Neurological Prognosis

Don’t Give Up!
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**Which has a better prognosis?**
- Diabetic Ketoacidosis
- Discharge from hospital
- 70%

- Feline Meningioma
- Discharge from hospital
- 95%
Granulomatous meningoencephalitis

- **Survival**
  - 15 Alive 60%
  - 9 Dead 40%

- Mean survival time – **21 Months** – 630 days (Range 10-49 Months 300-1470 days)

IMHA

- Mean survival rates at discharge and at 30 days and 1 year after evaluation collated from 7 published reviews of canine IMHA
  - 57%, 58%, and 34%


- Weinkle TK, et al. Cornell
Hypertrophic Cardiomyopathy

- Java 1992 Aug 15;201(4):613-8
  Atkins CE, et al. NC state

- 732 days mean
- Heart failure 92 days median

  Rush JE, et al. Tufts

- Median survival time was 709 days for cats that survived > 24 hours.
- Cats in the subclinical group lived the longest (1,129) days
- cats in the ATE group (184 days)
Meningioma

- 121 Cats
- Surgical Removal of feline intracranial meningiomas – clinical features and outcome in 121 Cases. S Cameron, et al Cornell
- ACVIM Proceedings 2012
- Median survival 17.8 months
- 5/26 died related to surgery or meningioma
Meningioma Dogs

- Justin Greco, Sean Aiken, Jason Berg et al

- 3/17 died 82% survival
- Median 1254 days!
Degree of Resection

- Median survival for standard excision 204 days (96-316)
- Median survival for cortical resection 480 (38-676)

- Standard N=5
- Cortical Resection N=6

Medical Management vs Hydroxyurea

- N=28
  - 17FS; 11MC
  - Age – Mean 10.4 Range 5.9 - 14.75
  - Breeds
    - 6 Golden Retrievers
    - 5 Mix
    - 3 Boston Terriers
    - 2 Labrador Retrievers

- N=20
  - 9FS, 10MC, 1?
  - Age Mean 9.4; Range 5.9-13.3
  - Breeds
    - 7 Mix
    - 3 Chihuahuas
    - 2 Golden Retrievers
Survival

- Median 25
- Mean 53
- Range 1-257

- I still alive

- Median 134
- Mean 185
- Range 95-500d

- 5 still alive
DCM

- median survival time < 60ms of 25 weeks
- dogs with a QRS duration ≥60 ms had a median survival time of 13 weeks


Association of QRS duration and survival in dogs with dilated cardiomyopathy: a retrospective study of 266 clinical cases.

Pedro BM, et al. Portugal
DCM

- Overall prognosis was poor, with survival rates of 17.5% at one year and 7.5% at two years.
- Survival and prognostic factors in 189 dogs with dilated cardiomyopathy.
- Tidholm A, et al, Sweden
Atlanto-Axial Subluxation

- **Age/Breeds**
  - Young (6 months to 2 years)
  - Yorkie; other small breeds

- **Clinical Signs**
  - PAIN (intermittent)
  - Tetraparesis
  - Acute
AA Anatomy

- Atlas and Axis – Unique vertebrae – allow us to say yes/no
- No disc
- Multiple ligaments
- Oodontoid process/dens
AA Diagnosis

- Radiographs
  - Gently! Flex — evaluate alignment of body and space between arch of C1 and dorsal process of C2
- +/- MRI
AA Treatment

- **Medical**
  - Cervical splinting
  - Cage rest

- **Surgical – Treatment of Choice**
  - Dorsal techniques
  - Ventral techniques
Prognosis

- Multifactorial
  - Age
  - Neurological Status
  - Surgeon experience
  - Anesthesia/Post op care
Atlanto-Axial Subluxation

- Medical management – splint – 38% success
- Surgical Mortality reported 10%
- Long term success 47-92%
- Tobias
Adrenal Tumors

- Schwartz P, et al AMC
- 9 (22.0%) dogs did not survive to discharge. Intraoperative mortality rate was 4.8%
- median survival time was 690 days
Grading Scheme for Clinical Signs
T3-L3 myelopathy

- Grade 1: Pain only
- Grade 2: Ataxia, conscious proprioception deficits.
- Grade 3: Paraplegia
- Grade 4: Paraplegia with urine retention and overflow
- Grade 5: Paraplegia with urinary retention and overflow and loss of deep pain perception.
Laminectomy for 34 dogs with thoracolumbar intervertebral disc disease and loss of deep pain perception

H. W. Scott¹, W. M. McKee²

- Twenty-one dogs (62 per cent) recovered neurological function
  - seven (21 per cent) failed to recover neurological function
  - three (9 per cent) developed progressive myelomalacia postoperatively
  - three dogs (9 per cent) were euthanased intraoperatively because of diffuse myelomalacia.

- Twenty of the dogs that recovered neurological function showed a return of deep pain perception within two weeks of decompressive surgery.
Surgery vs medical management
Grade 3 and 4 dogs

Average recovery
<2 weeks with surgery
6-12 weeks with medical management

Success rate
surgery is 96%
without 20-60%

Recurrence
medical 50%
surgery <20%
Immune Mediated Hemolytic Anemia


- Idiopathic immune-mediated hemolytic anemia: treatment outcome and prognostic factors in 149 dogs.
- Piek CJ, et al Netherlands

- The estimated Kaplan-Meier half-year survival was 72.6%
IMHA

- A mortality of 29% during hospitalization
- Idiopathic immune-mediated hemolytic anemia in dogs: 42 cases (1986-1990)
- Klag AR, et al. Upenn

- Mean survival rates at discharge and at 30 days and 1 year after evaluation collated from 7 published reviews of canine IMHA
  - 57%, 58%, and 34%

- Weinkle TK, et al. Cornell
GME

- A tentative diagnosis may be based on clinical and laboratory data; however, confirmation requires microscopic evaluation of the CNS.
- Prognosis is poor.
- Long-term treatment is unsatisfactory, although temporary remission is often achieved with glucocorticoid administration.
Braund
Granulomatous meningoencephalomyelitis 1985

- First to describe disseminated vs focal vs ocular

- Course – 25% dies in 1 week; 50% 2-6 week course; ocular form – sudden onset and can be static; focal course 3-6 months or longer

- Diagnosis – first to report that definitive exam is after postmortem

- Temporary remission with Prednisone
Prognosis

- Fatal??
- Initial studies from the 1970-1990 – necropsy studies with little consideration given/discussed about treatment – primarily pathologic studies

- Adamo - >900 day median survival – 10 cases
**GME Study Cases**

- **Treatment**
  - Dexamethasone sole agent: 10
  - Dexamethasone + cyclosporine: 3
  - Prednisone + azathioprine: 1
  - Dexamethasone + cyclosporine then chlorambucil: 1

- **Currently on medications: 9/15**

- **Currently weaned off medications: 6/15**

- **Current dose if on dexamethasone only: EOD to 1x/week**

- **Combination therapy: EOD for both to 1x/week for both**
Study GME

- **Survival**
  - 15 Alive 60%
  - 9 Dead 40%

- **Mean time to death** - 2.75 weeks (Range 3d to 2 months)

- **Mean survival time** – 21 Months – 630 days (Range 10-49 Months 300-1470 days)
Maltese Encephalitis
Maltese Study

- 13 Cases

- Average age 5.2 years; Median 4.6 years – Range (2.1-9 years)

- CSF protein 59 mean (Range 22-110)

- TNCC 141 mean (Range 0-396)

- Majority differential cell
  - Lymphocytes 36%; Mononuclear/macrophages 10%; PMNs 10%; Mixed 54% (50% of these had 36-40% neutrophils)
Maltese

- 5/9 Live dogs are on dexamethasone only
- 2 are dexamethasone and cyclosporine (1x/day for 1 dog and 1x/week dexamethasone 2x/week cyclosporine for the other dog)
- 1 is on dexamethasone and CCNU
- 1 is on chlorambucil (EOD) and dexamethasone (q3d)
- 1 is off all medicine
- Dead dogs 3 were on dexamethasone alone and 1 was on cyclosporine and dexamethasone
Maltese

- 9/13 Alive: Mean 26.5 months; Median 18 months (Range 8-58 months)
- 4/13 Deceased: Mean 17 Months; Median 4.5 months (Range 2-58 months)
Yorkie Encephalitis
Yorkie

- 2 lost to follow up at 24 months
- 1 Died
- 1 Euthanized 50 months after diagnosis – had repeat MRI – showed progression of the changes
- 1 Alive

- Survival (including 24 months for 2 lost to follow up)
  - 29 months
Dexamethasone vs Prednisone

  - Lowered relapse rate
    - 25.6 (pred) to 14.3 (dex) by switching steroids

  - Patients with dexamethasone had a 3.7% 6y relapse rate
    - vs 7.1% with prednisone
GDV

- Association between outcome and changes in plasma lactate concentration during presurgical treatment in dogs with gastric dilatation-volvulus: 64 cases (2002-2008).
- Zacher LA, et al Tufts

- 36 of 40 (90%) dogs with an initial lactate concentration ≤ 9.0 mmol/L survived
- compared with only 13 of 24 (54%) dogs with a high initial lactate (HIL) concentration (> 9.0 mmol/L)
GDV

  Beck JJ, et al. CSU
  Short-term mortality rate was 16.2% (27/166)

  Overall mortality rate was 26.8%

No significant differences that received lidocaine and dogs that did not
1.31 Hansen type II disc herniation. This occurs mainly following fibroid metamorphosis in the non-chondrodystrophoid breeds. The anulus fibrosus is damaged and there is displacement of the intervertebral disc into the vertebral canal.

From: Small Anima Spinal Disorders 2nd Ed. Nicholas J H Sharp and Simon J Wheeler P. 13
Surgery is sometimes required in cases of Type II disk disease, and the surgical procedures are generally the same as those used for Type I disk disease."

Patients with Type II disk disease are often controlled adequately for long periods of time with medical therapy.

The prognosis for surgical treatment of Type II disk disease is generally guarded

Substantial, sometimes permanent, neurologic deterioration after surgery is more likely in these patients - may be due to such factors as reperfusion injury and lack of spinal cord functional reserve capacity (due to chronic compression)
IVDD vs DM
12y Dalmatian TL IVDD Type 2
12y Dalmatian
Follow up GSD

- Surgical average survival 32 months post surgery (7/31)

- Excluding 1 case – dorsal laminectomy – no deep pain post surgery – euthanized 1 month

- 1 Dog progressed and was euthanized 5 months after surgery (suspect DM)

- Nonsurgical group survival 16 months average

- DM group survival – 4.5 months
Pituitary Dependent Hyperadrenalcorticism
Cushing’s

- Barker et al 2005 JVIM 19:810

- Median survival
  662d trilostane
  708d mitotane
Cyberknife radiosurgery

- 52 Brain tumors
  - 25 probable meningioma
  - 14 probable glioma
  - 8 probable pituitary macroadenoma
  - 4 probable 5\textsuperscript{th} CN sheath tumors
  - 1 probable choroid plexus
• CK-MST - exceeds 44 weeks
  ◦ 10 dead of disease, 4 dead of other causes, 1 other
    • 5 meningiomas (tended to be large)
    • 5 gliomas
  ◦ 3 severely neurologic at time of tx
Virtually no side effects
Cyberknife-treatment of choice for nonresectable tumors

Nasal, Pituitary, TCC – 31 months
Hemangiosarcoma

- Surgery & Chemotherapy MST 6-7 months
Hydrocephalus

Contrast ventriculogram
Ultrasound
Medical management

- Serial lumbar punctures

- Medical
  - Corticosteroids
  - Furosemide
  - Carbonic anhydrase inhibitors
  - Prilosec
  - Osmotic agents – mannitol, glycerol
Revisions Human

109 (27%) underwent a revision operation.

51 needed a second revision

19 needed a third.

2 underwent a seventh revision.
Case Series – Hydrocephalus VP Shunt

18 Dogs
3 Feline

2003-2008
PRIMARY HYDROCEPHALUS

8 Cases – Primary hydrocephalus – communicating - 1 cat 7 dogs

Survival
5d-1050d

Median 750d; Mean 665d

6 Associated with COMS malformation
440-1620d,

Median 720d, Mean 928d
Clinical signs
Inappropriate behavior/behavior change (6/8)
Persistent or episodic Increased ICP (cerebellar/brainstem herniation) (4/8)
Seizures (3/8)
Neck pain (2/8)
Level of consciousness change (1/8)

Post Shunt 7/8 Alive
**All resolved or improved clinical signs** except for seizures (all continued to have with progression in frequency over time)

Complications – Distal catheter not placed into abdomen – SQ – replaced without incident
Overshunting – Cerebral collapse
SECONDARY OBSTRUCTIVE HYDROCEPHALUS

Neoplasia
Confirmed
Choroid plexus papilloma/carcinoma (1)
Meningioma (1)

Suspected
Meningioma (1 DSH) (3rd ventricular)
CPP/ependymoma – intraventricular mass (2)

2 Alive, 3 deceased
90d-810d (Median 210, Mean 320)
NEOPLASIA

Clinical signs

Increased ICP (2)
Forebrain (4)
Neck pain 1
Vestibular 1

Post surgery

All normal except residual vestibular signs in 1
NEOPLASIA

Complications

1. Ventricular catheter bent secondary to malplacement. Reduced 1 day post surgery – recovered fully

2. Declined during RT – shunt patent

3. Psuedocyst – SQ abdomen – no treatment
Cryptococcus

- Initial improved with secondary waxing and waning of signs
- Treated with fluconazole
- Euthanized at 90d
CEREBELLAR CYST

VP shunt placed lateral ventricle and cyst incised

Euthanized 3 years later for splenic mass– no clinical signs

Complications - None
Bebop 3m Chihuahua
Diabetic Ketoacidosis

- Bruskiewicz KA, et al UCD

- 11/42 (26%) cats died or were euthanatized during the initial hospitalization period for treatment of DK or DKA
**DKA Dogs**

- **Outcome of dogs with diabetic ketoacidosis: 127 dogs (1993-2003).**
- Hume DZ, et al. Upenn

- Of 121 treated dogs, **89 dogs (70%) survived** to be discharged from the hospital.

- Survival was correlated to degree of anemia, hypocalcemia, and acidosis.
Cervical IVDD

- Effectiveness of cervical hemilaminectomy in canine Hansen Type I and Type II disc disease: a retrospective study.
- Schmied O, et al Switzerland

- Ambulatory tetraparesis 44%
- Treatment was effective in 88% of dogs.
- Five large breed dogs (12%) did not improve.
- Hansen Type I disc extrusion, clinical signs improved in 96% of the cases.
There is more space in the cervical canal, so a large amount of material can be present w/o causing tetraplegia unless explosive→tetraplegia

Some disk may protrude to one side causing root signature (holding up or dragging one leg.)
Multiple cervical discs

• Arguments against multiple ventral slots
  • Adequate ventral slot size difficult to achieve in small dogs
  • Disruption of internal venous plexus causing hemorrhage
  • Biomechanical instability and risk of subluxation

• BUT...
• No clinical evidence or literature to support these statements

• First paper documenting ventral slot technique included a dog with 2 affected sites
Study

- **Clinical Signs Pre-operatively**
  - Mean duration 52 days, median 23 days
  - Grade 1: 7 dogs
  - Grade 2: 11 dogs
  - Grade 3: 3 dogs
  - Unknown: 2 dogs

- **Sites Affected**
  - 2 sites: 19 dogs
  - 3 sites: 4 dogs
Study

- Clinical Signs S/R
  - Normal: 3 dogs
  - Grade 1: 6 dogs
  - Grade 2: 5 dogs
  - Grade 3: 1 dog
  - Unknown: 8 dogs

- Long Term
  - Mean duration follow up: 21.3 months
  - Range follow up: 1 - 41 months
  - Unknown: 5 dogs
  - Excellent outcome: 15 dogs
    - $15/18 = 83.3\%$
Study Results

Complications

- Peri-operative complications
  - None reported
  - Could be falsely low due to retrospective nature of study
- Mortality 1/23 dogs = 4.3%
  - 1 dog died 4 days post-operatively due to aspiration pneumonia
Study Results

• Recurrence
  ◦ 2/23 dogs = 8.7%
    • 1 dog did well for 6 months, then had progressive gait change and was euthanized 1 year post-operatively
    • 1 dog showed steady improvement for 18 months, then had relapsing clinical signs and was euthanized
      • This dog also had a concurrent Chiari malformation on initial MRI
  ◦ Neither dog had repeat imaging so unsure what cause of recurrent signs was
Study Results

• Recurrence
  ◦ Previous large scale studies reported recurrence rates of 5.6%, 10% and 36%
  ◦ Our study shows results comparable to previous reports
Study Results

• Addressing the “Naysayers”
  ◦ Excellent outcome in majority of dogs indicates adequate slot size not difficult to achieve in small dogs
  ◦ Hemorrhage not a significant peri-operatively complication
  ◦ Recommended ventral slot width no > 50% the width of vertebral body did not increase risk of subluxation with multiple sites
  ◦ Recurrence and complications rates similar to those in previous studies
Medical Management

- Often recommended in cases with multiple affected sites
- 33% of dogs had recurrence of cervical pain and 18.1% had treatment failure when managed medically
GN

- Median survival was significantly shorter for Nephrotic syndrome (12.5 days) versus GN dogs (104.5 days)
- serum creatinine (< or ≥1.5 mg/dL), survival of NS versus GN dogs was only significantly different in nonazotemic dogs (51 versus 605 days)

- Comparison of signalment, clinicopathologic findings, histologic diagnosis, and prognosis in dogs with glomerular disease with or without nephrotic syndrome.
- Klosterman ES, et al Purdue
Lumbosacral – Cauda Equina

- Large breed/older
  - German Shepherd Dog
- L7 nerve root most commonly affect
  - SI nerve root also
Pathophysiology

- Instability/subluxation
- Transitional vertebrae
- Disc protrusion
- Ligamentum flavum hypertrophy
- Stenosis
- Nerve root impingement – foraminal stenosis
- Osteophytes
Instability
LS Clinical Signs

- Pain – most common
- Paresis
- Tail tone
- Urinary/Fecal Incontinence
- Pseudohyperreflexia
- Crouched gait
- Overflexion of hock, stifle, CF joint
- Short Strided
- Trouble rising/sitting

- Do GOOD orthopedic exam
Treatment

- Medical management
  - Physical Therapy
  - Pain Management – medications
    - NSAID, gabapentin, corticosteroids, others
  - Acupuncture
  - Epidurals

- Surgery
  - Dorsal laminectomy vs stabilization
  - Foramenotomy
    - 75-90% improvement
    - Earlier the better
Lumbosacral

- De Risio L, et al Italy.

- The outcome was excellent or good in 54 of 69 (78%) dogs over a mean follow-up period of 38+/−22 months.
- Five of these 54 dogs had been incontinent for a median of 2 weeks prior to surgery.
- Six of the 15 dogs with a poor outcome had been incontinent for a median of 8 weeks before surgery.
Overall improvement after surgery was recorded in the medical records in 79.0% (83/105) of the dogs.


Review and retrospective analysis of degenerative lumbosacral stenosis in 156 dogs treated by dorsal laminectomy.

96.5% of 86 dogs treated with this method relief of dorsal pressure and permanent rapid regression of clinical symptoms was achieved.

- Cauda equina compression syndrome (CECS): retrospective study of surgical treatment with partial dorsal laminectomy in 86 dogs with lumbosacral stenosis.
- Kinzel S, et al. Germany
Hepatocutaneous Syndrome

- According to the published literature
  - The long-term prognosis for Superficial Necrolytic Dermatitis is generally grave
  - Dogs in phenobarbital study were euthanized a median of 12 weeks after diagnosis
  - In another study, 14 of 22 dogs with SND were euthanized within 3 months
June 2011 Rex presented for ascites, anorexia, and lethargy.

AUS – mottled irregular liver

Treatment – spironolactone, lasix, denamarin, milk thistle, colchicine, actigal, discontinue phenobarbital
In December 2011 Rex presented for a sudden onset of polydypsia/polyuria.

- Diabetes mellitus

- Start Humulin N
Atlantic Coast Veterinary Specialists is now offering a back surgery package for qualifying cases referred by you. The package includes all of the following:

- Workup & Surgery (Board Certified Specialist ONLY)
  - Post operative care
  - Pain management
  - Up to one week of hospitalization

Your clients will pay a flat fee of $4500.

This package price is also good for any acutely paralyzed small breed dog.

At Atlantic Coast Veterinary Specialists we welcome and appreciate your referrals.