External auditory canal atresia of probable congenital origin in a dog

A nine-month-old Labrador retriever was referred to the Clinica Veterinaria Privata San Marco because of frequent headshaking and downward turning of the right ear. Clinical examination revealed that there was no external acoustic meatus in the right ear. Computed tomography confirmed that the vertical part of the right auditory canal ended blindly, providing a diagnosis of external auditory canal atresia. Cytological examination and culture of fluid from the canal and the bulla revealed only aseptic cerumen; for this reason, it was assumed that the dog was probably affected by a congenital developmental deformity of the external auditory canal. Reconstructive surgery was performed using a “pull-through” technique. Four months after surgery the cosmetic and functional results were satisfactory.

K. Schmidt, T. Piaia, G. Bertolini and D. De Lorenzi

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INTRODUCTION
External auditory canal atresia (EACA) is a rare abnormality that is either congenital or secondary to trauma (Brodey and Harvey 1969, Simpson 1997, House 2001). The reported cases in dogs have been treated surgically, one by the Lacroix technique (Brodey and Harvey 1969) and the other two by total ear canal ablation and bulla osteotomy (TECALBO). This case report describes the clinical features, computed tomography (CT) findings and surgical correction by a “pull-through” technique in a young Labrador retriever with EACA of probable congenital origin.

CASE HISTORY
A nine-month-old, male Labrador retriever, weighing 36 kg, was referred to the Clinica Veterinaria Privata San Marco because of frequent headshaking and downward turning of the right ear, which began following blunt trauma to the head a few days before. The owner had noticed no postural or behavioural abnormalities before this. Clinical examination revealed that there was no external acoustic meatus in the right ear (Fig 1), and palpation revealed that the vertical part of the right ear canal ended abruptly at about the mid-point of its expected length. CT (Lightspeed 16; GE Medical Systems) was used for three-dimensional visualisation of both hard and soft tissues. The CT scan revealed a normal auditory canal and bulla on the left side, whereas on the right side, the vertical part of the auditory canal ended blindly 1 cm distal to the base of the pinna. There was no apparent anatomical abnormality of the middle or the inner ear. The wall of the blind vertical canal was slightly thickened and the lumen abnormally filled with dense fluid that extended into the right tympanic bulla (Fig 2). Under CT guidance, the fluid was collected from the canal by fine-needle aspiration, for cytological examination and culture. It proved to be sterile ceruminous material.

Because of the dog’s young age, the absence of signs of inflammation or infection, and the normal appearance of the middle and inner ear on CT, reconstructive surgery using a pull-through approach was elected. After premedication with 20 μg/kg acpromazine maleate (Prequillan; Fatto S.p.A.), anaesthesia was induced by intravenous administration of 5 mcg/kg fentanyl citrate (Fentanest; Pharmacia), 0·1 mg/kg midazolam (Iponovel; Roche) and 2 mg/kg propofol (Rapinirov; Schering-Plough). Anaesthesia was maintained with fentanyl citrate by intravenous infusion and isoflurane MAC 1.1 (Isofa; Shering-Plough) and oxygen in a closed breathing circuit. At induction, 20 mg/kg cefazolin (Cefazolina; Merck Generics) was administered intravenously.

The dog was positioned in left lateral recumbency, and the area around the left ear was prepared for surgery. The skin was incised horizontally below the tragus and then vertically over the vertical part of the auditory canal to a point corresponding to the base of the canal. The vertical portion of the canal was freed from its muscular attachments by blunt dissection, and the blind end was opened (Fig 4). The contents of the canal (dark ceruminous material and hair) were removed by flushing with sterile 0·9 per cent NaCl solution and aspiration.
The recipient site for the auditory meatus was prepared with an elliptical full-thickness incision (2.5 cm long × 1.5 cm wide) between the tragus and the antihelix. The auricular cartilage was attached to that of the vertical auditory canal by interrupted sutures of braided lactomer 9-1 2/0 USP (Polysorb; Syneture) (Fig 3). The skin of the pinna was attached to that of the external ear canal by interrupted sutures of polyglactin 910 5/0 USP (Vicryl Rapid; Ethicon), and the incision over the auditory canal was closed with interrupted sutures of nylon 3/0 (Ethicrin; Ethicon).

Following surgery, video otoscopy with a rigid endoscope (64018BS; K. Storz) revealed a defect in the tympanic membrane, through which the tympanic bulla was seen to contain the same material found in the auditory canal. After collection of a sample for cytological examination and culture, the bulla and the auditory canal were cleaned by lavage and aspiration. A padded bandage was applied for seven days to protect the ear without occluding the opening of the vertical canal. Postoperative analgesia was provided by 0.2 mg/kg methadone (Eptadone; Molteni Farmaceutici) and 2 mg/kg carprofen (Rimadyl; Pfizer). The dog was discharged on the day after surgery with 22 mg/kg cefalexin (Rilexine 600; Virbac) for eight days and 2 mg/kg carprofen (Rimadyl; Pfizer) for three days. Healing proceeded uneventfully. Twenty days after surgery, there was no evidence of pain in the ear and the external auditory meatus was clean and open, even if the opening was slightly reduced compared with the auditory meatus of the other side (Fig 4). At 30 days, otoscopy revealed that the tympanic membrane was healing and the auditory canal was normal in appearance. At four months, a well-canalised external ear canal was evident and the auditory meatus did show only a moderate narrowing compared with the controlateral auditory meatus. The owners reported that the dog was normal in posture and behaviour and seemed to hear in both ears.

**DISCUSSION**

Congenital atresia of the external auditory meatus is an extremely rare condition in dogs, and, in human beings, its incidence is one in 10,000 to 20,000 livebirths (Blevins and others 2003). Atresia can occur in the setting of a normal pinna or can be associated with abnormal development of the pinna, usually microtia. In children, the average age of diagnosis is three years as EACA is not always evident at birth; especially if asymptomatic, this abnormality is detected on medical examination at school (Teufert and De la Curz 2004).

In our case, the pinna developed normally and the dog did not show any clinical signs before the traumatic event to the ear. For this reason, both the owner and the breeder did not notice the absence of the auditory meatus.

External auditory canals arise from an ectodermal cell proliferative layer related to the first branchial cleft; these cells grow towards the endodermal structures of the tympanic recess (originating from the first pharyngeal pouch); ear ectodermal tissue persists in newborns until the opening of external auditory canals (Barone 1983). Developmental disturbances may affect different stages, making it difficult to distinguish a congenital versus a traumatic developmental disturbance; in addition, external auditory canals open normally after six to 14 days, and trauma during this period may affect normal development (Taibo 2003).

During adult life, trauma may cause acquired meatal atresia: usually, the auditory canal ruptures at the junction between the auricular and the annular cartilages (Venker-van-Haagen 2005), and if not treated promptly, it can lead to closure of the top of the proximal part of the vertical canal by a pseudotympanic membrane (McCarthy and others 1995, Boothe and others 1996, Connery 2001, Taibo 2003). Clinical signs of auditory canal atresia are ear pain, headshaking, para-aural abscesses and turning of the affected ear downwards because of the inflammation.
and the accumulation of ceruminous material in the ear canal and the tympanic bulla when the tympanic membrane is interrupted (Brodey and Harvey 1969, Simpson 1997, House 2001, Taibo 2003).

In the author’s opinion, the assumption of a congenital origin of the condition in the described case is supported by the absence of bacteria both in cytological and culture samples taken by fine-needle aspiration during CT examination. The absence of bacteria and inflammatory cells in the presence of a great quantity of ceruminous material and cellular debris can be considered a sign that the external ear canal never opened and remained sterile until the problem was detected; after birth, bacteria should be present as normal inhabitants of the external ear canal and should cause an inflammation following accumulation of ceruminous material in a closed canal. In all described cases of traumatic separation and secondary closure of the external ear canal (Brodey and Harvey 1969, McCarthy and others 1995, Connery 2001, House 2001), the canal was filled by septic inflammatory exudate and not by sterile, dark brown ceruminous fluid; in contrast with this, in a case of EACA (Simpson 1997), the ear canal and the tympanic bulla contained only wax, hair and exfoliated squamous, and no bacteria was cultured from the contents of the external and the middle ear.

In the described case, the absence of clinical signs for eight months, the lack of cutaneous signs of previous trauma and the presence of an abnormal accumulation of sterile ceruminous material in the atresic auditory canal leads the authors to assume that the dog was probably affected by a congenital developmental deformity of the external auditory canal.

Several surgical techniques have been described for correction of such congenital deformities and traumatic injuries to the canine ear canal. They include total ablation of the ear canal and lateral bulla osteotomy, drainage of the vertical canal, pull-through of the horizontal canal with or without ablation of the vertical canal and the Lacroix procedure (Brodey and Harvey 1969, McCarthy and others 1995, Boote and others 1996, Simpson 1997, Bojrab 1998, Connery 2001, House 2001, Krahwinkel 2003).

Tirgari and Pinniger (1986) described a pull-through technique for the treatment of chronic otitis externa in dogs, which we modified slightly. The vertical part of the ear canal was preserved and sutured to a new opening at the bottom of the auricular cartilage, instead of to a cutaneous opening. The presence of a healthy epithelial lining of the ear canal probably helped the rapid healing of the tympanic membrane.

The normal anatomical aspect of both the pinna and the middle and the internal ear and the short distance between the two parts of the external ear canal suggested that the authors should perform an anatomical reconstruction of the external auditory canal to preserve external ear appearance and functions. The surgically obtained auditory meatus was slightly narrower if compared with the controlateral, and this could predispose to recurrent external otitis; since writing this article (seven months after surgery), the dog was asymptomatic.

In human medicine, high-resolution CT is preferred in the workup and evaluation of patients with EACA. It is
performed by obtaining contiguous images 1 mm or less in thickness in both the axial and the coronal planes. This enables the surgeon to decide whether surgical repair is feasible (Swartz and Faerber 1985). In this canine patient, high-resolution CT scanning was essential for the evaluation of anatomical abnormalities and the choice of the surgical technique.

References


