TUFTS CUMMINGS SCHOOL OF VETERINARY MEDICINE

Your Dog

The Newsletter for Caring Dog Owners

HEARING TEST FOR THE BRAIN

If you suspect you're having difficulty hearing, the first obvious step is to call your doctor for an exam. You'll explain the loss you've been experiencing, its length and degree. Then you'll have a hearing test, raising your hand when you hear a tone.

Now suppose you believe your dog has a hearing problem. Although the anatomy of the dog's ear isn't exactly identical to a human's, he can be born with or acquire similar deficits and deafness.

The tricky part is identifying the problem - dogs can't tell us if one exists. It becomes the owners' responsibility to pay attention to their dog's behavior and activity, especially if he's in puppyhood, a crucial period of development. Observation can help identify hearing impairments. Affected dogs may be immune to sounds when sleeping. They may fail to interact with others and appear confused.

An array of behavioral traits can be easily confused with a hearing deficit, however, so testing is always the wisest course of action. A test in human medicine precisely graphs the brain's response to sound transmission through the ear without eliciting a conscious yes-or-no response. Called the brain auditory evoked response, the BAER test is more involved than the average hearing test. It's usually performed under the supervision of a veterinary neurologist.

WORK WITH PUPPIES

At the Cummings School's Foster Hospital for Small Animals, BAER tests are performed nearly every week in the neurology department, the majority on litters of puppies 6 to 8 weeks of age. Neurology technicians Brynn Harrington and Cassie Lutz, who are among those running the tests, look forward to the puppies' arrival each week. "They always attract a crowd," Harrington said. "Everyone is so interested in what we are doing with the pups. It's the best part of our day."

Barring any abnormal findings, the technicians perform the tests relatively quickly. A litter of eight puppies takes 30 minutes and costs about $53 each.

The BAER is highly specific in part because a computer that collects signals from a series of electrodes on the patient can interpret this data and plot an accurate graph of auditory function. Since the test doesn't require a conscious response, it can be performed on a sedated or anesthetized pet - some are too excitable to remain still for the procedure. Surprisingly, puppies tend to be more compliant than adult dogs because they're easily distracted. Holding them off the table or rubbing the nose or belly is often enough to keep them occupied during the test.

RARE SEDATION

It begins by placing four tiny needle electrodes under the skin - two at the base of each ear, one on the forehead and one on the scruff of the neck. Expandable foam earplugs, connected to a noise transmitter, are then fit into each ear. Despite the elaborate setup, involving many wires and electrodes, most patients tolerate it well and rarely require sedation.

When all components are in position, noise is pumped into the earplugs at a specific frequency and volume in rapid clicks lasting about 30 seconds per ear. Sound is received

in the ear canal, passes through the middle and then the inner ear. Deep inside the fluid-filled, snail-shaped cochlea of the inner ear lies a series of small hairs called the Organ of Corti. Side-to-side movement of these hairs in response to sound-induced waves in the fluid opens and closes microscopic electrolyte channels - a process that transmits sound information from the ear to the brain.

After the brain interprets the signals, electrical activity is released in a form that can be received by the electrodes and graphed on the computer screen. Dogs with normal hearing yield graphs with a typical series of waves, while deaf dogs have flatlined graphs.

A small handful of dog breeds is known to carry inherited genetic abnormalities responsible for early degeneration of the hairs in the channel, namely, Dalmatians, Jack Russell Terriers, English Bulldogs, Australian Cattle Dogs, English Setters and English Cocker Spaniels They suffer deafness as a result.

"The heritability of this genetic disorder is hard to predict - it can skip generations because many dogs can be carriers," said neurologist Dominik Faissler, DVM, at the Cummings School. *"Deafness also has a proven correlation to pigment. Inheriting a strong version of a gene that inhibits coat color ignites this early cell death cascade in the inner ear. The whiter the dog, the greater the risk."*

For this reason, breeders should be well informed of the complete family lineage before breeding dogs with the potential for congenital deafness. The American Kennel Club recommends BAER certification for show pups of the aforementioned breeds. Veterinarians also suggest BAER testing those high-risk puppies before selling them.

"We may not be able to cure this disorder. The best thing we can do is keep the breeding pool safe by spaying and neutering congenitally deaf dogs as well as by keeping accurate records for every litter," Dr. Faissler said.

GENETIC SCREENING

A genetic screening test to identify hearing puppies who are carriers of the gene would be ideal. "But we're not quite there yet," Dr. Faissler said. "For now, the more testing we can do and information we can gather, the more likely we'll be to eradicate the disorder in future generations."

Deafness not only poses greater risks of injury to dogs because of decreased awareness of dangers like vehicles and animal predators, but more important, the genetic underpinning of early hearing loss easily can be passed on to future generations. The importance of avoiding this can't be overemphasized - responsible breeders understand that testing a litter gives information about those puppies as well as the rest of the family tree.

Later onset deafness isn't attributable to the degenerative changes seen in congenitally deaf puppies. Instead, some dogs with chronic ear infections encounter significant inflammation, infection, scar tissue or ruptured ear drums, resulting in partial or considerable hearing loss. BAER testing usually reveals significantly shorter waves on the computer graph but rarely the flat-lined graphs seen in deaf puppies.

Less frequently, a tumor may alter the normal architecture of the ear. Affected dogs may

hear sound at high volume, so BAER tests are run in stages, increasing noise incrementally to find the dog's threshold. Because the adult test takes longer and requires multiple steps, the fee is $120.

Complex advances in human medicine have yielded devices like the cochlear implant, an electrode-based device surgically implanted in the inner ear to amplify sound. The implants can sometimes help humans when external hearing aids can't. However, the technology is still being finely tuned, and the surgery is invasive. The implants have yet to be used in veterinary medicine - more research and testing are necessary. In addition, veterinary training would be extensive and the cost of the procedure high.

Overall, the occurrence of deafness in the overall canine population remains fairly low. Limited data is available. Three studies indicate a prevalence ranging from 0.025 to 0.875 percent. But it's important to understand that the prevalence in certain breeds is much higher. Jack Russell Terriers and Dalmatians are reported to have a prevalence of complete deafness ranging between 8 to 9 percent. Each year, many deaf puppies continue to be euthanized because they're difficult to sell or adopt.

Owners who learn they have deaf dogs will need to provide a low-stress environment and perhaps a bell on their collars to alert them to their dogs' location. They may decide to teach the dogs sign language or hand signals. And they'll need to know, despite the challenges, deaf dogs can live full, happy lives.