Pathogenesis and diagnosis of cruciate disease

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Rupture of the cranial cruciate lig. (CCR)
- most frequent cause of lameness
- 1926 first reports, 1952 Diss S. Paatsama
- rarely purely traumatic with acute onset of lameness
- mostly chronical course of disease
- lameness episodical and load dependent
- optimal treatment not really found yet? (TPLO)

Cruciate ligaments
- anterior cruciate lig.
  - dorso-cranial-lateral
  - antero-caudal-medial
- posterior cruciate lig.
  - antero-cranial-medial
dorsal-caudal-lateral

Cranial cruciate lig.
- anteromedial part
- postero-lateral part

Function of the anterior cruciate lig.
- anterior cruciate lig. is a passive stabiliser
- important component of knee stability
- limits cranial tibial displacement
- limits excessive internal rotation
- limits (prevents) hyperextension
- during standing phase
  - stability is dependent on anterior cruciate ligament
  (not during pending limb phase!)
- posterior cruciate lig.
  - avoids caudal tibial displacement
  - limits tibial external displacement

Function of the muscles
- Muscles are active stabiliser
  (Arnoldy et al. JAVMA 1977; 171: 1361-1364)

Loss of Function
- Anterior cruciate ligament
  - dislocation of the tibia to cranial
  - allows internal rotation of the tibia
  - not going into detail
Causes / Occurrence

• **traumatic injury** (rarely)
  - Hyperextension
  - abrupt internal foot torsion (slightly flexed joint)
• dogs < 4 years
• bowlegged dogs
• very active dogs
• big breeds
• rupture of ligament - bony fragments
  => young dog

Clinical symptoms

• acute / traumatic
  - partial / complete rupture
  - acute, severe lameness (caused by trauma)
  - partially with weight bearing
  - improvement within 2-3 weeks
  - progressing atrophy of muscles
  - in the beginning no or only mild arthroses
  - after weeks worsening of lameness
  (Osteoarthroses ↑)
  (meniscal injury)

Causes / Pathogenesis

• non-traumatic injuries (often)
  • associated to
    - biomechanical stifle imbalance
    - overload
    - chronic stress
    - ligament weakening
  • leads to:
    partial rupture → complete rupture
  • usually bilateral (asynchronous)
    quiet dogs too

Causes / Pathogenesis

• chronic degenerative changes of cruciate lig.
  → multifactorial
  - recurrent / chronic inflammation
    → different origin (e.g. OCD, biopath)
  - aging process
  - false distribution of weight (loading)
  - instability (patella lux.)
  - bold tibia plateau angle
  - immunomediated - cause/result?
    - host immune system reaction against collagen
    - overweight

Causes / Occurrence

→ (partial) rupture of the CrCL
  often without recognisable trauma
• large breeds up to 5 years
  (e.g. Boxer, Doberman Pinscher, Rottweiler a.o.)
• small breeds from 7th year on
  (e.g. Yorkies, Chow, Bullmastiff, Mischling a.o.)
• castrated female >> male
  (sex hormones → collagen synthesis)
• Obesity
• 50% of the patients also show meniscopathy

Diagnosis

• anamnesis
• clinical symptoms
• palpation
• radiographs
• (MRI)
• (ultrasound)
• (arthroscopy)
**Anamnesis**

- **Cause/progression**
  - direct trauma?
  - acute / slowly onset
  - recurrent
  - intermittent
  - stress dependant
  - muscle atrophy
  - alternating lameness
  - bilateral CrCL rupture (> 30%)

**Clinical symptoms**

- **Adseption**
  - mild, moderate, severe lameness
  - relieving posture
  - tip toe position
  - weight displacement
  - shifting of the bodyweight
  - positive sitting test
  - muscle atrophy

**Palpation**

- **painful joint**
- **knee-joint „swollen”**
  - joint effusion?
  - loss of detail
  - of the patellar tendon
  - periarticular fibrosis
  - osteoarthrosis
  - reduced range of motion
  - swelling (medial buttres)
  - medial at the level of the collateral lig.

- **cranial drawer sign**
  - Extension position 150 – 160°
  - „neutral position“ 130 – 140°
  - Flexion position 45 – 90°
  - Cranial tibial displacement → rupture of cranial cruciate lig.
  - best results in neutral position
  - → if nec. in sedation / anesthesia rep.

- **craniocaudal drawer sign**
  → 98% Rupture of the cranial cruciate lig.

**Reference points**

- Lateral fabellae
- Patella
- Head of the fibula
- Tibial crest

**Palpation**

- **craniocaudal drawer sign**
  - cranial / caudal drawer sign
  - positive in flexion and extension= Complete rupture
  - negative in extension= Partial tear
Increase of internal rotation
37 of 79 patients (46.8%) (Schäfer 1991)
95 of 132 patients (72%) slight
32 of 132 patients (24.2%) severe (Timmermann 1995)

Radiographic examination
1. medio-lateral view
2. caudo-cranial view
3. cranio-caudal view
- Patella tendon
- Fat pad
- Joint profiles

Radiographic examination
- Partial tears usually become complete rupture or develop severe OA
- Lesion progression is always associated with OA progression
- There is no reasons for not treating a partial tear!

MRI
- different gravities (e.g. T1, T2)
- different planes of section
  - assessment of cruciate ligaments
  - assessment of meniscus

- joint effusion
- ruptured cruciate ligament
- cartilage lesions
- soft tissue alterations
- bone oedema
- degenerative alterations

Arthroscopy
- no primary diagnostic agent in humans
  - partial rupture of cruciate lig.
Arthroscopy

- no primary diagnostic agent in humans
- diagnosis of meniscus disease
- treatment with extraarticular technique
  - for example TPLO, TTA

Many Thanks!