

Deafness & Hearing Testing in Cats

Over the past few years, it has become increasingly common knowledge that certain breeds of animal are, unfortunately, more prone to being born deaf than others. Most people, for instance, know that Dalmatian dogs suffer more with congenital deafness than “Dogdom” in general. Outside the breeds concerned, though, not many people realise that white cats, especially those with one or more blue eyes, are also at risk of deafness.

How Hearing works

Sound waves enter the external ear canal and strike the eardrum, which begins to vibrate. This, in turn, causes vibration of tiny bones in the middle ear (the ear ossicles). These vibrations set up waves in the fluid of the cochlea, the spiral-shaped structure in the inner ear. The change in pressure causes movement of the hair cells, inside the cochlea, which are connected to the auditory nerve. This triggers a nerve impulse through the auditory pathway to the brain.

Deafness is defined as any interruption in the delivery of sound to the brain.

There are several types of deafness:

Conductive deafness is due to interference in the transmission of sound waves to the inner ear, e.g. due to a foreign body in the ear canal, rupture of the ear drum or infection in the middle ear.

Sensorineural deafness results from damage or defect in any part of the nervous tissue from the cochlea in the inner ear, via the auditory pathway to the brain.

Sufferers from **Congenital deafness** are born deaf, whilst **Late Onset deafness** occurs later in life, such as that associated with old age.

Inherited deafness is passed down through one or both parents whereas **Acquired deafness** is due to external factors such as injury or disease.

Congenital deafness is due to failure of the blood supply to the cochlea in the first few weeks of life, which causes degeneration of the hair cells. The loss of the hair cells is permanent and irreversible, resulting in the animal becoming deaf.

Deafness may occur in both ears (**bilateral deafness**) or in one ear only (**unilateral deafness**).

Congenital deafness is often associated with absence of pigment caused by the dominant white gene (W), manifesting itself as white coat colour, and also causing blue eye colour in one or both eyes.

Cats which are homozygous for the white gene (i.e. have two copies of the gene) are more prone to either unilateral (one ear affected) or bilateral (both ears affected) deafness. They are also more likely to have one or more blue eyes. A link between blue eyes and deafness has been suggested, supported by information from the US, with incidence of deafness increasing depending on the number of blue eyes.

From studies of mixed-breed white cats, when three separate studies were reviewed, out of 256 cats, 12.1% were unilaterally deaf and 37.9 were bilaterally deaf – a total of 50% affected overall.

In another study, where the subjects were the offspring of two white parents, the prevalence of deafness (unilateral or bilateral) ranged from 52% to 96%.

When two studies compared the incidence of deafness in cats with blue eyes, they showed that the overall incidence (both unilateral and bilateral deafness) in cats with two blue eyes was 85% and 64.9%, for those with one blue eye the incidence was 40% and 39.1% and for cats with no blue eyes the incidence was 16.7% and 22% respectively.

In one study, long-haired white cats showed a higher incidence of deafness than short-haired cats.

Purebred cats are reputed to have a lower prevalence of deafness than mixed-breed cats, but no supporting data are available.

There are, however, no recent studies with data from UK white cats.

Pure breed cats carrying the white (W) coat pigment gene and at risk from congenital deafness include:

White Scottish Fold, European White, Norwegian Forest Cat, White Turkish Angora, Foreign White, White Cornish Rex, White Devon Rex, White British Shorthair, White Manx, White Exotic Shorthair, White Persian, White Oriental Shorthair, Turkish Vankedisi and the Russian White.

How can you test a cat's hearing?

Bilateral deafness may sometimes be identified by the skilled observer, as totally deaf animals may show characteristic behaviour patterns. Suspicion that an animal is deaf may sometimes be confirmed by observing the animal's response to banging on a saucepan or jingling keys, but this subjective method of testing hearing ability is very open to misinterpretation.

Some animals that can hear are unresponsive; others adapt quickly and stop reacting. Deaf animals may respond to other cues (vibration, air current or body smell), which are undetectable to the person conducting the test.

A **Unilaterally deaf** cat is very difficult to identify as it hears perfectly in the non-affected ear, and so usually behaves normally. It is almost impossible to confirm unilateral deafness without performing a more objective test, such as the **Brainstem Auditory Evoked Response** or **BAER test** as it known.

What is the BAER test?

The BAER test can be defined as the electrical response of the brain to auditory stimuli. When a sound enters the ear, tiny electrical impulses are generated by components of the auditory pathway in the brain. The signals can be picked up by recording electrodes positioned on the head, and are in turn passed into a computer. A series of clicks are passed into the ear through a headphone.

The test may be performed without sedation on cats which are calm enough to tolerate the application of tiny electrodes, similar to acupuncture needles, under the skin of the head.

Figure 1: Russian White kitten accepting the insertion of the fine needles

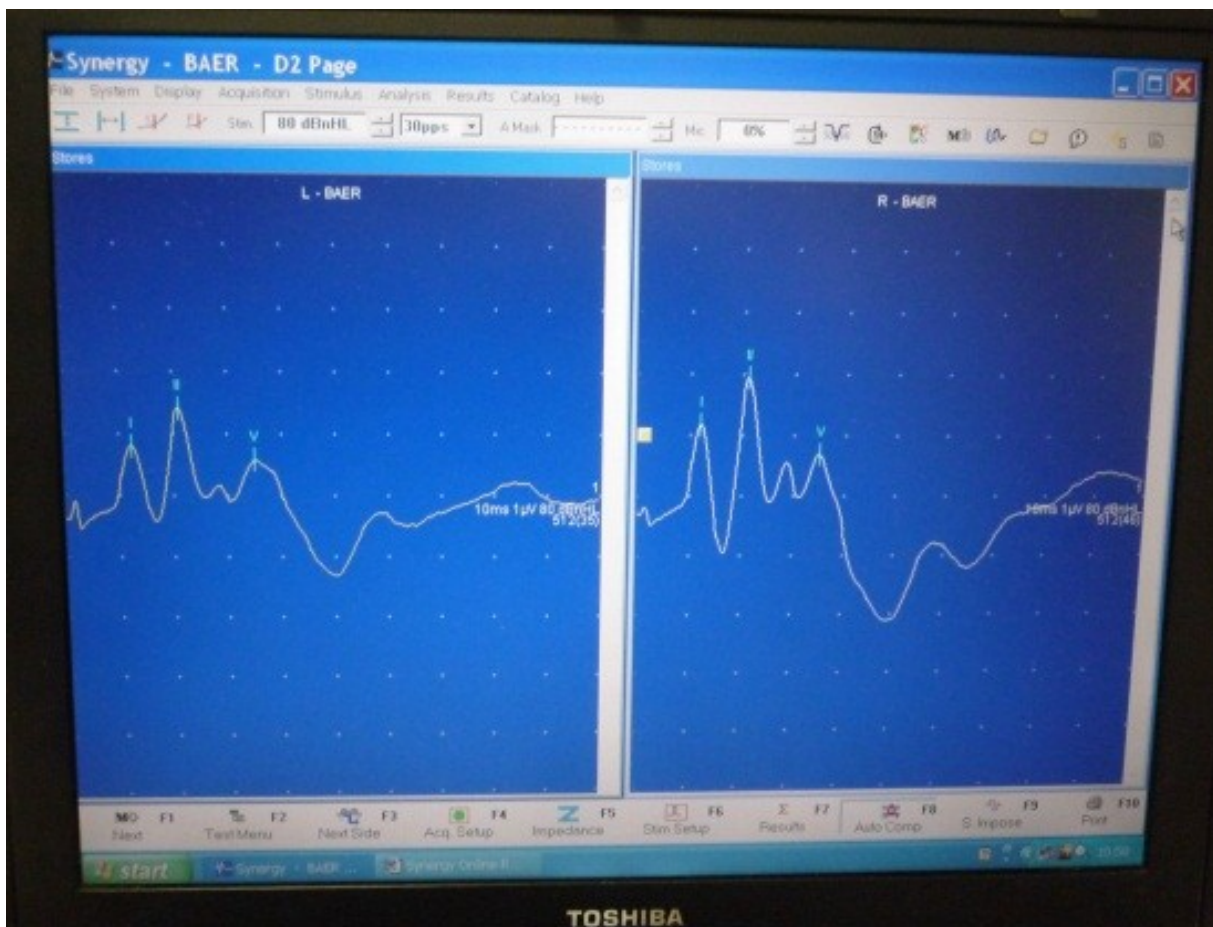


However, in an anxious or uncooperative cat, a light sedative may be used, which has worn off by the time the cat is ready to leave. Testing can be carried out on kittens as young as 8 weeks. Tests can also be carried out on adult cats (a pre-mating hearing assessment, for example).

Figure 2 shows the test being carried out on an 8 week old Russian White kitten.



Figure 3. Computer screen displaying results from an animal with normal hearing in both ears. The trace on the right is from the right ear at 80dB, the trace on the left is from the left ear at 80dB. Notice how similar the traces are to each other.



What do the results mean?

Deafness from cochlear damage eliminates all peaks in the BAER waveform, so a straightforward yes-or-no assessment of hearing ability is possible, depending on the trace obtained.

If a characteristic trace is acquired from both ears, the animal is classified as having a normal BAER result, as shown on the screen in Figure 3.

Where a normal waveform can be obtained from one ear only, these animals are identified as being unilaterally deaf.

Many **unilaterally deaf** cats will have gone through life unrecognized as such, because their behaviour is completely normal.

When no waveform is present in either ear, the cat is unfortunately bilaterally deaf. The deafness is complete, there is no "partial hearing" in this case, and any perceived hearing by the owner is probably due to the cat's reaction to cues picked up by other senses, such as vibrations or scent.

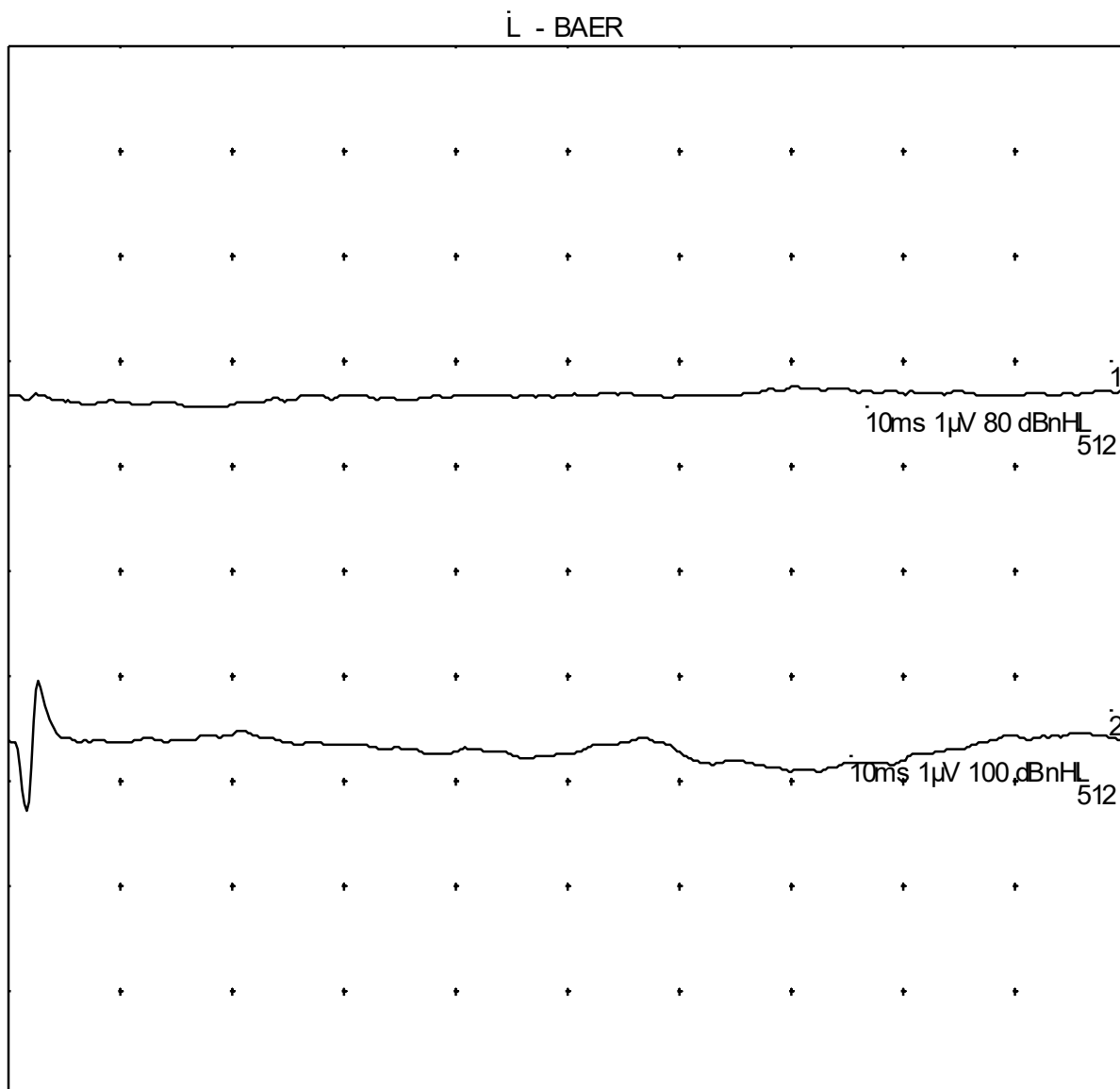


Figure 4. Printout from a bilaterally deaf animal, where the upper trace in each waveform is obtained at 80dB and the lower trace at 100dB. No waveform is elicited from either ear.

There is unfortunately no treatment for congenital deafness. It is thought to be inherited, although the way in which the problem is passed on is not yet known. However, it may be advisable to exclude affected individuals from breeding programmes, as this could possibly reduce the incidence of affected offspring.

With thanks to Mrs Julia Freeman BSc (Hons)
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for the information contained in this document.

Details of testing centres can be found on this page of the GCCF website:

<https://www.gccfcats.org/Health-Welfare/BAER-Testing-white-cats>