

Predisposition to Avian Tuberculosis (MAC) in Miniature Schnauzers

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Systemic avian tuberculosis (also referred to as mycobacterium avium complex or MAC) in dogs is characterized by enlarged lymph nodes, fever, diarrhea, weight loss, and respiratory problems. We have recognized that some young adult Miniature Schnauzers worldwide succumb to this infectious disease, while generally dogs and humans are resistant to this ubiquitous bacterium unless immunocompromised. This genetic predisposition to MAC has an autosomal recessive inheritance pattern in Miniature Schnauzers, but we do not yet know if every dog that is genetically at risk will develop this systemic overwhelming infection. We also do not yet know if the predisposed dogs develop other infections such as skin and ear infections.

Our laboratory has been studying MAC in Miniature Schnauzers for several years, has been working with the Health Committee of the American Miniature Schnauzer Club as well as breeders, veterinarians and pet owners of affecteds, and kindly acknowledges the receipt of funding from the Gray Lady Foundation and more recently the AKC Canine Health Foundation.

In the past a diagnosis of MAC was solely made when clinical signs occurred and was based upon histopathology of a lymph node or similar tissue, culturing the mycobacterium avium or at autopsy as this disease is progressive and fatal; because of the inherited immunodeficiency there is no effective treatment for infected Miniature Schnauzers. Carriers could only be identified by pedigree analysis – parents and offspring of affecteds are obligate carriers (but could even be affected).

We most recently characterized the molecular basis of the genetic predisposition to MAC and developed a DNA test for MAC predisposition in Miniature Schnauzers. With this genetic test which uses EDTA blood or cheek swabs, we can not only readily (1) confirm clinically diseased Miniature Schnauzers, but also (2) identify Miniature Schnauzers at risk of developing MAC before showing signs (from birth on); both of them are genetically affected, i.e. homozygous for the mutant allele/gene. Furthermore, this DNA test also (3) detects carriers (heterozygotes) which carry the mutant allele/gene but remain clinically asymptomatic, i.e. they are not genetically immunocompromised and thus not at risk of developing MAC but can pass on the mutant allele to their offspring.

Instructions for Testing: Testing is done by PennGen Laboratory of the School of Veterinary Medicine at the University of Pennsylvania and can be done by going on the PennGen website, setting up an owner/breeder/clinic account and submission for each individual dog. Cheek swab or EDTA blood samples will need to be submitted along with the completed online submission form to PennGen. For the initial roll-out of the test the AMSC Health Committee will be involved and will provide sterile cheek swabs to assist in controlling the volume of requests so the lab is not overwhelmed by sheer numbers.

MAC DNA Test Result: Testing offered at PennGen reports a result of “2-2” (affected), “1-2” (carrier) or “1-1” (normal/clear). Results are kept confidential by the laboratory and are sent only to the email mentioned on the primary sample submitter’s account (PennGen account). Of course pet owners and breeders may independently report their results, submit results to registries, and post them at appropriate places to allow others to make informed breeding decisions.

Recommendations after MAC DNA Test: Avian tuberculosis shows an autosomal recessive inheritance pattern, affected dogs (2-2) already have the disease or are at risk to develop MAC. Due to the potential for zoonotic transmission to family members, particularly the very young and old as well as immunocompromised people, allowing affected dogs to remain in the home is often problematic. Owners of affected dogs may also recognize other infectious diseases (e.g. dermatitis and otitis externa). Carriers (1-2) will not show clinical signs of the disease but can be safely used for breeding by mating only to tested normal dogs (1-1) in order to prevent any affected dogs from being produced (see Table below). At this time every breeding Miniature Schnauzer should be DNA tested for this disease, unless the animal completely descended from parents tested as normal dogs.

Predicted Genotype of Offspring when Breeding Miniature Schnauzers

Parent	1-1 (Normal)	1-2 (Carrier)	2-2 (Affected)
1-1 (Normal)	1-1	1-1 1-2	1-2
1-2 (Carrier)	1-1 1-2	1-1 1-2 2-2	1-2 2-2
2-2 (Affected)	1-2	1-2 2-2	2-2

(1: Normal gene/allele, 2: Mutant genes/alleles)

Those matings that are shaded will produce no affected offspring, and are safe to breed. However, offspring produced from these breedings should also be tested before being bred due to the possibility that they could be carriers of the gene (1-2).

Predisposed breed: Miniature Schnauzers – breed specific DNA test

Required Samples: EDTA Blood, 1-2 mL or 2-3 Buccal/Cheek Swabs.

Turnaround time for results/reports: Up to 4 weeks from the day samples are received in our laboratory

Cost: \$75. Payment is with credit card per secure online system after testing has been completed.

Account holder will receive an email.

For additional questions email PennGen@lists.upenn.edu

Once samples are collected they can only be sent after account has been set up with PennGen and should be shipped by reliable service to: PennGen/MAC DNA testing, Ryan Veterinary Hospital, University of Pennsylvania, 3900 Delancey Street Rm 4013, Philadelphia, PA 19104-6010 USA; 215-898-3375. Cheek Swabs and Self-addressed envelope/labels will be provided for your convenience by the AMSC Health Committee for the initial roll-out. Please refer to AMSC’s document *“Process for Submitting Requests for Cheek Swab Samples for MAC Test & TIER Designations”* for submission instructions for initial testing or email AMSCHealthgroup@yahoogroups.com.