



HEARING TEST

BRAINSTEM AUDITORY EVOKED RESPONSE (BAER)

Canine deafness is diagnosed with increasing frequency, largely as a result of heightened awareness among owners, breeders and clinicians. Congenital deafness is mostly recognised in dog breeds that carry the extreme piebald (e.g. Dalmatian) and the merle genes (e.g. Border Collie). Electrodiagnostic testing provides an objective way of assessing the presence or absence of auditory function, and is the gold standard of auditory testing in animals. The hearing test most commonly performed is the brainstem auditory evoked response (**BAER**).

Hearing:

The ear has three compartments:

- (1) the outer ear, including the ear flap and the ear canal down to the tympanic membrane
- (2) the air-filled middle ear, including the three ossicles (malleus, incus, and stapes)
- (3) the fluid-filled inner ear or cochlea, which contains the organ of Corti and the initial portion of the auditory nerve.

Air vibrations (sound) in the ear canal cause vibration of the tympanum; these movements (oscillations) are amplified and transmitted through the three ossicles to a membranous opening and into the cochlea. These oscillations are then transmitted through the fluids of the snail-shaped cochlea, causing deflections of the sensory hair cells of the organ of Corti. The deflections of the hair cells initiate nerve impulses which are transmitted into the auditory portion of the brain. A disruption of any of these structures that convey sound information to the brain will result in deafness.

There are 2 main types of deafness:

1. Sensorineural – failure of the sensory organ, nerve, or any portion of the auditory pathway (i.e. from the cochlea to the auditory cortex of the brain).
2. Conductive – failure to conduct sound vibrations (like in cases of middle ear disease).

Testing:

Behavioural testing of hearing is usually performed by producing a sound outside the animal's visual field or while the animal is asleep, and observing for a response. The lack of a response may be interpreted as bilateral deafness, but it may actually reveal an anxious or distracted animal. A response may indicate that at least one of the ears is normal, but deaf animals are especially attentive to other sensory signals, so the animal may be responding to visual, vibration, or air current stimuli. A unilaterally deaf animal will respond to sound stimuli, even if he/she might find it difficult to localise the sound source. As a result, behavioural testing is subjective and limited in its applications. So a more objective and definite test is necessary for unequivocal hearing testing.

The most widely used electrodiagnostic test of hearing is the brainstem auditory evoked response (**BAER**), detecting electrical activity in the cochlea and auditory pathways in the brain. The response is collected with a specialised system through small needle electrodes under the skin: one is placed in front of the ear, one in the top of the head and a ground electrode in the neck. A click sound is produced by the system and directed into the ear canal through an earphone. Each ear is tested individually and the test is usually completed in around 10 minutes. The test is usually performed in puppies **5-8 weeks** old as the ear canals only open at around 2 weeks of age and some types of congenital deafness develop over the first weeks of life and might not be identifiable before this age. As the ears are tested individually, it is possible to ascertain if both or only one ear (and in that case which one) is affected.

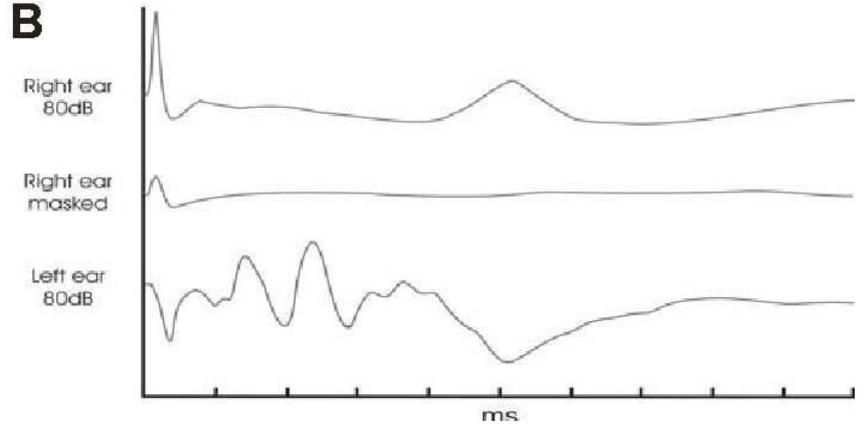
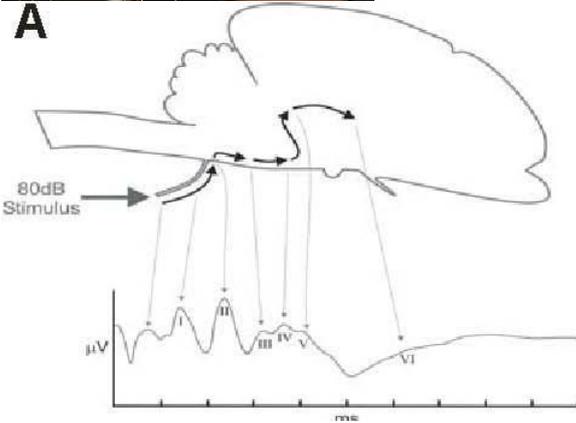


Figure: (A) The BAER trace corresponds to components of the auditory pathway.
 (B) BAER trace from a dog with complete deafness of the right ear.

Escape of the click stimulus to the left ear, while stimulating the right, results in a peak which can be abolished by white noise masking of the left ear. Sedation is usually unnecessary in puppies but if needed will not affect the test results. Adult dogs usually require sedation as the animals need to be still while the test is being performed. **All adult dogs should be fasted the day of testing in case sedation may be required.** Each dog will receive a certificate signed by the attending clinician stating the respective hearing status.