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Brainstem Auditory Evoked Response (BAER) Testing with Disc Electrodes in Dogs

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Abstract

Brainstem auditory evoked response (BAER) is widely used to detect deafness in human beings for many years. It is increasingly being used for dogs. Canine studies with needle electrodes are documented so far. Use of needle electrodes is painful and requires sedation or anesthesia. Disc electrodes allow non-sedation assessments. However, not much BAER studies are done in India. In this study, a total of 6 dogs were evaluated for brainstem auditory evoked response (BAER) using computerized BAER system with disc electrodes used in human medical practice. Apparently healthy dogs were selected. The mean latency for I, II, III, IV and waves V were 1.78±0.18, 2.68±0.11, 3.69±0.19, 4.71±0.08, and 5.73±0.20 ms in left ear, and 1.78±0.17, 2.79±0.07, 3.72±0.21, 4.67±0.14, and 5.77±0.09 ms in right ear, respectively. The mean inter peak latencies for the I-III, III-V and I-V intervals were 1.89±0.32, 2.00±0.42, and 3.95±0.26 ms in left ear and 1.92±0.25, 4.03±0.19, and 2.09±0.31 ms in right ear, respectively. On BAER analysis all the dogs were found to apparently healthy and free from deafness. This study also highlighted that the computerized BAER system with disc electrodes can be effectively used to assess BAER in dogs and to diagnose the deafness, if any.

Key words: BAER, Disc Electrodes**,** Dogs

The brainstem auditory evoked response (BAER) testing is an electrodiagnostic test which is commonly employed for assessing auditory function in humans and dogs. The test is objective, reasonably easy to perform, noninvasive, safe, and cost-effective, compared with other objective measures of auditory function (Wilson, 2005). The testing apparatus is portable, and test time is brief. Results are reliable, sensitive, anatomically specific, generally independent of the level of consciousness, and resistant to the influence of drugs and yield a comprehensive index of neurologic status (Hall, 1992).

Modern BAER equipment is typically personal computer based and can be divided into stimulus components and recording components. The stimulus components include a stimulus generator (clicks, pure tones) or bone conduction stimuli (applying vibrations to the mastoid region of the skull) being delivered to the ear. The recording components include recording electrodes and amplifier, signal averager, and display screen (Wilson, 2005; Strain *et al*., 1993 and 1997). Today, all of these components, including medical softwares, can be acquired as a single package and is supplied by companies specializing in clinical electrodiagnostic equipment. The high cost and specialized nature of electrodiagnostic equipment precludes them from being purchased for general veterinary use.

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To record BAER, a noise (usually a multitonal click in veterinary medicine) is delivered to the ear via earphones, to the ear being stimulated. Alternatively, the cochlea can be stimulated directly by vibrating the bone of the mastoid region (with a bone stimulator) on the same side as the ear of interest (Munro *et al.,* 1997). In a clinically normal animal, the BAER recorded from each ear is symmetrical. It should be noted, however, that performing and interpretation of BAERs should only be done by specially trained and experienced clinicians as many factors must be considered when interpreting the BAER. During 19th century, BAER has occasionally been utilized to diagnose the brain stem lesions. Now a day many veterinarians and researchers have turned to BAER, detecting electrical activity in the cochlea and auditory pathways in brain.

Materials and Methods

Study population

The study was conducted at the Canine Cognition Lab of Department of Veterinary Medicine, Veterinary College and Research Institute, Orathanadu, Thanjavur. A total of 6 dogs were included in this study of brainstem auditory evoked response (BAER).

BAER measurement

BAER measurements were recorded by using a standard computerized electro diagnostic machine (RMS

Saluts 4C, Electromyography) used very commonly in human medical practice. Instead of needle electrodes, disc electrodes were used, as they are non-painful to animal subjects / patients. For a two channel recording we use Cz which is the top of the fore head, A1 for the left ear and A2 for the right ear. Each un-anaesthetized dog was positioned in the sternal recumbency and three non invasive electrodes were placed for the BAER recording. The recording electrode were placed in respective place (Ground: mastoid; Reference: fore head; Active: contra lateral mastoid) and earphone positioned over the dogs ear. The ear canals were examined and cleaned in order to deliver the stimulus correctly. The broad band frequencies were set at 100 Hz and 3 kHz, the sensitivity was set to 0.5µV/cm and the analysis time to 30 ms/cm. The headphone was positioned manually over the external auditory meatus of the dog. Rarefaction clicks were applied at 10 Hz, recording was made at 85 dB intensity. Contralateral ear noise masking was done by using 40 dB. An average recording of 1000 sweeps for each ear of each dog was recorded and was stored for later measurement and analysis. In each test, the absolute latencies of waves I, II, III, IV and V, and the I-III, III-V and I-V intervals for each side were measured. Initially, the distribution of variables was analyzed and no abnormalities were found and statistics were produced to characterize the average latency of waves (ms) in the groups studied.

Result and Discussion

From the available Indian literature on this subject, this study appears to be the first study to describe the use of brainstem auditory evoked response (BAER) testing in dogs in India. The study included a total of 6 dogs. All the dogs were subjected to recording of parameters with digital BAER system. The mean latency for I, II, III, IV and waves V were 1.78±0.18, 2.68±0.11, 3.69±0.19, 4.71±0.08, and 5.73±0.20 ms in left ear, and 1.78±0.17, 2.79±0.07, 3.72±0.21, 4.67±0.14, and 5.77±0.09 ms in right ear, respectively. The mean inter peak latencies for the I-III, III-V and I-V intervals were 1.89±0.32, 2.00±0.42, and 3.95±0.26 ms in left ear and 1.92±0.25, 4.03±0.19, and 2.09±0.31 ms in right ear, respectively. Mean and standard deviation values of wave latencies and inter peak latencies are depicted in Table 1. In the current assessment of BAER results, all the dogs were found to be free from deafness. In contrast to our study in Brazil, normative study conducted by Palumbo *et al.*(2014) reported that out of 40 boxer dogs were subjected to BAER examination of which 3 dogs were found deaf (1 unilateral deafness and 2 bilateral deafness). The prevalence of deafness in different breeds of dog reported by different researchers are Dalmation (21.8% unilateral and 8.0% bilateral), Bull terrier (10.3% unilateral and 0.8% bilateral), Australian cattle dogs (12.2% unilateral and 2.4% bilateral) (Strain, 2004), English Setters (12.7% unilateral and 2.4 bilateral) (Strain, 1996) and English Cocker Spaniels (7% unilateral and 1.8% bilateral) (Strain, 1996) and Border Collies (2.3% unilateral and 0.5% bilateral) (Platt *et al.,* 2006).

These BAER parameters of healthy dogs will serve as base line reference values for further studies. This study also documented the computerized BAER system used in human medical practice can effectively be utilized for dogs and for clinical veterinary applications. Another advantage of modern BAER machines used in human medicine is that they have disc electrodes, which are non-painful and most patient friendly. Many documented canine studies used the Conventional BAER systems with needle electrodes, which are painful to dogs and hence they need to be sedated or anaesthetized for optimal recording. But such challenges are overcome with the modern digital BAER units, as they come with surface disc electrodes, which can be attached using special conductive gel. This is more convenient for usage in dogs. As neuro diagnostic testing is very essential in assessment of brain and other neurological disorders, these portable digital models of BAER can be very effective for veterinary application and for selection of deafness free animals for dog breeding purposes. Deafness free dogs are essential for security and military works. Hence evaluation of such dogs will be best, if BAER assessment is made an integral part of their selection,

Table 1: Mean and standard deviation values of wave latencies and inter peak latencies (ms) of left and right ear

Particulars	Wave I latency	Wave II latency	Wave III latency	Wave IV latency	Wave V latency	Wave I-III latency interval	Wave I-V latency interval	Wave III-V latency interval
Left ear	1.78±0.18	2.68±0.11	3.69±0.19	4.71±0.08	5.73±0.20	1.89±0.32	3.95±0.26	2.00±0.42
Right ear	1.78±0.17	2.79±0.07	3.72±0.21	4.67±0.14	5.77±0.09	1.92±0.25	4.03±0.19	2.09±0.31

health care and performance assessments.

Conclusion

BAER is a vital electromagnetic testing protocol not only for clinical veterinary applications; but also for selection of dogs for police, military forces, as deaf animals are unsuitable for such works. Digital BAER systems with disc electrodes used in human medical practice can be successfully utilized for evaluation of dogs. Healthy dogs had a mean latency values of I, II, III, IV and waves V were 1.78±0.18, 2.68±0.11, 3.69±0.19, 4.71±0.08, and 5.73±0.20 ms in left ear, and 1.78±0.17, 2.79±0.07, 3.72±0.21, 4.67±0.14, and 5.77±0.09 ms in right ear, respectively and these values can serve as base line reference values for future studies.

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