CLINICAL MEET PRESENTATION

AN 11 YEAR OLD CHILD WITH KYPHOSCOLIOSIS POSTED FOR SURGICAL CORRECTION

CASE HISTORY

- Informant – Mother

- Astha Vithkar, 11 year old female child, was brought by parents to the hospital with chief complaints of –

- Deformity of back since 3 years of age

HISTORY OF PRESENTING ILLNESS

- Patient was apparently asymptomatic 8 years back when her mother noticed the deformity of back.
- Deformity was gradually progressive and has increased over the subsequent years.
- Was associated with change in gait which was more noticeable as the deformity increased with age.
- Not associated with pain or discomfort.

BIRTH HISTORY

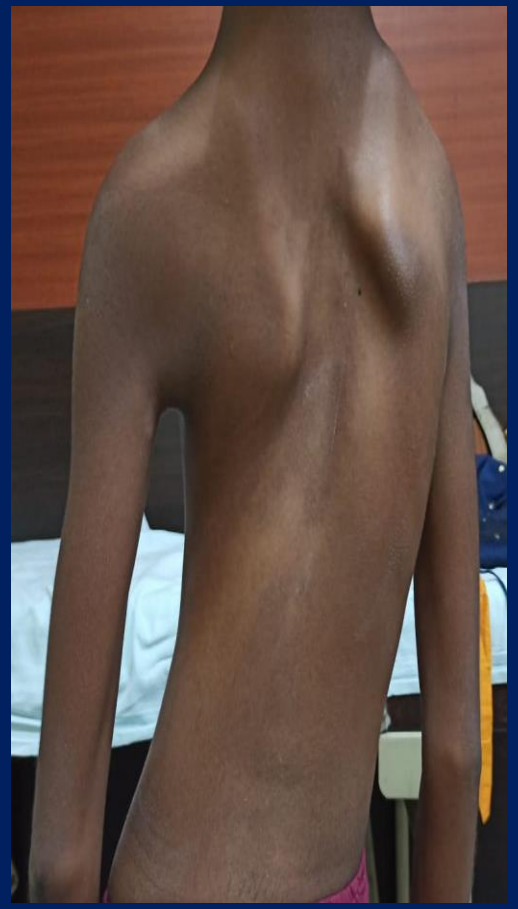
- Full term normal vaginal delivery in Hospital, CIAB
- BW –3 kg

GENERAL EXAMINATION

- **Child is conscious and oriented to time, place and person**
- Weight – 15kg
- Pulse – 86/min, regular, taken over right radial artery.
- Blood Pressure- 110/72mmHg in right arm supine position
- Respiratory rate – 18 /min, thoraco-abdominal
- No pallor, icterus, clubbing, cyanosis, oedema or lymphadenopathy

- ***AIRWAY ASSESSMENT–*** **MPC 1**

BACK AND SPINE EXAMINATION



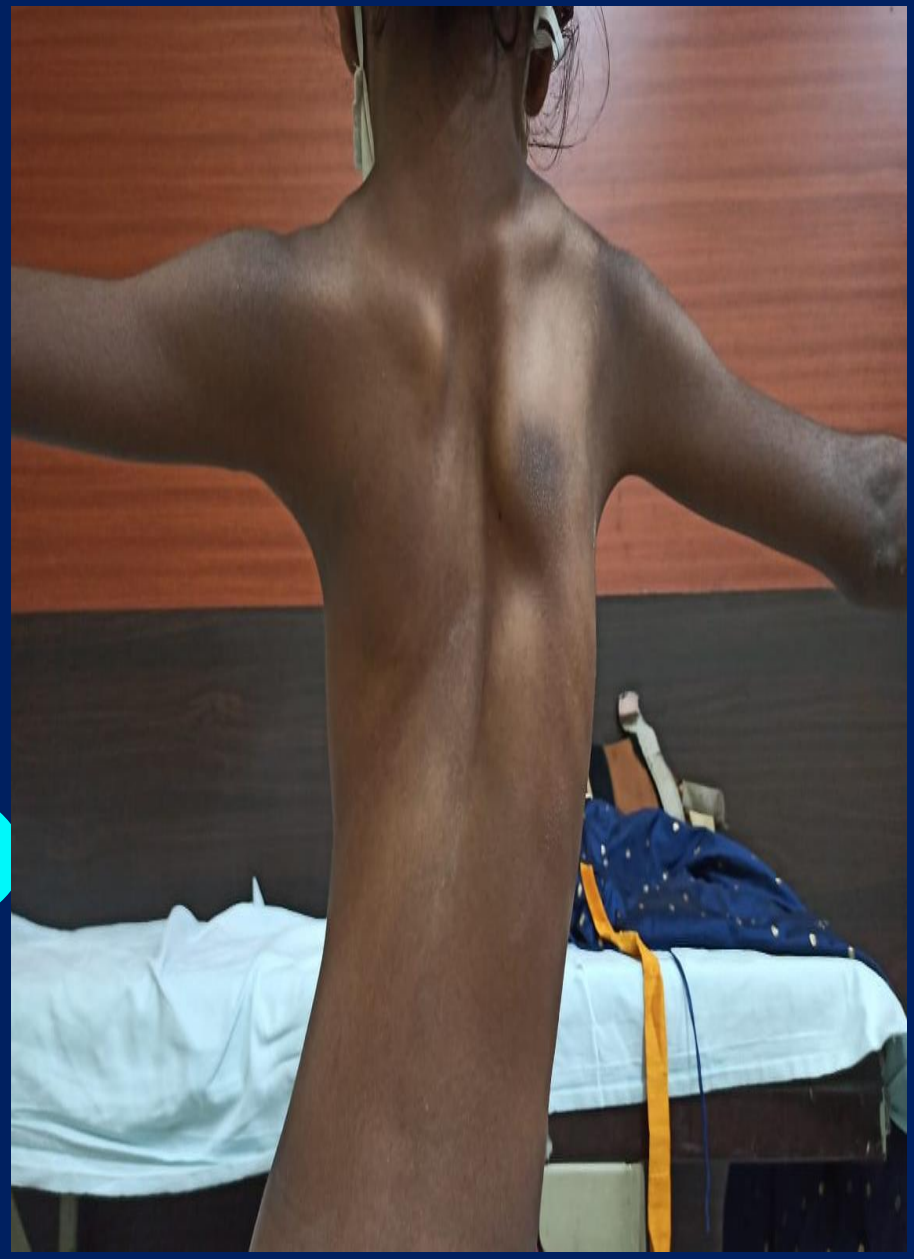
- Head normal position
- Left scapula lower than right scapula
- Lateral body margin convex to right side
- Left iliac crest is more prominent
- Dorsal spine convex towards right side
- Lumbar spine convex towards right side-Lordosis
- Vertebrae (T4 to L1) becomes more prominent on bending forward
- Gait- lurching to right side

ADAMS FORWARD BENDING TEST

Right sided curvature persists.	Right rib T9 to T12 more prominent.	Right sided scapular prominence present

RANGE OF MOVEMENTS

- Thoracolumbar spine flexion-25
- Combined lateral flexion to each side-30
- Lumbar spine flexion -10
- Thoracic spine rotation to each side-20



SYSTEMIC EXAMINATION

- ***RS –*** Chest movement reduced on right side. Air entry bilaterally equal. No adventitious sounds heard
- ***CVS –*** S1 and S2 are normal.
- ***CNS –*** Conscious and oriented to time place and person.
- ***Per Abdomen –*** Soft, non-tender.

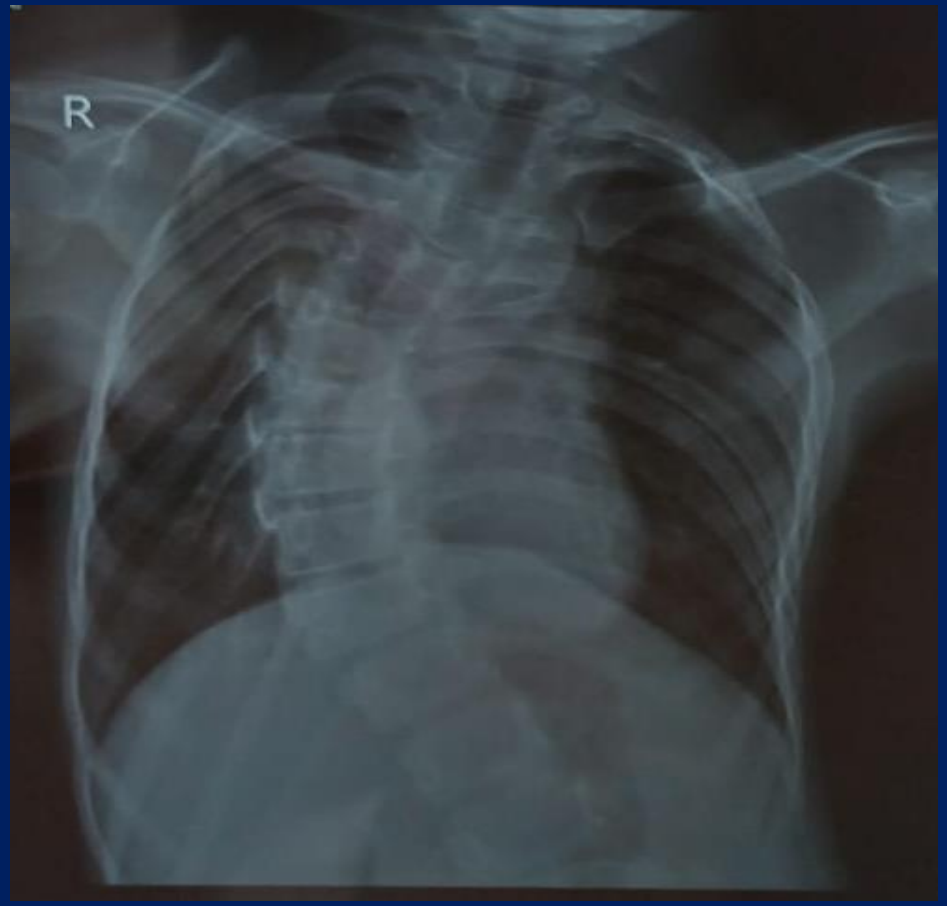
PROVISIONAL DIAGNOSIS

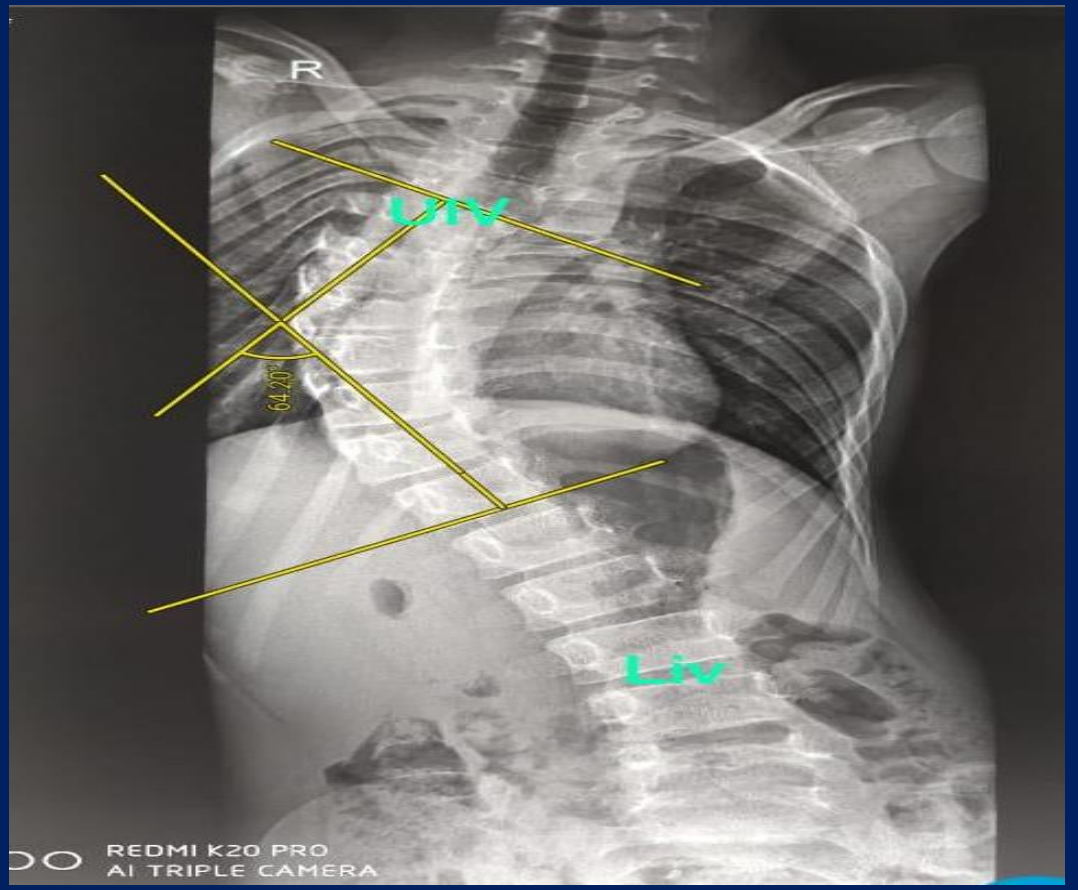
- A 11 year old female with thoraco-lumbar scoliosis with spine convexity to right to be confirmed by further investigations, posted for pedicle screw with rod fixation.

INVESTIGATIONS

Complete blood count	Hb-13.2mg/dL TLC-12600/cumm PC-3.20lacs
Serum electrolytes	Na-141meq/L K-4.10meq/L
Liver function tests	TB-0.42, DB-0.19
Renal function tests	U-17mg/dL, Cr-0.53mg/dL
Coagulation profile	PT-11.82, INR- 1.05
Serology	Negative for HIV, HBsAg, HCV
Blood sugar level	105mg/dL

- ***ECG-*** **Normal Sinus Rhythm**
- ***2D ECHO-*** **Normal study with intact septae and pressures**
- ***ABG-*** **As patient cannot perform PFT so we did pre-op ABG which came as normal**





CXR

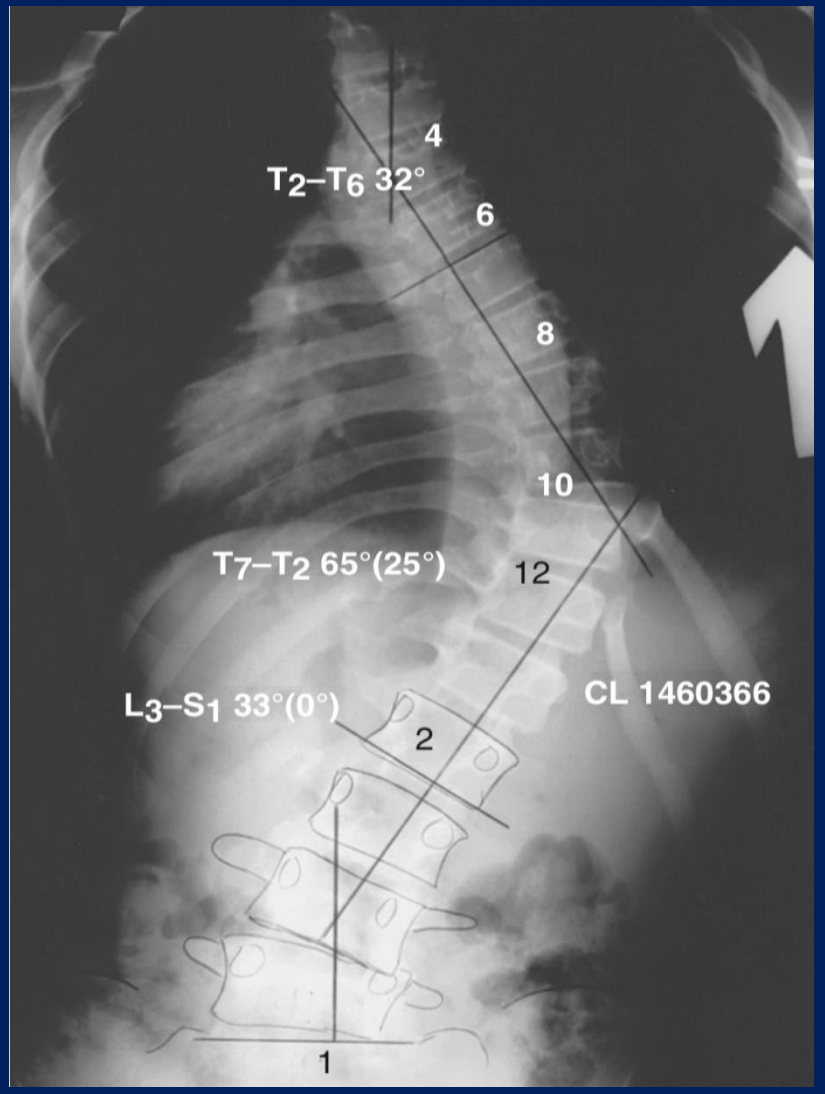
- C-shaped thoracolumbar scoliosis with curvature towards the right side with L1 lower transitional vertebra and T3 upper transitional vertebra and apical vertebra as T8.
- Ribs on concave side are prominent anteriorly and crowded together
- Cobb's angle- 64.20 degree

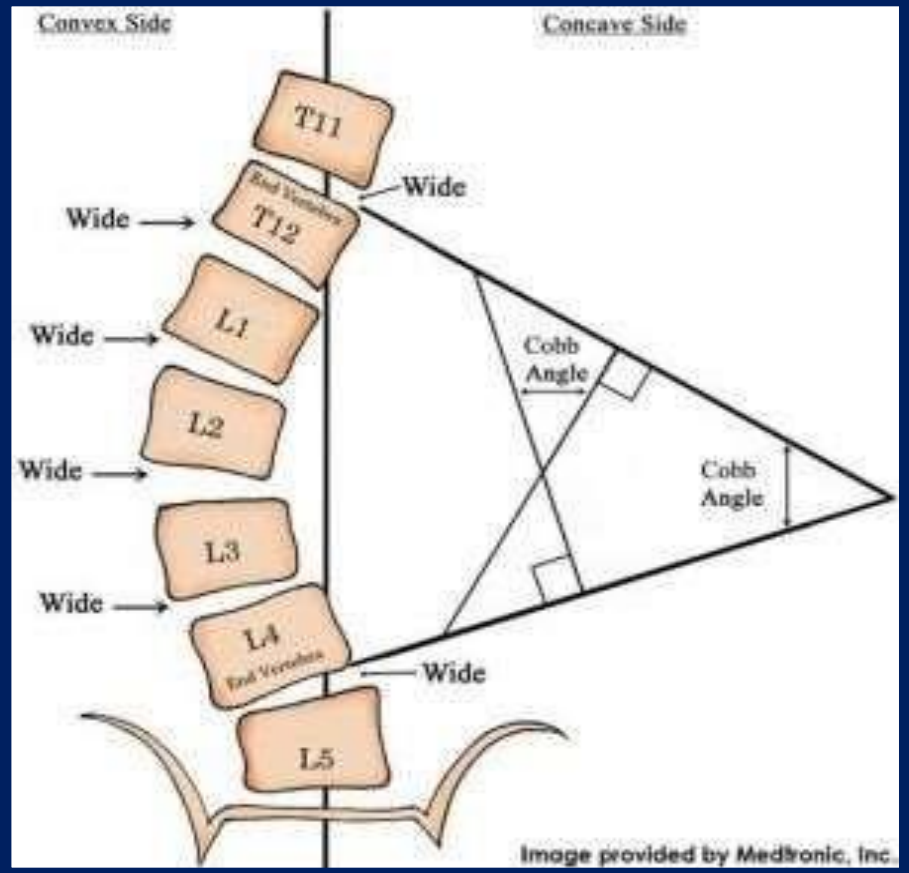
PROGRESSION AND SEVERITY

- Corrrelates with the angle of curvature measured.
- **Cobb Angle-** is derived by drawing lines parallel to the superior surface of the proximal-end vertebra and the inferior surface of the distal end vertebra.

Perpendicular to these lines are erected and the angle of intersection of these lines is measured.

"angle between the upper surface of 'top-end' vertebra and the lower surface of 'bottom-end' vertebra"





Cobb's angle (degrees)	Clinical manifestations
<10	No symptoms
>25	Increase in pulmonary artery pressure
>40	Consider surgical intervention
>70	Significant decrease in lung volume
>100	Dyspnea on exertion
>120	Alveolar hypoventilation, chronic respiratory failure.

Drawback: measures a complex deformity in only two dimensions.

ANAESTHETIC CHALLENGES

1. *RESPIRATORY SYSTEM-*

Abnormal PFT

- Restrictive pattern
- Decreased VC
- Decreased compliance

Blood Gas Abnormality

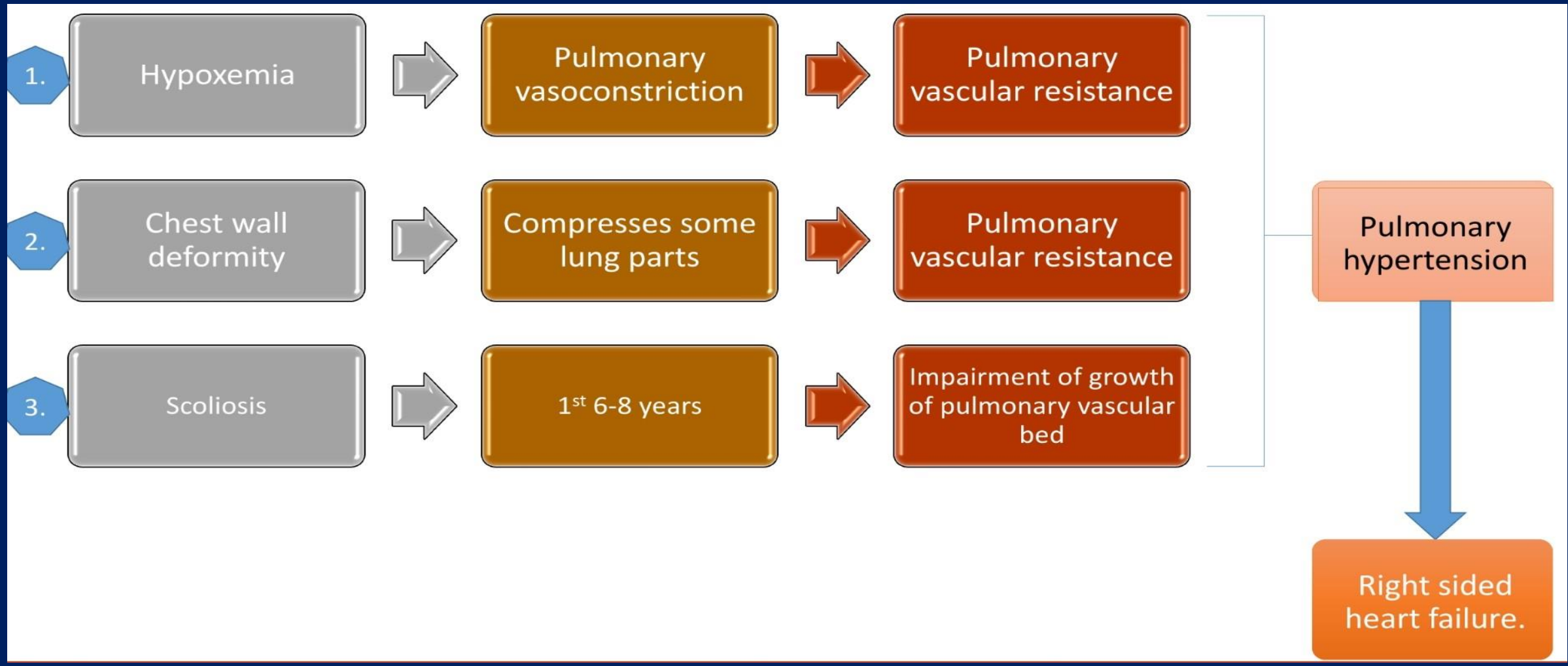
- Arterial Hypoxaemia
- Decreased PaO2 but normal PaCO2 and Ph
- D/t ventilation perfusion mismatch

2. *NEUROLOGICAL SYSTEM-*

A detailed neurologic evaluation and documentation is important because of medicolegal issues

3. *BLOOD LOSS*

4.CARDIOVASCULAR SYSTEM-



5. POSITIONING

- Depends on the level of spine to be operated.
- Peripheral nerves, eyes, genitals and bony points should be padded and protected
- Prone positioning requires an uncompressed abdomen

Problems of prone position

Airway- ETT kinking, dislodgement, upper airway oedema

Neck- Hyperextension/hyperflexion, cervical rotation

Eye- orbital pressure

Abdomen- pressure transmitted to epidural veins and increased bleeding

Upper extremity- brachial plexus injury, ulnar nerve compression

Lower extremity- flexion of hips- occlusion of femoral vein, peroneal nerve injury, lateral femoral cutaneous nerve injury

6. SPINAL CORD MONITORING DURING ANAESTHESIA

1) Motor evoked potential (MEP) was measured using multiple electrodes attached to frontal part of cranium, left and right upper limbs, left and right lower limbs.
2) Somatosensory evoked potential (SSEP) to monitor sensory function of posterior column of spinal cord.
3) Train of four monitoring (TOF) was done to check level of neuromuscular blockade.
4) Bispectral index (BIS) was used to assess depth of anaesthesia.

BIS, TOF, SSEP and MEP were measured before surgery, intra-operatively and final reading was taken after fixation of rods.

After the confirmation of readings, surgery proceeded ahead.

ANESTHETIC MANAGEMENT

- Patient was accepted ASAII.
- Blood- cross-matched and kept ready.
- NBM for 6 hours prior to surgery.
- Choice of anaesthesia –

General anaesthesia with Total intravenous anaesthesia and minimal MAC inhalational agents

- Premedications given.
- Oxygen & Sevoflurane (MAC 0.5) administered using face mask of size 2.
- Monitors (ECG, pulse oxymeter, blood pressure cuff) were attached

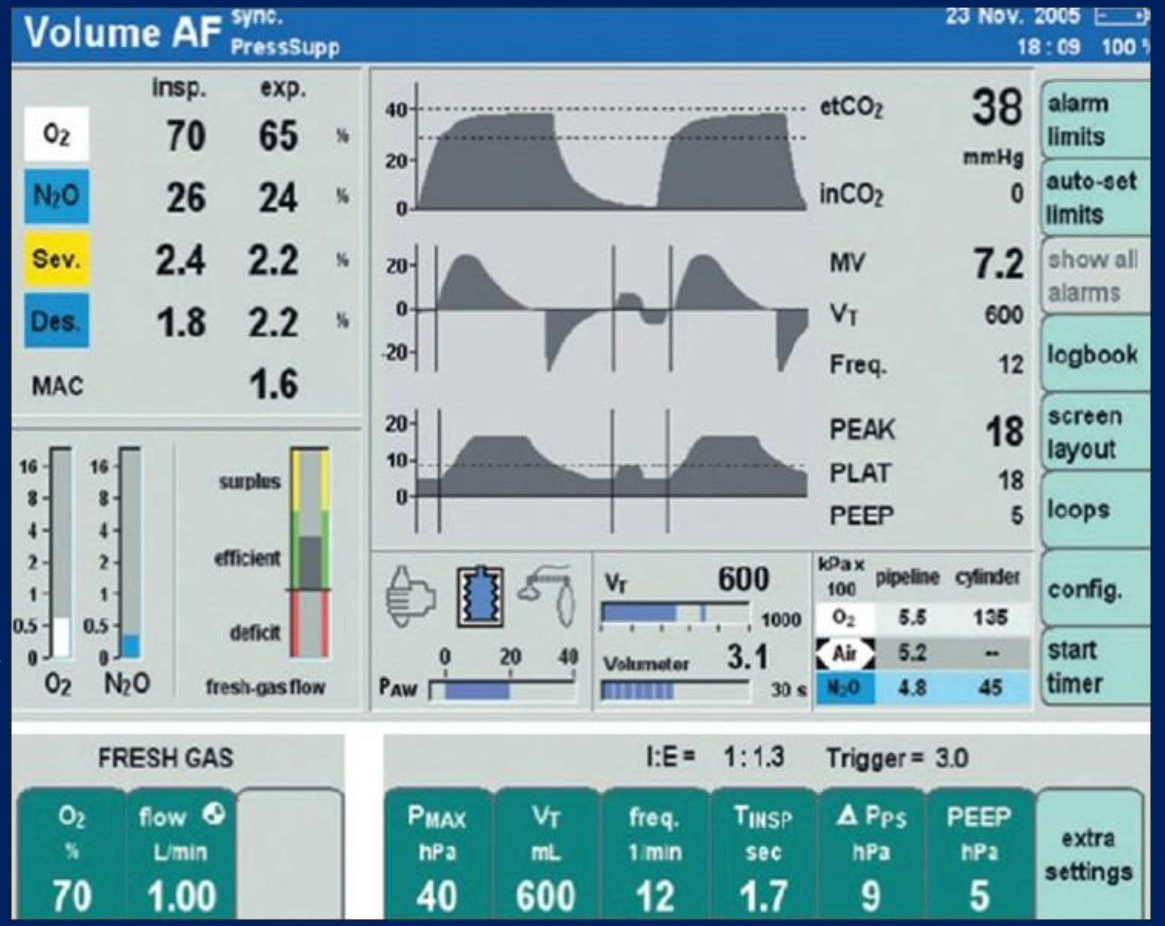
- Induction-

➢Inj. Propofol (2 mg/kg IV)

➢Inj. Fentanyl (2 mcg/kg IV)

➢Inj. Atracurium 7.5mg

- Size 5.5 flexometallic cuffed endotracheal tube.
- Nasogastric tube. Temperature probe.
- Throat pack and Bite block placed.



- Central venous line- Right internal jugular vein (5.5 french, 8cms)
- Intra-arterial cannulation- Right radial artery(22G)

- ***Total intravenous anaesthesia-***

➢Inj.Fentanyl infusion, Inj.Dexmedetomidine, Inj.Propofol infusion

- Shifted to prone position and air entry re-confirmed.
- Maintained on O_2 : Air, Sevoflurane (MAC 0.5).
- **Muscle relaxant was not used.**
- Warm intravenous fluids and a warming mattress used

INTRA-OPERATIVE VITALS:-

TIME	PR	IABP	BL	IVF	UO	TEMP
9:00am	100bpm	118/78mmHg	15ml	105ml	80ml	38.6”F
10:00am	110bpm	120/80mmHg				38.4”F
11:00am	90bpm	108/68mmHg	50ml	105ml	100ml	38.8”F
12:00pm	88bpm	106/70mmHg				38.6”F
1:00pm	94bpm	110/76mmHg	250ml	230ml	110ml	38.4”F
2:00pm	70bpm	106/88mmHg				38.0”F
3:00pm	25bpm	30/25mmHg	500ml	100ml	110ml	37.8”F
4:00pm	80bpm	80/50mmHg				38.2”F
5:00pm	112bpm	122/76mmHg	600ml	100ml	110ml	38.4”F

Total duration of surgery- 8hours
Blood loss- 600ml
Urine output- 520ml
Total IV fluid given- 1350ml, Blood transfused-350ml, FFP given- 150ml

CHECK LIST FOR SIGNIFICANT IONM :-

Anaesthesiologist →

- Check if bolus of anesthesia drug or muscle relaxants given
- lighten depth of anesthesia
  - Reduce MAC or stop inhalational agents
  - Reduce IV anaesthetics (propofol)
  - Add adjuvant e.g. ketamine
- Increase BP (MAP > 90mm HG)
- Oxygenation, tachycardia, Hb, pH, temperature, I/O
- Check limb position

Surgeon →

- Stop current manipulation
- Release traction
- Check dura for compression
- Reverse corrective maneuver & rod removal
- Confirm stability of spine
- Look for implant malposition
- Blood loss
- Warm saline wound wash

Neurophysiologist →

- Repeat trials of MEP
- Increase strength stimulus
- Check technical faults & electrodes
- Assess pattern of changes

OT technician → Reduce noise & electrical interference

If no improvement

↓

Increase MAP > 100mmHG

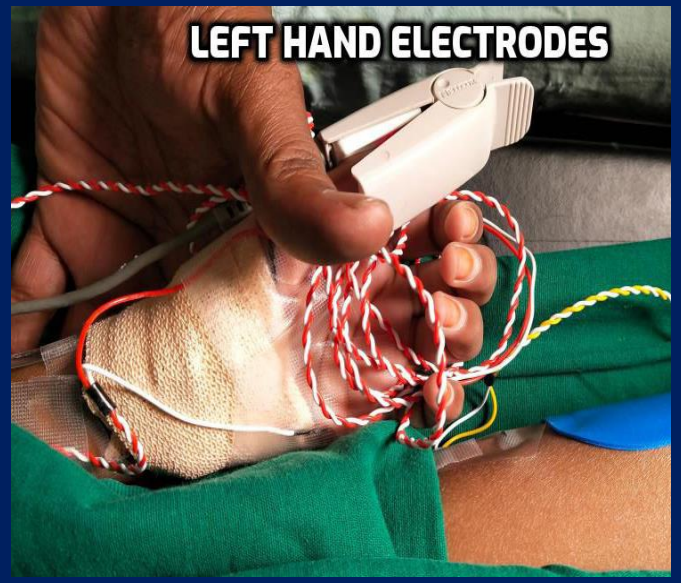
Consider steroids administration

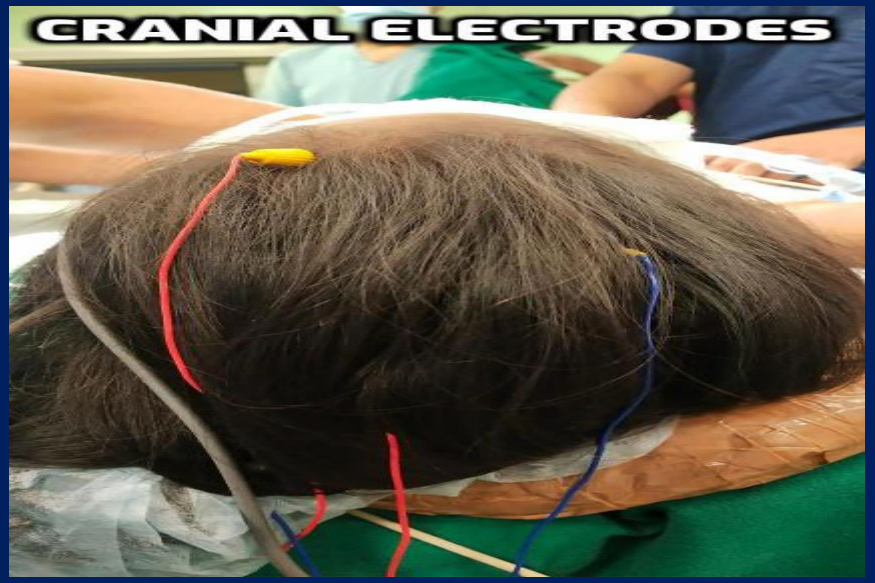
Consider CCB (Topical / IV)

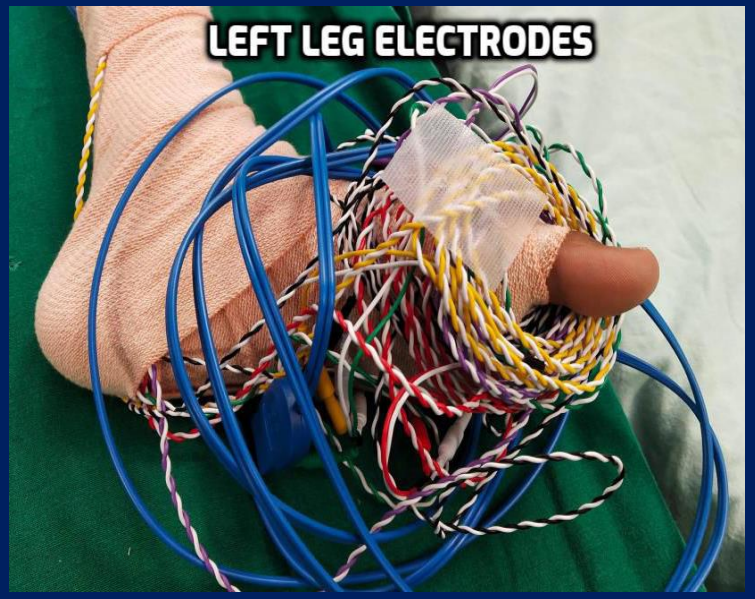
Consider wake up test

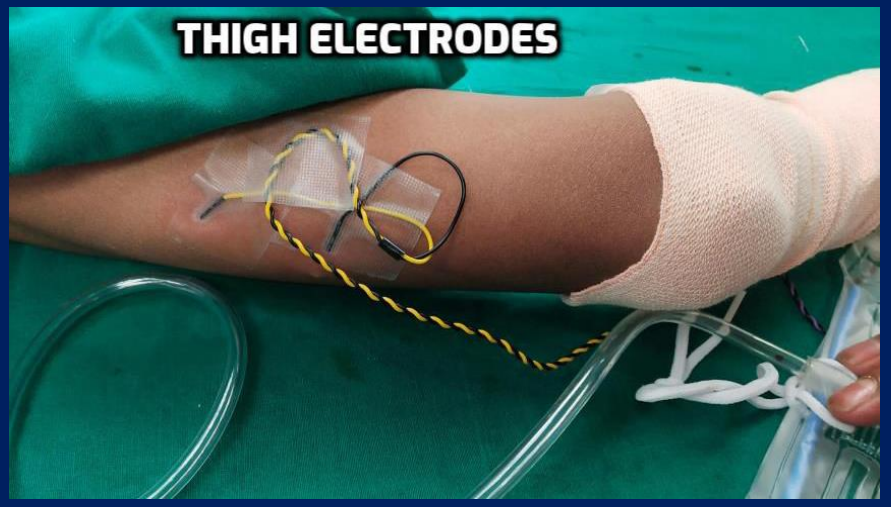
Consider aborting surgery

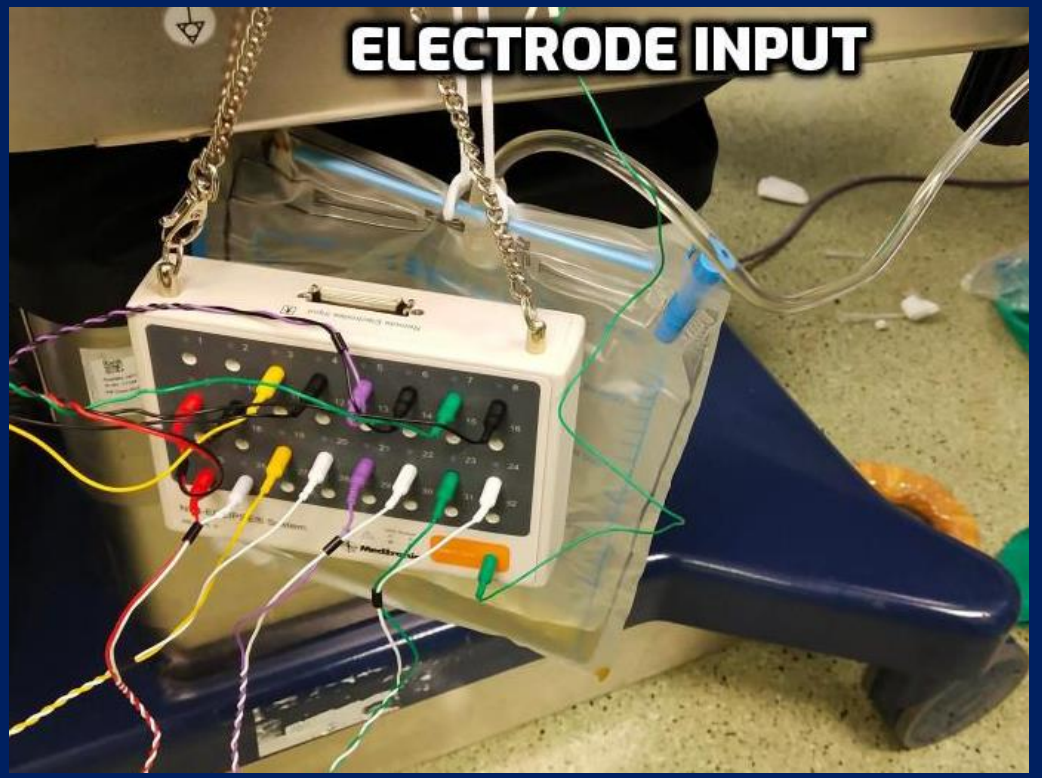
Electrodes atttached at various locations for generation and recording of potentials:-





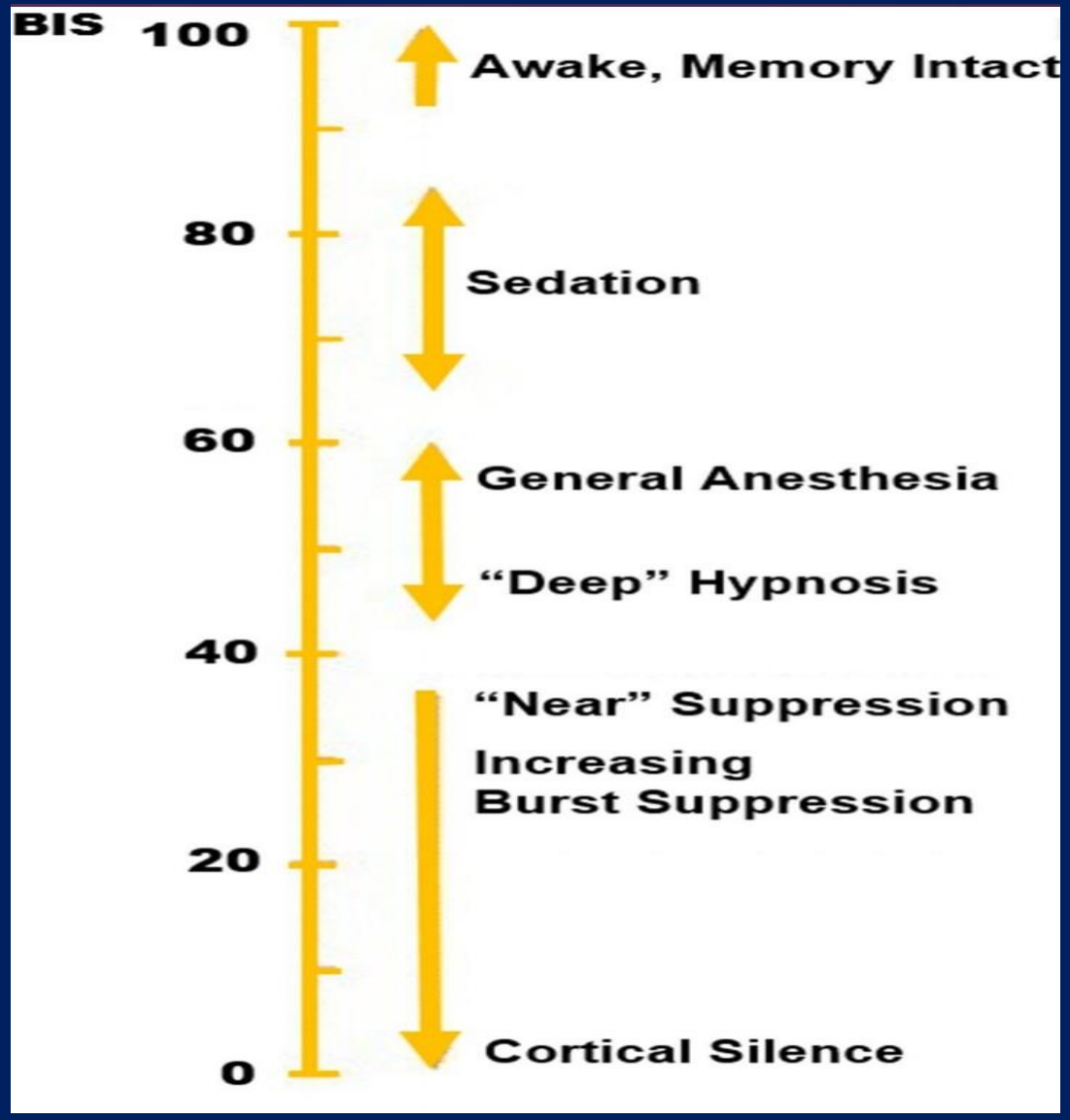






- Electrophysiological monitor which is used to generate and record evoked potentials for intraoperative monitoring of spinal cord function.
- This monitor show graphs for- MEP, SSEP, TOF and BIS
- These responses are recorded from the electrodes attached at different locations from head to toe.

Normal BIS values:-



Normal TOF values:-

No. of twitches	Approximate percentage of receptors blocked
0	100
1	90
2	75-80
3	75
4	0

SOMATOSENSORY EVOKED POTENTIALS

Non invasive

AIM:

They monitor the function of posterior sensory portion of spinal cord

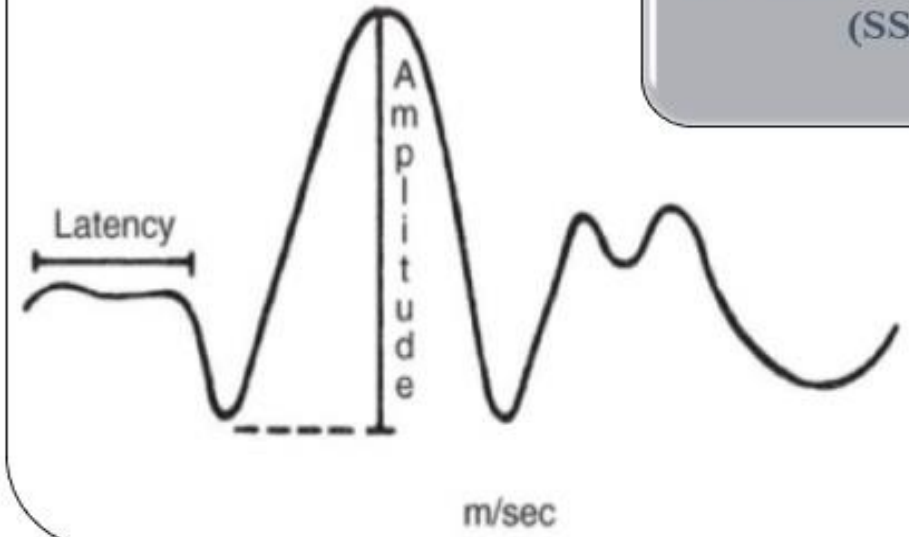
Peripheral nerves commonly used are posterior tibial N, median N , ulnar N

TECHNIQUE:

→ Repeated electrical stimuli applied to a peripheral nerve & measuring evoked responses over cerebral cortex using standard EEG electrodes or s/c needle electrodes

Can also be recorded with invasively by placing electrodes in epidural space of high thoracic or cervical cord

2.SOMATOSENSORY EVOKED POTENTIAL (SSEP)



A typical SSEP has an amplitude of 1-3 mV.

Increased latency>10-15% &decreased amplitude >50 %

Significant.

Latency determines conduction velocities.

Amplitude determines function nerve fibers.

MOTOR EVOKED POTENTIALS

Non invasive

AIM:

Used to monitor anterior motor function of spinal cord.

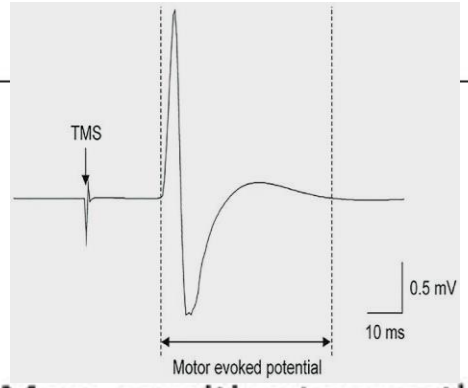
TECHNIQUE:

Electric or magnetic trans-cranial stimulation.

Epidural , neurogenic or myogenic MEP.

Conduction of these stimuli through the motor pathways is monitored as peripheral nerve impulses, electromyographic signals, or actual limb movements.

3. MOTOR EVOKED POTENTIAL (MEP)

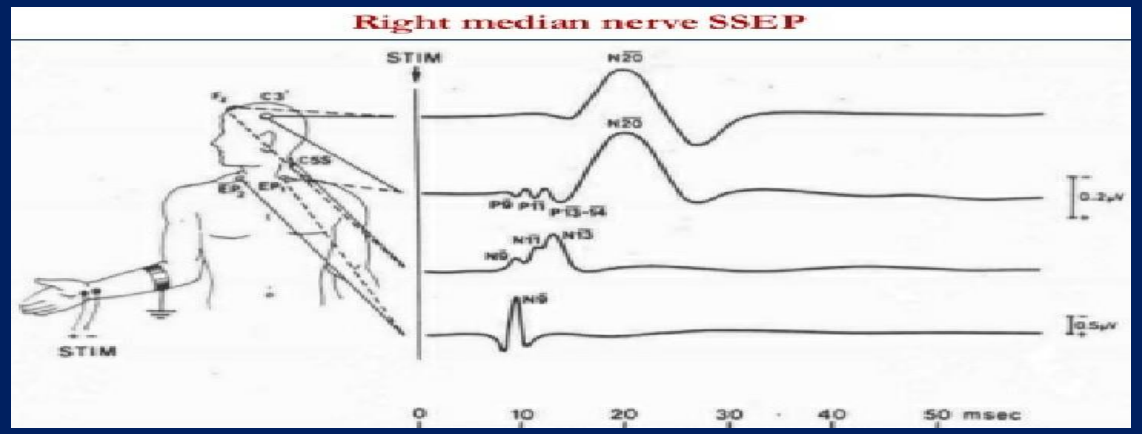


- More sensitive to anesthetic interface.
- More sensitive than SSEP's in predicting postoperative outcome.

ADVERSE EFFECTS:

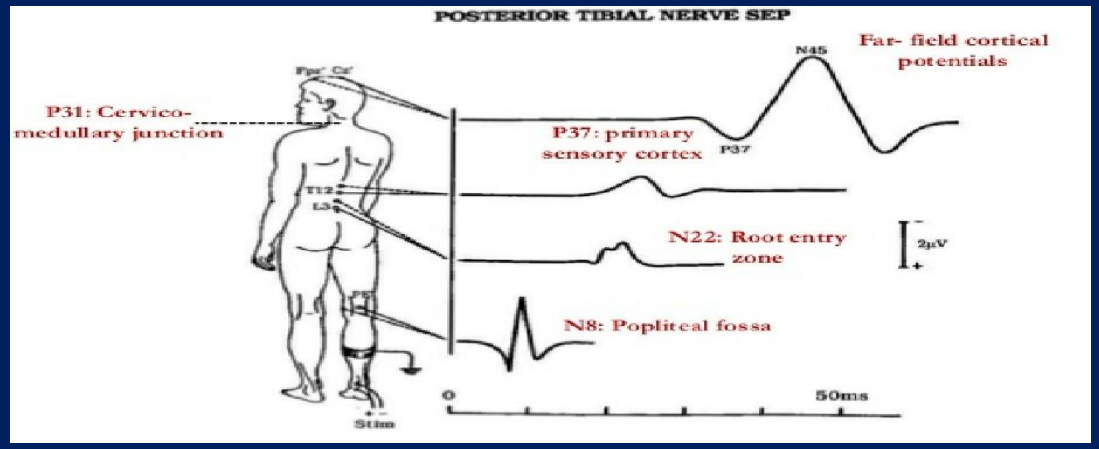
→ Cognitive dysfunction , seizures, bite injury, cardiac arrythmias, scalp burns, awareness

Normal SEP recordings:-



SSEP lower limbs

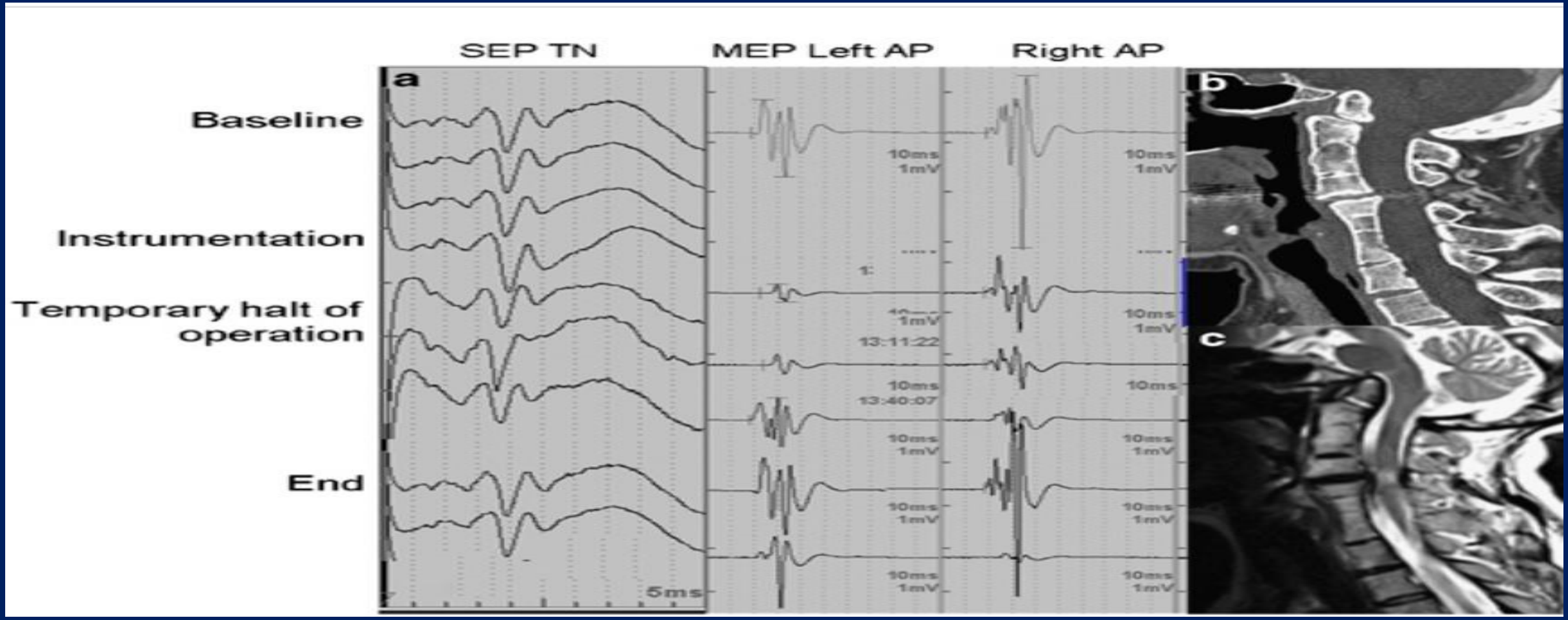
In lower limb SSEP latency is between 37-42msec, and is a trough (negative peak)



SSEP upper limbs

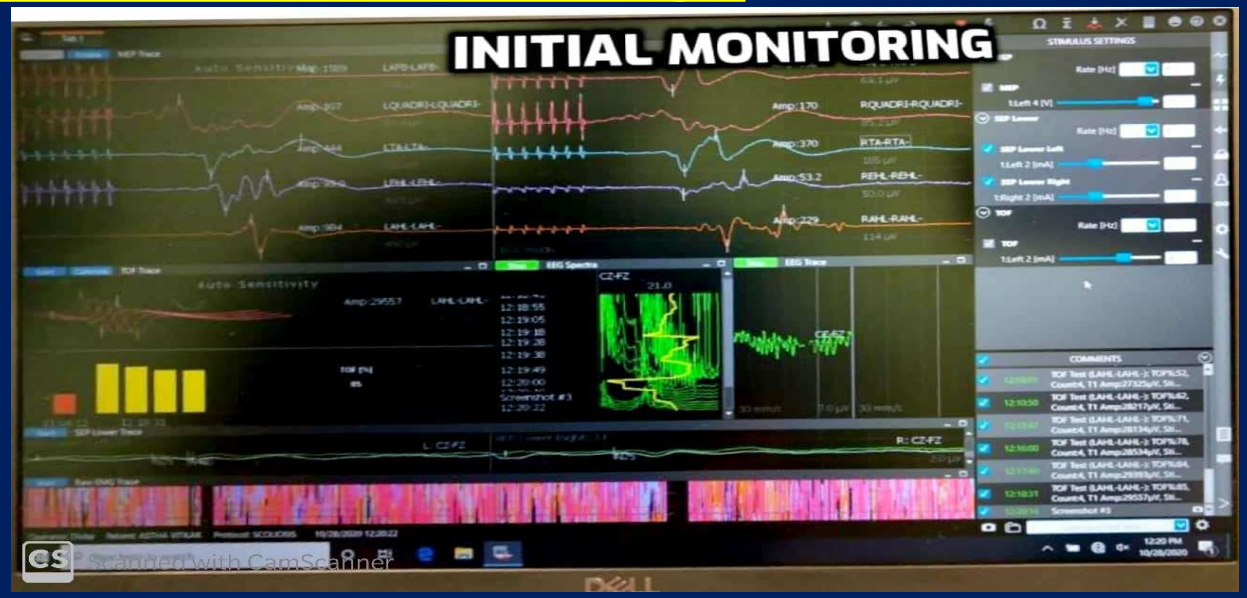
Latency of upper imb SSEP is between 18-22msec in normal situation and is a positive peak

Recordings during instrumentaton:-

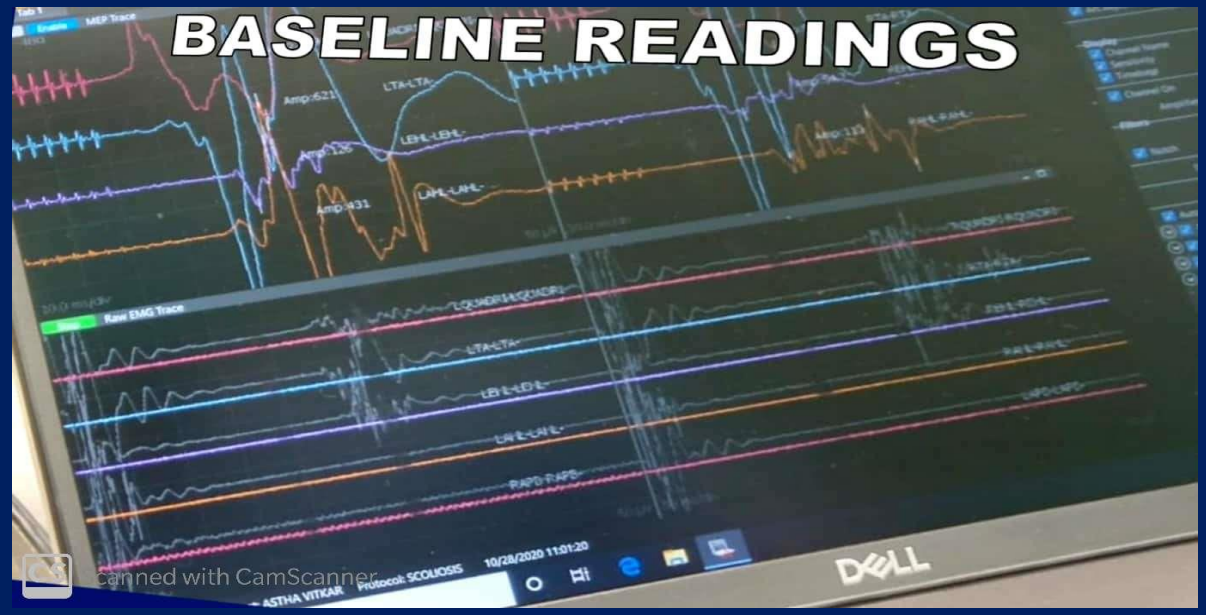


➢Tracing of somatosensory evoked potential (SEP) and motor-evoked potential (MEP) during the critical stage of operation.

Baseline initial monitoring:-



MEPs are flat due to the effect of muscle relaxant and inhalational agents.



TOF-74 BIS-50

Symmetrical and monitorable waveform latencies and amplitude with clearly defined and consistent cortical and subcortical depolarization waveform morphologies.

INTRA-OP IMAGES-

Normal signals

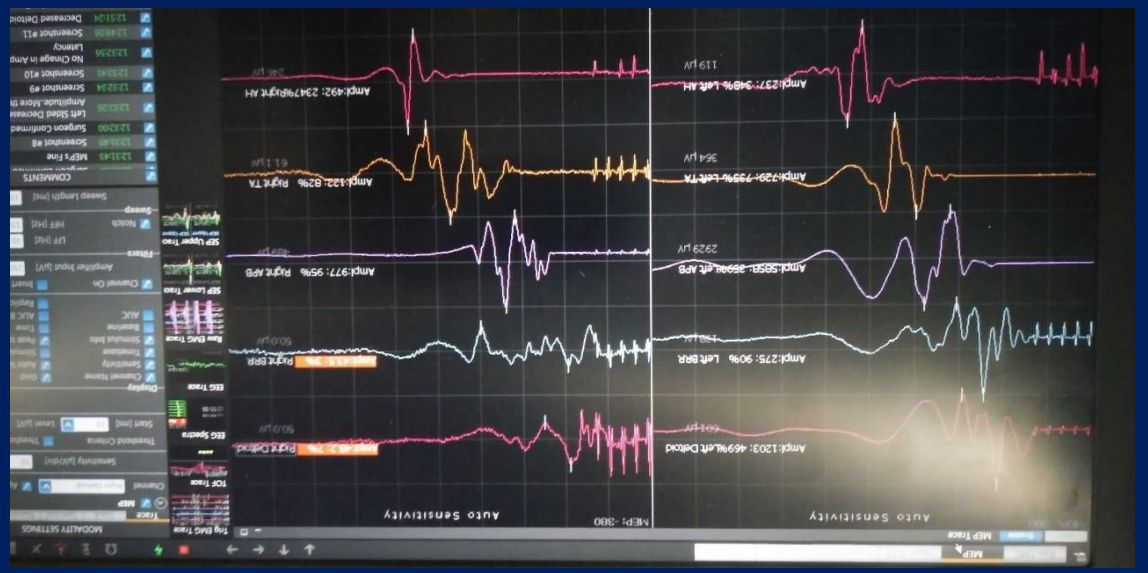
Normal right and left MEPs- M (upper limb)
D waves

Normal right and left MEP- M waves (llower limb)
D waves
Lower Limb SSEP

Low responses because of low BP

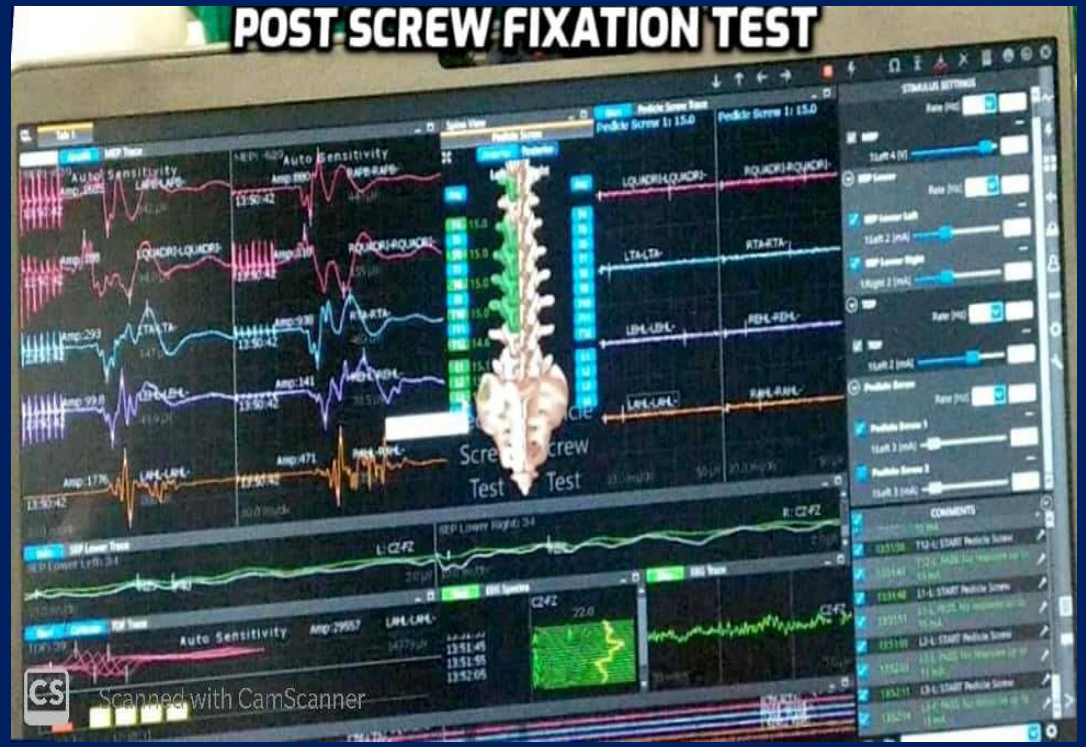
Responses were retained after BP increased

Drop in response during spine correction

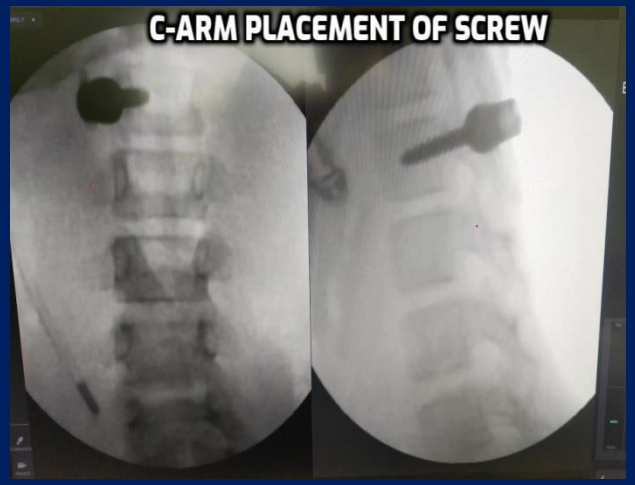


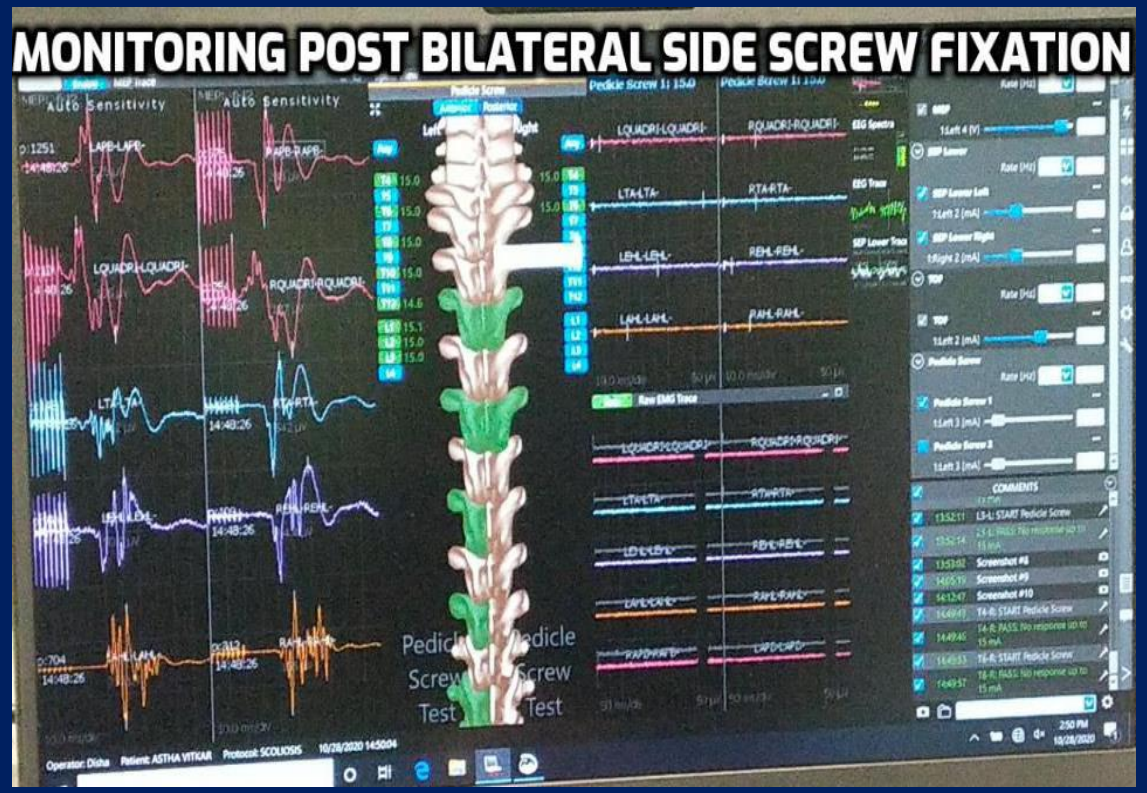
Final MEP retained

Recordings post instrumentation:-

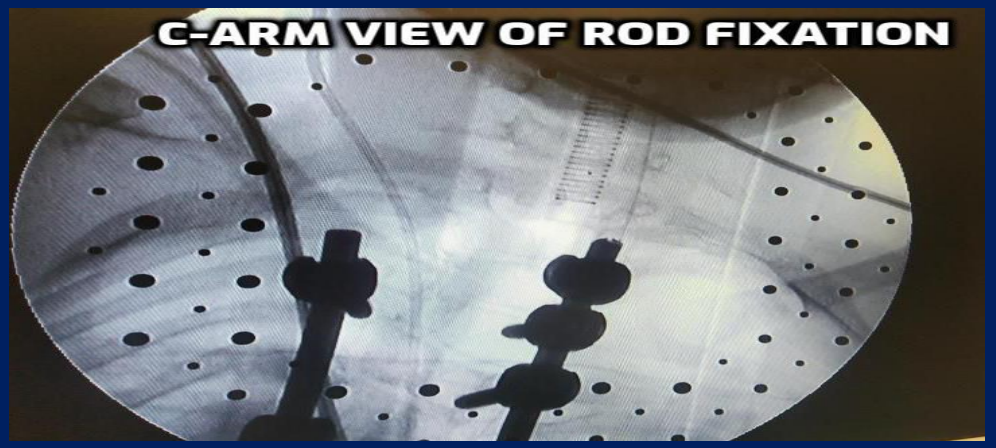


Intact MEP after fixation of the one side screw.
TOF-84
BIS-48





Intact MEP recordings after bilateral side screw fixation was done.
MEPs are retained bilaterally with adequate amplitude and frequency.
TOF-72
BIS-39

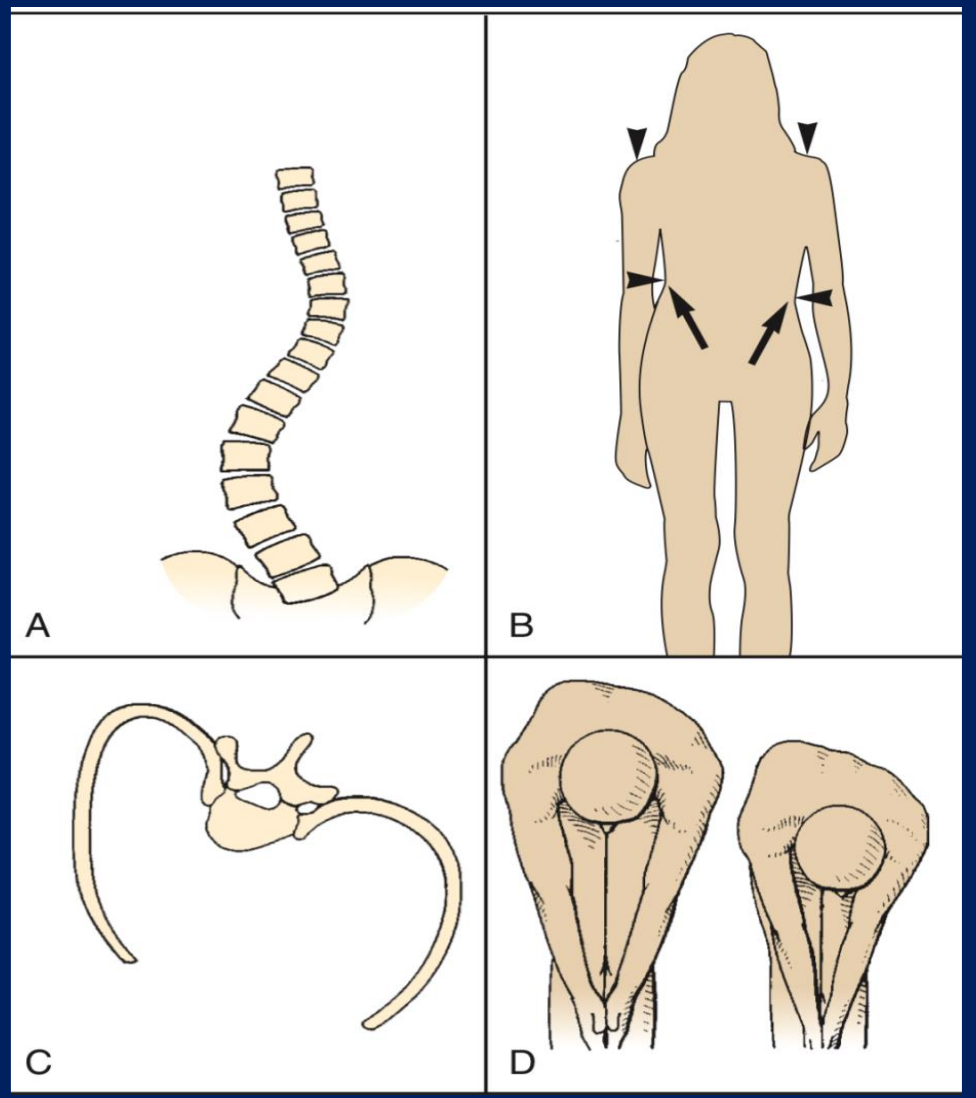


•During closure, one dose of muscle relaxant was given.
•At the end of surgery, oral suctioning was done, throat pack was removed, and neuromuscular blockade was reversed by Inj. Myopyrrolate.
• After tone was regained, patient was extubated. Vitally stable.
•Patient was shifted to Pediatric ICU for 1 day for postoperative observation.

DISCUSSION

SCOLIOSIS

- Derived from Greek root meaning “crooked”.
- Kyphosis (“humpback”) or Lordosis (“bent backward”)
- Defined as- a lateral curvature of the spine greater than 10° as measured by the Cobb method on a standing x-ray of the thoraco-lumbar spine



CLASSIFICATION OF SCOLIOSIS

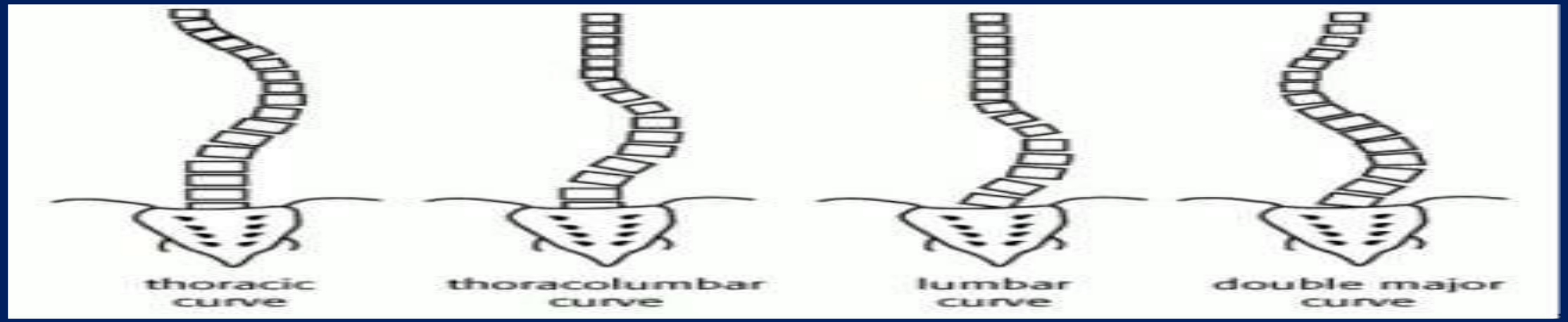
Congenital Scoliosis
Vertebral anomalies
Rib anomalies
Spinal dysraphism
Idiopathic scoliosis
Infantile (<3 years of age)
Juvenile (3–10 years of age)
Adolescent (>10 years of age)

Scoliosis Associated with Neuromuscular Disease
Cerebral palsy
Poliomyelitis
Myopathies
Muscular dystrophies
Syringomyelia
Friedreich ataxia

Traumatic Scoliosis
Fractures
Irradiation
Burns
Surgery

Syndromes Associated with Scoliosis
Neurofibromatosis (von Recklinghausen disease)
Marfan syndrome
Osteogenesis imperfecta
Mucopolysaccharidosis
Rheumatoid arthritis
Neoplastic Disease

BASED ON REGION CAN BE:-



MANAGEMENT

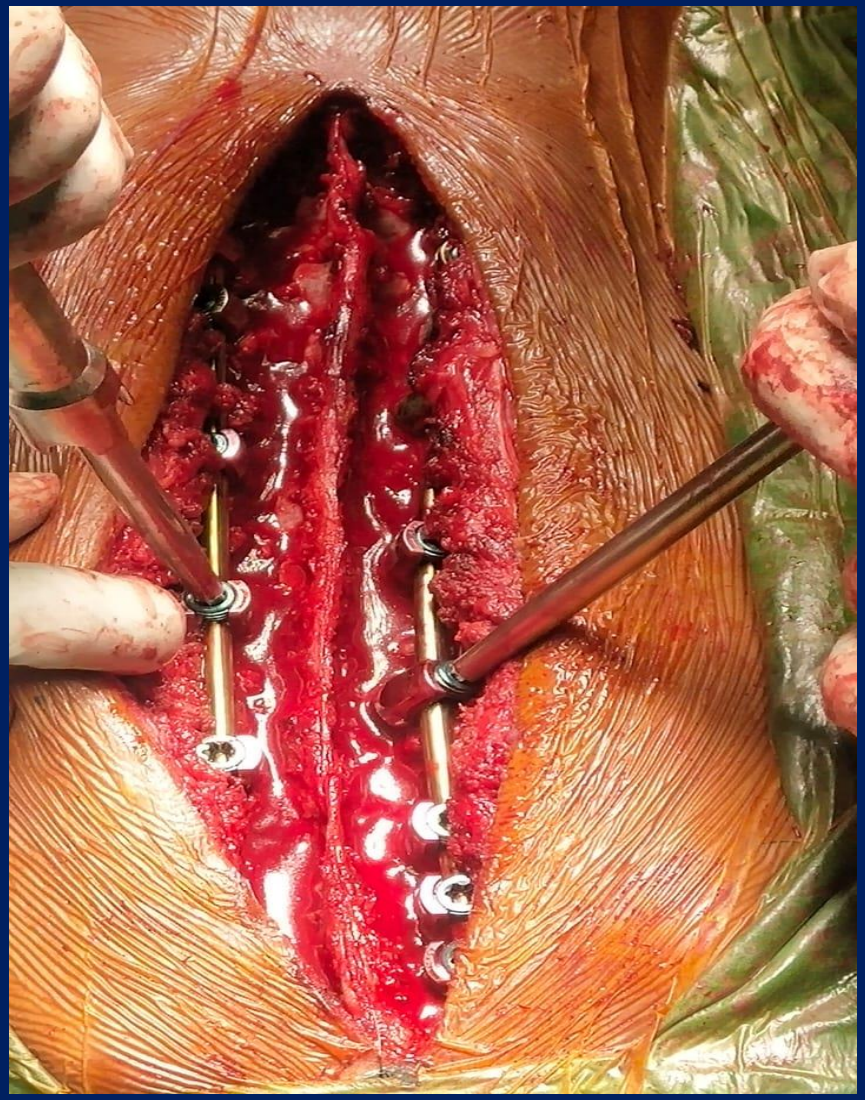
- **SURGICAL**- posterior approaches, anterior approaches, combined/staged procedures

- **Surgical techniques-**

➢Harringtom system

➢Luque and Cotrel Dubousset systems

➢Pedicle Screw fixation



NEUROMONITORING

- Goal- to identify disruption in nerve signals quickly so that surgical adjustments can be made before final spinal column configuration is set.
- Allows surgeon to make adjustments in real time during the operation if signals change.

SSEP	• **Stimulating a peripheral nerve and measuring signals generated in the somatosensory cortex**
MEP	• **Stimulating near the motor cortex and measuring signals at the target muscle**
BIS monitor	• **Depth of anaesthesia - a processed EEG monitor (Bispectral Index)**

Gold Standard	Evaluate posterior/sensory portion of cord	Integrity of anterior motor spinal cord
Wake up test	SSEP	MEP and Electromyogram

Effect of common agents on SSEP and MEP

Agent	Amplitude	Latency
Desflurane	↓	↑
Isoflurane	↓	↑
Sevoflurane	↓	↑
Nitrous oxide	↓	↔
Barbiturates	↓	↑
Etomidate	↑	↔
Ketamine	↑	↔
Midazolam	↓	↔
Opioids	↔	↔
Propofol	↔	↔
Dexmedetomidine	↔	↔

↓ = decreases; ↑ = increases; ↔ = remains the same

Intermediate duration NDMR like rocuronium, veccuronium, atracurium, cisatracurium can be used for intubation when baseline neuromonitoring is not needed before positioning..

For SSEP monitoring no restriction to NMBAs.

For MEP monitoring restriction to NMBAs

Physiological factors affecting SSEP

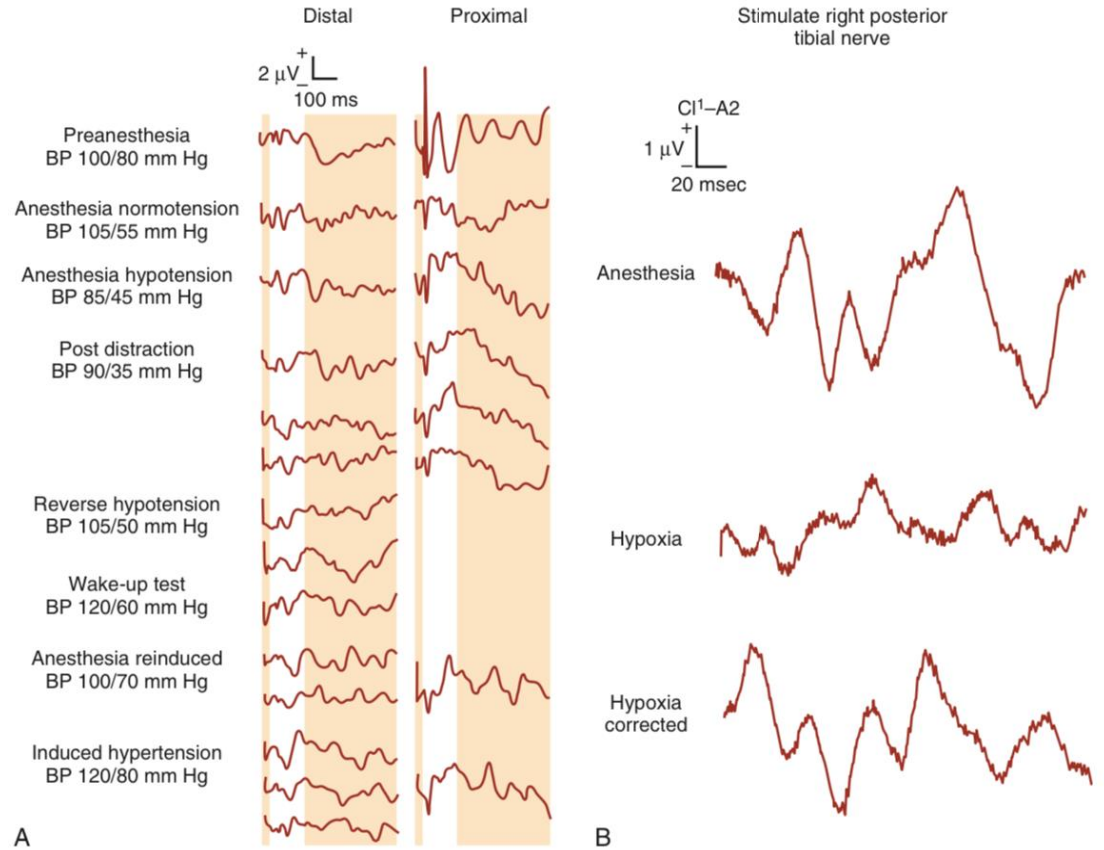


FIG 33-4 Somatosensory Evoked Potentials (SEPs) Change with Hypertension and Hypoxia. **A,** During the combination of distraction and hypotension, distal SEPs were unchanged. Resumption of normotension restored the SEP to baseline. **B,** SEP responses are exquisitely sensitive to hypoxia (PO_2 = 41 mmHg). Resumption of normoxia restored the SEP to baseline.

Parameter	Effect
Hypothermia or Hyperthermia	↓
Anemia	↓
Hypotension	↓
Hypoxia	↓
Hypocarbia	↓

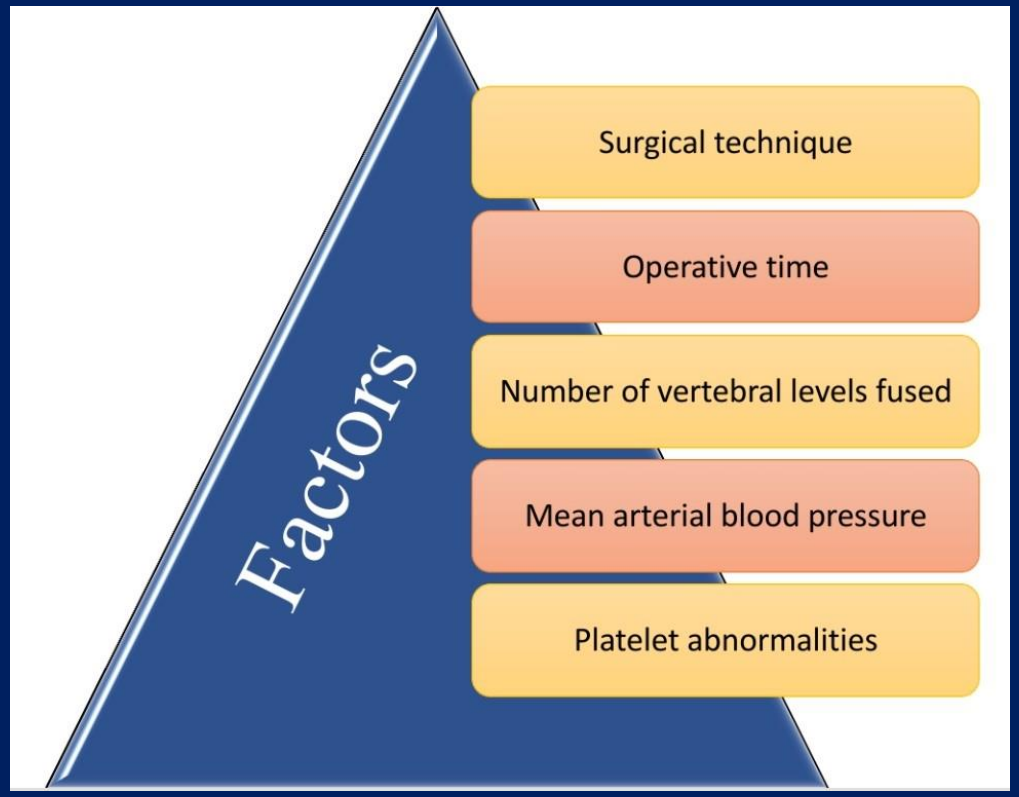
Alterations in physiologic parameters that alter SSEPs and MEPs

INTRA-OP BLOOD LOSS

- Average blood loss → **1500-2500ml** or **250ml / spinal segments fused** or **15-25ml/kg**
- Keep allogenic blood transfusion to a minimum considering the risks.

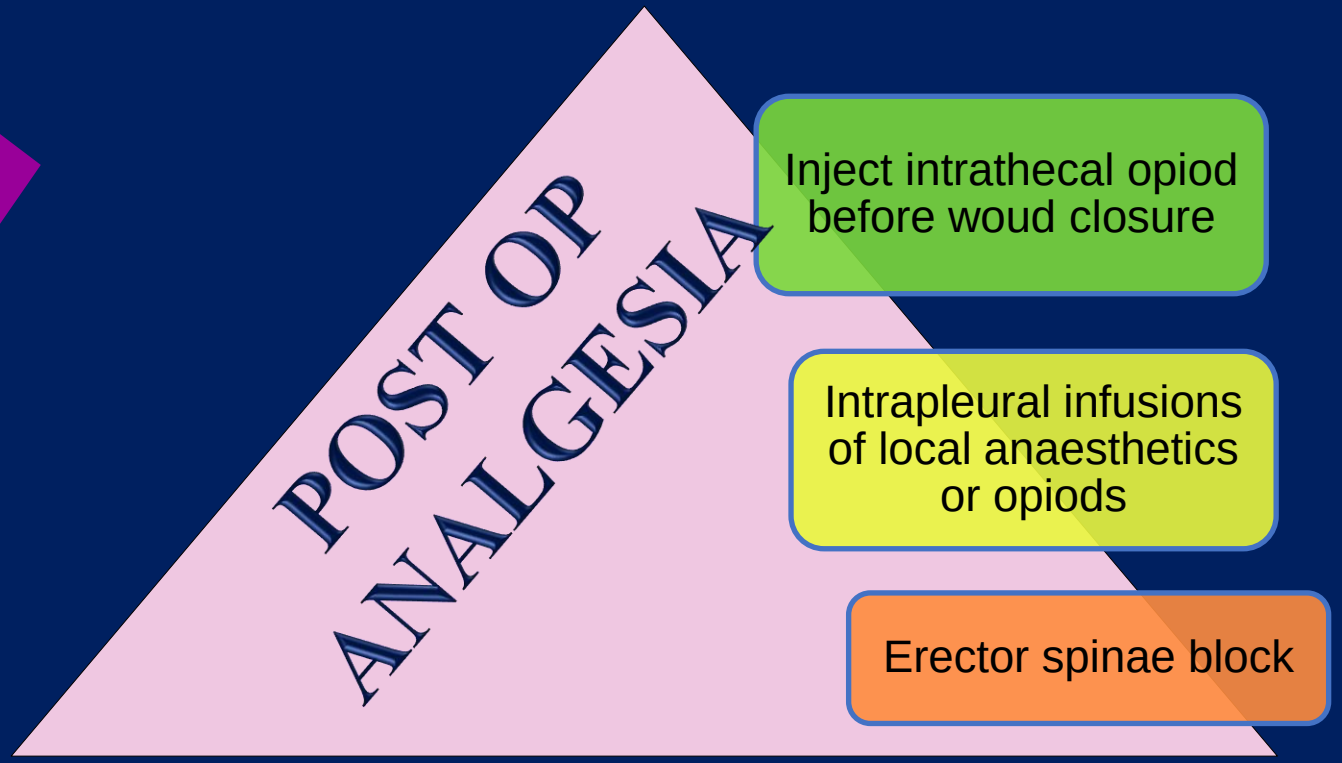
TO REDUCE BLOOD LOSS:-

- Intraabdominal pressure should be minimum
- Hypotensive anaesthesia
- Mean arterial pressure is maintained at 60-65mmHg
- Antifibrinolytic agents



POST-OPERATIVE CARE AND ANALGESIA

- Should be cared in ICU



SUMMARY

- Careful preoperative assessment is required Cardio-respiratory dysfunction.
- Surgery aims to correct the curvature, improve posture and reduce progression of respiratory dysfunction
- Intraoperative considerations include the monitoring spinal cord integrity, prone position, avoiding hypothermia, fluid balance and minimizing blood loss.
- Good postoperative pain control and respiratory care is needed

POST OP VIDEOS-

Post
operative

THANK YOU!