Intracranial Neoplasms: Clinical Aspects and Diagnosis

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Some Reference Sources

Cezar

- 12 yo MC Chihuahua
- Diagnosed with a brain tumor-suspect meningioma
- Diagnosed 3 yrs ago
- Treated with Cyberknife and oral hydroxyurea
Mr. Magoo

- 11 yo MC DSH
- Behavior change over last few months
- Focal facial seizures

Mr. Magoo's MRI

Brie-12 yo FS Miniature Poodle

- Progressive obtundation over several weeks
- Forebrain signs, then vestibular dysfunction
- Examined previously at two other specialty centers
- Worsening now by the hour—irregular heart rate and blood pressure, increasing obtundation tending toward stupor
Brie’s MRI

• Large intraventricular mass-third and lateral
• Extensive edema
• Ventriculomegaly
• Cerebellar herniation
• Now what?

Brain Tumors in Dogs and Cats

• Fairly common
• Diagnosed more readily now (MRI availability)
• Be aware of both palliative and definitive therapy options
• General knowledge and communication skills more important than expertise

Primary Brain Tumors

• From brain parenchyma (glial cells and neurons)
• From meninges and ependyma
• From vascular elements
Most Commonly Encountered Primary Brain Tumors

• Meningioma
• Glioma (Astrocytoma, Oligodendroglioma)
• Choroid plexus tumors

Less Commonly Encountered Primary Brain Tumors

• Ependymoma
• Olfactory neuroblastoma
• Gliomatosis cerebri
• Primary histiocytic sarcoma
• PNET
• Medulloblastoma
• Microglial tumors

Primary Brain Tumors in Dogs and Cats: General Information

• Signalment: mean age for dogs-9 years; cats->10 years
• Behavior change most common complaint in cats, seizures in dogs
• Meningiomas and gliomas in dogs, meningiomas predominate in cats
Primary Brain Tumors in Dogs: Clinical Features

- Often occupy more than one anatomic region of brain (important when interpreting neurologic examination findings)
- Nearly ¼ have another tumor type elsewhere
- Astrocytomas-diencephalon and cerebellum (clinical experience-usually diencephalon)

Primary Brain Tumors in Dogs: Clinical Features

- Canine meningiomas much more aggressive than feline or human meningiomas (80% are "atypical" histologically)
- All forms of gliomas considered aggressive, but details on specific tumor types are lacking
- Choroid plexus tumors may occur in lateral, third or fourth ventricles

Choroid Plexus Tumors in Dogs

- Most commonly in 4th ventricle
- Choroid plexus papilloma (CPP) and choroid plexus carcinoma (CPC)
- CPC tends to occur in lateral ventricle
- CPCs exhibit intraventricular or subarachnoid metastases ("drop" metastases)
Diagnosis of Primary Brain Tumors in Dogs and Cats

- Signalment
- History
- Neurologic examination
- Advanced Imaging (MRI)
- CSF?
- Histopathologic confirmation

Primary Brain Tumors in Dogs: Signalment

- Golden Retrievers and Boxer dogs common
- Goldens and other dolicocephalics tend to get meningiomas
- Boxers and other brachycephalics tend to get gliomas
- Average age is 9 years

Primary Brain Tumors in Dogs: Signalment

- Golden Retrievers also predisposed to developing choroid plexus tumors
- Pembroke Welsh Corgis predisposed to intracranial histiocytic sarcoma
Primary Brain Tumors in Cats: Signalment

• Median age over 10 yrs
• May be male predilection
• No breed predilection

Diagnosis of Primary Brain Tumors in Dogs and Cats

• Signalment
• History
• Neurologic examination
• Advanced Imaging (MRI)
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Primary Brain Tumors: Historical Features

• Progressive neurologic dysfunction over weeks to months is common, especially with meningioma
• Specific clinical complaint also dependent on tumor location
• More rapid development of signs is possible (hemorrhage, exhaustion of compliance mechanisms, herniation)
• Seizure activity most common complaint in dogs (about 50% of cases)
• Behavior change most common complaint in cats
Primary Brain Tumors: Historical Features (Cat Specific)

- Non-specific complaints: lethargy, inappetence/anorexia (over 20% of cases)
- No obvious attributable clinical signs (i.e., incidental finding on necropsy for other reason)

Diagnosis of Primary Brain Tumors in Dogs and Cats

- Signalment
- History
- Neurologic examination
- Advanced Imaging (MRI)
- CSF?
- Histopathologic confirmation

Neurologic Examination of the Brain Tumor Patient

- Tumor location will dictate neurologic examination findings
- Majority of primary brain tumors are located in the forebrain
- Regardless of location, brain tumor patients typically will exhibit neck and head pain on palpation
- Most brain tumors are markedly asymmetric, and neurologic examination reflects this
Forebrain Dysfunction: Clinical Features

- Circling (usually wide and in direction of lesion)
- Gait normal to near-normal
- Head and neck pain on palpation
- Mild anisocoria (opposite lesion side)
- Mild facial paresis (opposite lesion side)
- Hemi-neglect/Hemi-inattention

Forebrain Dysfunction: Clinical Features

- Head turn (vs head tilt)
- Decreased facial sensation (contralateral to lesion)

Hemi-Neglect or Hemi-Inattention Syndrome

- An anatomic phenomenon moreso than a “syndrome”
- Usually evident with lateralized forebrain tumors
- Based on majority of environmental cues/stimuli being interpreted on opposite cerebral hemisphere
Hemi-Neglect/Hemi-Inattention

- Head turn and circle to side of the lesion (ignoring other side)
- Difficulty responding to auditory stimuli on inattentive side
- Decreased response to nociceptive stimuli on inattentive side
- Difficulty finding food/treats on inattentive side

Brainstem (Midbrain through Medulla) Dysfunction

- More obvious gait abnormalities
- Central vestibular dysfunction common
- Abnormal mentation
- Pharyngeal dysfunction possible

Cerebellar Dysfunction

- Intention tremors
- Ataxia
- Paresis usually, as involvement of underlying brainstem is common
- Vestibular dysfunction
- Menace deficits with normal vision
Diagnosis of Primary Brain Tumors in Dogs and Cats

- Signalment
- History
- Neurologic examination
- Advanced Imaging (MRI)
- CSF
- Histopathologic confirmation

Diagnosis of Primary Brain Tumors

- Imaging: MRI (usually) or CT
- CSF usually of no benefit, potential danger (CPP/CPC differentiation an exception)
- Definitive diagnosis via histopathology

MRI Appearance of Intracranial Meningioma

- Broad-based, extra-axial attachment
- Distinct tumor margins
- Uniform contrast enhancement (unless cystic component)
- Displace tissue (expansile) vs infiltrating
- “Dural tail” may be evident
MRI Appearance of Intracranial Gliomas

- Intra-axial location
- Indistinct tumor margins
- Infiltrative vs expansile
- Non-uniform and often poor contrast enhancement
- May have areas of hemorrhage within tumor
- Ring enhancement possible

MRI Appearance of Choroid Plexus Tumors

- Intraventricular location
- Tend to uniformly contrast enhance
- Intraventricular metastases in 35% of CPCs

Treatment of Intracranial Tumors in Dogs and Cats

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Brie’s Surgery

- Large rostroventorial craniotomy
- Entered lateral ventricle through dorsolateral cerebrum
- Removed part of the mass

Brie Post-Operatively

- Improved mentation
- Progressive improvement daily
- Planning on radiation therapy in 2-4 wks

Treatment of the Brain Tumor Patient: Decision-Making

- Brain surgery and rocket science
- Won’t make a “wrong” decision—maybe
- Prevent emotional post-MRI euthanasia
- Treatment decisions can change
- Assume the average patient
More on Decision-Making

- Canine vs. feline
- Meningiomas
- Gliomas
- Other tumor types
- Owners plans and expectations
- Other owner factors
- Patient factors

Treatment of Primary Brain Tumors

- Supportive therapy
- Surgical removal
- Megavoltage irradiation
- Chemotherapy

Supportive Therapy for the Brain Tumor Patient

- Prednisone
- Anticonvulsant drugs, if seizing
- Additional pain medications, as needed
Survival Times for Primary Brain Tumor Patients with Supportive Therapy

- Typically 1-6 months
- About 2 months overall average
- Supratentorial about 6 months
- Infratentorial about 1 month

Definitive Therapy for Brain Tumors

- Surgery
- Radiation therapy
- Chemotherapy

Brain Tumor Removal-Operable or Inoperable?

- Everything is operable
- Everything is treatable
- Always a judgment call
- Some guidelines
“Sadie”-10 yr old FS Min Schnauzer

- Recent onset seizures
- Head/neck pain on palpation

Sadie’s MRI

- Very large, contrast-enhancing mass
- Somewhat right-sided, crossing midline
- Very ventral

Sadie Post-Operatively

- Radiation therapy
- Oral hydroxyurea therapy
- Good prognosis
- 3 year survival with great QOL
Lily-12 yo FS mixed breed dog

- Progressive ataxia and paresis all four limbs (worsening over several months)
- Increasingly obvious left-sided head tilt
- Absent menace bilaterally
- Intention tremors
- Head and neck pain on palpation
Neurosurgical Instrumentation

- High-speed air drill
- Army/Navy osteotomes
- Probey thing
- Lens loops
- Long bipolar cautery

Neurosurgical Instrumentation

- Bishop-Harmon forceps (no teeth)
- Strabismus scissors
- Castroviejo needle holders
- Weitlaner retractor

Neurosurgical Instrumentation

- Gelfoam
- Surgicel
- PMMA
- CUSA
- Intraoperative ultrasound
Surgical Removal of Brain Tumors

- Typically chosen for surface-oriented masses, over cerebral or cerebellar convexities
- Usually for meningiomas
- Sole therapy for cat meningiomas, not dogs
- Not performed as frequently as previously in dogs

Surgical Approaches to the Brain

- Rostrotentorial (lateral)
- Transfrontal
- Suboccipital
- Combined approaches

Lateral (Rostrotentorial) Approach
Transfrontal Approach

Caudal (Suboccipital) Approach

Brain Tumor Removal: Suggestions for Success

- Three-dimensional appreciation preoperatively
- Avoid prolonged brain exposure
- Commit to the procedure
- Wide exposure (decompressive effect)
Meningioma Removal

• Cats—typically sole therapy
• Dogs—postoperative adjunctive radiation
• Dogs—postoperative oral hydroxyurea
• Cats—can tolerate hydroxyurea as well

Meningioma Regrowth in Cats

• Re-removal
• Success appears to be similar to the first time around

Olfactory Bulb Meningiomas in Dogs

• More uneventful recoveries
• Longer post-operative survival
• Important aspects of closure
Prognosis/Complications of Brain Tumor Removal

- Dog meningiomas
- Cat meningiomas
- Gliomas - unknown
- Postoperative anemia - cats
- Postoperative pneumonia - dogs

Radiation Therapy for Brain Tumors: Traditional

- Total administration of 50 Gy
- Typically administered over 4 wks in fractions, M-F schedule
- “Old school”

Radiation Therapy: Stereotactic Radiosurgery

- Cyberknife
- Gamma knife
- More precise collimation of beam
- Fewer treatments (2-5)
- Favorable results reported
Chemotherapy for Brain Tumors

- Information for dogs only
- Lomustine (CCNU) for gliomas-oral
- Hydroxyurea (Hydrea) for meningiomas-oral

Lomustine for Canine Gliomas

- Nitrosourea compound
- Crosses BBB
- Oral drug-60 mg/M²
- Side effects: bone marrow suppression/hepatotoxicity

Hydroxyurea for Canine Meningiomas

- Based on human literature
- Recent retrospective study in dogs significantly increased survival times
- Induction of tumor cell apoptosis
- Inhibits ribonucleotide reductase
- Dose: 20 mg/kg PO SID
- Average survival time (as only definitive tx): 7-8 mos vs. 4 mos
- Side effects minimal, inexpensive drug
Prognosis for Dogs and Cats with Primary Brain Tumors

- Depends upon tumor type and location
- Cats with meningiomas-median >4 yrs with surgery alone
- Dog meningiomas and gliomas
  - Supportive
  - Surgery
  - Radiation
  - Chemotherapy
  - Combination therapy

Problems with Reporting Prognoses for Brain Tumors

- Much of the literature is old
- Many reports have few cases
- “Lumping” effect may be misleading
- For some situations, purely conjecture

Some New Information Regarding Prognosis for Brain Tumor Patients

- Supportive therapy alone-supratentorial about 6 months, infratentorial about 1 month (dogs)
- Intracranial meningiomas-radiation alone between 1-3 yrs (dogs)
- Intracranial meningiomas in cats-median survival >4 yrs with surgery alone
- Intracranial gliomas in dogs-median survival times of 6 mos overall with lomustine (supratentorial longer than infratentorial)
- Intracranial gliomas in dogs-median survival times of about 1.5 yrs with CyberKnife radiation
Secondary Brain Tumors

- Dogs: hemangiosarcoma, pituitary tumors, lymphoma, metastatic carcinoma, invasive nasal tumors, MLO
- Cats: pituitary tumors, lymphoma.
- Prognosis poor overall for most, pituitary tumors most treatable - radiation therapy (1-2 yr median survival)

Questions?