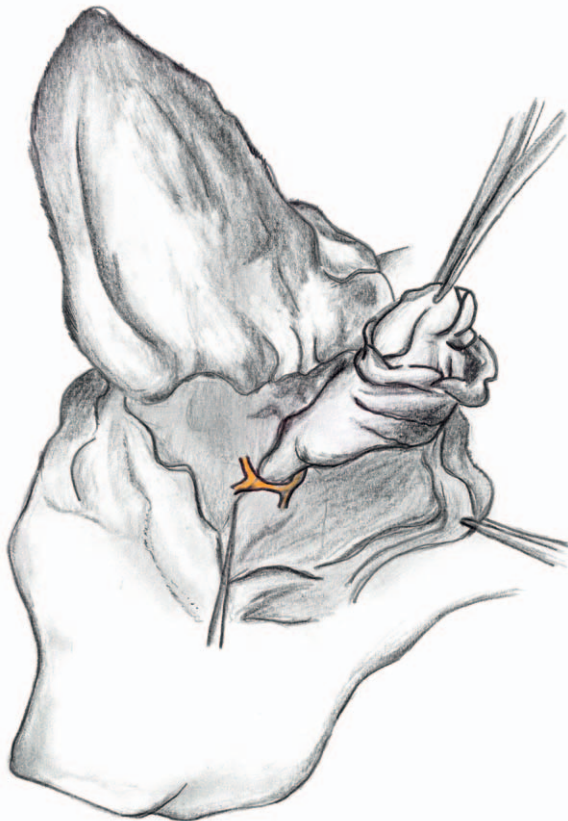


Surgery of the ear

Study material for Small animal surgery
and orthopaedics practicals



MVDr. Andrea Nečasová, MVC. Lucia Kasalová,
MVDr. Markéta Mrázová, Ph.D., MVDr. Jana Lorenzová, Ph.D.

*This educational material was created in relation to the project
IVA VFU Brno no. 2020FVL/1660/15.*

ANATOMY

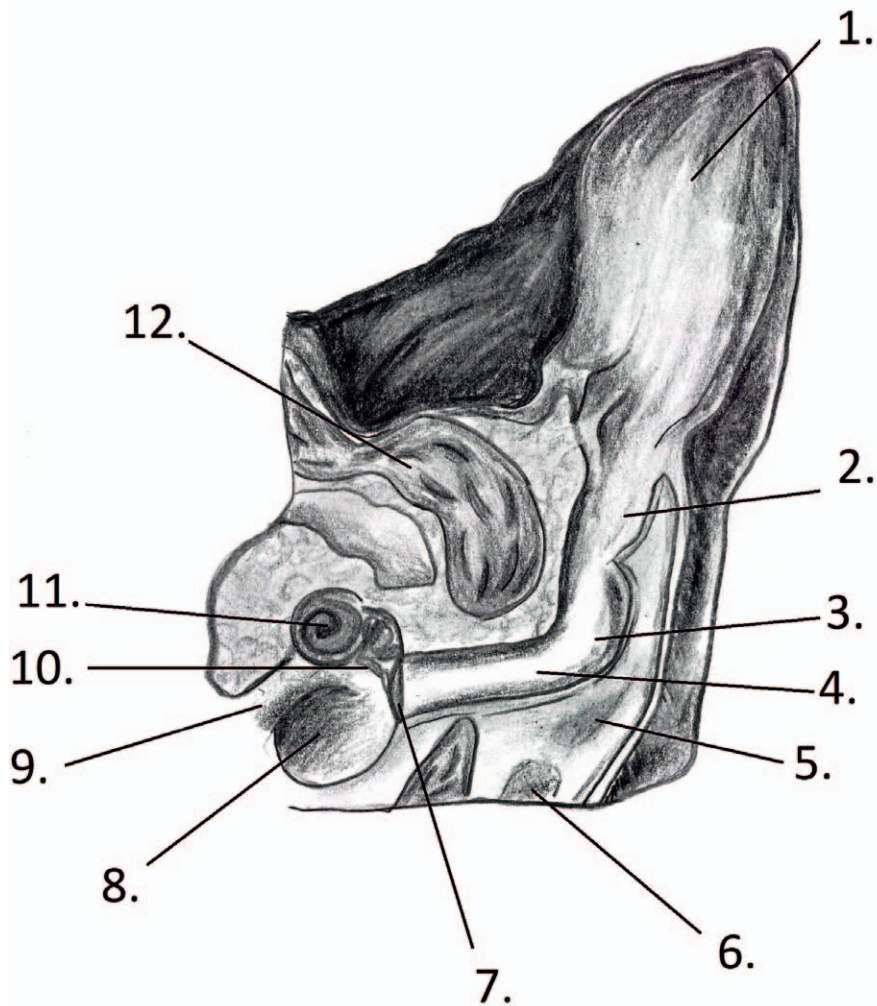
The ear is composed by three main parts:

- **outer ear** – auricle (pinna), vertical and horizontal ear canal, tympanic membrane (eardrum)
- **middle ear** – *bulla tympanica* and auditory tube (Eustachian tube)
- **inner ear** – membranous and osseous labyrinth, auditory and statokinetic system.

The primary function of the outer ear and the pinna is capture and transmission of sound. The pinna is composed of cartilage. Size, length and shape of the pinna differs according to the breed, its movement is provided by several auricular muscles. Ear canal can be divided into vertical and horizontal canal. These two parts are connected with a cartilaginous annulus.

The middle and the outer ear are separated by the tympanic membrane – eardrum. The middle ear is mainly composed of the tympanic cavity (*cavum tympani*). This cavity is subdivided into two parts – the *recessus epitympanicus* in the dorsal aspect and the tympanic bulla (*bulla tympanica*) in the ventral aspect of the cavity. There are three auditory ossicles in the rostromedial part of the tympanic cavity – *malleus*, *incus* and *stapedus*. These ossicles are connected with tympanic membrane, which receives sound waves from the outer ear. The sound waves cause vibrations of tympanic membrane, which are then transmitted by ossicles to the perilymph within the vestibular organ and by this provide transmission and perception of the sound. The tympanic cavity in cats is divided into two smaller cavities by a bony septum. This septum lies in the cranial part of the cavity and it is often necessary to damage it during the surgery to completely drain the tympanic bulla. There is a small fissure in the bony septum near the area of cochlear window, near which the promontory takes a place – the promontory is a site where the sympathetic plexus is forming. During the surgical procedure in this area the sympathetic plexus can be irritated easily and clinical symptoms of the Horner syndrome may occur. The middle ear is connected with nasopharynx via the auditory tube.

The inner ear is located in the *pars petrosa ossis temporalis* and contains auditory and statokinetic apparatus. It is formed by the membranous and osseous labyrinth, space between the two is filled with perilymph, membranous labyrinth is filled with endolymph. The membranous labyrinth contains the vestibular system with receptors for balance and motion sensation, and the cochlea with the organ of Corti for sound perception.



1. Auricle (*pinna*)

2. Vertical canal

3. Cartilaginous anulus

4. Horizontal canal

5. *Gl. Parotis*

6. *Gl. Mandibularis*

7. Tympanic membrane (eardrum)

8. *Bulla tympanica*

9. Auditory tube (Eustachian tube)

10. Auditory ossicles

11. *Cochlea*

12. *M. temporalis*

AURICULAR (AURAL) HEMATOMA (OTHEMATOMA)

= collection of blood between the skin and the cartilage of the ear

Etiology

Auricular hematoma occurs after a blunt trauma of the ear (injury, intensive head-shaking), most commonly due to other primary disease (otitis externa, ear canal foreign body, etc.). Increased capillary fragility or autoimmune disease can also be the cause in some animals.

Clinical presentation

Auricular hematoma clinically appears as a painful, soft, fluctuant swelling on the inner side of the auricle. It can be reddish initially. Later, the hematoma can fibrose and “harden”. There is a concurrent otitis externa in the majority of cases.

Therapy

First of all, we need the auricular hematoma to organise itself for about 10–14 days and to treat the primary cause (otitis externa). In this phase we use the accumulated fluid as a source of pressure to compress the vessel and therefore to stop the bleeding, and we wait for the cruor to become the seroma. Besides the otitis treatment we can support absorption of the hematoma with a local application of an ointment facilitating resorption of the hematoma. After 10–14 days we can proceed to conservative or surgical treatment.

a) Conservative treatment:

1. Aspiration of the hematoma

- clip and aseptically prepare the site of the injection
- inject 18G needle into the highest point of the hematoma, aspirate the fluid
- success rate: circa 10 %, relapses occur very often due to quick refilling of the cavity inside the ear that remains empty after fluid aspiration
- use E-collar

2. Aspiration of the hematoma with application of long-acting corticosteroids

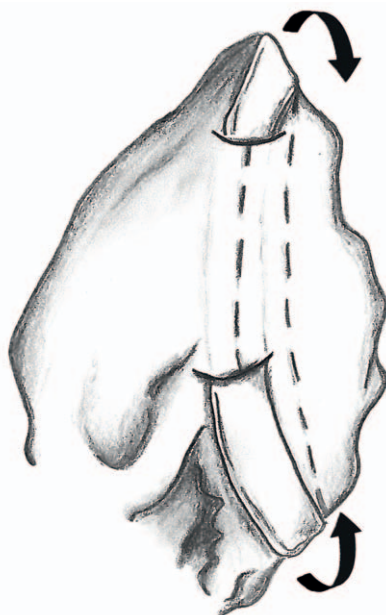
- clip and aseptically prepare the site of the injection
- inject 18G needle into the highest point of the hematoma, aspirate the fluid and apply long-acting corticosteroid (methylprednisolone-acetate 0,5–1 ml pro toto)
 - contraindication for corticosteroid application: Cushing's disease, autoimmune disease, reaction to previous corticosteroid application
- use E-collar
- success rate: up to 90 %

Advantage of these method is that they are quick to perform and can be perform without putting the patient under general anaesthesia. Disadvantage is their high risk of recurrence. In case of recurrence, the aspiration of the aural hematoma can be repeated twice, always after 10–14 days from previous treatment. In case of another relapse, we proceed to the surgical treatment (drainage, incision, suturing).

b) Surgical treatment:

1. Drainage

- clip and aseptically prepare the auricle
- make an incision in the proximal and the distal part of the hematoma, apply rubber drain and tie its ends together
- administer antibiotics systemically, use E-collar until healed
- massage the ear twice a day, clean the secretions from the ear and ear canal, remove the drain after the secretion stops (circa 10 days)
- success rate: circa 95 %
- risks: cumulation of secretions inside the ear canal and subsequent impairment of the concurrent otitis a následné zhoršení otitidy



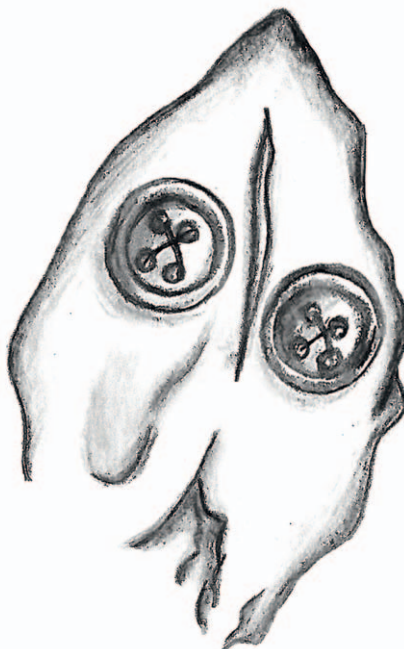
2. Incision with suture

- clip and aseptically prepare the auricle
- make an incision in the centre of the hematoma on the inner side of the auricle, the incision should extent from one end of the hematoma to the other, remove the fibrin and clots
- place multiple simple interrupted sutures to the inner side of the auricle along its entire length using nonabsorbable monofilament suture material (1,5–3M thickness)
 - place the sutures through the cartilage, do not penetrate the skin on the outer side of the auricle
 - sutures should be placed alternately starting at the periphery of the hematoma and proceeding to the incision, so the cavity is fully closed and no re-accumulation of the fluid occurs, do not suture the incision
- administer antibiotics systemically, bandage the ear for 1–2 days, use E-collar
- success rate: circa 95 %
- disadvantages: auricle deformation after complete healing



3. Incision with a suture over a padding layer

- clip and aseptically prepare the auricle
- make an incision in the centre of the hematoma on the inner side of the auricle, the incision should extent from one end of the hematoma to the other, remove the fibrin and clots
- suture the padding layer (knob, old X-ray film, infusion set, etc.) laterally on each side of the incision using nonabsorbable monofilament suture material (1,5–3 M thickness), place the sutures through the cartilage, the padding should be secure in place with at least one stitch, do not suture the incision
- administer antibiotics systemically, bandage the ear, use E-collar, clean the area of incision regularly
- advantages: less deformation of the auricle compared to incision with suture
- disadvantages: pressure necrosis can occur when the padding layer is sutured too tight, the method might not be successful if the padding layer is sutured too loose; you might not be able to perform cleaning of the auricle sufficiently when using a padding that is too large and placed over the incision



EAR CANAL RESECTION

Ear canal resection is an adjuvant method in treatment of chronic otitis. The principle of the resection is to achieve opening of the vertical canal and to transpose entrance into the ear canal to the area of cartilaginous annulus. Horizontal ear canal becomes more accessible, drug application is easier, drugs get easily to the diseased site and better “ventilation” of the ear is provided.

Indications

- recurrent otitis with a minimal hyperplasia of the vertical canal epithelium
- vertical canal neoplasia
- vertical canal strictures as a result of chronic inflammation

Contraindications

- horizontal canal obstruction
- horizontal canal stenosis
- concurrent otitis media
- extensive hyperplasia of the vertical canal epithelium

Surgical technique:

1. prepare the surgical area aseptically; make two parallel skin incisions laterally to the vertical canal, size circa 1,5–2× the length of the vertical canal;
2. connect these incisions in the ventral part, dissect the skin flap and reflect it dorsally, so the cartilaginous wall of the vertical canal is exposed, dissect parotid gland to the side or cut it sharp;
3. make two parallel incisions in the vertical canal cartilage, dorsally from pretragic/ intertragic part of the canal, ventrally to the beginning of the horizontal canal, retract the cartilaginous flap of the canal ventrally, resect excessive parts of the skin flap;

4. suture the subcutis (subcutis “underneath the skin” to a subcutis/connective tissue on the cartilage side) with a continuous suture pattern using absorbable monofilament/polyfilament suture material (1,5–3 M thickness) and suture the epithelial tissue of the canal to the skin with simple interrupted sutures using nonabsorbable monofilament suture material (1,5–3 M thickness), sutures in the area of cartilaginous annulus are the first to be placed.

- administer antibiotics and analgesics systemically, use E-collar until healed
- remove the stitches in 10–14 days.

1.



2.



3.



4.



TOTAL EAR CANAL ABLATION

= total removal of the ear canal

This technique is usually performed in conjunction with a *bulla tympanica* osteotomy.

Indications

- chronic otitis externa refractory to conservative treatment
- hyperplasia of horizontal canal epithelium
- ear canal neoplasia
- otitis media – always in conjunction with bulla osteotomy!

Surgical technique:

1. prepare the surgical area aseptically; make a “T-shape” incision along the tragus and ventrally about 1-1,5 the length of the vertical canal;
2. continue with dissection around the vertical and horizontal canal (close to the cartilage) and excise the entire ear canal close to the bony base,
 - while dissecting, be careful not to damage *n. facialis* and *a. maxillaris*! (arrow = *n. facialis*);

then perform a tympanic bulla osteotomy – remove the bone of the ventromedial part of the tympanic bulla using bone pliers, perform a curettage of the tympanic bulla content (avoid the rostromedial part of the bulla – there are auditory ossicles in this part!), place a drain with fenestrations – place the drain medially to the auricle and ventrally away from the incision;

3. suture the subcutis with a continuous suture pattern using absorbable monofilament/polyfilament suture material (1,5–3 M thickness) – start with the subcutis in the vertical part of the incision, then proceed to the horizontal part of the incision; suture the skin with a simple interrupted suture pattern using nonabsorbable monofilament suture material (1,5–3 M thickness) and secure the drain to the skin with simple interrupted sutures using nonabsorbable monofilament suture material (1,5–3M thickness).

- administer antibiotics and analgesics systemically, use E-collar until healed, flush the drain with sterile saline solution twice a day
- remove the drain when the secretion stops, circa in 7–10 days, remove the stitches in 10–14 days.

1.



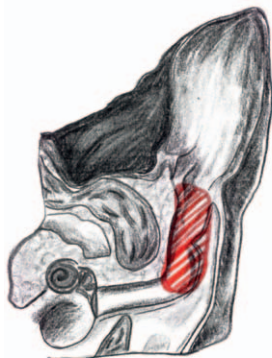
2.



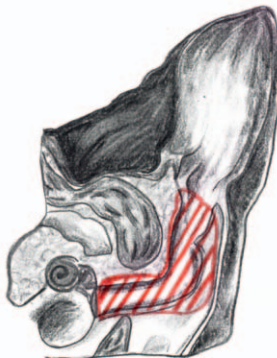
3.



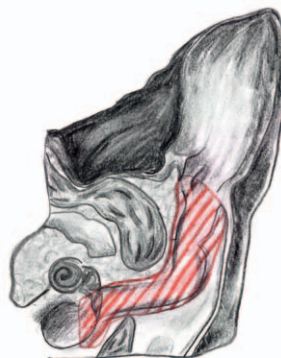
COMPARISON OF EXTENT OF THE SURGICAL INTERVENTION OF DESCRIBED METHODS



1. Ear canal resection



2. Total ear canal ablation



3. Total ear canal ablation + tympanic bulla osteotomy

Author of the illustrations: MVC. Lucia Kasalová

References:

- Fossum T.W. Surgery of the ear. In Fossum, T.W., Small animal surgery, 5th ed. St. Louis: Elsevier, 2019, p. 302–330. ISBN 978-0-323-44344-9.
- Mertens D., McDonald Mertens M., Nečas A a kol. Otitidy a možnosti jejich chirurgického řešení. Hradec Králové: Vetinform, 2003.
- Liebich H.G. König, H.E. Ústrojí rovnováhy a sluchu (organum vestibulocochleare). In König, H.E. – Liebich H.G. Anatomie domácích savců 2. díl: splanchnologie, cévní a nervová soustava, 1st ed. Bratislava: Hajko & Hajková, 2002, p. 319–334, ISBN 80-88700-57-4.