AWAKE CRANIOTOMY

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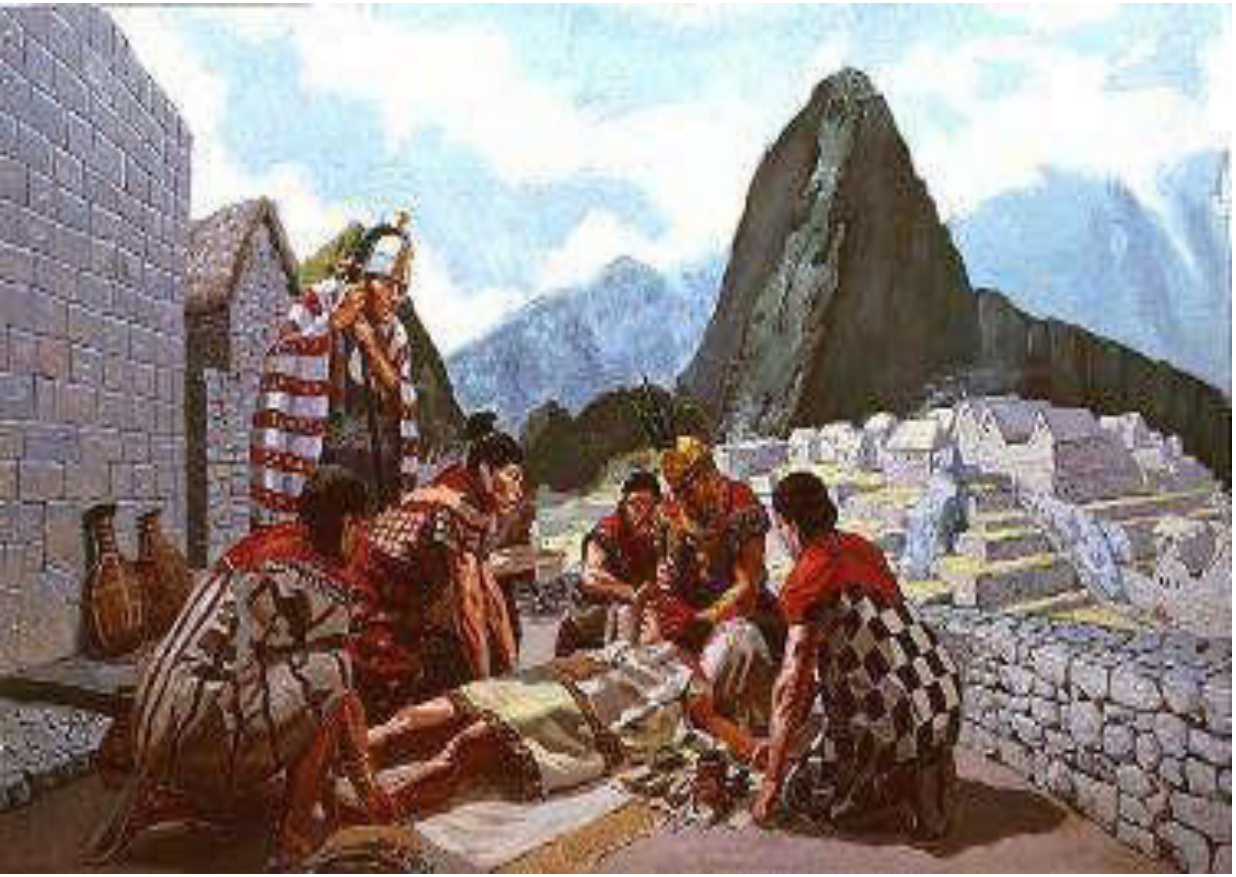
Introduction..

- Neurosurgical technique and type of craniotomy that allows a surgeon to remove a brain tumour close to eloquent cortex while the patient is awake to avoid brain damage.

Misleading..

- Not fully awake for entirety of the procedure.
- Different surgical phases require various levels of sedation.
- Patient is completely awake only during the mapping procedure.

History..



- Trephanation.

Indications..

- Epilepsy Surgery
- Excision of lesions adjacent to eloquent areas of the cortex in the dominant hemisphere
- Stereotactic surgery

Cont..

- Deep brain stimulation (DBS) surgery for Parkinson's disease
- Pallidotomy, Thalamotomy
- Ventriculostomy, Endoscopy.
- A-V malformations.

Contraindications..

- **Absolute:**

1. Patient refusal
2. Inability to stay still for any length of time
3. Inability to co-operate

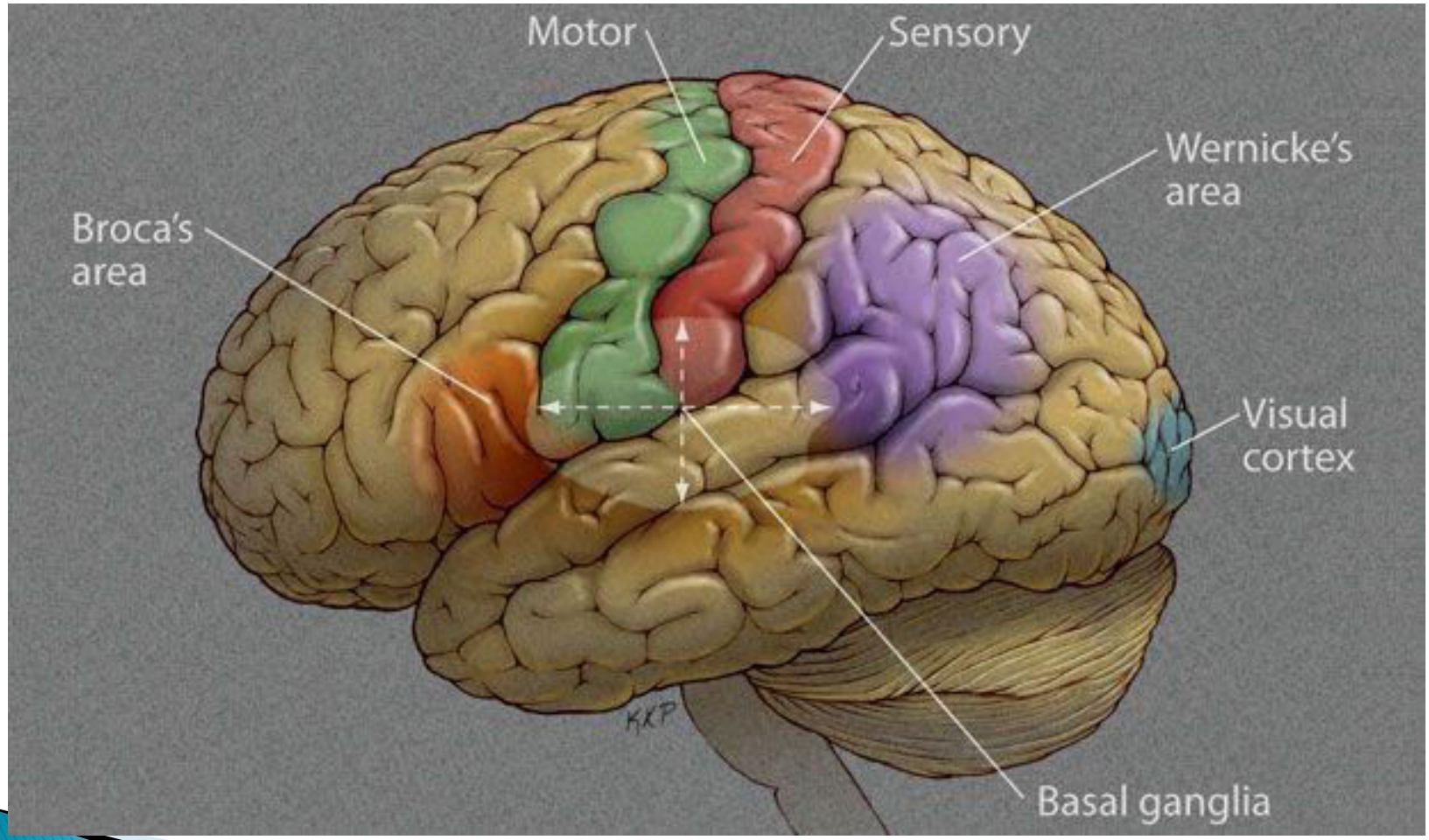
- **Relative:**

1. Cough
2. Learning difficulties and language barriers.
3. Anxiety
4. OSA
5. Young age.

Advantages:

- Maximize Tumor Removal
- Minimize Damage to Eloquent cortex by cortical mapping.
- Facilitates intraoperative electrocorticography to identify seizure foci.
- Decreased postop complications.
- Shorter hospital stay

Eloquent cortex



Presurgical evaluation

- WADA test
- Inj.of Amobarbital sodium into carotid artery
- Localizes the cerebral hemisphere that controls speech
- To confirm bilateral representation for speech.
- Speech – posterolateral portions of temporal lobe
- Memory – Mesial.

- Video-telemetry – to localize seizure focus.

Anaesthetic considerations

Preoperative Evaluation..

- **Patient's Preparation**:
  - Obtaining the patient's confidence & agreement to cooperate during surgery is key.
  - Developing good rapport with pt & their family is crucial.
  - Inform pt. of our expectations of them during the awake phase… and what they can expect from us.... "*Commitment, safety, comfort.*"

Cont..

- Airway examination:
  - Prediction of difficult tracheal intubation (physical confirmation and past intubation)
  - Obstructive apnea risk (obesity, sleep apnea, retrognathia)
- Epilepsy:
  - Pharmacotherapy
  - Antiepileptic drug serum concentration
  - Type & frequency of seizures

Cont..

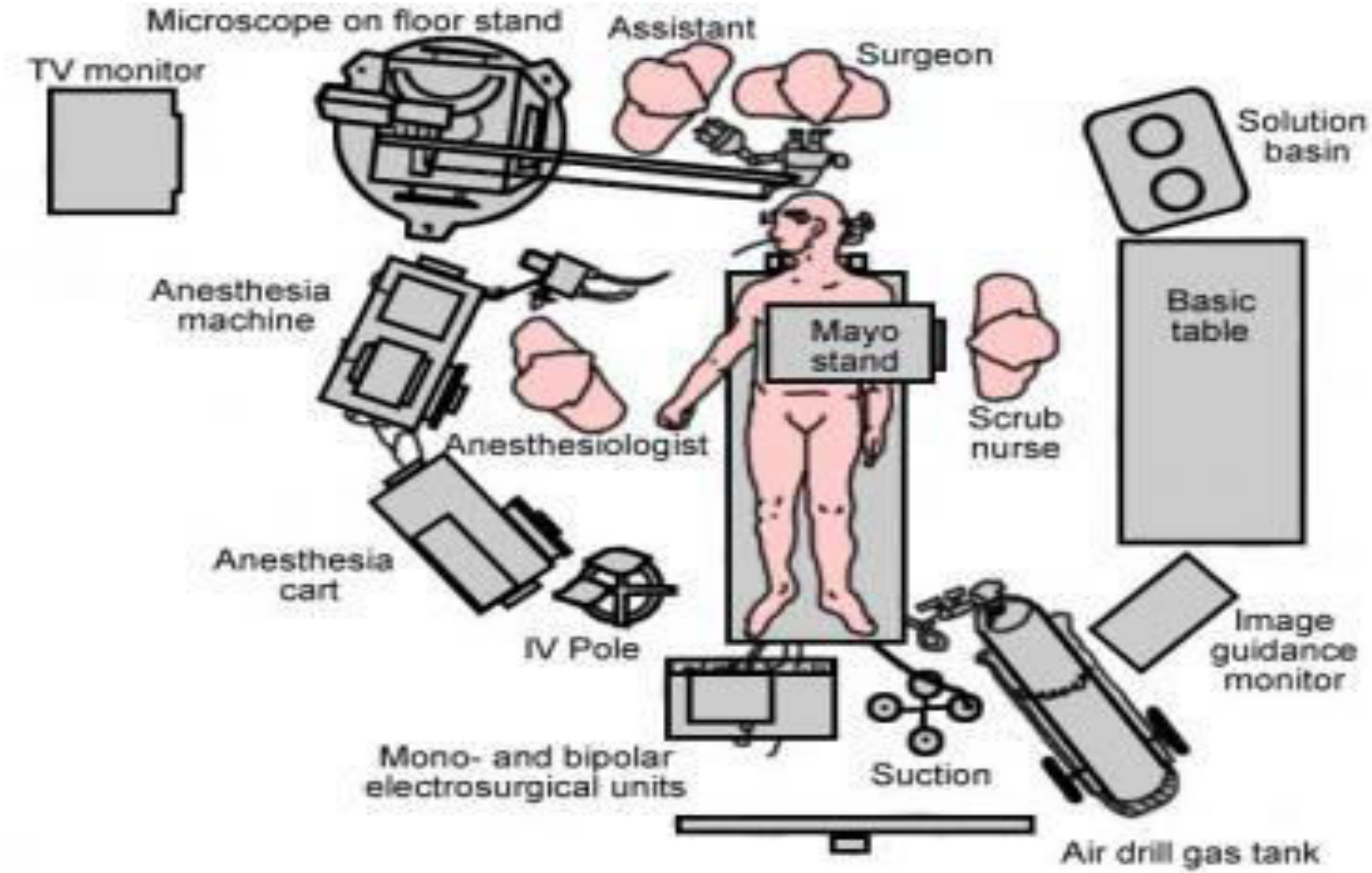
- Nausea & Vomiting:
  - Past anaesthesia
  - Kinetosis (Motion Sickness)
- Intracranial pressure estimation:
  - Type of lesion
  - Radiological & clinical signs
- Hemorrhagic risk:
  - Type & localization of lesion

Cont..

- Patient cooperation:
  - Anxiety
  - Pain tolerance
  - Neurological deficits

"A visit to the operating room before surgery is a good idea in order to familiarize the patient with the sounds & equipment in the operating rooms".

Theatre preparation



Positioning

- Depends on location of lesion.
- Patient must remain in rigid pinion fixation or head may rest in gel pad.
- Patient must lie immobile for several hours.
- Soft mattress and padding of extremities, warming blanket.
- Sterile drapes must not encroach over patients face – claustrophobia.

ANAESTHETIC PRINCIPLES

Aims..

1. Maintaining patient cooperation:
   - Optimal analgesic care.
   - Adequate sedation and anxiolysis during the different stages.
   - Comfortable position.
   - Nausea, vomiting and seizure prevention.

Cont..

2. Homeostasis:

   - Safe Airway and adequate ventilation.
   - Hemodynamic stability.
   - Normal intracranial pressure.

3. Most important for epilepsy surgery:

   - Limited interference with electrophysiological recordings.

Premedication..

- There is no general consensus regarding premedication, and decisions should be made based on the patient's clinical condition, the anaesthetist's opinion, and hospital standards.

Cont..

- Benzodiazipines (e.g. midazolam)
- Anticholinergic (e.g. glycopyrrolate, atropine)
- Antiemetics
  - Metoclopramide (10 mg)
  - Ondansetron (4-8mg)
  - Droperidol (0.625-2.5mg)
  - Dexamethasone (4-16 mg)
- Antacids (e.g. ranitidine 150mg)
- Opioids (e.g. fentanyl, remifentanil)

Cont..

- NSAID's (e.g diclofenac or paracetmol)
- α- 2 adrenoceptor agonists (e.g. Clonidine, demetomidine)
- Antiepileptics as per the treatment protocol of the patient.
- Any other medications patient is taking for any other systemic manifestation.

"Most important of all is the thorough explanation of the **PROCEDURE**"

Monitoring..

- Standard monitors include :
- ECG

  NIBP

  Pulse oximeter

  Capnography
- Invasive monitoring is not essential for all patients.

Anaesthetic management..

- Sedation only – Awake throughout.
- Asleep - Awake – Asleep.
- Awake-Awake-Awake – New approach.

Sedation only – Awake throughout..

- Vary the levels of sedation
- Spontaneous ventilation.
- Sedation is deepened during the application of the Mayfield Pins, skin incision, removal of the bone flap,and dura mater.
- stopped for neurocognitive testing and mapping for resection of the lesion.
- Oxygen by nasal cannula/face mask.

Cont..

- Advantages

  Avoidance of airway manipulation.

- Risks

  Airway obstruction which can lead to hypercapnia, hypoxia.

  Increased intracranial pressure with a ‘tight’ brain .

  Inadequate sedation – anxious and uncomfortable.

Asleep - Awake - Asleep technique

- General anaesthesia and control of the airway with either a supraglottic device or intubation.
- When neurocognitive testing and intra-operative mapping needs to commence, the anaesthetic drugs are either reduced or stopped and the airway device is removed, when the patient has regained upper airway reflexes and it is safe to do so. Once resection of the lesion is complete, general anaesthesia can be re-introduced and with re-insertion of the airway device.

Cont..

- Advantages
- Ability to control ventilation and therefore control carbon dioxide concentrations and prevent airway obstruction and hypoventilation.
- It also facilitates greater depth of anaesthesia during the painful parts of the surgery

Drugs..

- **Propofol**: Widely employed for awake craniotomy due to:
  - Easily titratable sedative effect
  - Rapid recovery with clear-headedness
  - Decreased CMRO2
  - Reduces ICP
  - Potent anti-convulsant properties
  - Antiemetic properties
  - TCI – 150-250µgs/kg/hr

Cont..

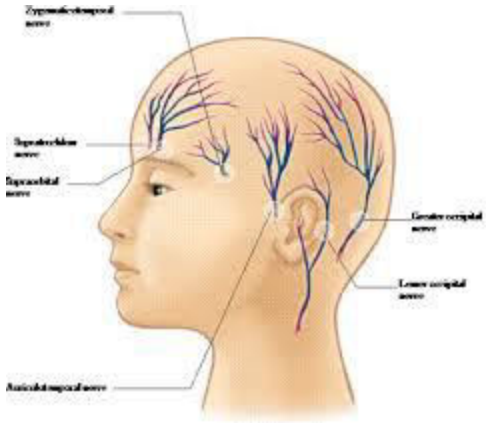
- **Remifentanil**: Ultra short-acting opioid, is becoming more popular:
  - Rapid onset of action
  - Remifentanil has an ester linkage which undergoes rapid hydrolysis by non-specific tissue and plasma esterases.
  - context-sensitive half life remains at 4 minutes after a 4 hour infusion.
  - Rapid awakening for neurologic testing
  - Smoother hemodynamic profile

Dexmedetomidine

- Sedative, anxiolytic & analgesic properties.
- Anaesthetic sparing effects.
- Distribution half life of 6minutes, with complete biotransformation by the liver & very little unchanged excreted in urine & faeces.
- No effect on intracranial pressure.
- Easily arousable despite sedation.
- Loading dose of 0.5-1 µg/kg over 20mins.
- Infusion at rates of 0.1 to 0.7 µg/kg/h .
- Dose dependant hypotension and bradycardia.

Awake-awake-awake technique

The anaesthesiologist should appreciate that the essential element of an “anaesthetic” for an awake craniotomy is the local anaesthetic technique via Scalp Block.



Need for Nerve block????

Scalp Block

- Occassionaally used as sole techenique.
- Minimizes sedative and opioid requirement.
- Lignocaine with adrenaline, Bupivacaine,Ropivacaine were commonly used.
- Used at Mayfield pin sites, scalp and dura.

Cont..

- A 40 to 60 mL of local anaesthetic volume is used .
- High local anaesthetic volume and well-vascularized areas may predispose to anaesthetic toxicity.
- Clinical vigilance is particularly indicated within 15 minutes after scalp block.
- With regards to toxicity, ropivacaine and levobupivacaine appear to be safer than bupivacaine.
- Despite this difference, bupivacaine is the most commonly used local anesthetic in the literature.

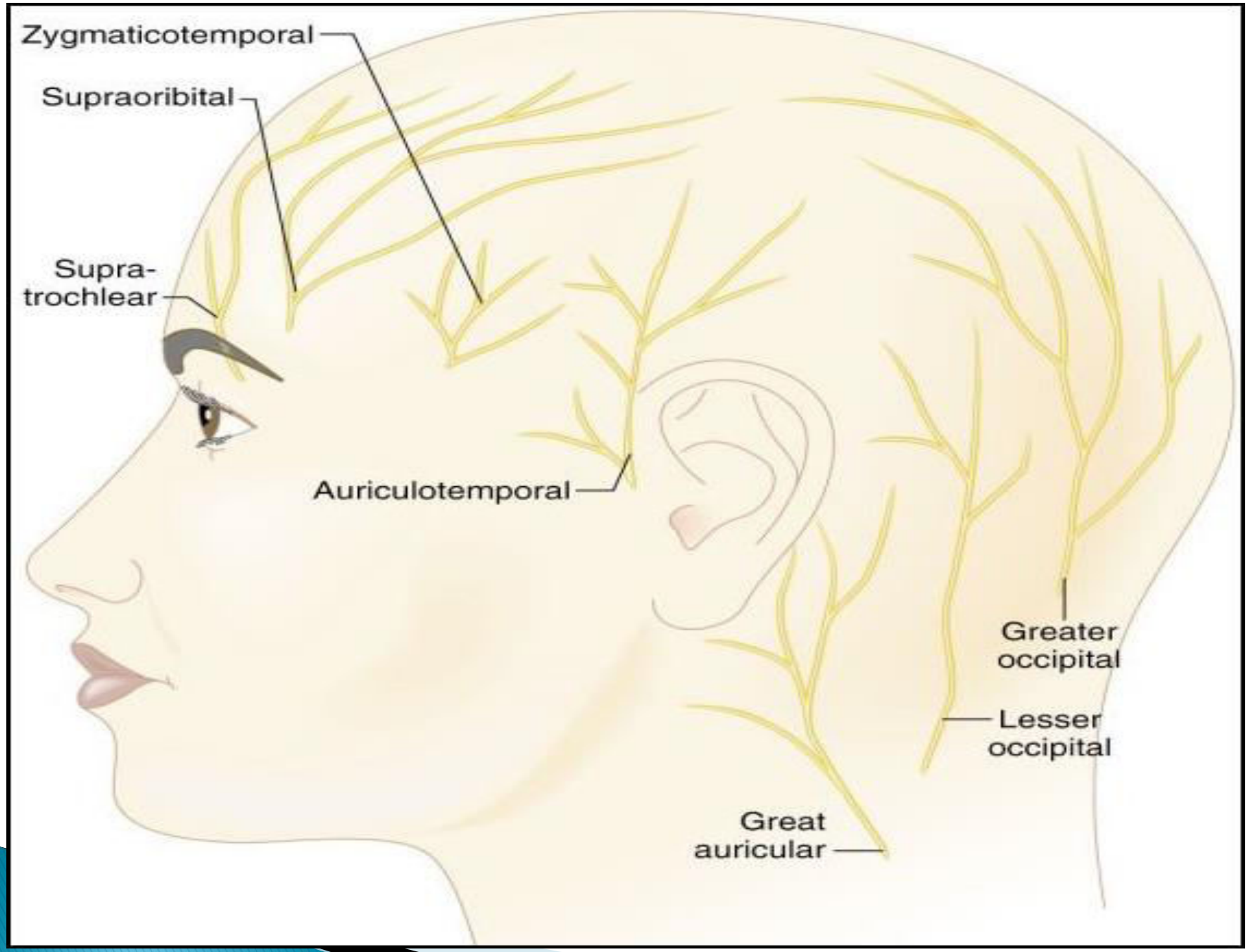
Cont..

- Nerves to be blocked:
  - 1. Supraorbital
  - 2. supratrochlear
  - 3. Auriculotemporal
  - 4. Zygomaticotemporal

} Trigeminal N

  - 5. Greater occipital
  - 6. Lesser occipital

} C2-C3


Zygmaticotemporal
Supraoribital
Supra-
trochlear
Auriculotemporal
Greater
occipital
Lesser
occipital
Great
auricular

Supraorbital nerve

- Palpate supraorbital notch, insert needle at the supraorbital notch perpendicularly(1 cm medial to supraorbital foramen)

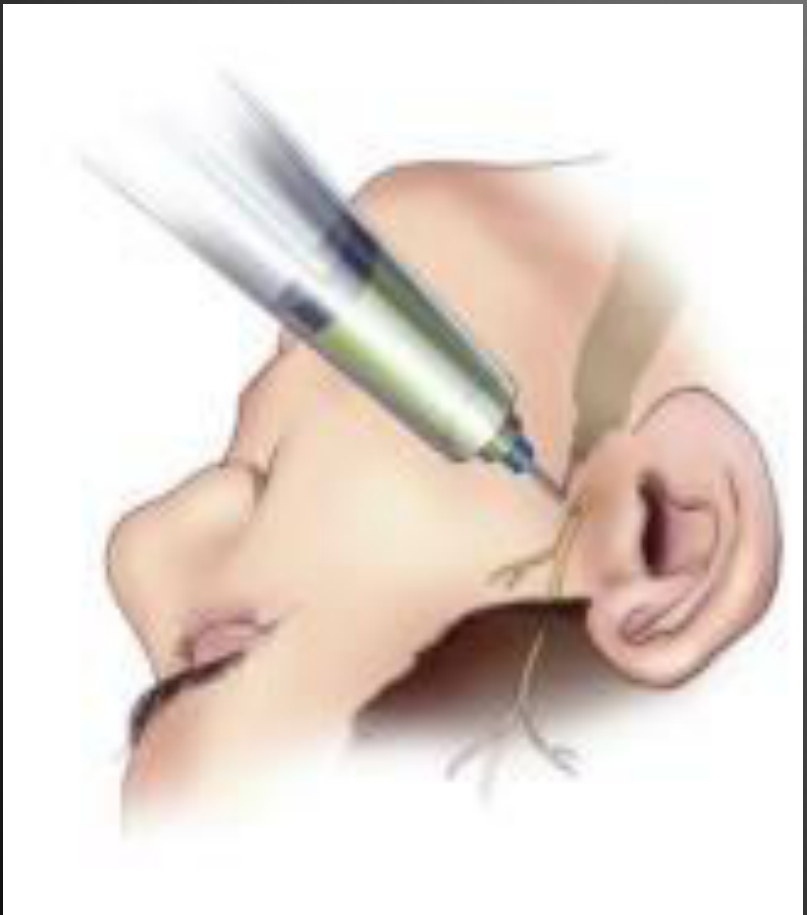
Supratrochlear nerve

- 1 finger breadth medial to supraorbital nerve block (stay above the eyebrow line)

Zygomatico temporal nerve

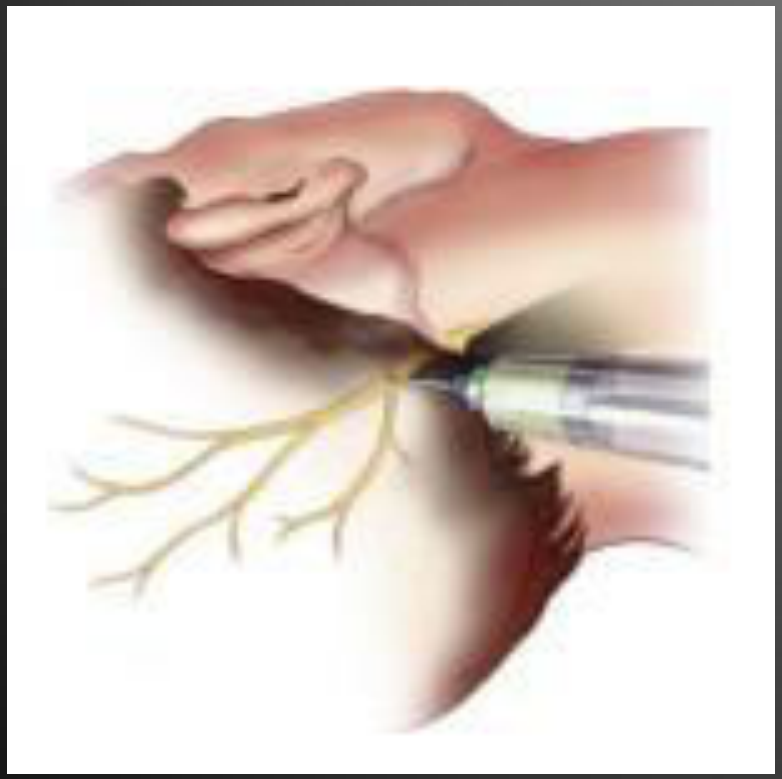
- 1 cm lateral and 1 cm superior to lateral canthus of eye above the zygomatic arch.

Auriculotemporal nerve



- At the tragus,1-1.5 cm anterior to auricle,palpate the superficial temporal artery

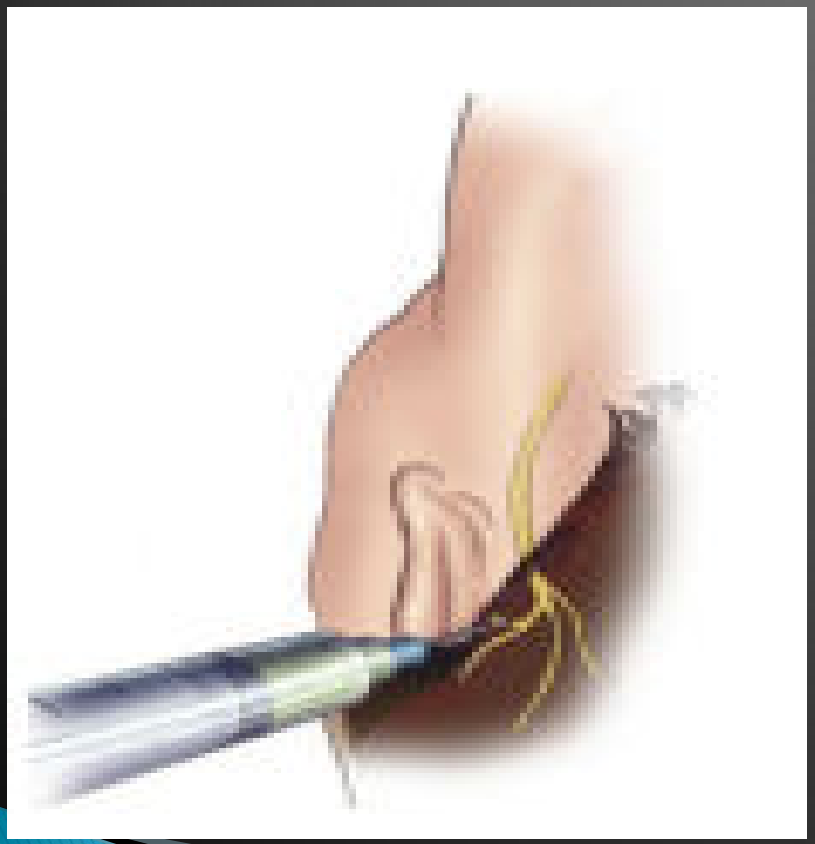
Greater occipital nerve



- Palpate occipital artery; inject medial to artery

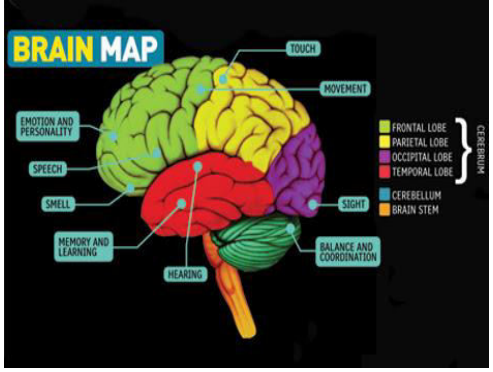
(cervical area between mastoid process and occipital protuberance)

Lesser occipital nerve



- Field block behind ear and occipital area.

Brain Mapping



- Originally used for epileptic surgery, is now utilized for tumor resection.
- More widely used within the last 2 decades.
- Identifies:
  - Regions of **language /speech**representation *(*dominant cerebral hemisphere)
  - **Motor** cortex (either hemisphere)

Cont..

- Intra-op mapping helps distinguish between eloquent cortex and tumor tissue, which facilitates:
  - Accessing the tumor from safest transcortical route.
  - Aggressive tumor resection while preserving functional tissue.

Language..

- Indicated if the surgical site is near language associated cortical sites or “speech areas”
  - **Broca’s**(expression): posterior/inferior/frontal lobe of dominant hemisphere.
  - **Wernicke’s**(comprehension): posterior/temporal lobe of dominant hemisphere.
- Direct electrical stimulation of the cortex during language tasks while observing for speech hesitation, arrest or dysnomia.

Motor..

- Grid of electrodes placed on brain surface to identify a phase reversal of SSEPs recorded over the posterior sensory cortex and precentral motor gyrus.
- Direct electrical stimulation of the cortex to elicit motor movement.
- MEPs, more recently, used to map and monitor subcortical motor pathways.


The bird flew
in the ____.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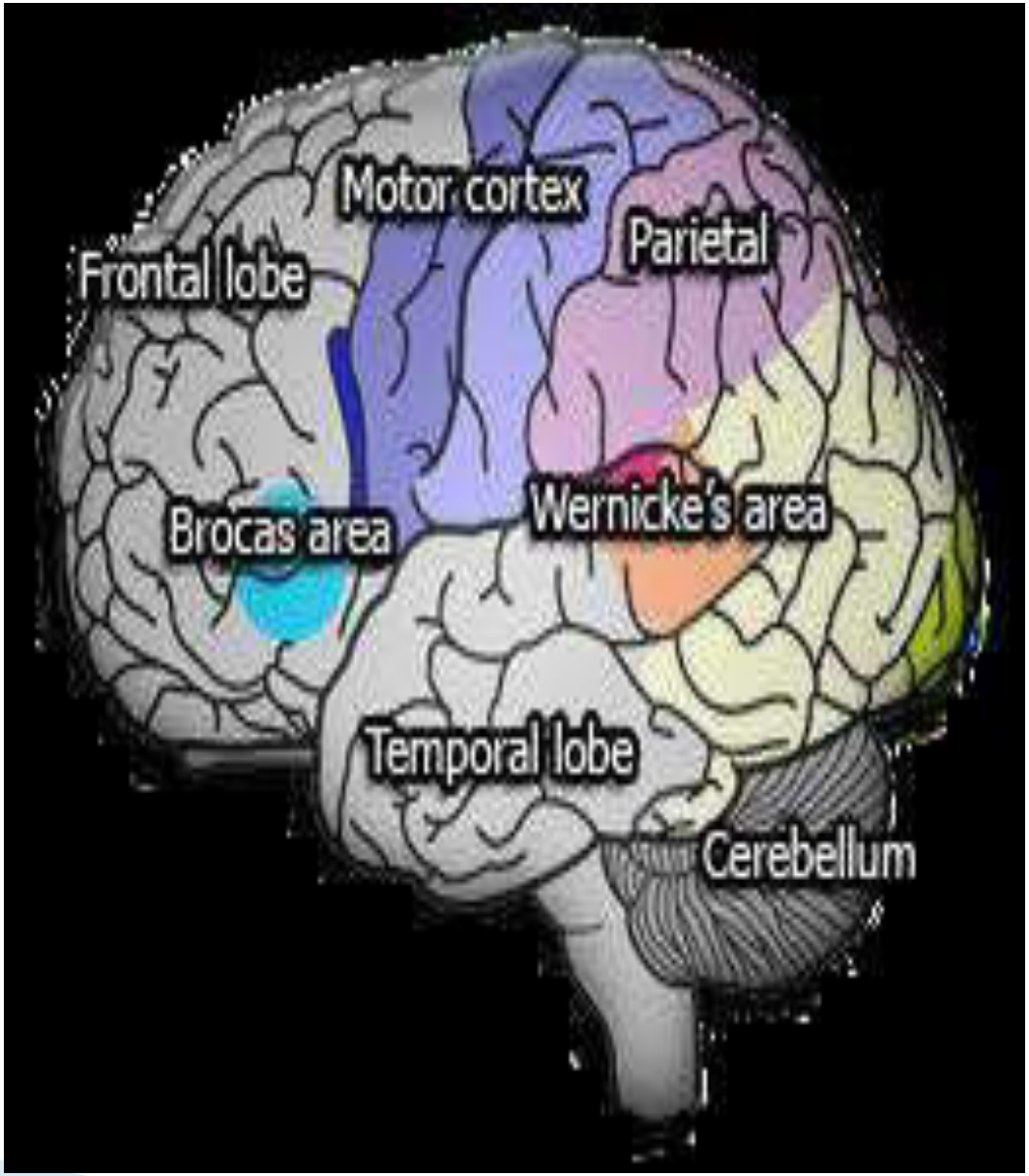

Motor cortex
Parietal
Frontal lobe
Wernicke's area
Brocas area
Temporal lobe
Cerebellum

Depth of Anaesthesia..

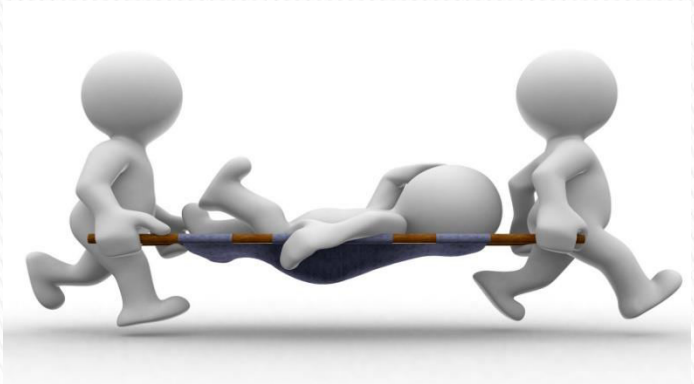
- **Bispectral Index**: Measures anaesthetic depth (correlates with hypnotic component of anaesthesia)

  40-60 (asleep phase)

  >85 (awake phase)

- **Entropy**: Another method of assessing anaesthetic depth
  - RE (Response Entropy)
  - SE (State Entropy)

Complications..



- Anaesthesia related

- Airway obstruction
- Hypoxia/Hypercapnia
- Tight brain
- Hypertension/hypotension
- Tachycardia/bradycardia

- Nausea/vomiting
- Shivering
- Local anesthetic toxicity
- Pain
- Poor cooperation/agitation
- Conversion to general anesthesia

Surgery related

- Focal seizures
- Generalized seizures
- Aphasia
- Bleeding
- Venous air embolism
- Anxiety/agitation/intolerance of the procedure

Conclusion..

- Neurosurgery in awake patients incorporates newer technologies that require the anesthesiologists to update their skills and evolve their methodologies.
- Effective communication skills and knowledge of selecting the right anaesthetic drugs to ensure adequate analgesia, akinesia, along with patient satisfaction is the need of the hour.
- The challenge of providing adequate anesthetic care to an awake patient for intracranial surgery requires more than routine vigilance about anesthetic management.

Thank u...