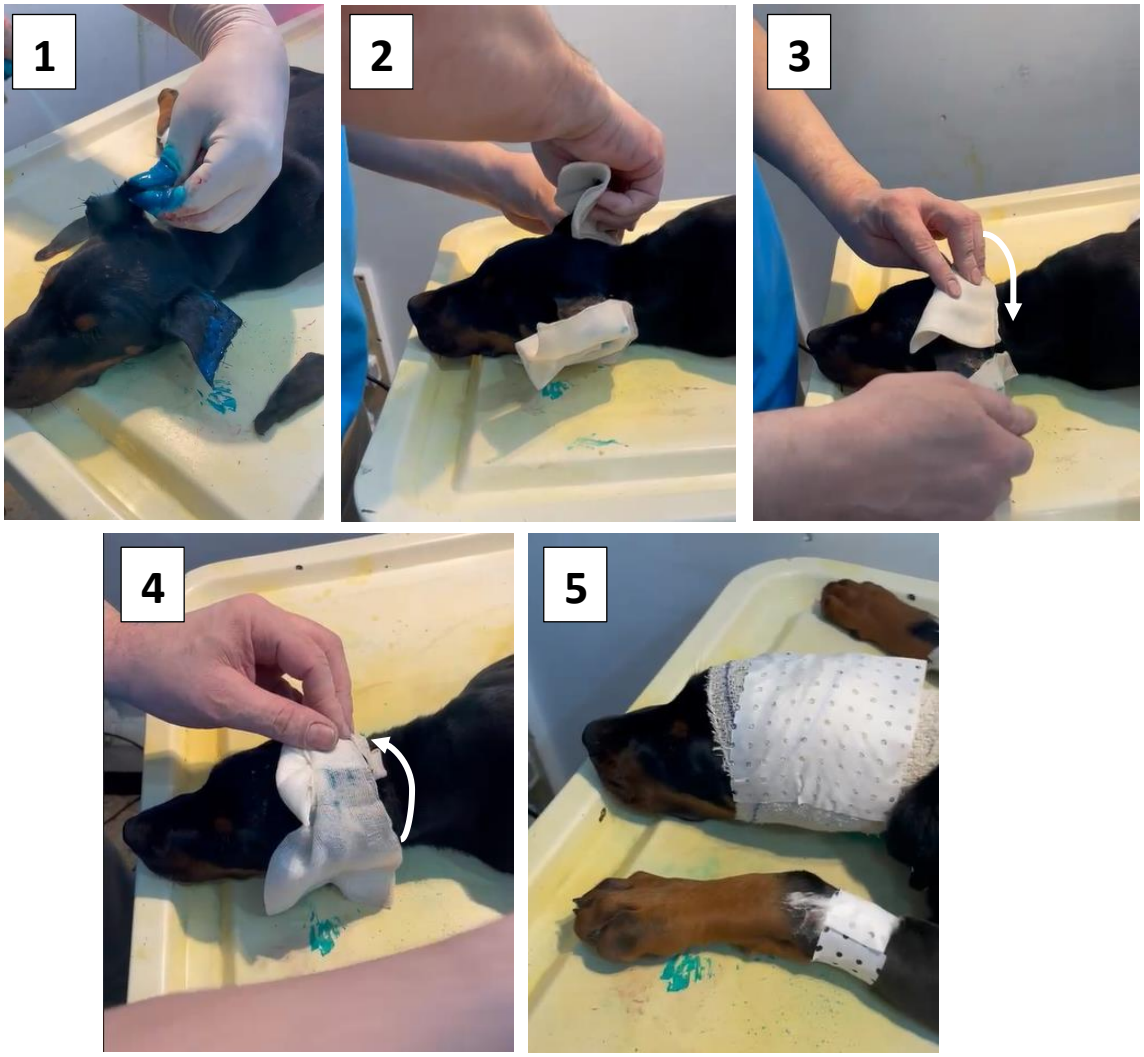


**Figure 39:** Postoperative steps (1) Application of topical antibiotic spray to the surgical wound (2) Placement of sterile gauze over the incised auricular margins (3)(4) Alignment of both ears by positioning them one over the other, as indicated by the directional arrows (5) Final bandaging using sterile gauze secured with adhesive tape. (Courtesy of dr tiouririre (veterinary clinic l'OASIS, 2025))

### II.4.2.4 Postoperative follow-up:

CLAMOXYL® 1 g was prescribed at a dosage of one-quarter tablet administered twice daily for 10 days. Suture removal was scheduled for 10 days postoperatively. The patient exhibited no complications during the recovery period, and wound healing proceeded without incident, resulting in complete and optimal cicatrization.

## III. Discussion:

The surgical interventions addressed in this part of the study include three cases of aural hematoma, which we must highlight as the most commonly performed ear surgery in domestic carnivores. The fourth case concerns a cosmetic procedure ear cropping. Although this practice is not widely performed by most veterinarians, it remains carried out by a small minority in Algeria.

In the 1st case, the veterinarian opted for a longitudinal incision to drain the aural hematoma. Although an S-shaped incision is often recommended in the literature to minimize skin retraction and promote better healing **(Gotthelf, 2004)**, the longitudinal approach remains acceptable and is not contraindicated. In this specific case, the patient was a cat, and the longitudinal technique proved to be technically easier to perform due to the smaller size and thinner structure of the feline pinna **(Griffin, 2010).** Moreover, the esthetic expectations for cats are generally lower than for dogs with upright pinnae, where any deformation may be more noticeable. Therefore, the choice of a longitudinal incision was justified by both technical convenience and the lesser cosmetic impact in this species.

In the same case during compression, the surgeon observed that the auricular cartilage was slightly damaged and showed signs of erosion, likely due to chronic pressure from the hematoma. While mechanical trauma remains the primary factor, **Joyce and Day (1997)** suggested that an early immune response may also contribute to the cartilage erosion frequently seen in affected dogs, though no evidence supported a true autoimmune etiology for this cat.

According to **Mikawa et al. (2005),** short plastic tubes can be sutured across the pinna following hematoma evacuation to act as mechanical supports. In the present case, the veterinarian opted for two longer tubes instead. This adaptation can be considered acceptable, particularly in cats, as their pinnae are thinner and more flexible, making them more tolerant of such modifications without compromising comfort or healing.

For case number 02 the veterinarian used a cotton-tipped applicator inserted deep into the ear canal. This is not a recommended technique. The use of a long and rigid object like this poses a significant risk of pressure necrosis of the pinna, especially compared to standard methods that use for protection of the ear canal a cotton ball **(Tear, 2021).** Additionally, the procedure was carried out without anesthesia, which is inappropriate for both ethical and practical reasons. Without proper sedation, the animal experiences pain, and the risk of iatrogenic trauma increases.

While material limitations are sometimes a reality in clinical practice, in this case, the choice of technique was neither safe nor justified, as less harmful and more appropriate alternatives are typically available even in resource-limited settings.

In this case, the veterinarian treated a feline aural hematoma by performing a single needle aspiration, followed by the placement of two long tubes across the pinna, as in the previous case. While **Mikawa et al, (2005)** reported that aspiration alone is associated with a high recurrence rate and generally fails without adjunctive corticosteroid therapy, the addition of mechanical support through sutured tubes may help reduce recurrence by maintaining the shape of the pinna during healing. However, as mentioned previously, the use of long tubes is not the standard recommendation.

In case number 03; the surgeon followed a well-established technique by performing an S-shaped incision, which is generally preferred to reduce skin retraction **(Gotthelf, 2004).** The evacuation of the hematoma was thorough, with removal of fibrin and debris, which is essential to prevent chronic inflammation. The use of 1 cm sections of infusion tubing, placed on both surfaces of the pinna and secured with perforating U-stitches, is a valid and effective method to maintain the ear's shape and minimize recurrence, especially in breeds with erect pinna **(Mikawa *et al,* 2005).**

The surgeon performed cosmetic ear cropping in the 4$^{th}$ case using a methodical and anatomically guided technique. The use of general anesthesia and proper preoperative preparation, including vagolytic and hemostatic support, demonstrates adherence to basic surgical protocols **(Venier, 1992).** The positioning, aseptic preparation, and draping ensured a clean operative field, and the procedure was executed with attention to symmetry and tissue handling.

The incision was made using an otectomy clamp and scalpel, followed by meticulous hemostasis and closure with interrupted absorbable sutures. Notably, the surgeon avoided cartilage perforation and tissue ischemia by respecting anatomical planes and suture tension. Postoperative dressing was appropriate, and the brief application of a 24-hour bandage followed by antibiotic therapy and wound monitoring allowed for uneventful healing and satisfactory cosmetic results.

However, it is important to state that ear cropping is a controversial procedure, widely discouraged or banned in many countries due to ethical concerns, as it offers no medical benefit to the animal **(Packová *et al,* 2021; Duckworth, 2009).** In Algeria, while it is still practiced by some veterinarians, its necessity and justification remain debated. This case illustrates a technically correct execution of the procedure, but from a welfare standpoint, it raises important questions regarding non-therapeutic surgeries in veterinary practice.

## IV. Conclusion:

These cases illustrate the diversity of surgical techniques used in the treatment of aural hematomas in dogs and cats. While some procedures closely adhered to recommended standards such as S-shaped incisions and the use of short tubules others showed deviations that may increase the risk of complications, such as incomplete treatment protocols.

These variations reflect not only differences in surgical choice but also the real constraints faced in daily veterinary practice, including a lack of materials and limited resources. Nevertheless, it is clear that veterinarians make significant efforts to apply the correct surgical techniques, adapting to the circumstances while striving to ensure effective treatment and minimize complications.

## GENERAL CONCLUSION:

This study explored a range of surgical interventions involving the external and middle ear in domestic carnivores. While ear surgery encompasses a wide variety of conditions including tumors, otitis, foreign bodies, and congenital malformations, the cases examined in this work were predominantly related to aural hematomas, which remain among the most common ear conditions requiring surgical intervention in practice.

Through the analysis of three aural hematoma cases and one cosmetic ear cropping procedure, the study highlighted the diversity of surgical approaches and their clinical outcomes. It demonstrated the importance of selecting techniques based on species-specific anatomy, lesion characteristics, and context. Despite some limitations, the veterinarians involved showed adaptability and a strong effort to apply appropriate surgical protocols.

The ear cropping case, although technically well-executed, raised ethical considerations, as it is a non-therapeutic procedure with no medical benefit. Its inclusion reflects the ongoing debate surrounding cosmetic surgeries in veterinary medicine and the need to prioritize animal welfare.

Overall, this work emphasizes the importance of evidence-based surgical decision-making, good postoperative management, and continued professional training. Maintaining high clinical standards and prioritizing the well-being of the animal are essential goals in all forms of ear surgery.

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