Neurosurgery Review

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Fundamentals of neurosurgical exam

- Basic principles
  - Quick and accurate assessment of the neurosurgical patient
  - Key question
    - Is the patient having an event that would need immediate neurosurgical evaluation or intervention?

Key components of neuro exam

And what they tell us

Key components of neuro exam

- Vital Signs
- BP, Pulse, RR
  - Cushing's triad (↑ICP)
    - HTN, Brady, Resp. irr.

Key components of neuro exam

- Vital Signs
- Cognition
- Mental Status
  - Oriented
  - Confused
  - Inappropriate
  - Incomprehensible

Key components of neuro exam

- Vital Signs
- Cognition
- Speech
- Comprehension
- Repetition
- Naming

Key components of neuro exam

- Vital Signs
- Cognition
- Speech
- Cranial nerves
- CN II
  - <1mm difference in pupil size is common in normal population
  - Look for acute changes in diameter

Key components of neuro exam

- Vital Signs
- Cognition
- Speech
- Cranial nerves
- Motor
- Move to command
  - Motor scale
    - 0- no contraction
    - 1- flicker
    - 2 – movement but not anti-gravity
    - 3 – anti-gravity
    - 4 – movement against resistance
    - 5- full strength

Key components of neuro exam

- Vital Signs
- Cognition
- Speech
- Cranial nerves
- Motor
- Move to command
- Localize
- Withdraw
- Flexor posturing

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Key components of neuro exam

- Vital Signs
- Cognition
- Speech
- Cranial nerves
- Motor
- Sensory

- Especially important for assessing spinal injury pts.

Glasgow Coma Scale

- Developed initially to assess comatose vs. non-comatose pts in brain trauma
- Can be used to track overall neuro status of severely impaired patients but not for following subtle changes in neurological condition

Glasgow Coma Scale

The GCS is comprised of three assessment criteria: best eye response, best verbal response and best motor response. They are as follows:

The best eye response
1 no eye opening
2 eye opening to pain
3 eye opening to verbal command
4 eyes opening spontaneously

The best verbal response
1 no verbal response
2 incomprehensible sounds
3 inappropriate words
4 confused response
5 clear, orientated response

The best motor response
1 no motor response
2 extensions to pain
3 flexion to pain
4 withdrawal from pain
5 localizing pain
6 obeying commands

The score should be broken down into its core parts. For example, if the patient opens his eyes spontaneously (score of four), responds verbally with inappropriate words (score of three) and responds by localizing pain (score of five), the overall Glasgow Coma Score should be presented as E4-V3-M5. Although the score is most effective when broken down into parts, the most common practice is to communicate an overall score, as in the previous example, where the GCS is 12. It is important to note that the lowest score possible is 3; a dead patient would have a GCS of 3.

- GCS<=8 is “coma”

Neurosurgical Nursing

Care of neurosurgical pt from ER to Floor

ER

- Pt with acute neurological deterioration due to high ICPs (Hemorrhage, Tumor, Cerebellar stroke etc.)
  - ABCs, Hyperventilation (temporarily)
  - BP parameters will vary but usually SBP<145 mmHg
  - Rise HOB
  - No circumferential taping of ET tube
  - Use lidocaine prior to suctioning.

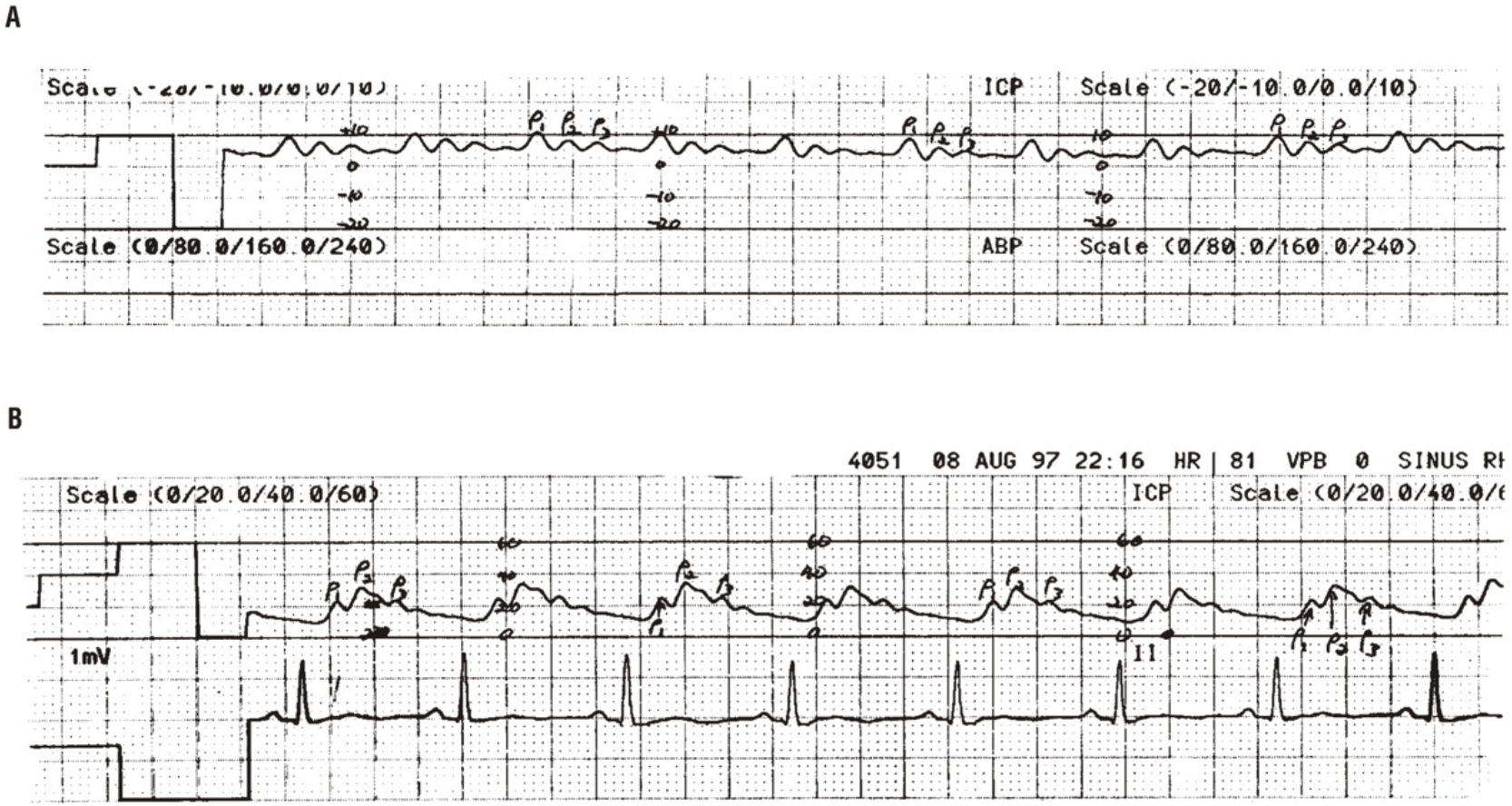
PACU

- BP control
- Pain control
- Good baseline neurological exam

ICU

- Ventricular drain care
- At insertion
  - Everyone in the room should have a hat and mask
  - Once inserted, drain is typically be managed in the following manner
    - Level of drainage
      - At what height relative to the ear is it going to be open
    - Recording
      - ICP and hourly CSF output
  - Any dressing change on the scalp should be done with sterile gloves

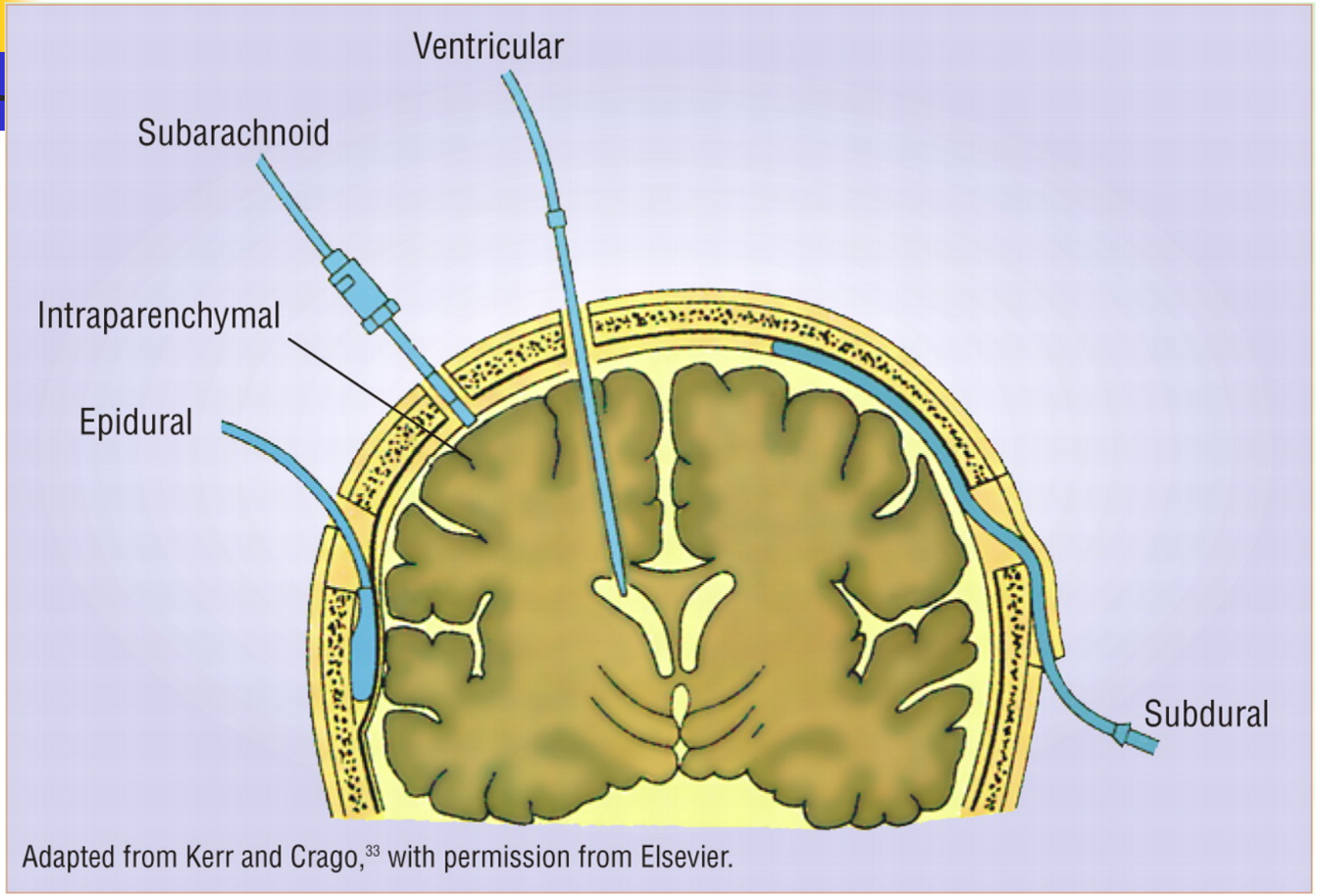
ICP waveforms



Abbreviations: ABP, arterial blood pressure; ICP, intracranial pressure.

ICP

- Guided by Monroe-Kellie doctrine
  - Rigid skull has 3 components – blood, brain and CSF
    - Any increase in volume of a component must result in high ICP unless other components decrease
- CPP = MAP-ICP (ideally >60mmHg)



Adapted from Kerr and Crago,[33] with permission from Elsevier.

ICU

- Other types of neurosurgical drains
  - Subdural drains
    - Usually placed after surgery for subdural hematoma
    - Important to have these at half-suction
    - Pt's head must be flat for these drains to work
  - Subgaleal drains
    - Most common type of drain – placed under the scalp after a craniotomy

ICU

- Lumbar drains
  - May be used after surgery for a spinal cord tumor
  - Used to promote dural healing by diverting CSF away from the dural opening
  - Pt's position usually flat while the drain is in
  - Drain position very important – no lower than pt's abdomen

Neurological deficits

Categorized by location in the brain

Neurological deficits

- Frontal lobe
- Emotional instability
- Seizures

Neurological deficits

- Parietal lobe
  - Contralateral neglect
  - Aphasias

Neurological deficits

- Temporal lobe
- Visual problems
- Seizures

Neurological deficits

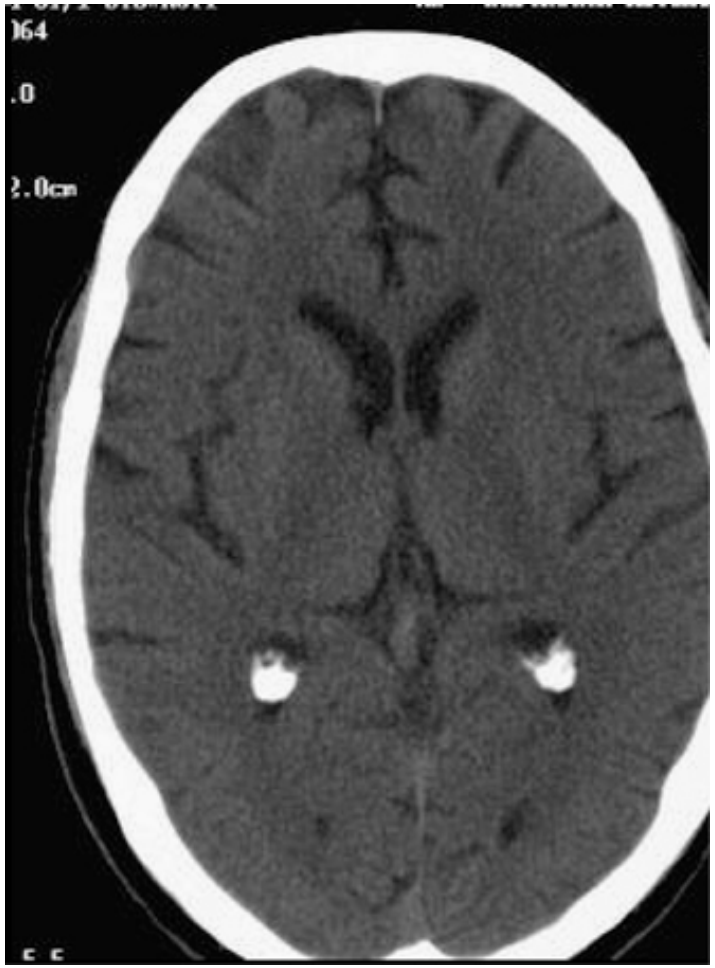
- Occipital lobe
- Visual deficits

Neurological deficits

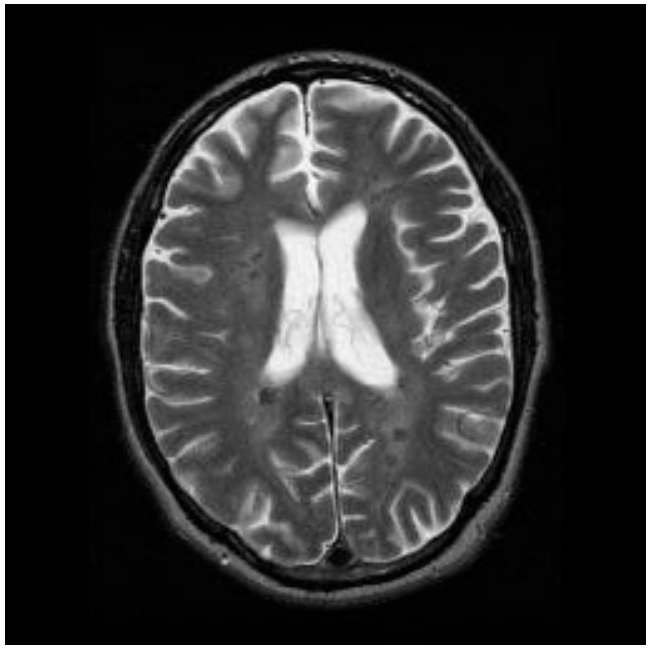
- Cerebellum
- Ipsilateral ataxia

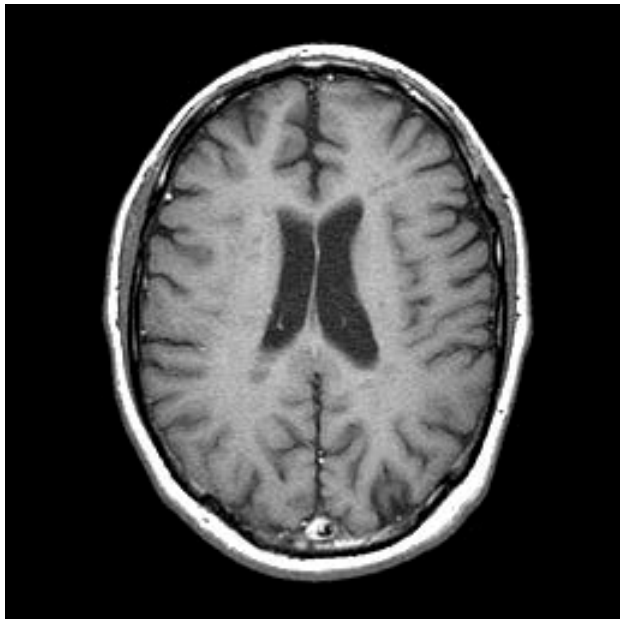
Neuroradiology Primer

Head CT



Brain MRI





Neuro-pathology Primer

Discussion of common types of brain tumor

Broad Categories

- Intra-axial vs. extra-axial
  - Intra-axial – arising within the neural tissue
  - Extra-axial – displacing the neural tissue

Intra-axial tumors

- Among primary tumors (arising from neuronal cells), astrocytoma (“glioma”) most common.
- Classified by WHO into four grades based aggressiveness.

Astrocytoma Grades

- Grade I

- Best prognosis
- Surgery is curative
- Frequently found in children

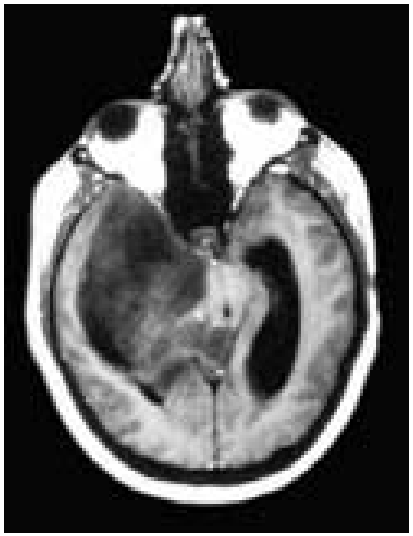
Astrocytoma Grades

- Grade I
- Grade II

- Slightly higher chance of recurrence
- Frequently need radiation in addition to surgery

Astrocytoma Grades

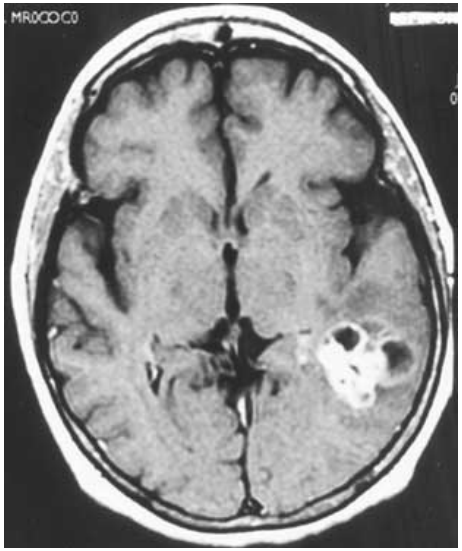
- Grade I
- Grade II
- Grade III



- Also called Anaplastic Astrocytoma
- More aggressive
- Recurrences common
- Median survival 2-3 years

Astrocytoma Grades

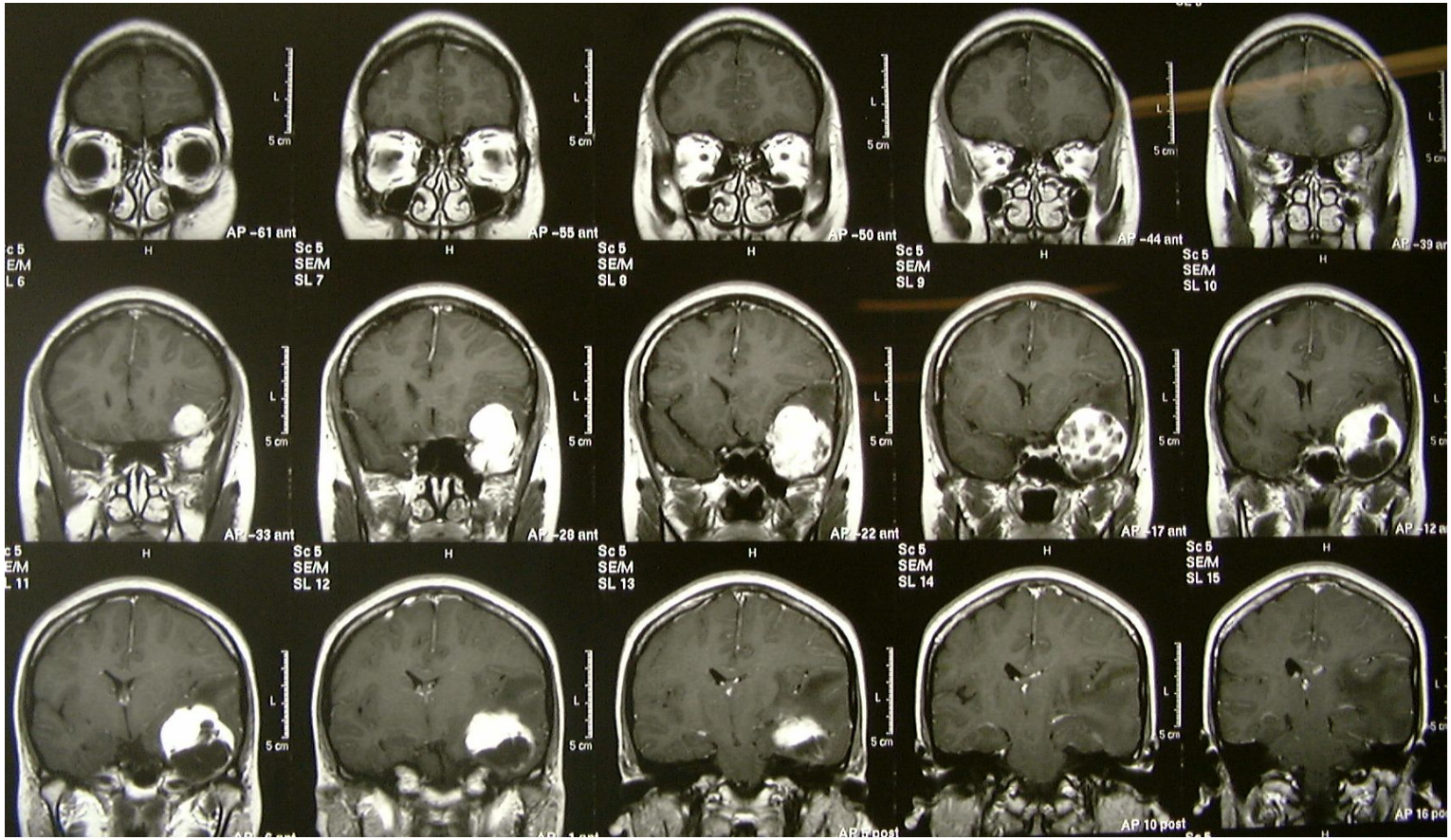
- Grade I
- Grade II
- Grade III
- Grade IV



- Also known as Glioblastoma Multiforme (GBM)
- Most common primary brain tumor in adults
- Worst prognosis - median survival 8 to 18 months

Extra-axial Tumors

- Arise outside the neuronal tissue.
- Meningioma most common type.
- Arise from the meninges (arachnoid cap cells).
- “Typical” subtype – surgery curative if complete resection achievable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SL 10
AP -33 ant
AP -28 ant
AP -22 ant
AP -17 ant
AP -12 ant
Sc 5
SE/M
SL 12
Sc 5
SE/M
SL 13
Sc 5
SE/M
SL 14
Sc 5
SE/M
SL 15
AP 10 post
AP 16 post
5 cm

Pituitary Tumors

- Special subset - presenting symptoms slightly different
- May have visual deficits (bitemporal hemianopsia)
- May have hormonal imbalance
- Work-up includes hormone panel, ophthalmology eval and imaging
- Treatment includes surgery, radiation and meds (for Prolactinoma)

Pituitary Tumors

- Surgery poses special issues
  - CSF leak may be a concern
    - Treated with raising head of the bed and/or lumbar drain
  - DI may occur
    - UOP>250ml/H for 2H, serum Na>145, urine spec. gr.<1.005 at the same time
    - Treated with fluid replacement and SQ DDAVP

Cerebral Metastases

- Most common brain tumor
- In 15% of pts, cerebral met is the presenting symptom of Ca.
- Incidence increasing
  - Longer survival
  - Better diagnostics

Cerebral Metastases

- Sources of brain mets
  - Lung (44%)
  - Breast (10%)
  - Renal Cell (7%)
  - GI (6%)
  - Melanoma (3%)
  - Unknown (10%)

Treatment modalities in Neuro-Oncology

Surgery

- Total resection, subtotal resection, stereotactic biopsy
  - Real estate principle

Adjuvant Therapy

- Chemotherapy
  - Temodar shown to be effective for GBM
- Radiation Tx
  - Conventional (e.g. WBRT)
  - Stereotactic
    - Gamma Knife
    - Cyberknife

How SRS works

- Concentrate highly precise radiation
- Deliver the prescribed dose *externally*
- Target only the lesion
- Critical nearby structures spared
- Few treatment sessions
  - Typically single treatment for Gamma Knife

Cyberknife Suite

What can be treated with Cyberknife

- Acoustic Neuroma
  - Small (<3 cm)
- Arterio-venous malformations (AVMs)
- Brain Metastases
- Pituitary tumors
- Primary Brain Tumors
  - Gliomas, Hemagioblastomas, Meningiomas
- Spinal Tumors and AVMs
- Other Body tumors
  - evolving

Thank You!

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