

Sound Theories By Dr. K. Gary Magdesian.

"Sometimes linked to Paint coat patterns, deafness isn't the end of the road for your horse."

Deafness associated with coat color and white spotting has been described in dogs (Dalmatians), white cats, laboratory animals and even humans (Waardenburg syndrome). Deafness in horses is rarely recognized and is most often associated with head trauma, neurological diseases, ear infections and drug toxicities. Recently, however, deafness has been definitively associated with coat-color spotting in overo horses, as has been suspected by some Paint breeders for many years.

My first encounter with deafness in horses was as a youth with my American Paint horse mare, "Kena." As a foal, Kena was very quiet and did not respond to loud noises like other horses. She would sleep through sounds that would frighten all of other horses in the barn. Since then, I have examined several other deaf Paints, which led to my pursuit of researching the syndrome.

The initial investigation occurred with Kena. The first step was to confirm the deafness through a neurophysiological test called brain-stem auditory evoked response (BAER). This test examines the receptors, nerves and nerve pathways within the brain necessary for hearing. The BAER yielded a flat line, consistent with complete deafness originating in the hearing receptors. Next was ruling out other causes of deafness through careful ear and neurological examinations, blood work and head X-rays. All of these results were negative, indicating the cause was from a congenital problem with the hair cells of the inner ear.

As a veterinarian, I continued to pursue this interest in deafness. I studied 14 deaf horses confirmed through the BAER test, and an additional 20 horses that were believed to be deaf by their owners.

In order to describe the phenotype associated with deafness, the horses' coat patterns and eye colors were documented. All of the deaf horses were overos or toveros. The most common pattern represented was splashed white, either solely or along with frame---it represented at least 65 percent of the cases. Others included frame overos (nine) a few solid white horses, toveros and frame-sabino blends. No horses in my study exhibited only the tobiano or sabino patterns.

Interestingly, the amount of white spotting varied from minimal (small belly spot with four socks and bald face) to very extensive (more than 50 percent of the surface area of the hair coat). All had extensive head white (bald-, apron- or bonnet-faced) leg white (socks or stockings) and at least a partial blue eye. The majority of horses had two blue eyes and three to four white legs. Blue eyes are associated with deafness in a number of other species, including dogs.

The link between white spotting and deafness lies in the origin of the cells within the embryo. Melanocytes, the cells that produce pigment in the skin, are necessary for normal development of the hearing cells within the inner ear. The overo genes select for a lack of migration of melanocytes from the neural crest cells in the embryo, leading to white spotting in those areas. They can also lead to abnormal migration of these cells to the inner ear, leading to deafness.

In order to compare the deaf Paint Horses with hearing horses, I also studied hearing Paint and Pinto horses. In contrast to the deaf horses, the hearing horses included tobianos and sabinos as well as patterns observed in the deaf horses. Many of these horses looked phenotypically similar to the deaf horses.

Based on these results, phenotype alone cannot predict deafness. However, it can be concluded that certain phenotypes are at risk for deafness. This is especially true with splashed white, splash-frame blend and, less commonly, the frame overo patterns. Not all splash overos are deaf, but rather the prevalence of deafness is likely highest among horses with this pattern.

The horses were tested for the endothelin B receptor gene mutation. this mutation causes overo lethal white syndrome (OLWS) in the homozygous state and is associated with the frame overo phenotype in the heterozygous state. The majority of the deaf horses (91 percent) were positive for the mutation. In contrast, only 43 percent of tested hearing horses carried the mutation. The deaf horses were statistically more likely to be positive for the mutation. While this does not imply that the OLWS gene alone is responsible for the deafness, it does show an association.

I hypothesize that the presence of more than one overo gene may increase the chances of deafness. However, this requires further study. For example, many of the deaf horses with a classic splash overo phenotype and no frame characteristics also carried the OLWS gene. Currently, a genetic test for the splashed gene is not available. When the gene is found, it will aid in elucidating the genetics of deafness.

It should also be emphasized that the OLWS gene is not necessary for a horse to be deaf, as nine percent of the deaf horses did not carry the mutation. Interestingly, three lethal white foals were hearing-tested prior to being humanely euthanized. All three were homozygous for the OLWS gene, and all were completely deaf.

An important finding of the study was that deaf horses can lead productive, normal lives. Many of the horses in this study were used for pleasure riding and showing, including halter, Western pleasure, cutting, dressage, team penning and jumping. Some owners felt that their horses were less skittish than hearing horses, whereas others believed the deaf horses were more easily startled by visual stimuli.

Deaf horses need to be identified early, especially prior to training. People working with deaf horses could easily become frustrated with the animal if the deafness is not recognized, as deaf horses are unable to respond to vocal commands. Once recognized, deaf horses are easily trained through visual and tactile cues.

Having lived with a deaf mare, I know firsthand that deafness does not have to limit the horse's success as a performance horse. No one, except those who knew her intimately, ever noticed anything different about Kena. She was shown at halter, ridden and eventually retired to pasture until her death at age 26. Being aware of deafness, and training accordingly, is very important to the success and well being of these horses.

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