Patient presentation

- “Suddenly my dog can not walk”
- Very worried owner asking for prompt treatment !!!

Clinical case

- Poodle, m, 5 years old
- History:
  - The dog has showed reluctance to move for 24 hours, then suddenly it showed severe weakness on the back
Clinical case

- Neurological exam:
  - Paraparesis, hyper-reflexia hind limbs, focal back pain.
- NEUROANATOMICAL LOCALIZATION?

Differential Diagnosis

- Vascular
- Inflammatory
- Trauma
- Anomaly
- Metabolic
- Idiopathic
- Neoplastic
- Degenerative
**Differential diagnosis**
- VERTEBRAL PAIN
  - COMPRESSION EXTRADURAL LESION
- ABSENT VERTEBRAL PAIN
  - INTRADURAL LESION

**DISC HERNIATION**
- DISC EXTRUSION
  - HANSEN TIPO I
- DISC PROTRUSION
  - HANSEN TIPO II

**ACUTE DISC EXTRUSIONS**
- Only in chondrodystrophic breeds?
- Chondrodystrophic dogs exist in each single breed
Acute Spinal Cord Injury (ASCI)

- PRIMARY DAMAGE (MECHANICAL)
  - CONTUSION, HEMORRHAGIA, NECROSIS
- SECONDARY INJURY MECHANISMS (BIOCHEMICAL, VASCULAR)
  - MYELOMALACIA

SECONDARY INJURY MECHANISMS

- FREE RADICALS (O2, H2O2, OH-)
  - PEROXIDATION OF CELL MEMBRANE LIPIDS
- INTRACELLULAR Ca++ accumulation

EXCITOTOXINS, ENDOGENOUS OPIOIDS, SEROTONIN

ISCHEMIA

ASCI TREATMENT

- METHYLprednisolone Sodium Succinate (MPSS)
  - 30 mg/Kg WITHIN 8 HOURS FROM TRAUMA
  - 5.4 mg/Kg/hr
  - FOR 24 H FOR 24 H STARTED WITHIN 3 h
  - PER 48 H IF STARTED BETWEEN 3rd & 18th h
**MPSS**

- PRO:
  - National Spinal Cord Injury Study (NASCIS)
    - I, II, III (Bracken et al.)
- CONS:
  - Canadian Association Emergency Physicians
    - MPSS for a spinal cord injury is not a standard of care; it’s a treatment option

**MPSS**

- Only in plegic animals
- Do not administer for more than 48 h
- Do not start MPSS if the trauma is older than 8 h
- DO NOT USE IN ANIMALS ALREADY IN STEROID TREATMENT

**ASCI**

- Polietienglicole (PEG)
- Preliminary Results

MPSS

- In Veterinary Medicine benefits are not proved

ACUTE DISC EXTRUSION
CLINICAL CLASSIFICATION

<table>
<thead>
<tr>
<th>GROUP</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>ONLY PAIN. NO NEUROLOGICAL DEFICITS</td>
</tr>
<tr>
<td>II</td>
<td>PAIN, MILD ARASS AND AMBULATORY PARAPARES</td>
</tr>
<tr>
<td>III</td>
<td>SEVERE PARAPARES NON-AMBULATORY</td>
</tr>
<tr>
<td>IV</td>
<td>PARAPLEGIA WITH PRESENT DEEP NOCEPTION</td>
</tr>
<tr>
<td>V</td>
<td>PARAPLEGIA WITHOUT DEEP NOCEPTION</td>
</tr>
</tbody>
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ACUTE DISC EXTRUSION
TREATMENT

<table>
<thead>
<tr>
<th>GROUP</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>CONSERVATIVE SURGERY. Lack of improvement, recurrences or massive extension</td>
</tr>
<tr>
<td>II</td>
<td>SURGERY FUNCTIONAL RECOVERY 15-20% (Surgery within 24-48h)</td>
</tr>
<tr>
<td>III</td>
<td>SURGERY FUNCTIONAL RECOVERY 50-60% (Emergency treatment)</td>
</tr>
<tr>
<td>IV</td>
<td>SURGERY FUNCTIONAL RECOVERY 50-70%</td>
</tr>
<tr>
<td>V</td>
<td>SURGERY FUNCTIONAL RECOVERY 50-80%</td>
</tr>
</tbody>
</table>

- In Veterinary Medicine benefits are not proved
CONSERVATIVE TREATMENT

- CAGE REST FOR 20 DAYS
  - Recovery 50%
- ANALGESICS (WITH CAGE REST)
- SURGERY IF
  - PAIN PERSISTS AFTER 20 DAYS

GROUP I

- Does “discogenic” pain exist in the dog?
- The dorsal longitudinal ligament is well innervated, few nerve fibers are contained in the outer layers of annulus
- Disc material in spinal canal in 90% of patients with just pain
GROUP I

- CURRENT APPROACH:
  - Always advanced imaging (MRI)
  - Huge compression: surgical treatment
  - Mild Compression: Conservative treatment

Group V - Absent nociception

- Better prognosis if surgery is performed within 12 h
- Worse prognosis in case of hyperacute paralysis (< 1 hour)
- Nociception must be recovered within 2 weeks (?)

GROUP V

- Decompressive surgery within 24 h:
  - 59-62% functional recovery
  - In some patients nociception does not recover
  - Persistence of urinary incontinence
  - After 24 h?
Clinical case

- Dachshund, “ETTORE”, 7 years old
- Onset of paraplegia 3 weeks before presentation
- Nociception absent.

15 days after surgery

2 months after surgery
ACUTE DISC EXTRUSION
DIAGNOSTIC WORK-UP AND TREATMENT

- NEURO EXAM AND LOCALIZATION
- HAEMATOLOGICAL PROFILE
- ECG
- THORAX X-RAY

X-ray study
- ANESTHETIZED PATIENT
- PERFECT POSITIONING
- HIGH QUALITY X-RAY
- MOVING THE PATIENT GENTLY
X-RAYS

Radiological signs of potential disc extrusion:
- Decreased or cuneiform IV space
- Decreased foramina
- Closer facet joints
- Calcified material in the canal

Esame radiologico

Calcified discs

No diagnostic value

Prognostic value:
Potential recurrence

Imaging

- Myelography
- CT (+ myelo)
- MRI
MYELOGRAPHY

- INVASIVE AND OBSOLETE TECHNIQUE
- LITERATURE STILL JUSTIFY IT'S USE

CONTRAST MEDIA

- NON-IONIC MONOMERS (class 3)
  - IOPAMIDOL
  - IOHEXOL
- NON-IONIC DIMERS (class 6)
  - IODIXANOL (visipaque®)
  - OSMOLALITY EQUAL TO PLASMA
  - LESS NEUROTOXICITY
MRI IN DISC EXTRUSION

- STANDARDIZED STUDY PROTOCOL
- HIGH SENSITIVITY AND SPECIFICITY

MAGNETIC RESONANCE IMAGING IN THE DIAGNOSIS OF DISC EXTRUSIONS: EVALUATION OF 50 CASES

DARIO BAGNOLI, CRISTIANO SALZANO

MAY 2008
DECOMPRESSION SURGICAL TECHNIQUE

- MINI-EMILAMINECTOMY WITH REMOVAL OF THE EXTRUDE MATERIAL
- FENESTRATION DISCS "AT RISK"
  - At least one cranial and one caudal to the extruded disc

Mini-hemilaminectomy
SURGICAL TECHNIQUE

- Wide hemilaminectomy
- (Decompressing all segments involved)
CERVICAL DISK EXTRUSION

CLINICAL SIGNS:
- Usually dramatic pain, root signature, no neurologic deficits
- Acute tetraparesis or tetraplegia is not rare
- Respiratory compromise possible for C2/C3 and C3/C4 localization

Cervical disc extrusion

- In case of tetra paresis:
  - Diagnostic work-up (MRI)
  - Surgery (ventral slot)
  - Recovery rate 90%

VENTRAL SLOT
SPINE TRAUMA MANAGEMENT

- CHALLENGING!
- IT INVOLVES KNOWLEDGE ABOUT:
  - EMERGENCY MEDICINE
  - NEUROLOGY
  - ORTHOPAEDICS
- APPROPRIATE DECISIONS IN A SHORT PERIOD OF TIME

SPINE SURGERY

- APPROPRIATE TECHNIQUE
- DETAILS IN PERFORMING IT

PATIENT APPROACH

- POLYTRAUMA PATIENT (45.3%)
  - SHOCK
  - PULMONARY OR PLEURAL LESIONS (33%)
  - HEAD TRAUMA
  - BLADDER ROPTURE
  - ETC.
PATIENT APPROACH
- ABC ASSESSMENT
- THOROUGH PHYSICAL EXAMINATION
- NEUROLOGICAL EXAMINATION
  - AVOID EXCESSIVE MANIPULATIONS
  - ANALGESICS AFTER NEURO EXAM
  - EARLY IMMOBILIZATION

NEUROLOCALIZATION
- MULTIPLE LESIONS?
- L4-S3 LESION COULD MASK T3-L3
- C6-T2 LESION COULD MASK C1-C5
- SURVEY RADIOGRAPHS
  - ENTIRE SPINE

FINAL DIAGNOSIS
- PATIENT STABILIZATION
- MORPHOLOGICAL DIAGNOSIS
- IMMEDIATE TREATMENT
**DIAGNOSIS**
- Delineate spine dislocation
- Assess potential spinal cord compression
- Define best choice of treatment

**SPINE**
- X-ray
- CT

**CT AND TRAUMA**
- Fast procedure
- Provides excellent information about bone fragment displacement
- Detects spinal canal and intramedullary hemorrhage
MR AND SPINE TRAUMA

- PROVIDE INFORMATION ABOUT:
  - SPINAL CORD COMPRESSION
  - EXTENT AND TYPE OF SPINAL CORD DAMAGE
  - PROGNOSIS FOR SPINAL CORD RECOVERY

?
JUST ONE QUESTION:
- IS THE FRACTURE UNSTABLE?

STABLE OR UNSTABLE?
- I: THE DISC HAS FAILED
- II: A FACET HAS FAILED
- III: VERTEBRAL BODY (BATTRESS) HAS FAILED
- IV: TWO OR MORE COMPONENT FAILED
CLINICAL CASE

POST-OP AND FOLLOW-UP

TREATMENT

- CONSERVATIVE
  - CAGE REST
  - EXTERNAL SPLINT
- IN SELECTED CASES:
  - STABLE FRACTURE (DORSAL COMPARTMENT)
  - YOUNG ANIMALS
  - CERVICAL FRACTURES
  - ECONOMICAL RESTRAINTS
CONSERVATIVE TREATMENT

- STABLE FRACTURE
- GOOD NEUROLOGICAL STATUS
  - (GRADE I AND II)
- CONTROLLED PAIN
- NO SPINAL COMPRESSION
  - DIAGNOSTIC IMAGING (CT, MRI)

CONSERVATIVE TREATMENT

- PAY ATTENTION TO APPARENTLY STABLE FRACTURE/LUXATION!!!

EXTERNAL SPLINT

- RARELY IT'S A GOOD OPTION
  - MID CERVICAL FRACTURES
  - NURSING CARE!
  - URINE SCALD
  - DECUBITUS
  - NEUROLOGICAL DETERIORATION
CONSERVATIVE TREATMENT

- CERVICAL
  FUNCTIONAL RECOVERY 89%
  Heathorne JG et al 1999
- THORACOLUMBAR
  OUTCOME DOES NOT DIFFER BETWEEN SURGICAL AND CONSERVATIVELY MANAGED PATIENTS IN SOME STUDIES
  Seiber RP et al 1991
  Reports should have to be interpreted with caution!
  WORSE INITIAL NEUROLOGICAL STATUS IN SURGICAL PATIENTS

SURGICAL TREATMENT

- UNSTABLE FRACTURE/LUXATION
- SEVERE NEUROLOGICAL STATUS
- DISPLACED FRAGMENTS
- NOT RESPONSIVE PAIN
- HYPERACTIVE ANIMALS

SURGICAL DEVICES

- IDEAL CHARACTERISTICS:
  - GUARANTEE STRONG SPINE FIXATION
  - FIT THE ANATOMY OF THE SPINE
  - PERMIT AN EASY APPLICATION
  - FEW EARLY AND LATE COMPLICATIONS
**FIXATION DEVICES**

- **SPINAL STAPLING**
  - Voss K. Tension band stabilization of fractures and lacerations of the thoracolumbar vertebrae in dogs and cats. All cases. *JAVMA* 2004;225:76-83

**FIXATION DEVICES**

- **SPINAL STAPLING**
  - ALMOST HISTORICAL DEVICE
  - CAT AND SMALL DOGS
  - IMMOBILIZES A LONG SPINAL SEGMENT
  - DOES NOT CONTRAST AXIAL LOADING

**FIXATION DEVICES**

- **VERTEBRAL BODY PLATES**
  - LOCKING PLATES COULD HAVE A SPACE
    - Compact Unlock System (Voss K 2006)
    - SOP System (McKee 2008)
FIXATION DEVICES

VERTEBRAL BODY PLATES
- "IMPLANTS SHOULD BE ADAPTED TO THE SPINE ANATOMY AND NOT VICEVERSA"

VERTEBRAL PLATES
- SIMILAR BIOMECHANICAL PROPERTY TO PIN AND PMMA
- PROPER ADAPTATION TO SPINE ONLY IN LUMBAR (AND CERVICAL) REGION

PINS (SCREWS) AND POLYMETHYL METHACRYLATE (PMMA)
- THE MOST POPULAR TECHNIQUE
- GUARANTEES STRONG FIXATION
- (ROTATION, FLEXION, EXTENSION)
- DOES NOT INTERFERE WITH SPINE ANATOMY
- POTENTIAL INFECTIONS
**BILATERAL OR MONOLATERAL IMPLANT?**
- ALWAYS BILATERAL EXCEPT:
  - STABLE FRACTURES
  - CAT, TOY BREEDS

**SURGICAL APPROACH**
- IT'S A CHALLENGING SURGERY
- PHYLLOSOPHY BEHIND:
  - ACT AS A NEUROSURGEON
  - GENTLE MANIPULATIONS
  - FIRST GOAL IS TO ACHIEVE STABILIZATION
  - ANATOMICAL REALIGNMENT IS NOT MANDATORY
  - CONSIDER THE PRE-OP NEUROLOGICAL STATUS

**SURGICAL APPROACH**
- FRACTURE –LUXATION REALIGNMENT:
  - HAVE A RATIONAL SURGICAL PLAN
  - DO NOT HANDLE TOO MUCH THE SPINE
  - DO NOT CAUSE ADDITIONAL SPINAL CORD DAMAGE
  - JUST ONE MANOEUVRE TO REALIGN THE SPINE
L6-L7 Fractures

- Variable degrees of neurological deficit
- Often just pain
- L7 dorsal displacement
THORACOLUMBAR FRACTURES

- **PROGNOSIS**
  - DPP ABSENT: POOR PROGNOSIS
  - DPP RETAINED: GOOD PROGNOSIS
  - BETTER PROGNOSIS WITH SURGICAL TREATMENT (?)
  - RESULTS INFLUENCED BY TECHNIQUE, SURGEON, NEUROLOGICAL STATUS

CERVICAL FRACTURES/LUXATIONS

- CERVICAL FRACTURES RESPOND WELL TO CONSERVATIVE MANAGEMENT (89% FUNCTIONAL RECOVERY) (Hawthorne 1999)
- **PROPOSED CRITERIA FOR SURGERY:**
  - VERTEBRAL DISPLACEMENT
  - PERSISTENT PAIN
  - DETERIORATING NEUROLOGICAL STATUS

CERVICAL FRACTURES

- VENTRAL FIXATION WITH SCREWS AND PMMA IS THE MOST USEFUL TECHNIQUE
C2 FRACTURES
• THE MOST AFFECTED SITE

CERVICAL TRAUMA
• POTENTIAL FOR POOR VENTILATORY FUNCTION
• CHECK FOR ADEQUATE VENTILATORY FUNCTION BEFORE SURGERY
• OWNER SHOULD BE AWARE
  • COST OF INTENSIVE CARE
Diagnosi differenziale
- Vascolare
- Infiammatorio
- Trauma
- Anomalia
- Metabolico
- Idiopatico
- Neoplastico
- Degenerativo

FIBROCARTILAGENOUS EMBOLISM (FCE)
- Young large breed dogs more affected
- Usually chondrodystrophic dogs are not affected
- Peracute onset of paresis/plegia, asymmetric, not painful
- Prognosis depends on the site of lesion
  - if intumescences are affected, prognosis is more severe.

Diagnostic work-up
- MRI is essential
ANNPE (Acute non-compressive nucleus pulposus extrusion)

- Focal intramedullary spinal Cord T2 hyper intensity
- Decreased volume of nucleus pulposus
- No or mild spinal cord compression
- Abnormal epidural space

De Raco L et al. JAVMA 2000;216:495-504
FCE/ANNPE
TREATMENT

• CONSERVATIVE TREATMENT
• PHYSIOTHERAPY
• RECOVERY (COMPLETE OR PARTIAL)
  IN 6-8 WEEKS