Miniature Schnauzer Breed: Health & Avian Tuberculosis (MAC) AMSC @ Montgomery Dog Show 2016

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Hereditary Diseases in Miniature Schnauzers

- Progressive retinal atrophy
- Sick sinus syndrome
- Oxalate urinary calculi
- Myotonia congenita
- Mucopolysaccharidosis VI
- Stomatocytosis
- Hyperlipidemia
- Pancreatitis
- Hepatic AV fistula & others

- 900 hereditary diseases
- ~200 mutations
- Overall in dogs

[Diagram showing the number of hereditary diseases and mutations over time]

[Image of Miniature Schnauzer]
**Stomatocytosis in Miniature Schnauzers**

- Normal blood smear:
  - Stomatocytosis

- Abnormal blood cell counts – large red cells
- No clinical illness

**Hyperlipidemia in Miniature Schnauzers**

- White plasma instead of clear; predisposes to pancreatitis

**Calcium Oxalate Calculi in Miniature Schnauzers**

- Common
- Also others: bichon Frise, Shih Tzu
**Mucopolysaccharidosis – MPS VI in Miniature Schnauzers**

- Rare in Miniature Schnauzers
- DNA test available
- Skeletal deformities
- Ocular lesions
- Liver enlargement
- Neurologic disturbances

**Miniature Schnauzer Puppies – Myotonia congenita**

- Muscle hypertrophy
- Bunny hoping, dimpling
- Chloride channel-1 mutation
MYOTONIA CONGENITA IN MINIATURE SCHNAUZERS

>3000 dogs worldwide screened by DNA test since 2000
18% carriers, all related to one known common ancestor

today very rare

WSAVA HEREDITARY DISEASE COMMITTEE

World Small Animal Veterinary Association
Assisting clinicians with diagnosis, treatment and control of hereditary diseases and genetic predispositions in dogs and cats.

http://research.vet.upenn.edu/DNAGeneticsTestingLaboratorySearch/tabid/7620/Default.aspx
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Small Animal Hospital
~30,000 animals/ year
**Mycobacterium avium Complex (MAC)**

- Most mammals are naturally resistant including dogs
- Mostly seen in immunosuppressed people
- Rare reports in the canine literature
- *Mycobacterium avium* is a ubiquitous soil bacterium.
  - Intracellular pathogens - macrophages
- In the past 25 years, systemic avian tuberculosis has been seen in Miniature Schnauzers, suggesting a genetic predisposition to infection.
- Other breed predisposition: Basset hound ~1990
- Young to middle age dogs
- Often undiagnosed or misdiagnosed

**Mycobacteriosis avium Complex (MAC)**

- Lethargy
- Inappetence
- Weakness
- Nasal discharge
- Conjunctivitis
- Diarrhea
- Lymphadenopathy
- Hepatomegaly
- Splenomegaly

- Ddx:
  - Lymphoma
  - Histiocytic sarcoma
  - Systemic infection
  - Many acid fast staining organisms
  - Bacterial culture
  - PCR species identification
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**MAC in Miniature Schnauzers**

- No Giant and Middle Schnauzers
- However, also seen in Bassets.
MAC Investigations in Miniature Schnauzers

- Collect and select samples and dogs
- Genome wide association study (GWAS)
- Whole genome sequence
  - Affected dogs with MAC
  - Comparison to other Miniature Schnauzers
  - Comparison to other dogs
- Specific search for gene in region
- Identification of Mutation
- Immune dysfunction studies

Chromosomes
38 autosomes + XX/XY

~20,000 genes
~3 billion bases
SNPs = Single Nucleotide Polymorphisms (170K)

On 38 canine chromosome pairs
Green bars: Screening thousands of SNPs to look for variation

Canine Chromosomes (Autosomes)

Polymerase Chain Reaction

Thermocycler

Real-time Thermocycler
Genome Wide Association Study – GWAS Example

DNA Change in MAC Immune Function

- Single Nucleotide Polymorphisms (SNPs)
- Single base changes are called SNPs
- Representing mutation
- Some are variable between breeds and individuals of a breed.
- Functional defect not yet defined.
- EDTA blood
- Cheek swabs
- Semen
- Tissue

A – Adenine  G – Guanine
C – Cytosine  T – Thymine
SNP

CATCTGCATCG
CATCTTCATCG

GG
GT
TT

Dog 1
Dog 2
Dog 3
**MAC Screening**

- >300 Miniature Schnauzers screened
  - ~8% are carriers for MAC
- 223 reported to AMSC Health Committee
  - 6% or 14 dogs are carriers
- Common ancestor
  - All carriers have Jerry O’s Future Shock and Bandleman’s Newsprint (mother and son) in pedigree
  - Potential exceptions are being investigated.
- Small survey thus far.

**MAC Survey in Miniature Schnauzers**

- >300 Miniature Schnauzers screened
  - ~8% are carriers for MAC
- 223 reported to AMSC Health Committee
  - 6% or 14 dogs are carriers and 1 is affected
- Common ancestor
  - All carriers have Jerry O’s Future Shock and Bandleman’s Newsprint (mother and son) in pedigree
  - Potential exceptions are being investigated.
- Small survey thus far compared to
  - Myotonia congenita (>3000 Min schnauzers)
  - NAD in Papillons (~500 nearly same time period)
  - MPS IIIB in Schipperkes (~3000)
Accuracy of MAC Screening

- DNA mutation tests are most accurate – far better than others
- MAC DNA testing is precise to detect carriers and affecteds
- Limitation are related to dog identification and human errors

Autosomal Recessive Inheritance

Recessively inherited disorder are spread in the population by heterozygous, clinically asymptomatic/ unaffected dogs.
Breeding Recommendations against MAC

• Breed only DNA tested Min Schnauzers
  – In future dogs can be cleared by tested parents.

• DNA testing does not determine if you can
  breed or not but with whom.
  – Breed **clear to clear** or **clear to carrier**.

• Do not avoid breeding carriers with
  otherwise great breed characteristics.
  • Test offspring intended for breeding from clear
    to carrier matings.

• Do not select against/for one disease/trait

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Thank You!