

Exercise Induced Collapse in Retrievers – A Cautionary Tale

By Mike Holman

Disclaimer: The purpose of this article is to increase awareness of EIC in South Africa; it is not intended as a substitute for advice of veterinarians. Readers should consult their vet in matters relating to the health of their dogs and particularly with respect to any symptoms that may require diagnosis or veterinary medical attention.

A few years ago, if you asked Labrador breeders or your local Vet about Exercise Induced Collapse (EIC), many would probably have given a fairly blank look and apologised for not having any knowledge of the affliction. EIC was only identified during the 1990's firstly in the US and more recently in UK and initially appeared to be restricted to working or field trial Labrador bloodlines. So it is no surprise that little was known in South Africa until quite recently because EIC was a new phenomenon and Vets in this country had other important challenges to consider.

What is Exercise Induced Collapse (EIC)?

EIC is a fairly common inherited disorder in retriever breeds, mostly in Labradors but it has been detected in Curly-Coated and Chesapeake Bay Retrievers in the United States while in Border Collies (another high-energy breed) it is known as Border Collie Collapse (BCC). EIC is characterised by a number of signs and symptoms that occur together to create a medical condition or syndrome.

The first sign is usually a rocking or forced gait. The rear limbs then become progressively weaker and unable to support weight and due to the enthusiasm and drive common in working breeds, dogs may continue to run while dragging their back legs. The dog often appears to be uncoordinated, almost 'drunk' and unstable on its feet with a loose stride especially in the rear legs. In some dogs, collapse of the rear legs progresses to weakness in the front legs and occasionally to a total inability to move, hence the term 'collapse' where the dog's limbs cease to work and it simply drops to the ground. 'Collapsed' dogs remain totally conscious and alert during an episode and there is no evidence of pain or discomfort, rather just confusion.

American research has revealed that dogs most affected are fit, muscular and athletic, often excitable with high energy and drive. Signs of EIC in affected dogs may appear from a relatively young age of 6 months but more typically occur when the dog is older and engaged in more rigorous training or exercise up to around 3 years of age. What is so disconcerting is that dogs affected by EIC appear otherwise entirely normal. To confuse further, veterinary examination of dogs suffering a collapse have shown no unusual symptoms or abnormalities and clinical tests typically give results identical to a normal fit Labrador under intense exercise. EIC affects both sexes and all colours (black, chocolate and yellow) in Labradors.

The symptoms can often worsen a few minutes after exercise has stopped and there have been some rare cases of death. However most dogs recover quickly after an EIC event although this recovery is gradual rather than instantaneous and may take 5-20 minutes.

Likely Triggers of Collapse

Weather (high temperatures) - Hot weather may not necessarily be the immediate cause of EIC-related collapse but if the temperature is very warm, collapse is more likely to happen. Affected dogs are less likely to collapse in cold weather or while swimming but cases are known where dogs exhibited EIC-related collapse while retrieving waterfowl in very cold temperatures and to even have drowned when experiencing collapse in water.

Hot weather is particularly relevant in South Africa for people training dogs in summer months or going out shooting early in the season where temperatures may exceed 30°C.

Excitement - Dogs that commonly exhibit the symptoms of EIC are most likely to have highly excitable temperaments and it is very apparent that a high excitement level may induce collapse. Very exciting or stressful activities such as prolonged intense training, extended energetic play or prolonged exposure to a stress therefore may induce EIC related collapse.

Types of Exercise - Normal exercise such as dog walks, jogging or the like are much less likely to bring on an EIC related collapse. Activities that involve continuous intense exercise such as multiple retrieving or repeated hard retrieves where the dog struggles to find the bird, chasing live game, long training drills and notably in the US, electric collar pressure or anticipation of correction are most common associated with collapse.

EIC Detection:

Most of the primary research on EIC has been carried out through the University of Minnesota in cooperation with the Universities of California and Saskatchewan. It was only in 2008 that a genetic test was developed to demonstrate that EIC was an autosomal recessive syndrome. Up until that time, EIC was only presumed when all other disorders that could give rise to such signs and symptoms of collapse were eliminated by observing clinical features, laboratory test results and having insight into the history of affected dogs.

Once the genetic marker for EIC was identified, researchers were able to find the genetic mutation that caused EIC. The chromosomal locus (site) of the mutation was found on chromosome 9, and the genetic mutation responsible for susceptibility to EIC was identified. This is a mutation in the gene for dynamin-1 (DNM1), a protein expressed only in the brain and spinal cord which plays a key role in forming synaptic vesicles containing neurotransmitters. DNM1 is not required during low-level neurological stimulation but when a heightened stimulus creates a heavy load on release of CNS neurotransmitters (such as intense exercise or a high excitement level) DNM1 is essential for sustained synaptic transmission in the brain and the spinal cord.

EIC is inherited as an autosomal recessive trait which means that both the sire and the dam must be at least carriers (E/N) for one of their offspring to be affected. Now there is a standard Genetic test, Table 1 illustrates the likely possible outcomes to assist breeding strategies.

Table 1: Expected results for offspring by parent genotype (from Optigen)

Parent 1 Genotype	Parent 2 Genotype		
	<i>EIC Clear</i>	<i>EIC Carrier</i>	<i>EIC Affected</i>
<i>EIC Clear</i>	100% Clear	50% Clear 50% Carrier	100% Carrier
<i>EIC Carrier</i>	50% Clear	25% Clear 50% Carrier 25% Affected	50% Carrier 50% Affected
	50% Carrier		
<i>EIC Affected</i>	100% Carrier	50% Carrier 50% Affected	100% Affected

How common is EIC

Given that the test for the DNM1 Mutation has only been available for the last 6-7 years, the harsh reality is that EIC is probably far more prevalent than most Labrador breeders and owners realise. In N America, data from the first 10,000 Labradors tested showed that **30% to 40% of all Labradors tested have been carriers** and **3% to 14% of dogs have been affected** and therefore susceptible to collapse.

The variability in proportion of carriers and affected dogs reflects the different dog sample populations (e.g. dogs competing in shows and trials versus samples submitted by veterinarians from dogs being tested pre-breeding and collapsing dogs being tested searching for a diagnosis).

Probably the most alarming statistic is that the prevalence of carriers is no different between field trial/working dogs and show dogs from any of these sampling populations.

What is the Prevalence of EIC in South Africa?

We currently have little idea of the extent of EIC in SA because only a handful of reputable breeders undertake DNA testing. Available statistics have been kindly provided by the Kennel Union of South Africa (KUSA) based on the total of 319 results since the first EIC tests for a registered Labrador were submitted. To put in perspective, this is less than 2% of the total number of Labradors registered with KUSA over the same time period. If we exclude the dogs who are Inherited CLEAR through parentage (sire and dam are clear), ie 176 results, and only focus on the tested dogs, the results are:

- 86 dogs (**60%**) Tested as CLEAR
- 50 dogs (**35%**) Identified as CARRIERS

- 7 dogs (5%) identified as AFFECTED.

If one considers only the actual test results above, then 60% Clear, 35% Carriers and 5% affected is similar to the American statistics and given our breeding lines and small gene pool this seems more likely. EIC has probably escaped notice in this country because the majority of Labradors are pets and rarely exposed to the intense exercise or stress that may induce a collapse. Even if EIC 'affected' dogs did show symptoms in the past, it would more likely be diagnosed as heat exhaustion or perhaps related to an epileptic type seizure because there has been so little publicity about EIC.

In the US and UK, Labradors are big business (>100,000 registered by AKC and >32,000 by UK KC) and are the most popular breed on both sides of the Atlantic. There are many professional dog handler/owners who make a living from training and competing with dogs and numerous Lab breeding kennels that focus on the competitive side, be it in shows and field trials or both. These countries also have a sizeable demand and market for good working dogs for the bird hunting fraternity as well as pets.

With these numbers and growth of retriever competitions with associated training requirements, it stands to reason that EIC related collapse was more quickly recognised and awareness raised in these countries compared to other parts of the world. But the reality of DNA diagnostic tests only being available in the last 6-7 years means that we have already inadvertently brought EIC into SA and it has probably remained dormant for decades in older bloodlines.

South African Examples:

A small, long-established Labrador kennel in SA bred a litter every 1-2 years on average over many years, both show quality and for wingshooting and field trials. Fresh bloodlines were carefully selected and imported from UK on a regular basis. Back in the late 1990s some frozen semen was imported from a full UK Champion Lab (breed + working qualification) at the recommendation of the UK breeder of the kennel's foundation Lab bitch. Several straws were used on this bitch in 2000 and produced eight black puppies, two of whom were kept and ran in SA Field Trials up to Novice level, of which one was made up as a breed champion.

In around 2009 the breeder received an email from an Australian Labrador kennel owner who had imported very similar UK bloodlines who reported that following the rollout of the *Optigen* diagnostic genetic test for EIC, she had tested her dogs and found carriers. The SA kennel immediately started testing their own dogs and also identified an EIC carrier.

Fast forward to 2013 and semen from the original dog (born in 1993) which had been stored for 14 years was put to one of their home bred bitches. The bitch had tested as an EIC carrier but with only four straws left, it was decided not to test the semen given costs and uncertain outcomes of insemination. Once old enough, all 10 puppies whelped were tested for EIC, six proved to be EIC affected and four were carriers. A puppy was kept and the others are in great homes with all owners fully informed of the condition and accepting that their puppies carry breeding restrictions or in the majority of cases have they been happy to sterilize. One male puppy dog (EIC affected) was shipped back to UK to be with the owner of the stud dog. Three puppies of this litter have run successfully in field trials with no reports of collapse to date.

It can only be concluded that the UK sire was EIC affected but never showed signs or symptoms and of course the semen collection predates knowledge and diagnosis of EIC.

The second example occurred earlier this year at a Retriever field trial. The author is not a veterinarian and does not claim to be an expert in any way but witnessed what appeared to be an EIC related collapse by a dog while out working on a series of retrieves. Some of the factors described under EIC triggers above occurred on the day although the dog concerned could not be described as overly excitable or very high energy.

It was mid-morning and the temperature was getting hot (in the mid-20s°C); the dog had a long, protracted hunt while struggling to find the first bird down, followed by another long hunt on the second bird only to be sent out for a 3rd time (which would be stressful for many dogs). As the dog went out for the 3rd pick-up, after a few metres it staggered and then all 4 legs collapsed. It lay for a few moments before managing to get to its feet again but it was obviously disorientated and confused. The dog staggered off into longish grass cover and disappeared for a short time before its handler found and comforted it after which it appeared to recover.

Having been involved in field trials for over 20 years and judging for over 10, this is the first incident observed that could be interpreted as an EIC episode. That said, there has recently been mention of dogs exhibiting signs of EIC related collapse while training but the author did not witness these so this is pure hearsay.

EIC in South Africa – What lies ahead?

Inqaba Biotec based in Hatfield, Pretoria offers the DNA diagnostic test for EIC. Reputable and responsible breeders can now easily test their breeding stock at **Inqaba** as they would test routinely for PRA and other inherited eye disorders.

The major risk in South Africa lies in complacency, lack of information and knowledge about the EIC condition because there have been so few cases of EIC-related collapse reported.

The numbers of so called 'working' Labradors are very small when compared to pet Labs in this country however the Labrador breed is very popular. US statistics have shown equal prevalence of EIC carriers between working and show stock and this is just as likely to be the case in South Africa. Unfortunately, as with many of the other breeds, the number of Labs registered with KUSA has dropped significantly in recent years (from over 2000 in 2009/10 to less than 1000 in 2014/15). This does not mean fewer Labrador litters are being bred, rather that less Labs are being registered with KUSA.

This may in part be the consequence of introducing compulsory microchip identification for KUSA puppy registration with associated paperwork and costs. Regrettably this might lead to a reduction of genetic screening by breeders to reduce the price of unregistered puppies for prospective pet buyers. The consequences may be an increase in hereditary problems being spread, including EIC. Table 1 illustrates how easy it would be for EIC, as a recessive hereditary trait, to spread in South Africa if no testing is done on breeding stock.

Conclusions

Breeders: Test your breeding stock for EIC susceptibility so you know the risks and your options.

Puppy buyers: If you are planning to work your dog or expose it to lots of exercise and outdoor activity, ask the breeder for EIC test results of sire and dam before committing to buy.

References

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