Breed specificities of Canine Dilated Cardiomyopathy

Dr. Gerhard Wess

Diplomate ACVIM (Cardiology)
Diplomate ECVIM-CA (Cardiology)
Diplomate ECVIM-CA (Internal Medicine)
Inherent disease of the myocardium that results in a decrease in myocardial contractility

Most likely inherited abnormality in most dogs
  • Primarily seen in purebred dogs
  • Disease is most likely present at birth and then slowly progresses from there

Nutritional
Middle-age to older dogs in heart failure

May be identified earlier:
- If screening is performed
- If an arrhythmia/murmur is detected
Sex predilection

- Is not a sex linked trait although if often appears to have a male predominance
  - Males often progress more rapidly
  - Males may have more severe disease
In dogs the vast majority of the cases are idiopathic

**Taurine deficiency**
- Primarily seen in purebred dogs
- Unusual breeds or mixed breed dogs
- Nutritional (lamb and rice)

**Carnitine deficiency**
- Boxers?
- Other rare instances

**Tachycardia induced**

**Toxic (Doxorubicine)**
Initially decreased systolic function
- Cardiac output drops
- Blood pressure drops

Compensatory mechanisms start:
- Initially sympathetic activation
- Long term: activation of renin-angiotensin-aldosterone system (RAAS)
  - More blood volume returns to heart → stimulates myocyte replication → volume overload of heart

RAAS: Renine Angiotensin Aldosterone System
Commonly affected breeds (> 90%)

- Doberman pinscher
- Boxer
- Giant breeds
  - Great Dane, Irish wolfhound, St. Bernard, Newfoundland
- American cocker spaniel (Taurine)
- Dalmatian
- Portuguese water dog
**Table 1. The number of each of the breeds of dog diagnosed with dilated cardiomyopathy**

<table>
<thead>
<tr>
<th>Breed of dog</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dobermann</td>
<td>59</td>
</tr>
<tr>
<td>Boxer</td>
<td>53</td>
</tr>
<tr>
<td>Great Dane</td>
<td>38</td>
</tr>
<tr>
<td>Cocker spaniel</td>
<td>30</td>
</tr>
<tr>
<td>German shepherd dog</td>
<td>24</td>
</tr>
<tr>
<td>Saint Bernard</td>
<td>20</td>
</tr>
<tr>
<td>Labrador</td>
<td>20</td>
</tr>
<tr>
<td>Irish wolfhound</td>
<td>17</td>
</tr>
<tr>
<td>Golden retriever</td>
<td>15</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>14</td>
</tr>
<tr>
<td>Old English sheepdog</td>
<td>9</td>
</tr>
<tr>
<td>Weimaraner</td>
<td>6</td>
</tr>
<tr>
<td>Deerhound</td>
<td>6</td>
</tr>
<tr>
<td>Rottweiler</td>
<td>5</td>
</tr>
<tr>
<td>Flat-coated retriever</td>
<td>5</td>
</tr>
<tr>
<td>English bull terrier</td>
<td>5</td>
</tr>
<tr>
<td>Bull mastiff</td>
<td>5</td>
</tr>
<tr>
<td>Dalmatian</td>
<td>4</td>
</tr>
<tr>
<td>Springer spaniel</td>
<td>4</td>
</tr>
<tr>
<td>Staffordshire bull terrier</td>
<td>3</td>
</tr>
<tr>
<td>Border collie</td>
<td>3</td>
</tr>
<tr>
<td>Gordon setter</td>
<td>3</td>
</tr>
<tr>
<td>Neopolitan mastiff</td>
<td>3</td>
</tr>
<tr>
<td>Dogue de Bordeaux</td>
<td>3</td>
</tr>
<tr>
<td>Crossbreed</td>
<td>3</td>
</tr>
<tr>
<td>Cavalier King Charles spaniels</td>
<td>2</td>
</tr>
<tr>
<td>Leonberger</td>
<td>2</td>
</tr>
<tr>
<td>Belgian shepherd, border terrier, Pyrenean mountain dog, red setter, Bouvier des Flandres, standard schnauzer, standard poodle, saluki, mixed breed</td>
<td>1</td>
</tr>
</tbody>
</table>

---

**Canine dilated cardiomyopathy: a retrospective study of signalment, presentation and clinical findings in 369 cases**

FIG. 1 Bar chart showing the ratio of male compared with female dogs for the most commonly seen breeds (n>14 dogs included)

Results of the Multicenter Spaniel Trial (MUST): Taurine- and Carnitine-Responsive Dilated Cardiomyopathy in American Cocker Spaniels With Decreased Plasma Taurine Concentration

Mark D. Kittleson, Bruce Keene, Paul D. Pion, Carroll G. Loyer, and the MUST Study Investigators, JIVM, 1997

**Literature:** DCM american Cocker Spaniels is Taurine and Carnitine responsiv

**Reality:** Cocker have solely Taurine deficiency and respond to Taurine supplements

**Procedure:** Measure Taurine un Plasma

→ Taurine deficiency if < 50 nmol/mL!
Taurine deficiency in other breeds with DCM

- Golden retrievers
- Newfoundlands
- Dalmatians on a urinary crystals preventive diet
- Dogs on home made diets
- Mixed breed dogs on lamb and rices diets
GREAT DANES

- Prevalence 35%\(^1\)
- More common in males
  - X-chromosome recessive mode of inheritance suspected
  - New: autosomal dominant transmission
- Dogs can have atrial fibrillation or VPCs in the occult phase!

New: VPCs common (≈ 30%) in Great Danes with DCM

\(^1\)Stephenson et al, JVIM 2012
IRISH WOLFHOUNDS

- Prevalence: 29% (56% males – 44% females)
- Mean age at diagnosis: 4.4 +/- 2 years
- Mean survival after detection: 6 years
- Very often atrial fibrillation without ECHO changes
- May develop systolic dysfunction later

BUT: Many Irish Wolfhounds with atrial fibrillation never develop classical DCM!
Boxer Cardiomyopathy is now called: 

Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)

Fatty infiltrates starting in right ventricle, later in left ventricle
Two different forms

- **Ventricular arrhythmias** with normal myocardial function
  - Syncope
  - Sudden death
  - May or may not ultimately progress to DCM

- **Myocardial failure (DCM)** with ventricular arrhythmias
  - Syncope
  - **Sudden death**
  - Heart failure
ARVC IN BOXER: ECG

- Typical ventricular arrhythmias in ARVC
- LBBB morphology

LBBB: Left Bundle Branch Block
Special feature: disease progression

Initially – often several years: only arrhythmias
  • About 1/3 of the affected dogs die suddenly

Later: dilated cardiomyopathy
  • In this stage: pulmonary edema, ascites
  • Another 1/3 of the affected dogs die suddenly
DISEASE PROGRESSION

3 stages:

- Genetic defect on cellular basis
- “Occult” stage
- Clinical stage

<table>
<thead>
<tr>
<th>STAGE I</th>
<th>STAGE II</th>
<th>STAGE III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal heart</td>
<td>Abnormal heart</td>
<td>Abnormal heart</td>
</tr>
<tr>
<td>No clinical symptoms</td>
<td>No clinical symptoms</td>
<td>Clinical symptoms</td>
</tr>
<tr>
<td>Age Range</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>Genetic defects</td>
<td></td>
</tr>
<tr>
<td>2 - 5 years</td>
<td>No visible changes VPCs</td>
<td></td>
</tr>
<tr>
<td>3 - 6 years</td>
<td>VPCs and early echocardiographic changes</td>
<td></td>
</tr>
<tr>
<td>4 - 7 years</td>
<td>Mild to severe VPCs and moderate echocardiographic changes</td>
<td></td>
</tr>
<tr>
<td>6 - 9 years</td>
<td>Sudden cardiac death (25-30%) Syncope</td>
<td></td>
</tr>
<tr>
<td>Male 7 - 8 years</td>
<td>Congestive Heart Failure</td>
<td></td>
</tr>
<tr>
<td>Female 9 – 10 years</td>
<td>Congestive Heart Failure</td>
<td></td>
</tr>
</tbody>
</table>

Modified after Calvert 2000
Prevalence in USA/Canada: 45 – 63%\textsuperscript{1,2}

Prevalence in Europe in various age groups unknown

But suspected to be lower in Europe\textsuperscript{3}

\textsuperscript{1}O’Grady, 1995 and 1998, \textsuperscript{2}Calvert 2000, \textsuperscript{3}Calvert 2009
Evaluation of the overall prevalence

Prevalence in different age groups

Disease characteristics
### PREVALENCE STUDY

<table>
<thead>
<tr>
<th>AGE</th>
<th>PERCENTAGE WITH DCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to &lt; 2 years</td>
<td>3,3%</td>
</tr>
<tr>
<td>2 to &lt; 4 years</td>
<td>9,9%</td>
</tr>
<tr>
<td>4 to &lt; 6 years</td>
<td>12,5%</td>
</tr>
<tr>
<td>6 to &lt; 8 years</td>
<td>43,6%</td>
</tr>
<tr>
<td>≥ 8 years</td>
<td>44,1%</td>
</tr>
</tbody>
</table>

**Key message:** disease easier to diagnose in older dogs

**Overall prevalence:** 58,2%
Female
Male
age groups
14 12 10 8 6 4 2 0
Count
> 8
6 -> 8
4 -> 6
age groups
2 -> 4
1 < 2
Count
only VPC
only Echo
occult Echo and VPC
decompensated

Female
Male
Male = female dogs affected

**BUT: different disease progression**

- Male dogs get earlier classical DCM (Echo changes)
- Female dogs remain longer in the arrhythmogenic stage (VPCs)
CLINICAL SIGNS OF DCM

- Symptoms related to arrhythmias
  - Syncope

- Symptoms related to left heart failure
  - Low cardiac output
  - Exercise intolerance
  - Weakness
  - Pulse quality: weak
CLINICAL SIGNS OF DCM

- Symptoms related to right heart failure:
  - Ascites
  - Pleural effusion
  - Jugular vein distension

- Congestive heart failure
  - Dyspnea
  - Coughing
  - Arrhythmias
<table>
<thead>
<tr>
<th>BREEDS</th>
<th>AGE</th>
<th>SEX</th>
<th>PREVALENCE</th>
<th>GENETIC</th>
<th>ARRHYTMIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>COCKER SPANIEL</td>
<td>Middle age</td>
<td>Both</td>
<td>?</td>
<td>Taurine</td>
<td>Rare</td>
</tr>
<tr>
<td>GREAT DANE</td>
<td>Middle age</td>
<td>M &gt; F</td>
<td>35 %</td>
<td>Autosomal dominant</td>
<td>Atrial fibrillation or VPCs</td>
</tr>
<tr>
<td>IRISH WOLFHOUND</td>
<td>Starting 3 years</td>
<td>M &gt; F</td>
<td>30 %</td>
<td>Not a simple transmission</td>
<td>Atrial fibrillation</td>
</tr>
<tr>
<td>BOXER</td>
<td>Middle age</td>
<td>M &gt; F</td>
<td>&lt; 50 %</td>
<td>Autosomal dominant</td>
<td>VPCs with LBBB morphology</td>
</tr>
<tr>
<td>DOBERMAN PINCHER</td>
<td>Starting 2 years</td>
<td>M = F</td>
<td>&gt; 50 %</td>
<td>Autosomal dominant</td>
<td>VPCs</td>
</tr>
</tbody>
</table>