CASE 5: APPROACH TO PATIENT MONITORING

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- A-65 years old patient attended the operating theatre for vaginal hysterectomy.
- She is a known diabetic, controlled with oral medication.
- After induction of general anesthesia the patient developed hypotension so inhalational agent reduced to 1%
- Anesthesia was maintained by sevoflurane 1 % and frequent dose of muscle relaxant then patient ex-tubated and shifted to the PACU
- 2 days after, the surgeon call the anesthesia because patient complain of recall all conversation in OR and she was paralyzed feeling pain can't alert anybody because tube of in her throat (awareness under anesthesia)

Q1: DISCUSS THE ASA STANDARD MONITORING FOR THIS PATIENT?

- **The patient Is classified as ASA class 2 because she has a controlled systemic disease.**
  (DM on oral hypoglycemics)

ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but not limited to): current smoker, social alcohol drinker, pregnancy, obesity (30<BMI<40), well-controlled DM/HTN, mild lung disease

- **The patient's** oxygenation, ventilation, circulation **and** temperature **shall be** **continually evaluated**.

Q2: WHAT ARE THE METHODS FOR MONITORING AWARENESS UNDER ANESTHESIA?

Mentoring During Anesthesia

- Cardiovascular
- Temperature
- Peripheral nerve stimulation
- Urine output
- Neurological
- Respiratory

- **No single technique or equipment is perfect for monitoring and detecting awareness.**
- **Currently, bispectral index monitoring is popular.**

The autonomic changes that are monitored include:

- **Pupil size and reactivity**:
  Unreliable indicators. Mydriasis may be caused by anticholinergics (e.g. atropine, hyoscine), whilst opiates cause miosis.

- **Changes in blood pressure**:
  May be related to other factors, such as circulating catecholamines and drugs (e.g. beta blockers).

- **Heart rate variability**:
  There is a reduction in respiratory sinus arrhythmia with anaesthesia.

- **Sweating and lacrimation** are also warnings of awareness.

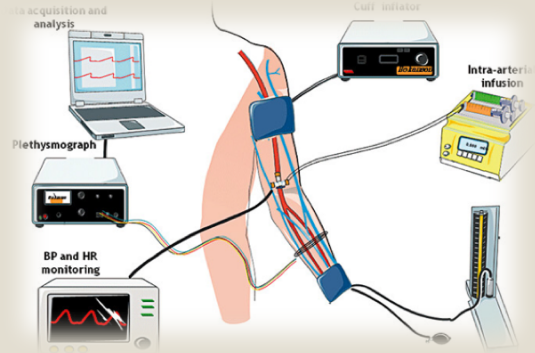
METHODS AVAILABLE TO MONITOR AWARENESS INCLUDE THE FOLLOWING:

Electroencephalograph (EEG):

- Tracks and records brain wave patterns

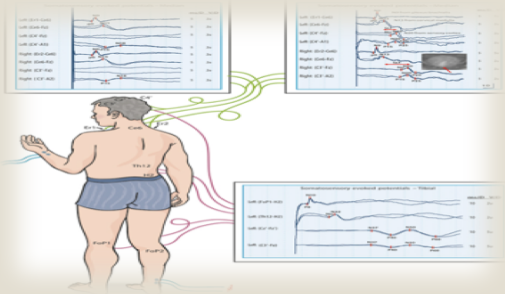
Bi-spectral index (BSI):

- a simplified EEG which uses an algorithm that converts EEG signals into an index of hypnotic level.



Isolated forearm technique (IFT):

- Blood pressure cuff before giving neuromuscular block agents then patients asked to squeeze their hands.



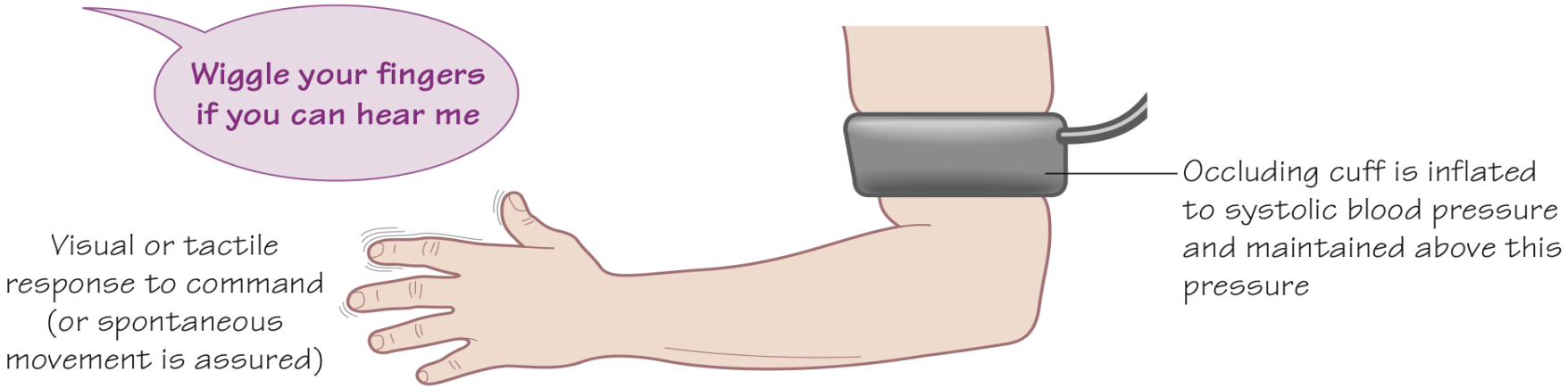
Evoked potentials :

1)Auditory evoked potentials (AEPs) Auditory clicks via headphones
2)Visual evoked potentials
3)Somatosensory evoked potentials Peripheral Stimuli (median nerve)

Q3:DISCUSS NON ROUTINE MONITORS TO DETECT AWARENESS UNDER ANESTHESIA?

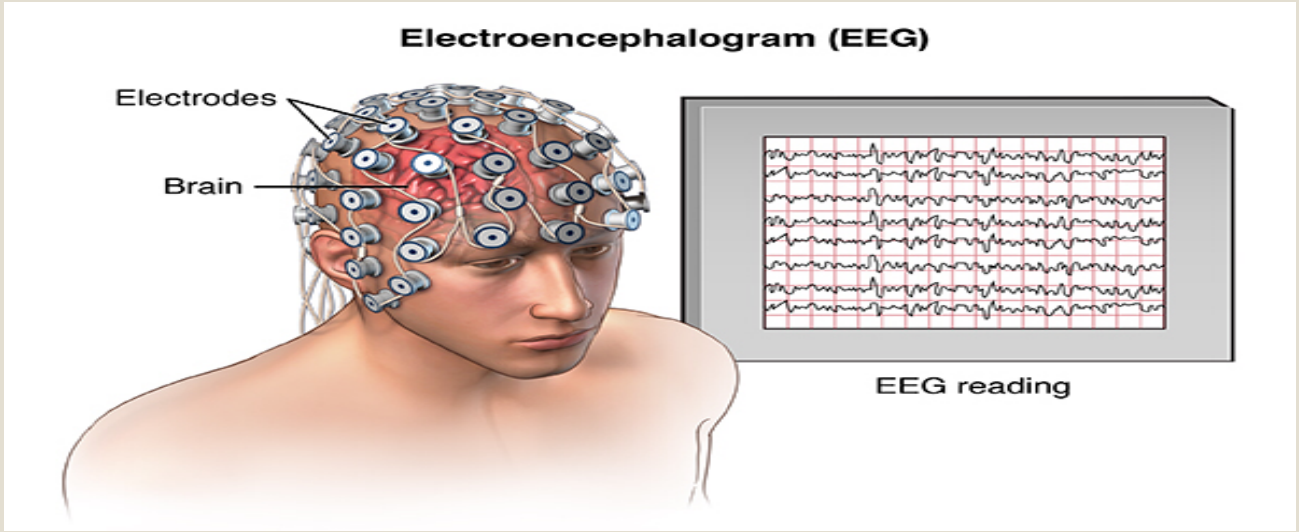
Isolated forearm technique (Mainly used as a research tool) :

- **A blood pressure cuff is inflated and maintained above systolic BP.**
- **Done before any neuromuscular blocking drug is given, leaving the limb distal to the cuff unaffected and able to mount a motor response.**
- **Movement, either spontaneous or in response to command, can then be observed.**
- Limb ischemia **caused by the tourniquet occurs and the adequacy of motor response is insufficient after 20 minutes.**



Electroencephalogram (EEG):

- **Not practical to be used routinely (both in terms of equipment and interpretation)**
- **With increasing depth of anesthesia, there is an increase in average wave amplitude and a decrease in average frequency.**
- **There is also a progressive change from beta to delta waveform.**



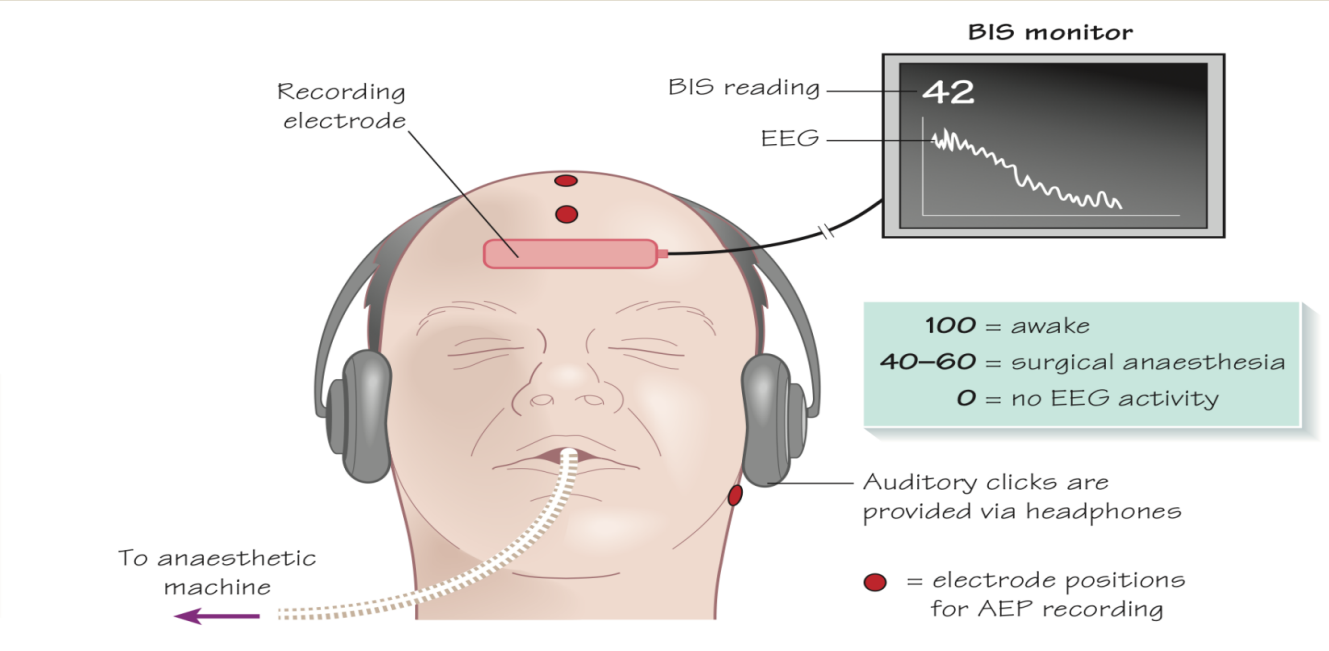
Patient state analyzer index (PSA):

Works by processing changes in anterior-posterior distribution of EEG, using more extensive electrode sensor than BSI.

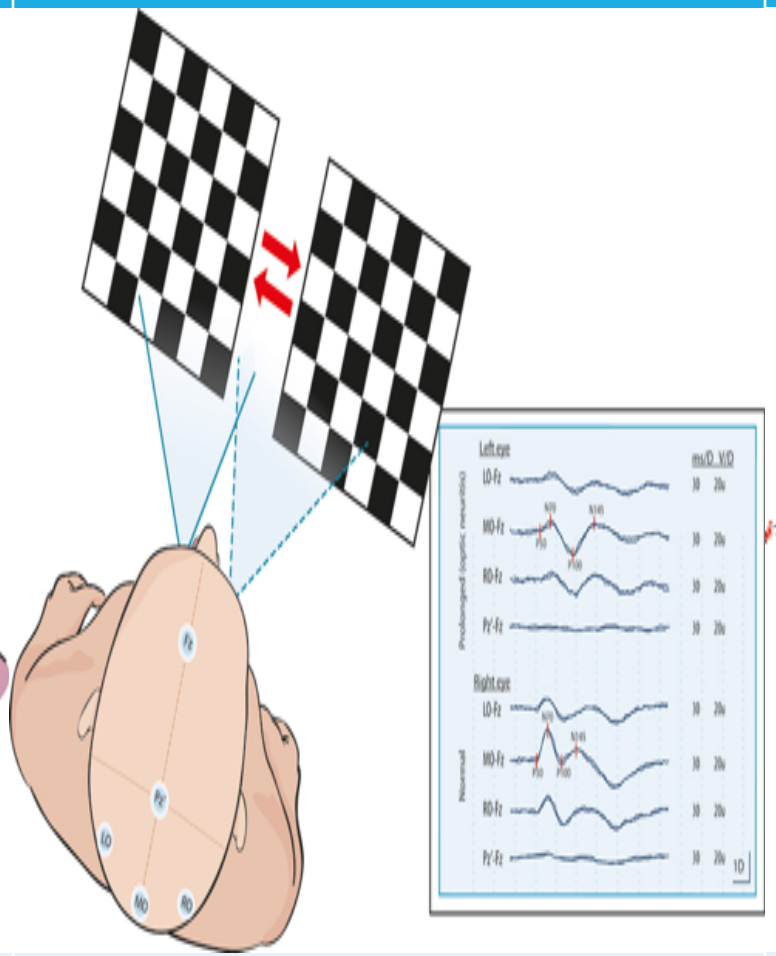
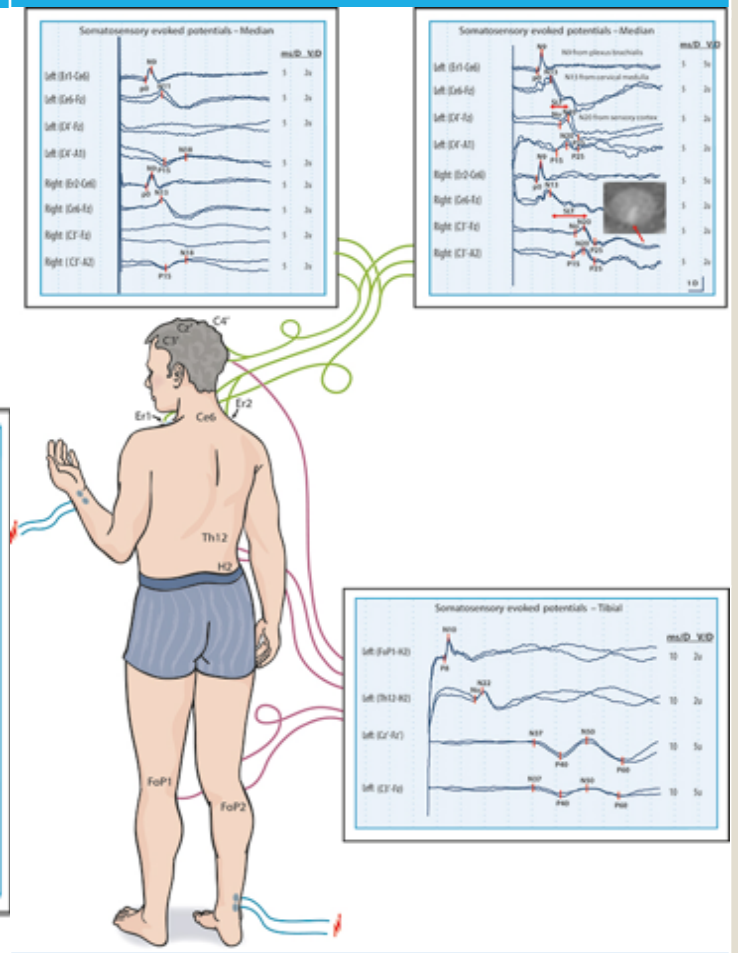
Bispectral index (BIS)

- **a simplified EEG which uses an algorithm that converts EEG signals into an index of hypnotic level.**
- **Readings range from 0 to 100 .**

100	Awake
60-80	measure of sedation
40-60	General anesthesia
0	No EEG activity



https://www.youtube.com/watch?v=EAtdFwbZ3I8

Auditory-evoked potentials	Visual-evoked potentials	Somatosensory-evoked potentials
		

anaesthesia

Auditory-evoked potentials	Visual-evoked potentials	Somatosensory-evoked potentials
Electrical activity passing from the cochlea to auditory cortex.	The patient wears goggles with light-emit-ting diodes lying within them.	stimuli are placed peripherally (e.g. median nerve) and the response is recorded over the cervical vertebrae and the contralateral somatosensory cortex.
EEG analysis shows characteristic waveforms whose amplitude decreases and latency increases with depth of anaesthesia	Visual-evoked potentials, which are detected and recorded over the visual cortex.	Each calculation takes over 1 minute and results are inconsistent.

Q4:WHICH PATIENT HAS RISK OF AWARENESS?

Table I shows the major and minor criteria of awareness frequency during general anaesthesia. The patient with the higher risk for awareness is the one with at least one major risk criterion or two minor risk criteria.

Table I. Major and minor criteria of awareness incidence during general anaesthesia.

Major criteria	Minor criteria
• Preoperative long-term use of anticonvulsant agents, opiates, benzodiazepines, or cocaine	• Use of beta-blockers
• Heavy alcohol intake	• Chronic obstructive pulmonary disease (COPD)
• History of anaesthesia awareness and/or history of difficult intubation	• Obesity BMI > 30
• ASA physical status class 4 or class 5	• Smoking two or more packs of cigarettes per day
• Cardiac ejection fraction (EF) < 40%	
• Aortic stenosis	
• Pulmonary hypertension	

RISK FACTORS

- **Anesthetic underdosing — The most important contributing factor for awareness with recall (AWR) is underdosing of anesthesia relative to a given patient's specific requirements. This can occur for the following reasons:**
  - The anesthetic technique results in inadequate anesthesia.
  - A specific patient's needs are underappreciated.
  - It is judged unsafe to administer sufficient anesthesia.
  - There is a mistake or failure in the delivery of anesthesia.

- **Total intravenous anesthesia** — Total intravenous anesthesia (TIVA) is probably associated with a higher risk for AWR compared with techniques based on a volatile inhalation agent .
- **Neuromuscular blockade** — Use of an NMBA is associated with increased risk and severity of AWR.
- **Resistance or tolerance to anesthetics** — Patients who have a history of AWR may be at higher risk for future events.
- **Type of surgery** — Surgical procedures with higher risk for AWR include trauma or cardiac surgery and cesarean delivery.
- **Technical issues** — Equipment malfunction and human error are infrequent causes of AWR. During a TIVA technique, infiltration of the intravenous (IV) catheter or a dosage miscalculation may result in inadequate anesthesia.

Q5:HOW WILL YOU MANAGE THIS PATIENT?

As for the diabetics we should consider a few things :

- Infections: These are more common and great care should be taken with any invasive procedures.
- The airway Glycosylation of collagen in the cervical vertebrae and temporomandibular joints: can cause difficulties in tracheal intubation.
- Gastroparesis: Patients with diabetes may have a delay in gastric emptying with autonomic neuropathy and may require tracheal intubation.
- Regional anesthesia: Avoiding general anaesthesia with a quicker return to diet and medication is desirable but patients with diabetes may compensate poorly following sympathetic blockade and the infec- tion risk (e.g. epidural abscess) is increased.
- Many of the endocrine changes that occur following major surgery (e.g. increase in catecholamines, cortisol, and glucagon): may increase blood glucose further so intensive monitoring for diabetics is required . Plus, we should monitor to prevent any vascular event and to prevent the ER consequences of poor glycemic control like DKA or HONK

General management of diabetic patients undergoing surgery

- **HbA1c is a marker of glycaemic control.** A non-diabetic HbA1c is 3.5–5.5%. In patients with diabetes, 6.5% (48mmol/mol) represents good control and >8% (64 mmol/mol) poor control, and thus more prone to micro- vascular complications.
- **Assessment of major diabetic complications.** especially vascular. The degree of compromise from cardiovascular, cerebrovascular and renovascular impairment should be estimated from simple tests (e.g. serum urea and electrolytes) to more detailed investigations such as exercise testing, cardiac scans and cerebrovascular scan.

REFERENCES :

- Anesthesia at glance by Julian & William
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2900098/
- http://www.europeanreview.org/wp/wp-content/uploads/1038.pdf

ANAESTHESIA MONITORING.

Heart Rate

DOG - 70-120bpm
CAT - 120-140bpm
RABBIT - 180-350bpm

RESPIRATORY RATE

DOG - 18-34brpm
CAT - 16-40brpm
RABBIT - 30-60brpm

EYE POSITION

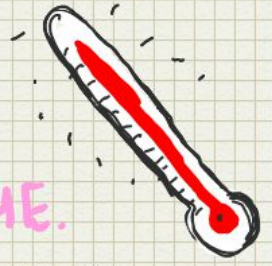
Central - Light

Rotated Down - Adequate

Central + dilated - Deep

TEMPERATURE

DOG = 37.9-39.9°C
CAT = 38.1-39.2°C
RABBIT = 38.6-39.9°C



GUM COLOUR.

- Salmon Pink (normal)
- Pale (blood loss)
- Red (congested)
- Blue (cyanotic)

CAPILLARY REFILL TIME.

Apply pressure to the gum, release and count the time to return to a normal colour. Normal is less than 2sec

REFLEXES =

Palpebral
tap the corner of the eye no blink indicates a good level of anaesthesia

Pedal
Pinch in between the toes, if the dog pulls back its foot it is too light.