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Popular Article

Deafness in dogs: An overview

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Introduction

Auditory function is important to animals because it is a means by which much of the interaction with its environment occurs; reduction or loss of this function can have a mild or an extreme impact. Deaf animals can survive, but deafness or diminished hearing precludes usefulness in working dogs, diminishes communication in pet-family relationships and can put affected animals in jeopardy in settings where motor vehicles or predator animals can inflict damage or even death (Qiu *et al.*, 1999).

Prevalence of Deafness in Dog

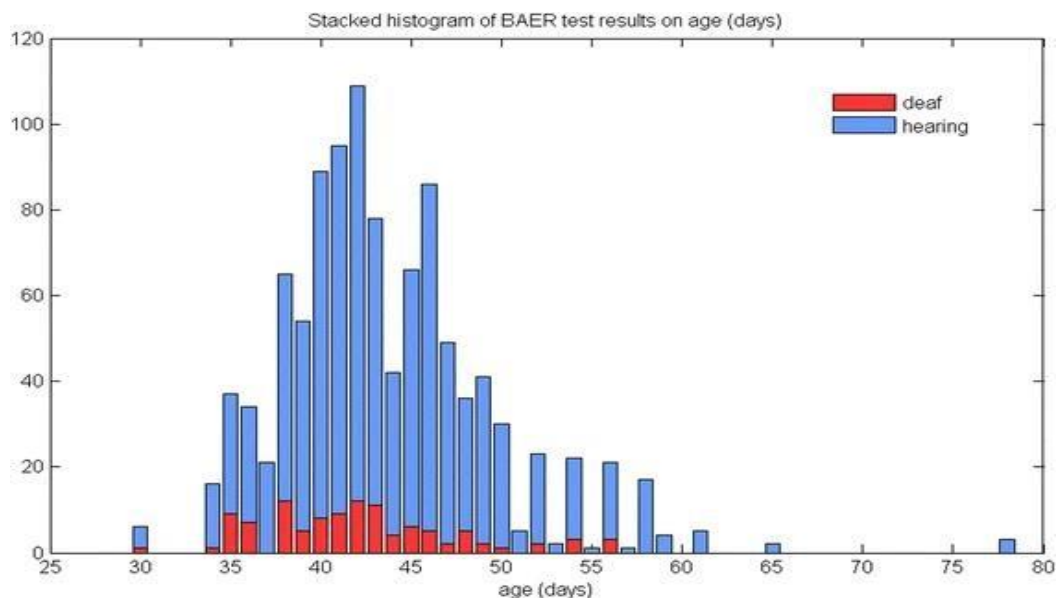
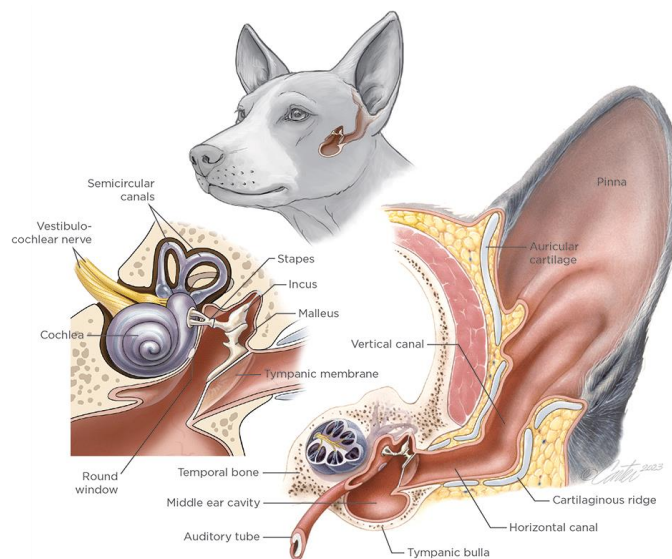


Figure 2: Age (in days) at time and hearing status in 1060 English Bull Terrier puppies.

Histogram showing that higher prevalence of deafness seen at age, 38 & 42 days. Data from 33 complete Dalmatian families were collected and data from 56 single Dalmatians were added. This resulted in a total of 575 dogs with 357 known phenotypes. All dogs were clinically evaluated and electrophysiologically tested with brainstem auditory evoked responses. The prevalence of deafness was 16.5% (9.4% unilaterally deaf, 7.1% bilaterally deaf). Females were 4.4% more affected than males but this difference was not significant. The prevalence of deafness in 1000 Dalmatian dogs in the US is approximately 8% bilateral deafness and 22% unilateral deafness, or 30% affected. Lower prevalence rates possibly due to the disallowance of blue eyes in the dalmatian breed standard of most European countries. These efforts to breed away from blue eyes reduced deafness prevalence in Dalmatians in Norway (Muhle *et al.*, 2002).

Anatomy and physiology of ear

The ear is divided into 3 major compartments- the external ear (ear pinna, articular cartilage and tympanic membrane), the middle ear (hollow air-filled space containing 3 bony ossicles, the malleus, incus and stapes) and the inner ear (Complex structure that comprises both the hearing and the vestibular apparatus). While hearing, the external ear must capture sound, transmit it to the organ of corti and translate it into neural impulses to be delivered into the brain. Organ of corti located in the cochlea which is a snail-like structure. Cochlea has 3 chambers – scala tympani, scala media and scala vestibuli. Scala media include tectorial membrane, basilar membrane and hair cells which send the mechanical forces. Scala media is the house of hearing or receptor organ of hearing. (Cole, 2010)



Etiologies of Canine Deafness

The etiology of canine deafness can be hereditary or acquired. The cause of hearing loss varies



depending on the type of deafness. The causes of congenital deafness are birth defects, abnormal post-natal development, white fur, merle or piebald pattern, etc. Causes of acquired deafness include ear infection, inflammation or tumor, nerve degeneration in old age, loud noises, ear canal blockages, ear canal, eardrum or brain trauma and drug or heavy metal toxicity (Strain, 2012).

Types of Deafness

Different types of deafness are seen in the canine population such as partial or total, peripheral or central and unilateral or bilateral. Amongst them, peripheral deafness was found commonly in dogs. Peripheral deafness can be sensorineural or conductive, inherited or acquired, or congenital or later onset. (Krahwinkel *et al.*, 1993)

White pigmentation is a risk factor for deafness in the dog and other animal species, but the mechanisms by which this risk ensues are not yet fully understood. Deafness prevalence was highest in Dalmatians and lowest in English cocker spaniels (ECS). Blue eyes are positively associated with deafness in Dalmatians (Karlsson *et al.*, 2007). Piebald and merle genes suppress melanocytes and produce white pigmentation in skin and hair, blue iris in some dogs that disrupted function in the stria vascularis and causes deafness (Juraschko *et al.*, 2003). Presbycusis or Age-related hearing loss (ARHL), is primarily sensorineural but may also include conductive hearing loss and central changes. It is progressive, usually bilaterally symmetric, and generally affects high frequencies before low frequencies. (Ter haar *et al.*, 2009)

Diagnosis of Deafness

Diagnosis of deafness is done by otoscopic examination, behavioral testing, X-rays and CT scans to reveal any underlying conditions affecting the dog's hearing. Identification of deafness is most accurate with Brainstem Auditory Evoked Response (BAER) testing at referral centers, but behavioral testing is typically used in the clinic. BAER test can accurately detect dogs that are unilaterally deaf (Ettinger *et al.*, 2016).

BAER is an electrophysiologic study that works on the same principle as ECG, which records the organ's electrical activity. Equipment needed for measuring the BAER includes headphones, three electrodes (recording, ground and reference), an electrode board (channel board) and a computer (Webb, 2009). Proper setup and technique are extremely important for the accuracy and interpretation of results. The presence or absence of waveforms, their width (latency) and their height (amplitude) are all considered in the final evaluation by the neurologist. (Jaggy and Platt, 2010)

Therapeutic Management

Unfortunately, no treatments can revert permanent deafness back to normal. Some cases of



deafness such as bacterial infections can be treated with antibiotics or blockages can be treated surgically. Hearing loss is inevitable with the aging process, but hearing loss for younger canines is often preventable. (Campbell *et al.*, 2005)

Conclusions

In conclusion, Deafness is common in dogs and has a variety of causes; the most frequent is congenital hereditary sensorineural deafness associated with white pigmentation. Conductive deafness often may be resolved, whereas sensorineural deafness is, at present, permanent. Definitive diagnosis of deafness requires brainstem auditory evoked response testing, because behavioural testing has limited reliability. If the infection has caused hearing loss, deafness is usually temporary and resolves with treatment.

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