TREATMENT APPROACHES TO EAR CANAL ISSUES IN CATS AND DOGS

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KELLY BOWLT identifies common ear conditions presented in practice, including otitis externa and media, and advises on potential underlying causes

COMMON conditions seen in the external or middle ear canal may include otitis externa and media, polyps, neoplasia, trauma, cholesteatomas, abscessation or congenital abnormalities.

Otitis externa and media are acute or chronic inflammatory diseases of the external and middle ear respectively. The incidence of otitis externa is five to 12 per cent in dogs and two per cent in cats[1]. Owners may seek veterinary attention for clinical signs associated with a combination of otitis externa (for example, pruritus, ear pain, head rubbing/shaking/tilt, aural haematoma and malodorous discharge – Figure 1), otitis media (for example, facial nerve paralysis and exposure keratitis) or, rarely, otitis interna (such as vestibular syndrome and ataxia).

In acute otitis externa cases, the ear canal and pinna may become erythematous and ulcerated but, as the condition becomes more chronic, hyperkeratosis, hyperpigmentation and canal stenosis usually predominate. One or both ear canals can be affected and it is important to appreciate the involvement of only one canal does not rule out a generalised, underlying disease such as atopy[1].

In some cases, infection can extend to the central nervous system, causing bacterial meningoencephalitis[2], or the internal ear, causing deafness[3]. However, any hearing impairment associated with otitis usually has characteristics of conductive hearing loss and improves with ear

canal cleaning[4].

Factors reported to be associated with development of otitis externa and media are presented in Table 1. In chronically affected dogs, the incidence of clinical skin complaints is seen in up to 59 per cent of animals[5]. Secondary infection is mostly due to commensal staphylococci or yeasts, *Pseudomonas*, *Proteus* or *Escherichia coli*[5]. For treatment of otitis externa or media to be successful, the underlying cause must be identified and effectively managed or eliminated.

Inflammatory polyps are non-neoplastic masses originating from the ear's epithelial lining. They most commonly originate from the tympanic bulla or auditory tube in young cats and their development is often noted following an episode of viral respiratory infection. Polyps may extend into the nasopharynx (identified behind the soft palate on oral examination) or external ear canal (seen as a fleshy coloured mass on otoscopy).

The majority of tumours found in the canine external ear canal are epithelial in origin – for example, ceruminous gland adenocarcinoma (most commonly), squamous cell carcinoma and ceruminous carcinoma) – with 60 per cent being malignant[6]. Soft tissue sarcomas and melanomas have also been reported[7]. A greater proportion (87.5 per cent) of feline aural tumours are malignant and may be bilateral[7]. With most external ear canal tumours, invasion across the cartilage into the surrounding soft tissue is rare.

Trauma to the ear can result in separation of the auricular and annular cartilage, resulting in obstruction of the canal, pain, periaural abscessation or an abnormally mobile pinna[8,9]. Aural haemorrhage is often reported at the time of trauma and should prompt investigation.

Investigation

Most otitis externa and media cases are associated with an underlying cause (Table 1) and exclusion of these conditions should be ensured with a full dermatological investigation. An exhaustive discussion is beyond the scope of this article, but investigation might include:

• Otoscopic examination – to better visualise the degree of canal inflammation, stenosis, ulceration, and debris. Foreign bodies, masses and parasites can sometimes be seen. A separate otoscope cone should be used to examine each ear and cones should always be thoroughly cleaned and sterilised after use.

• Cytology from each ear – examined under the microscope for otodectic or demodectic mites, bacteria, yeast, fungal hyphae and inflammatory or neoplastic cells. Where bacterial or fungal infection is suspected, culture may be useful in guiding treatment choices. Where masses are visualised, biopsies should be obtained for histopathological analysis.

• Bacterial culture and sensitivity from a swab from each ear – to help guide treatment choice. The

most commonly isolated microorganism (seen in 70 per cent of cases) associated with bilateral otitis externa is *Staphylococcus pseudintermedius*[10] and up to 82 per cent of patients are affected with polymicrobial infections. It is imperative to perform bacterial culture of swabs from each ear separately, because up to 68 per cent of dogs will have different microorganisms in different ears[10]. Considering the high resistance rates of *S pseudintermedius* identified in one study, antibacterial sensitivity results are imperative to ensure one ear is not being treated inappropriately. In some cases, different topical treatment may be required for each ear10. Otitis media is seen in 82.6 per cent of ears with otitis externa, despite the tympanic membrane being intact in 71.1 per cent of these ears[11]. Different isolates and antibacterial sensitivity is seen between the horizontal ear canal and middle ear in 89.5 per cent of ears, emphasising the requirement for swabs from different sites within the same ear (using a guarded swab or following myringotomy, as appropriate)[11].

It is important to emphasise that ear infections are secondary to another disease process (Table 1). The underlying cause must be identified and addressed before treatment of the ear infection can be successful. This is illustrated by a study investigating normal beagle ears, which demonstrated that bacteria and yeast were cultured from the vertical ear canal in 48.8 per cent and 83.7 per cent, respectively12. None of these dogs suffered from ear infections because there was no underlying disease process.

Imaging

On any imaging study, the normal external ear canal is symmetrical and air-filled, while the normal bulla is formed by thin, regular bone. The mucosal lining of the bulla forms a smooth, mildly contrast enhancing layer on MRI and CT studies. The inner ear structures are also evident on cross-sectional imaging studies, with the circular cochlear and semicircular canals often being visible within the petrous part of the temporal bone.

Radiography is able to outline the external ear canals and bullae with the use of lateral, dorsoventral, open mouth and oblique views, details of which have been described[13] (Figure 2). Ultrasound has been used to evaluate the bullae and periaural soft tissues and is sensitive and specific for detection of fluid within the lumen[14]. CT (Figure 3) and MRI (Figures 4a and 4b) both provide cross-sectional information on the aural structures. CT is the most useful for evaluation of the osseous components of the ear, whereas MRI provides more detail on the soft tissues. Positive contrast canalography has been described[8],[15], but is not routinely considered helpful by the author.

Surgical treatment

• External ear canal surgery

Surgery is indicated for ears in which exhaustive medical management for otitis externa or media has failed, an ear canal tumour is suspected, cutaneous fistulae develop, a para-aural abscess or cholesteatoma is diagnosed, or the ear is “end stage” – characterised by occlusion of the ear

canal as a result of chronic proliferation and inflammation of the canal's epithelial lining, leading to stenosis, fibrosis and mineralisation. Other considerations may include the animal's temperament and the ability/willingness of the owner to pursue continued medical therapy.

Lateral wall resection and vertical ear canal ablation have been described[16]. The former is described for cases of reversible otitis externa to improve the ear canal's ventilation and accessibility, or for small lateral wall tumours of the vertical ear canal lateral wall, but has a failure rate of up to 86.5 per cent[17].

The latter is indicated in cases of severe vertical ear canal disease, in the presence of a normal horizontal canal. In the author's experience, indications for both surgeries are extremely uncommon and, by the time the ear is considered unresponsive to medical management, total ear canal ablation and lateral bulla osteotomy (TECA-LBO) is usually the only realistic surgical option to provide relief from the clinical signs of otitis externa +/– media. The author also prefers TECALBO for aural neoplasms.

The surgical technique for TECA-LBO has been beautifully described in detail[16]. After general anaesthesia and local nerve block of the auriculotemporal and great auricular nerves, TECA-LBO starts with a circular incision (some surgeons prefer T-shaped) through skin and cartilage around the vertical ear canal opening and blunt dissection of the soft tissues, from the auricular cartilage to the osseous external auditory meatus (Figure 5). During the dissection, the facial nerve is located caudoventral to the canal at the level of the terminal horizontal canal and should be avoided. In cases of chronic otitis externa, the soft tissue may be well adhered to the cartilage and haemorrhage may be profuse in this inflamed tissue.

The ear canal is amputated as close to the bulla entrance as possible using a scalpel blade, cutting from ventral to dorsal to protect the facial nerve. The entire ear canal should then be submitted for histopathological analysis (Figure 6). Some surgeons also swab the bulla for bacterial culture at this stage.

The soft tissue overlying the ventrolateral wall of the bulla is reflected using a periosteal elevator, remaining close to the bone to avoid damage to the neighbouring vascular structures (retroglenoid and maxillary veins and carotid artery). This cleaned bone, ventral to the bulla entrance, is then removed with rongeurs (Figure 7), creating a keyhole-shaped entrance to the bulla through which debris can be removed.

The bulla epithelial lining is gently removed with small curettes, avoiding the bulla dorsal region where the round window is located. The bulla is gently lavaged to remove debris and aid in epithelial remnant identification. After soft tissue closure across the bulla entrance, the author infiltrates the wound with bupivacaine before routine closure of the remaining wound (Figure 8).

Postoperative care involves generous provision of opioids (for example, methadone or morphine)

and, if appropriate, NSAIDS as a minimum. Additional analgesia (for example, ketamine, fentanyl for dogs or lidocaine) may also be appropriate.

Cold packs should be applied to the site every four hours to reduce pain and inflammation. Antibiotics may be indicated and should be based on culture and sensitivity results. A buster collar may be appropriate to avoid patient interference with the surgical site, which may result in wound dehiscence or aural haematoma. Potential postoperative complications are not uncommon[16],[18] and may include:

• Facial nerve deficits – seen in up to 48.9 per cent of ears[18], which may be due to preexisting facial nerve damage secondary to the aural disease process, facial nerve damage during surgery, postoperative inflammation or the effects of local anaesthesia. The median duration of temporary facial nerve deficits is two weeks for dogs and four weeks for cats. TECA-LBO in cats has a significantly higher incidence of permanent facial nerve lesions (33.3 per cent of ears), compared with dogs (8.3 per cent of ears)[18]. The author prefers to apply eye lubrication until facial nerve function has been restored, to avoid exposure keratitis.

• Horner's syndrome is reported in 8.2 per cent of ears and is particularly common in cats (58.3 per cent), compared with dogs (3.3 per cent)[18] (Figure 9).

• Peripheral vestibular syndrome: head tilt is reported in 11.3 per cent of cases, but is temporary in 53.5 per cent[18]. Horizontal nystagmus is reported in 4.5 per cent of cases and lasts less than one week[18].

• Incisional dehiscence (5.3 per cent).

• Haemorrhage – usually due to retroglenoid vein damage. This may be extremely profuse and is reported in three per cent of cases[19].

• Pinna necrosis[20].

• Chronic para-aural abscessation, seen in six to 10 per cent of dogs after TECA-LBO for up to a year, postoperatively[21], or cholesterol granuloma[22].

• Variable hearing loss (although most animals with chronic otitis externa and stenotic ear canals have hearing impairment in the affected ear, preoperatively)[23].

Following TECA-LBO, relief from clinical signs can be seen in 57 to 92 per cent of patients[16],[19]. The clinician should be mindful that if TECALBO has been performed to address an "end stage" ear secondary to chronic otitis, continued management of any underlying causes (for example, atopy) may still be required. Where TECA-LBO has been performed to remove a tumour, surgery may be curative due to the rarity of tumour invasion through the entire auricular cartilage.

In dogs, TECA-LBO to remove an adenocarcinoma may be curative in up to 100 per cent of cases. Prolonged survival is reported, with tumours confined to the external ear canal (more than 30 months) compared with those also involving the bulla (5.3 months)[7]. Cats with adenocarcinoma undergoing TECA-LBO are reported to have a median, disease-free interval of 42 months and a recurrence rate of 25 per cent[24], but poorer results are achieved in cats with neurological signs or squamous cell carcinomas. Radiotherapy may be useful as an adjuvant therapy in cases with aural neoplasia and the advice of an oncologist should be sought.

• Ventral bulla osteotomy

Vetral bulla osteotomy (VBO) is a disease affecting the middle ear (bulla), in the presence of a normal external ear canal (for example, inflammatory polyp). Many inflammatory polyps are amenable to conservative management, being gentle traction and oral prednisolone, resulting in a recurrence of 10 per cent in cats with nasopharyngeal polyps and 50 per cent in cats with external ear polyps[25],[26].

In any patient with ear disease (but particularly in cats) it is important to determine whether the external ear canal is diseased (in which case TECA-LBO is indicated), or whether the lesion – for example, polyp or otitis media – is arising from the middle ear, but may or may not be extending into an otherwise normal external ear canal (in which case VBO is indicated). Accurate diagnosis should be made with advanced imaging (Figure 10). VBO has been described[27] and is almost never indicated in the dog, being a very challenging surgery in this species.

VBO is most commonly indicated in the cat. The patient is positioned in dorsal recumbency with support under the neck and the site of incision is situated directly over the palpably bony bulla (located within the triangle bound by the mandibular symphysis, the larynx and the caudal border of the mandible). Dissection is required through the thin platysma and sphincter coli muscle, before the facial and lingual veins are identified and retracted and the digastric and mylohyoid muscles are separated to identify the bony bulla (Figure 11). The periosteum is removed with an elevator and the osteotomy is performed with a drill or an enlarging series of Steinmann pins, using particular care and a slow, steady hand as the bone may be severely thinned as a result of the disease process.

Unlike the dog, the cat has a peculiarity to the bulla, being a bony septum within the bulla separating it into two communicating cavities – a larger ventral cavity (hypotympanum) and a smaller rostrolateral cavity (epitympanum and mesotympanum). This septum (Figure 12) must be gently broken down to access the entire bulla, with the osteotomy located as far laterally as possible to minimise risk of Horner’s syndrome. The bulla is gently cleaned of debris using curettes and lavage, avoiding the vestibular structures and submitting excised material for histopathological analysis (and bacterial culture, if indicated) (Figures 13 and 14). Closure is routine.

Postoperative care is similar to that for TECA-LBO, that is, generous provision of analgesia, cold packs and, if required, antibiotics. Potential complications include Horner’s syndrome or vestibular

signs, both of which may already be present preoperatively or may be caused by surgery. Persistence of these signs after six weeks means they are likely to be permanent. The prognosis for resolution of clinical signs after VBO is excellent.

• Para-aural abscessation

The most common cause of para-aural abscessation is incomplete debridement of the epithelial lining from the bulla during TECA-LBO, resulting in clinical signs such as fistulation, facial swelling, head tilt, facial palsy, ataxia or pain (particularly when opening the mouth). Antibiotics afford little, or only temporary, relief and exploratory surgery is always indicated. Advanced imaging (for example, MRI) will be useful in aiding diagnosis. A lateral approach is the author's approach of choice, but the lack of external ear canal following TECA-LBO means the landmarks, which aid in avoiding the facial nerve and retroglenoid vein, are absent.

• Canal separation

This condition has been beautifully described by Tivers[8], who demonstrated that primary repair of annular and auricular cartilage separation, via a caudal approach to the ear canal, was associated with excellent longterm outcome in patients with acute and chronic injuries.

Conclusions

• Otitis externa and interna are commonly seen complaints in practice and are usually secondary to underlying causes, the most common of which is an underlying skin complaint (for example, atopy or food allergy), seen in up to 59 per cent of cases.

• Diagnostic aids should include both cytological assessment and bacterial culture of swabs, taken from both ears and from different sites within the same ear.

• Advanced imaging (for example, MRI or CT) is useful in characterising the extent of ear disease.

• Where the external ear canal is diseased and not amenable to medication management, improvement in clinical signs following TECA-LBO can be seen in up to 92 per cent of patients[16].

• Where only the middle ear is affected in cats, VBO offers excellent postoperative prognosis.

• Complications following TECA-LBO or VBO are not uncommon.

Acknowledgements

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Further reading

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Figure 1. An elderly cat with right otitis externa and media, demonstrating a right-sided head tilt and aural discharge.

Figure 10. An MRI of the bulla in a cat, demonstrating otitis media.

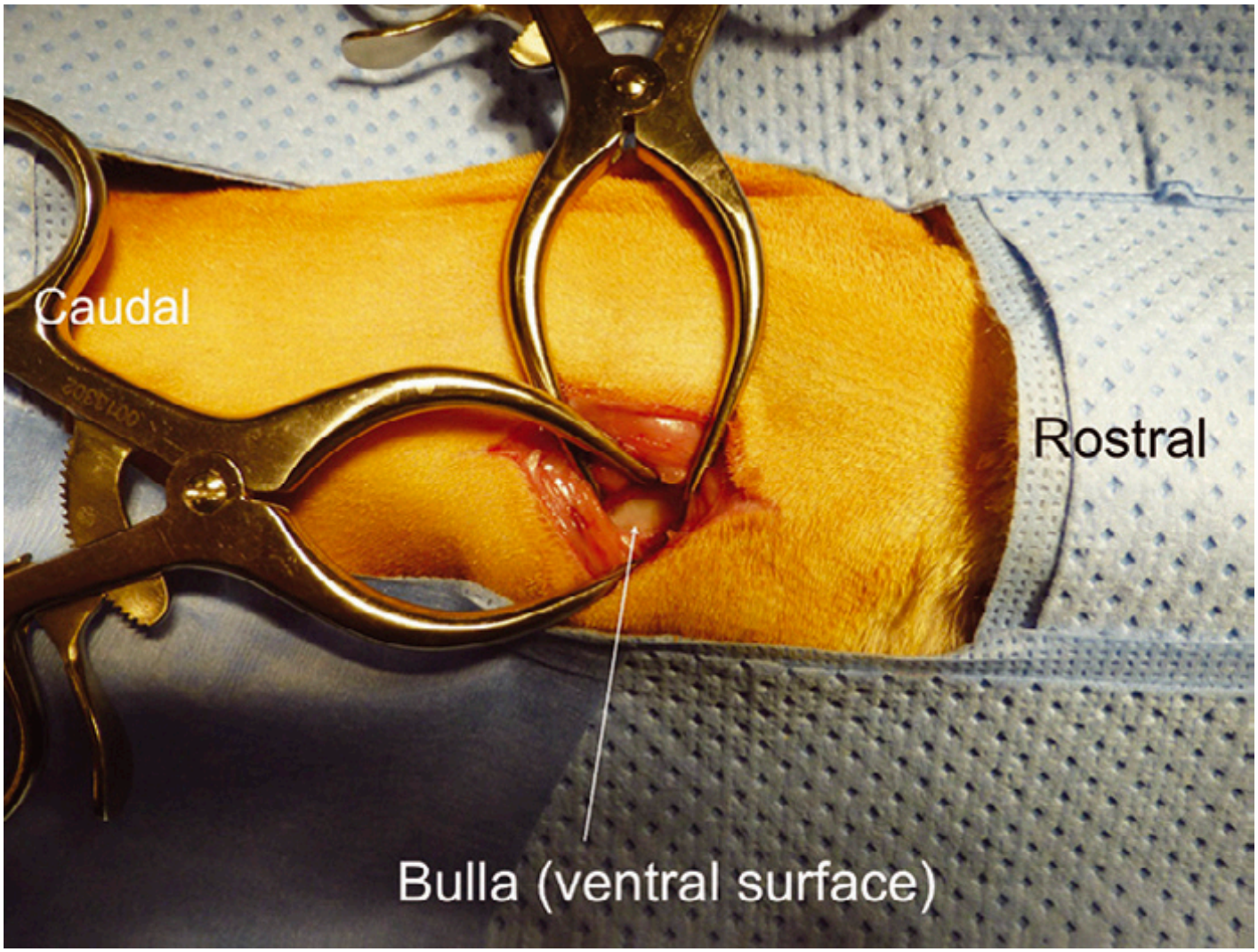


Figure 11. Surgical exposure of the ventral aspect of the bulla during VBO in a cat.

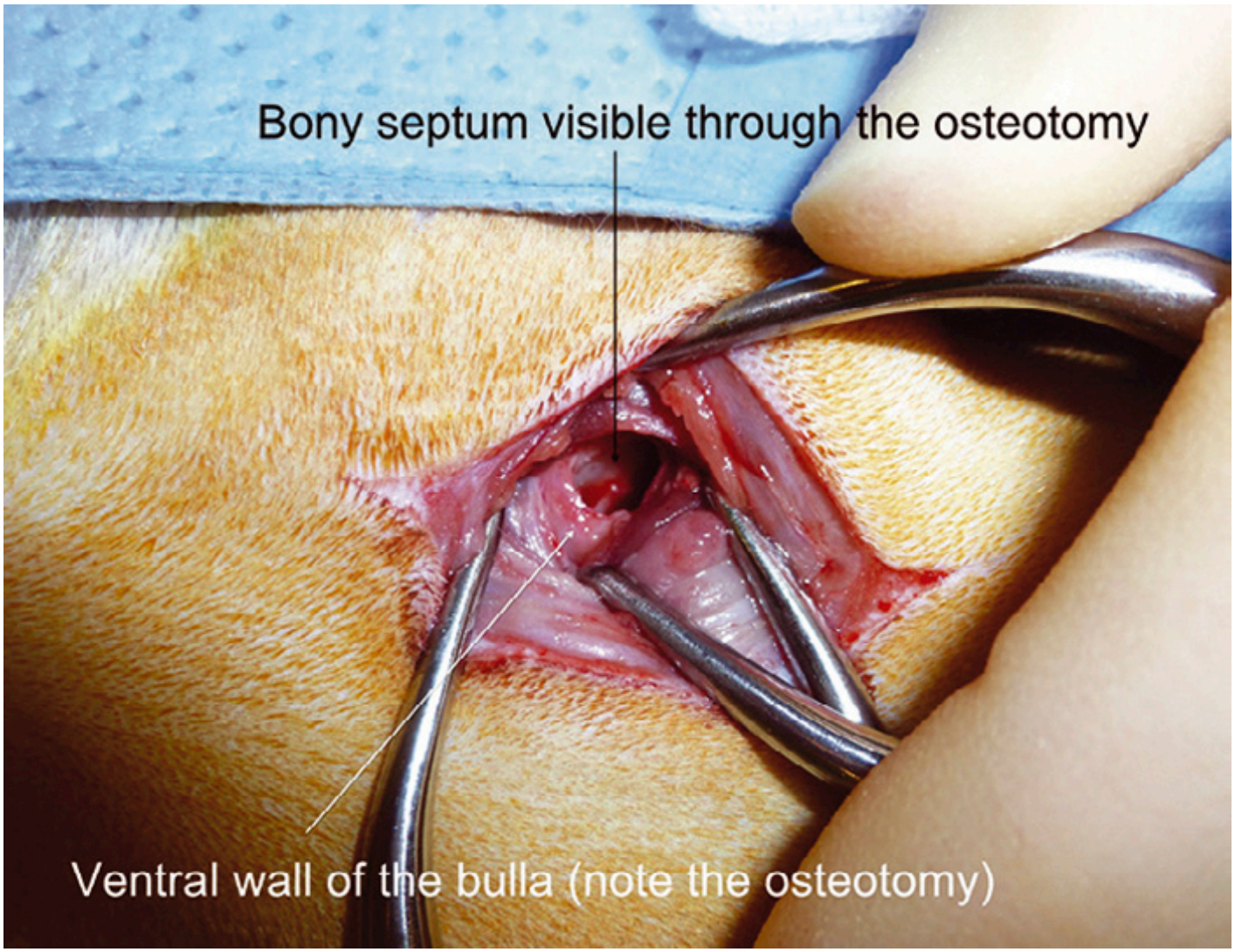


Figure 12. The feline bulla contains a bony septum, separating it into two communicating cavities – a larger ventral cavity (hypotympanum) and a smaller rostrolateral cavity

(epitympanum and mesotympanum).

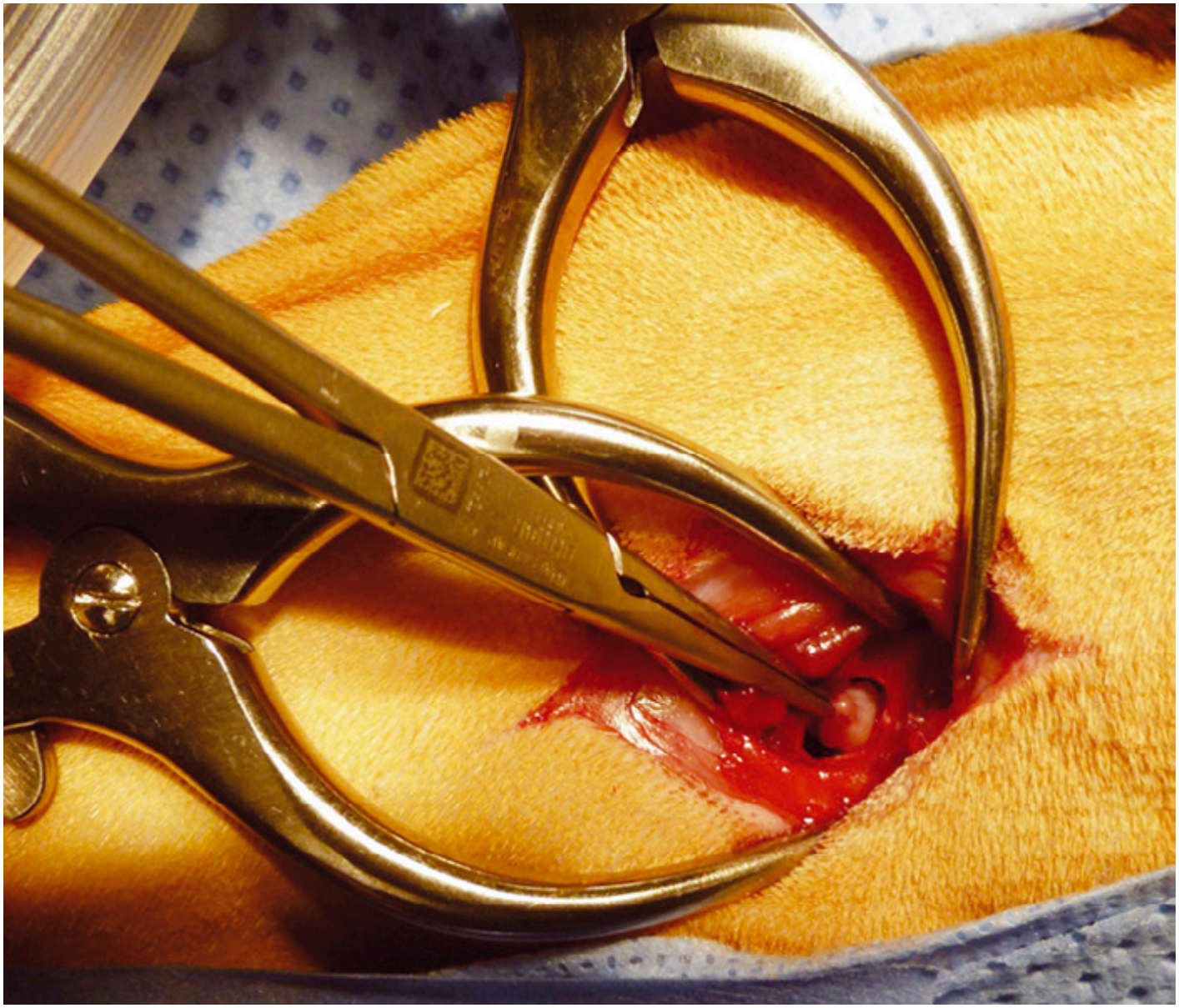


Figure 13. Soft tissue is removed from the bulla of a cat during VBO.

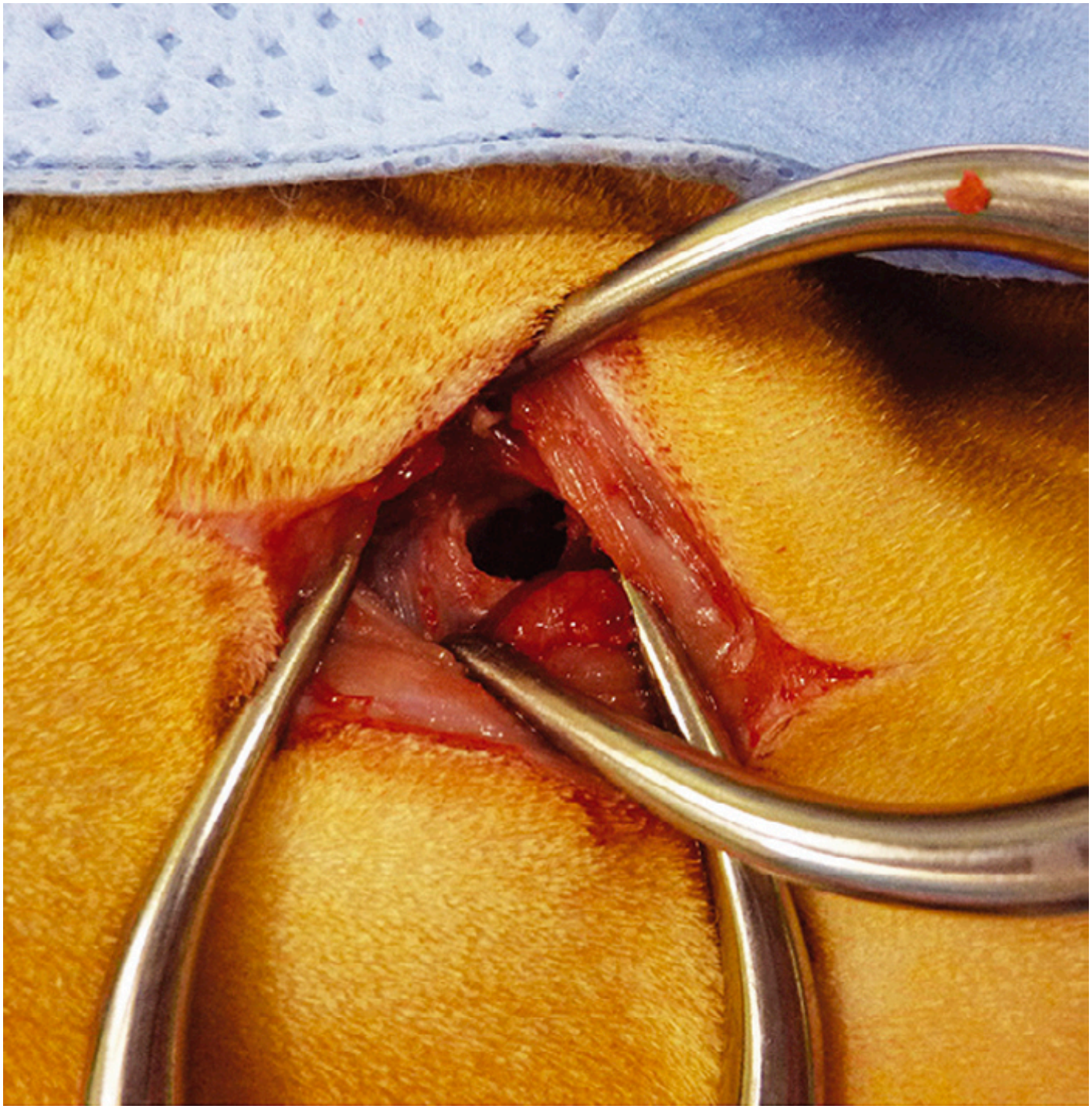


Figure 14. The cleaned bulla after VBO in a cat.

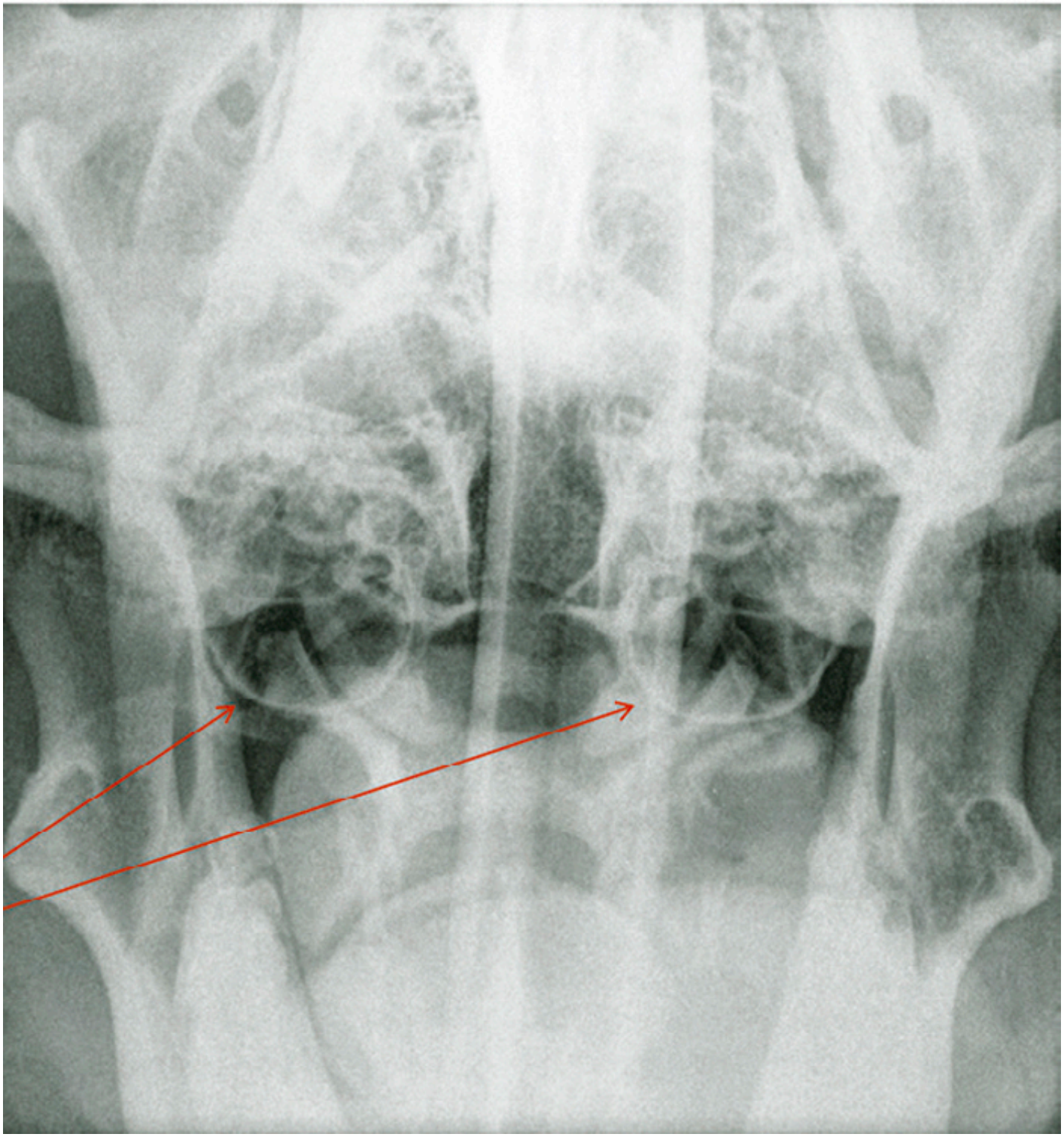
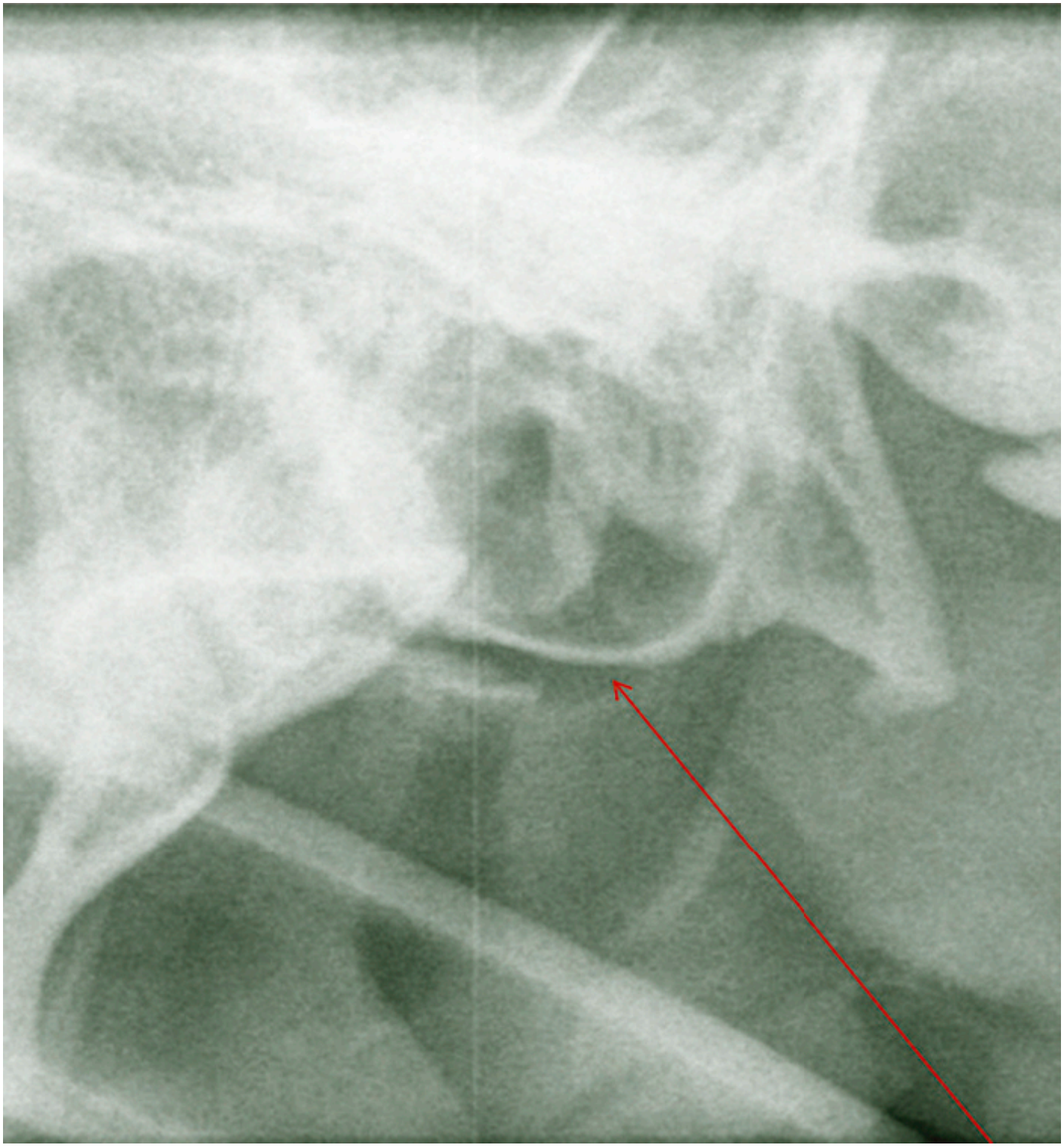


Figure 2. Open mouth rostrocaudal (2a) and lateral oblique (2b) radiographic images of a

normal bulla in a dog. The red arrows indicate thin, smooth, regular bone forming the air-filled bulla.



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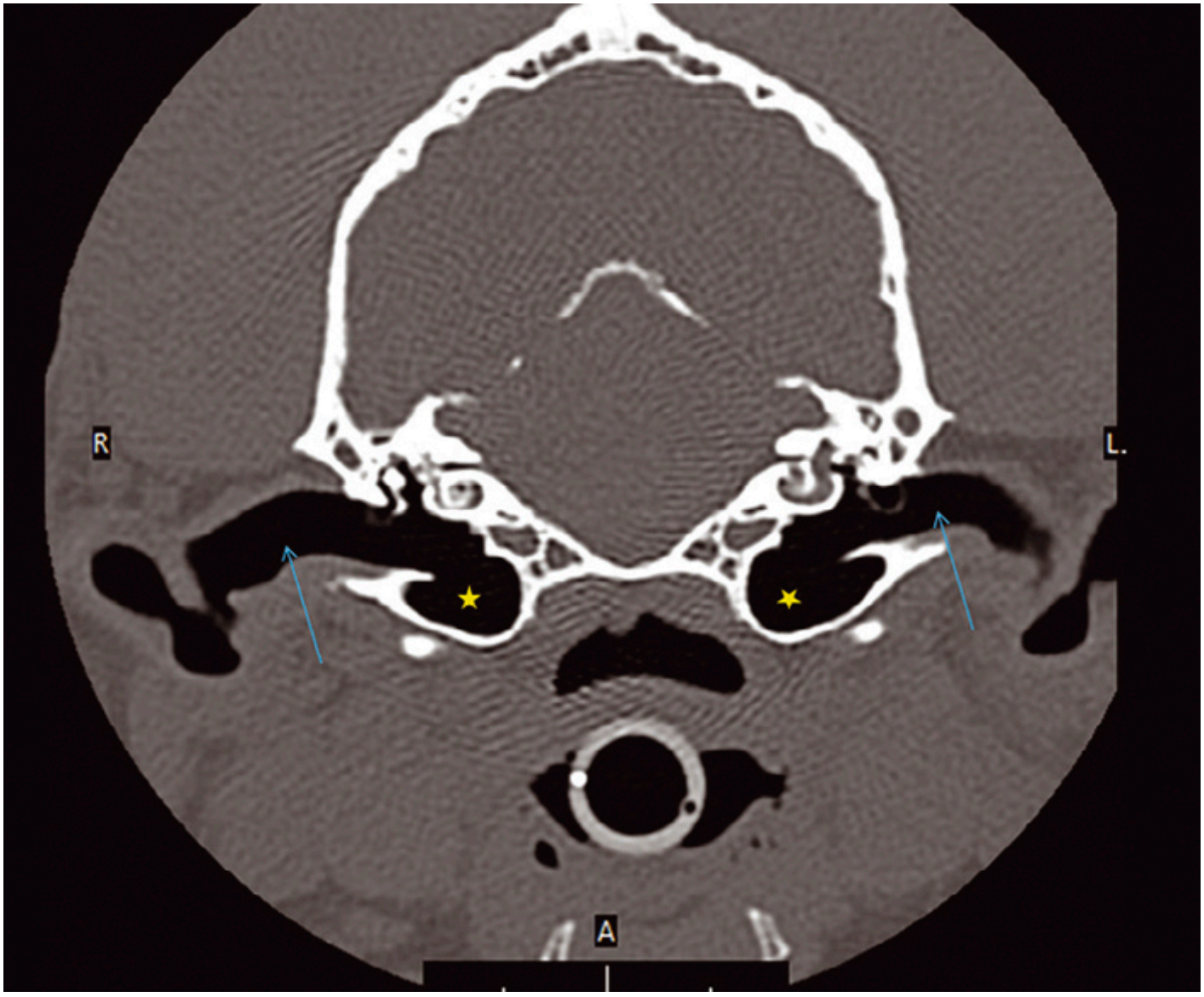

Figure 3. A CT image of normal external ear canals (blue arrow) and bullae (yellow star). Note the internal ear structures, namely the cochlear, visible in the petrous part of the temporal bone.

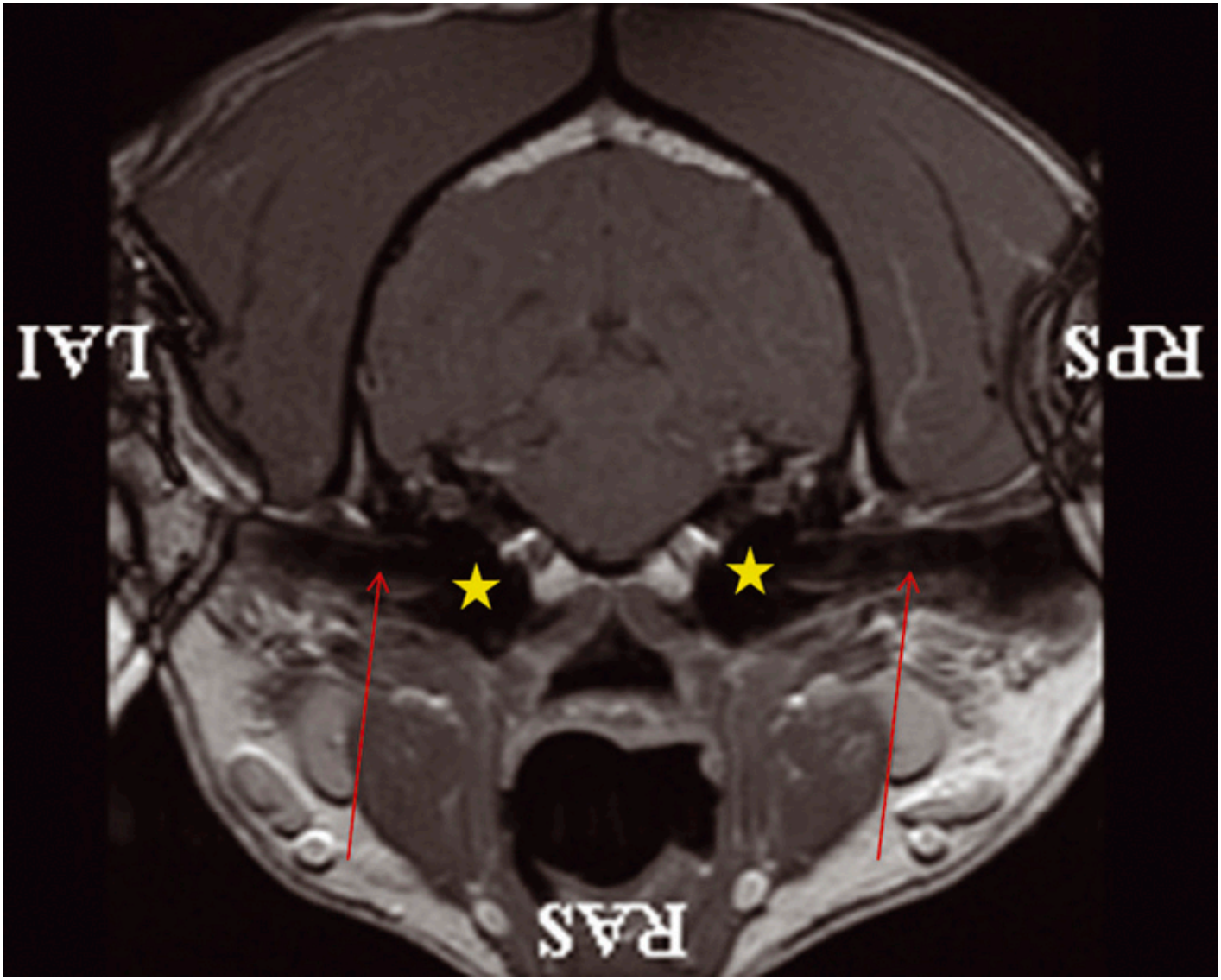

Figure 4a. Transverse T1 (postcontrast) MRI of a Labrador retriever undergoing MRI to investigate epilepsy. The ear canals (arrows) and bullae (stars) are included in the scan. The former are patent and air-filled, the latter are air-filled and formed from thin, uniform bone.

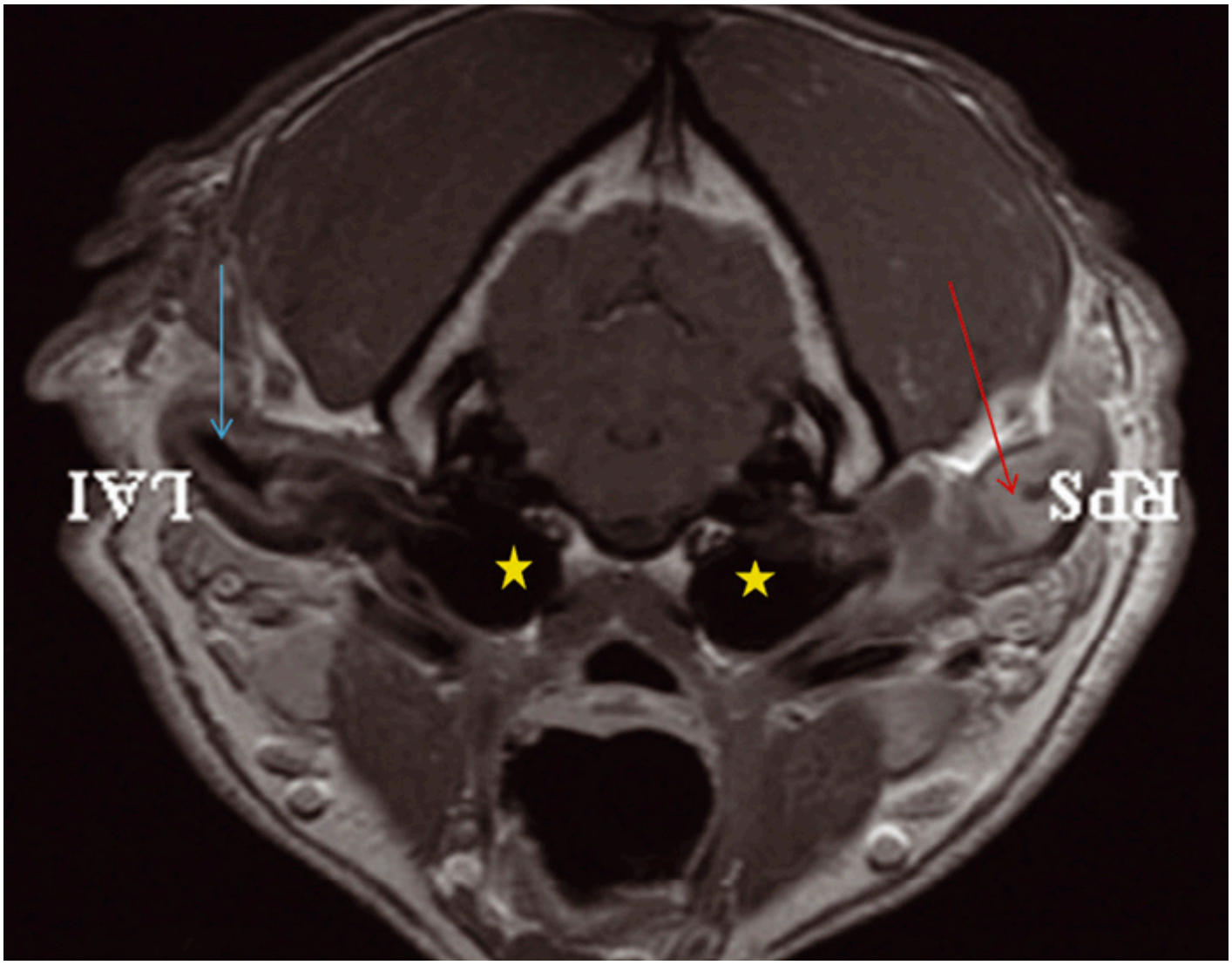

Figure 4b. Transverse T1 (postcontrast) MRI of an Airedale terrier with bilateral recurrent otitis externa. The right ear canal is completely filled with soft tissue (red arrow) and there is no patent canal identifiable. The left ear canal is stenotic, with some gas visible within the lumen, and inflammation/ thickening of the epithelial lining of the external ear canal wall (blue arrow). Both bullae (yellow stars) are normal.

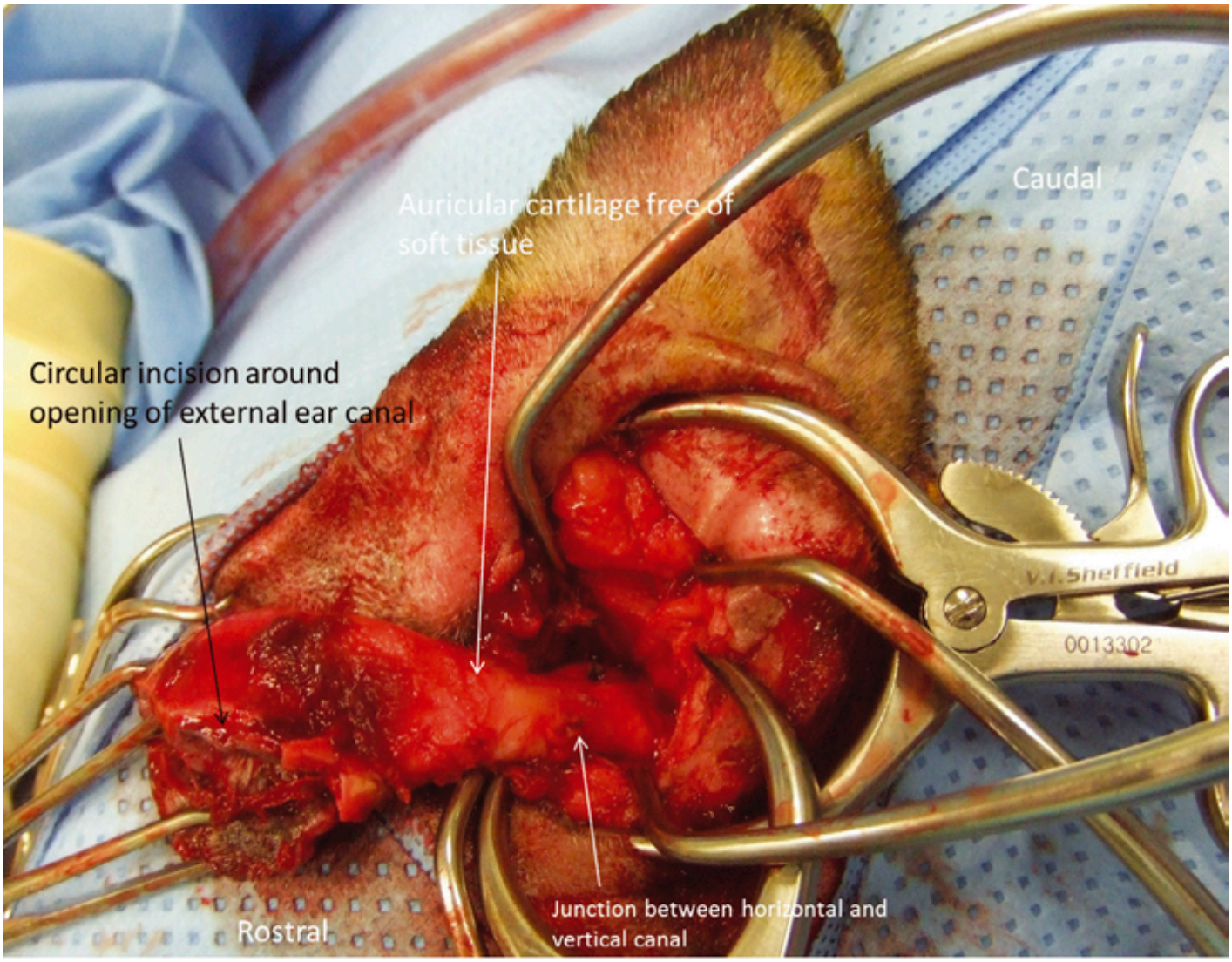

Figure 5. TECA-LBO starts with a circular incision (through skin and cartilage) around the opening of the vertical ear canal (some surgeons prefer a T-shaped incision) and blunt

dissection of the soft tissues from the auricular cartilage to the osseous external auditory meatus.

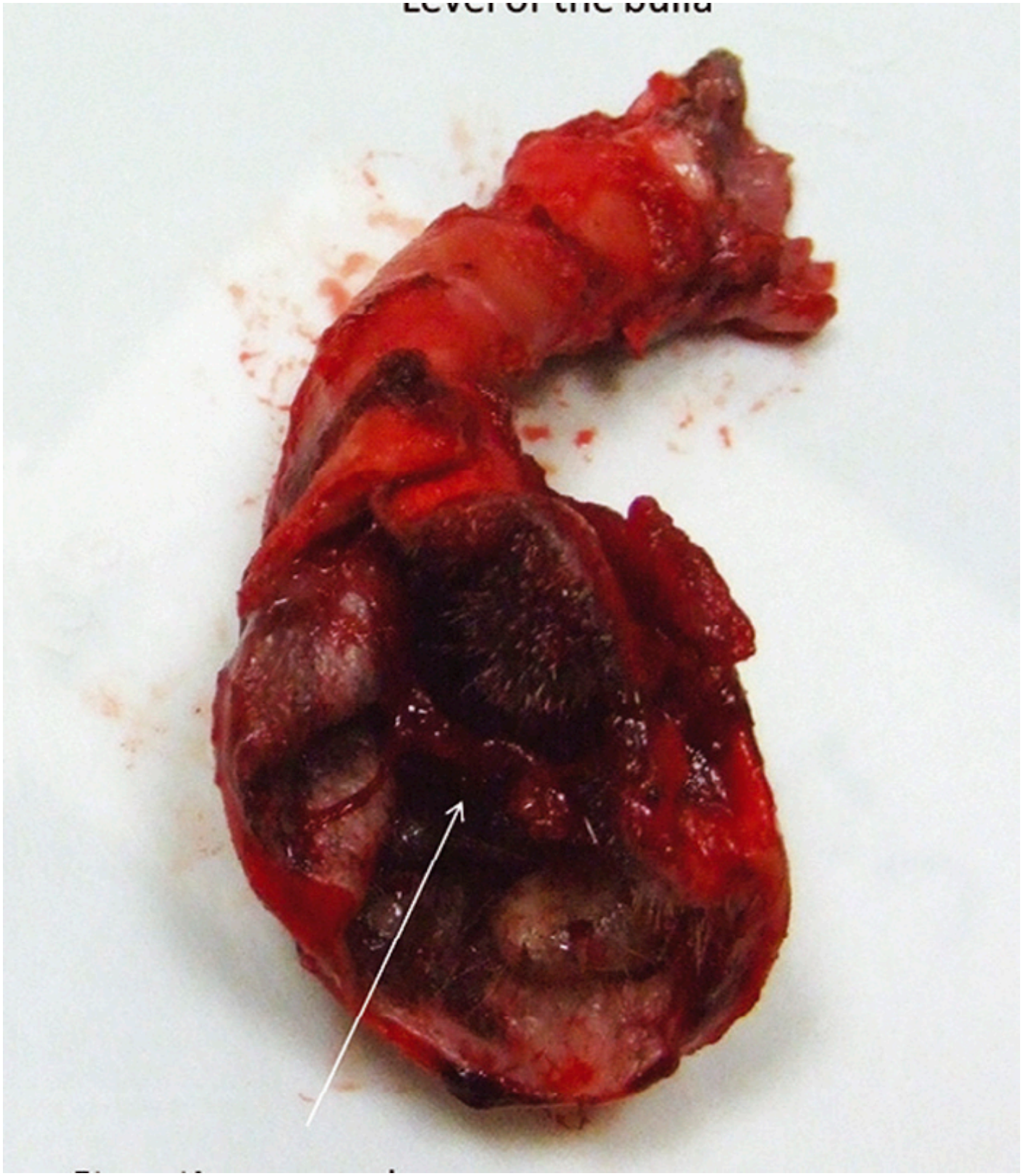

Figure 6. The entire ear canal should be submitted for histopathological analysis.

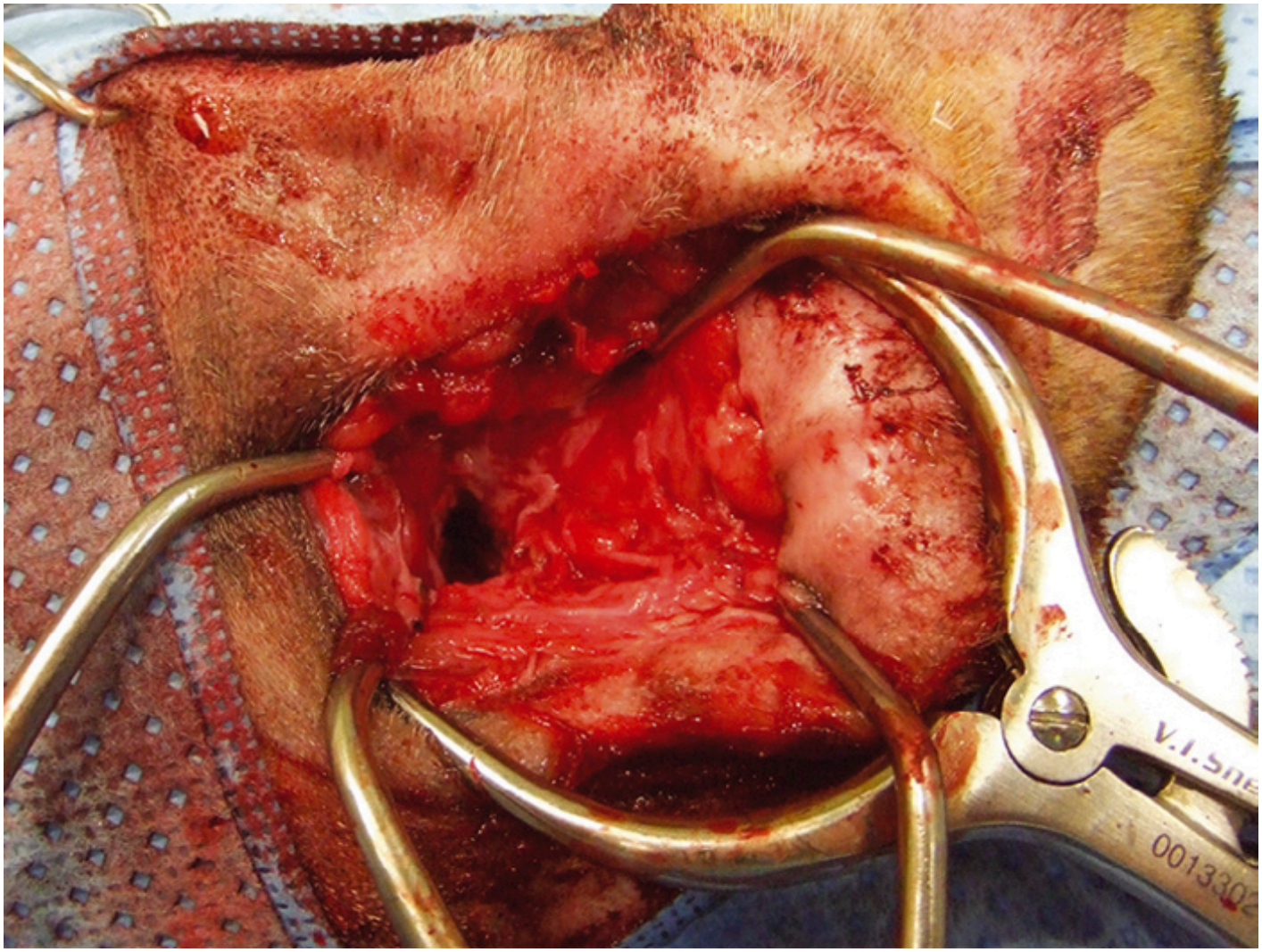

Figure 7. Lateral bulla osteotomy. The cleaned bone, ventral to the bulla entrance, is removed with rongeurs, creating a keyhole shaped entrance to the bulla, through which debris can be removed.

Figure 8. Postoperative image of a French bulldog, following TECA-LBO on the right ear.

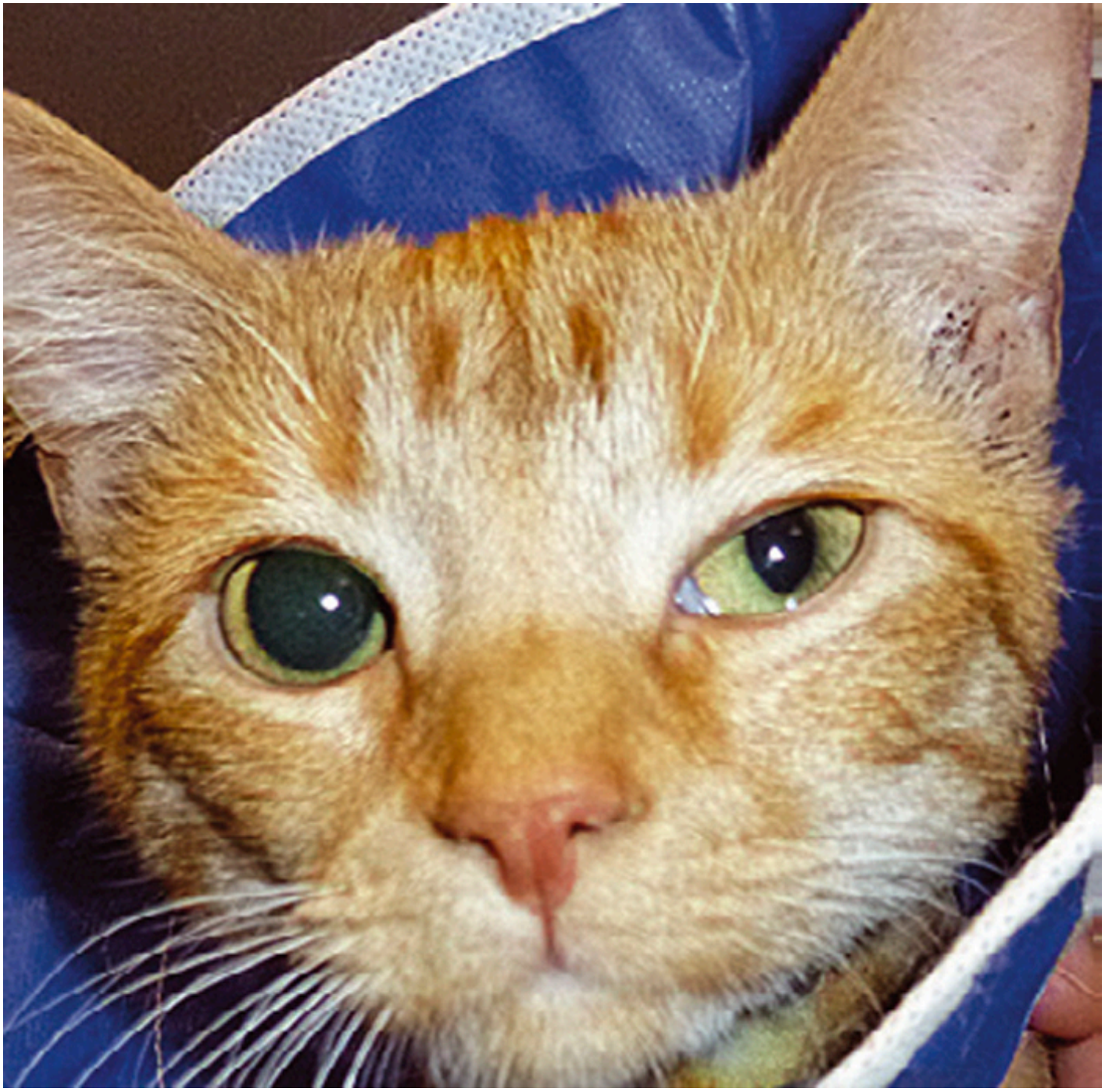

Figure 9. Horner's syndrome, following TECA-LBO, is reported in 8.2 per cent of ears and is particularly common in cats (58.3 per cent). The Horner's syndrome in this patient resolved one week after surgery.

	Factor	Examples	Notes
Predisposing factors	Conformation	Pendulous ears (spaniels) Hair in ear canals (poodles) Narrow ear canals (Shar Peis)	The most commonly affected breeds in one study were spaniels and poodles[5].
	Moisture	Swimming	
	Trauma	Irritant medication or cleaning regimes	
	Treatment protocols	Incorrect product used Poor owner compliance	
	Ear canal obstruction	Polyps Neoplasms	
Primary causes	Hypersensitivities	Atopy Food allergy Contact dermatitis	Clinical skin complaints are seen in up to 59 per cent of dogs with chronic otitis externa[5]. In dogs with food hypersensitivity, otitis externa is seen in up to 80 per cent of cases, while in 20 per cent, otitis externa is the only clinical sign[28].
	Foreign bodies	Grass seeds	
	Parasites	*Otodectes cyanotis* Demodicosis *Sarcoptes*	*Otodectes* can be responsible for up to 50 per cent of otitis cases in cats[28].
	Endocrine disorders	Hypothyroidism Cushing's disease Sex hormone imbalances	
	Keratinisation disorders	Canine primary seborrhoea	Dogs predisposed to seborrhoea (for example, German and Belgian shepherd dogs) are also predisposed to ceruminous otitis[1].
	Autoimmune diseases	Juvenile cellulitis Pemphigus foliaceus/ erythematosus	
Perpetuating factors	Bacteria	*Staphylococcus* *Streptococcus* *Pseudomonas* *Proteus* *Escherichia coli*	*Staphylococcus intermedius* isolated in 70 per cent of ears[10].
	Yeast	*Malassezia* *Candida*	*Malassezia pachydermatis* is seen in up to 83 per cent of dogs with otitis externa[16]. *Candida* is isolated in three per cent and *M pachydermatis* in 34.2 per cent[11].
	Otitis media		Chronic otitis externa (more than two months) may lead to otitis media, which may then be the source for repeat[28].

TABLE 1. Factors associated with development of otitis externa