

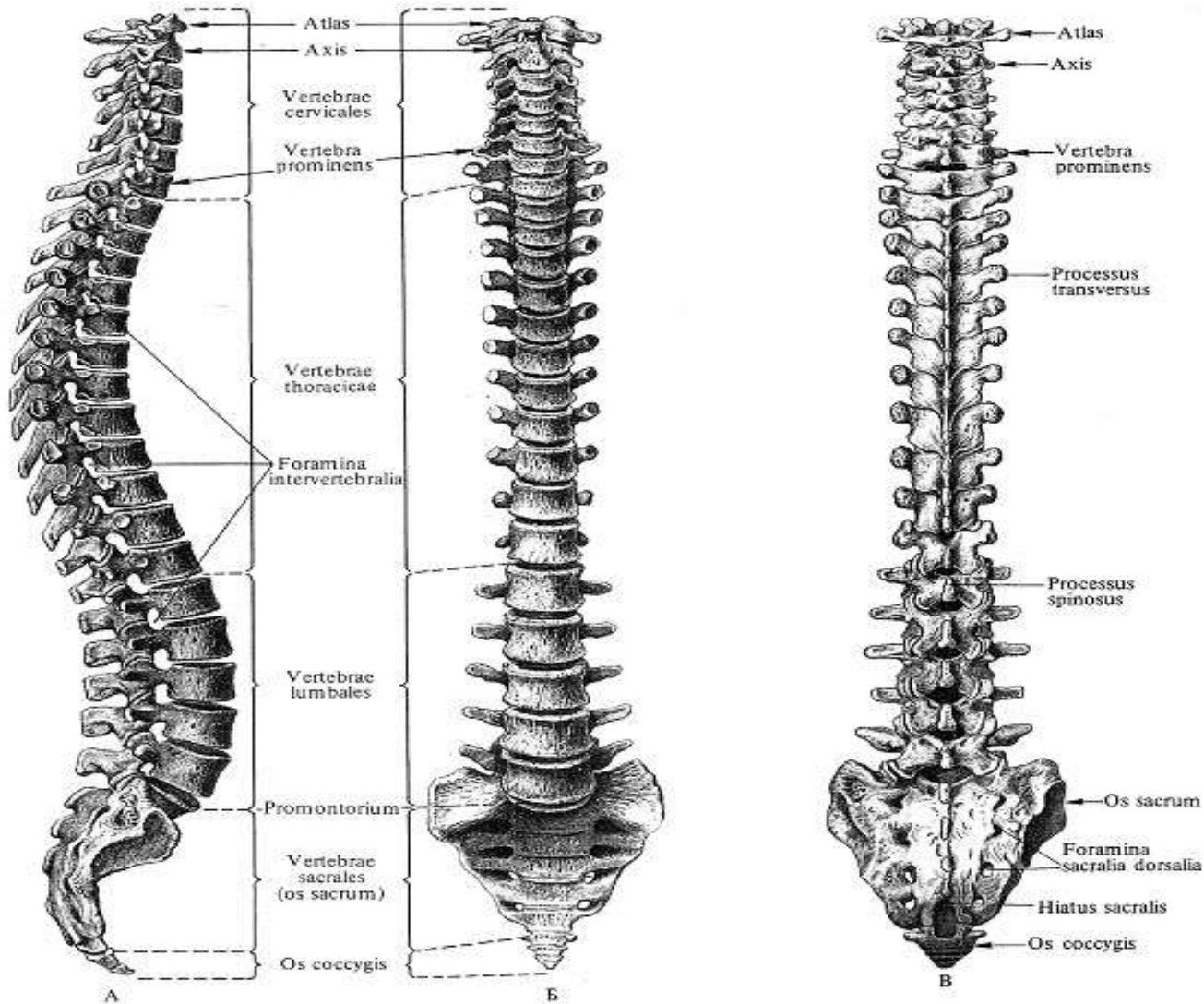


# Managementul anesteziei perioperator în corecția chirurgicală a scoliozelor

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# Generalități



# Definition

Scoliosis is a complex deformity of the spine resulting in lateral curvature and rotation of the vertebrae, as well as a deformity of the rib cage.

There is usually a secondary involvement of the respiratory, cardiovascular and neurologic systems.



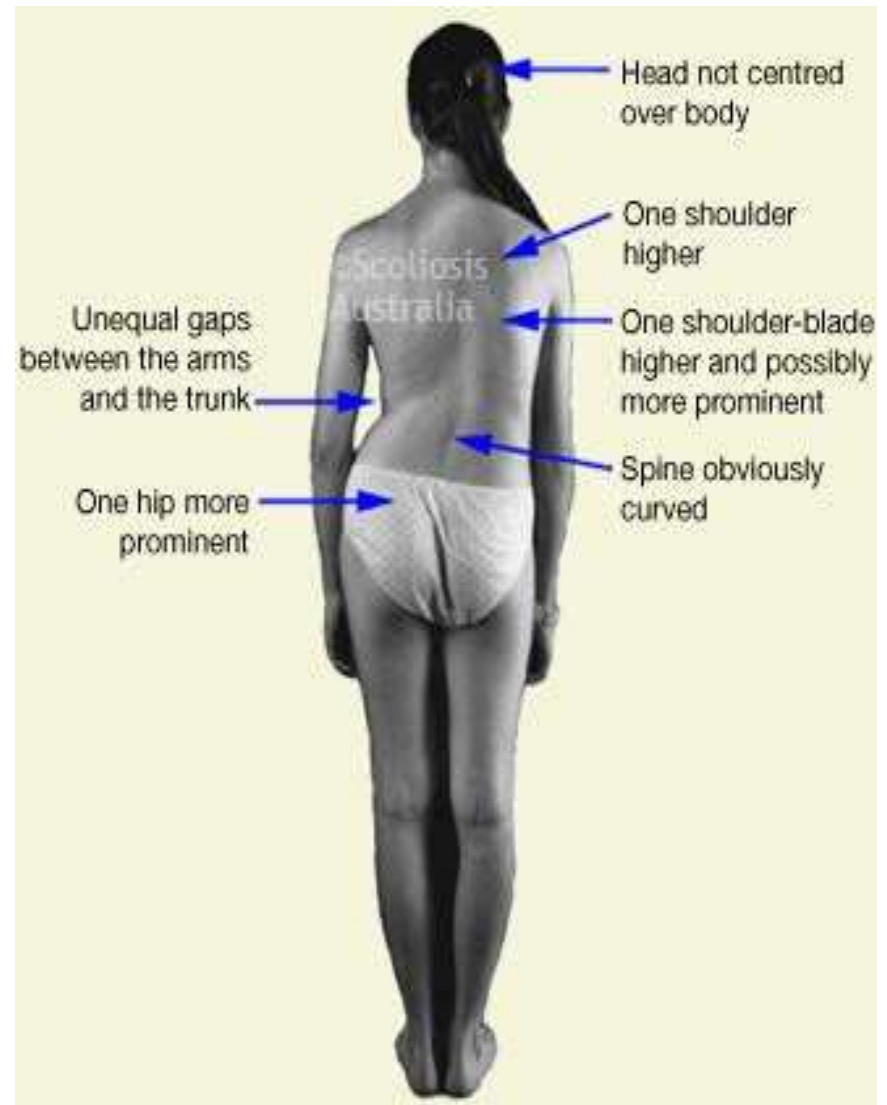
# Etiology and classifications of structural scoliosis

1.	Idiopathic (genetic) scoliosis (approximately 70% of all cases of scoliosis; classified by age of onset)
2.	Congenital scoliosis (probably not genetic) Vertebral Open- with posterior spinal defect With neurologic deficit (e.g., myelomeningocele) Closed- no posterior element defect With neurological deficit (e.g., diastematomyelia with spina bifida) Without neurological deficit (e.g., hemivertebra, unilateral unsegmented bar) Extravertebral (e.g., congenital rib fusions)
3.	Neuromuscular scoliosis Neuropathic forms Lower motor neuron disease (e.g., poliomyelitis) Upper motor neuron disease (e.g., cerebral palsy) Others (e.g., syringomyelia) Myopathic forms Progressive (e.g., muscular dystrophy) Static (e.g., amyotonia congenita) Others (e.g., Friedrich's ataxia, unilateral amalia)
4.	Neurofibromatosis (Von Recklinghausen's disease)
5.	Mesenchymal disorders Congenital (e.g., Marfan's syndrome, Morquio's disease, amyoplasia congenita, various types of dwarfism) Acquired (e.g., rheumatoid arthritis, Still's disease) Others (e.g., Scheurmann's disease, osteogenesis imperfecta)
6.	Trauma Vertebral (e.g., fracture, irradiation, surgery) Extravertebral (e.g., burns, thoracic surgery)



# Signs and symptoms

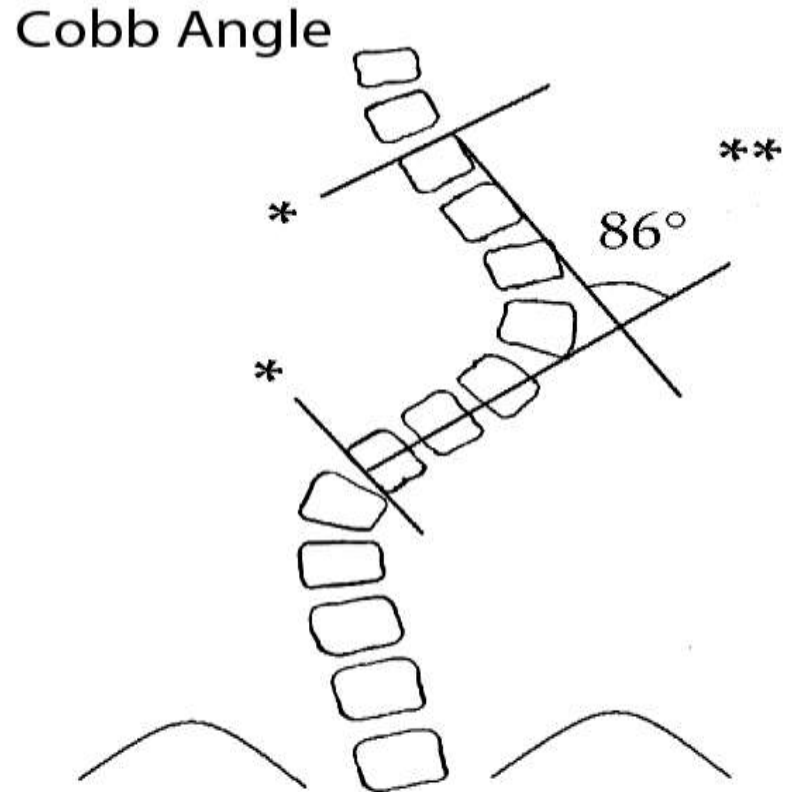
- Back pain
- Leg length discrepancy
- Abnormal gait
- Uneven hips or waist
- One shoulder higher than other
- Prominent shoulder blade.
- Appearance of leaning to one side
- Increased space between the body and the elbow while standing in natural posture.
- Chest/rib prominence.



# Assessment of severity

## Cobb's angle

- To measure coronal plane deformity on antero-posterior plane radiographs in the classification of scoliosis
- Determining severity of disease



\*Both lines are drawn along the end of the vertebrae that are most tilted from the horizontal.

\*\* The Cobb angle is the angle formed by the intersection of these two lines.

# Cobb' s angle

- $< 10^\circ$  : normal curvature
- $> 25^\circ$  : ECHO evidence of increased pulmonary artery pressure
- $> 40^\circ$  : surgical intervention required
- $> 65^\circ$  : restrictive lung disease
- $> 100^\circ$  : dyspnea on effort
- $> 120^\circ$  : alveolar hypoventilation

# Effects of scoliosis on various organ systems

Respiratory system

Cardiovascular system





# Respiratory system

## Abnormalities in PFTs

- Restrictive pattern is seen -  $\downarrow\downarrow$  vital capacity (60-80% of predicted)
- $\downarrow$  TLC,  $\downarrow$  FRC,  $\downarrow$  IC,  $\downarrow$  ERV.
- FEV1/FVC remains normal
- During exercise the ventilation is adequate but there is  $\downarrow$  TV and  $\uparrow$  RR the maximum work capacity decreases.

# Cardiovascular system

- May be associated with ↑pulmonary vascular resistance and pulmonary hypertension.
- May result in Right ventricular Hypertrophy and Right ventricular failure.
- **Cause-** hypoxemia → pulmonary vasoconstriction → ↑Pulmonary vascular resistance (**PVR**) → ↑ **PULMONARY ARTERY (PA)** pressure.
- Chronic hypoxemia → Pulmonary Arterial Hypertension.
- A/w with mitral valve prolapse. Antibiotic prophylaxis before catheterization & laryngoscopy

# Treatment

- Surgical intervention occurs when the curve magnitude estimated by the Cobb method is more than 40 degrees
- Posterior correction
- Anterior correction
- Combined anterior & posterior

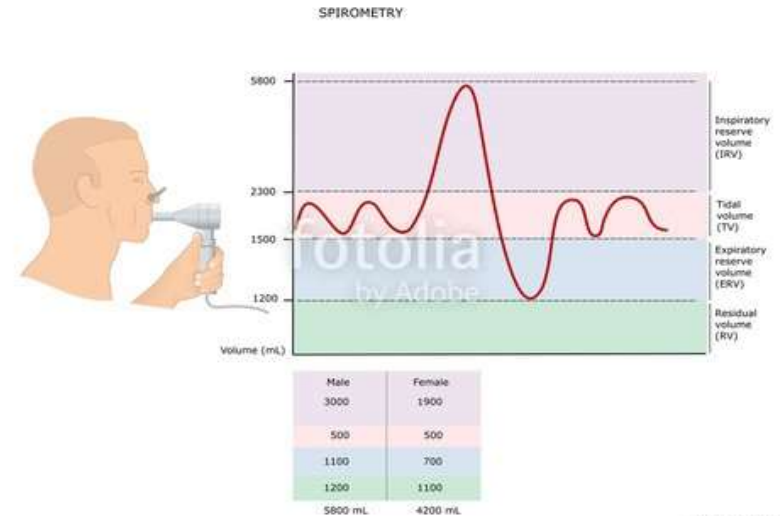


# Physical examination

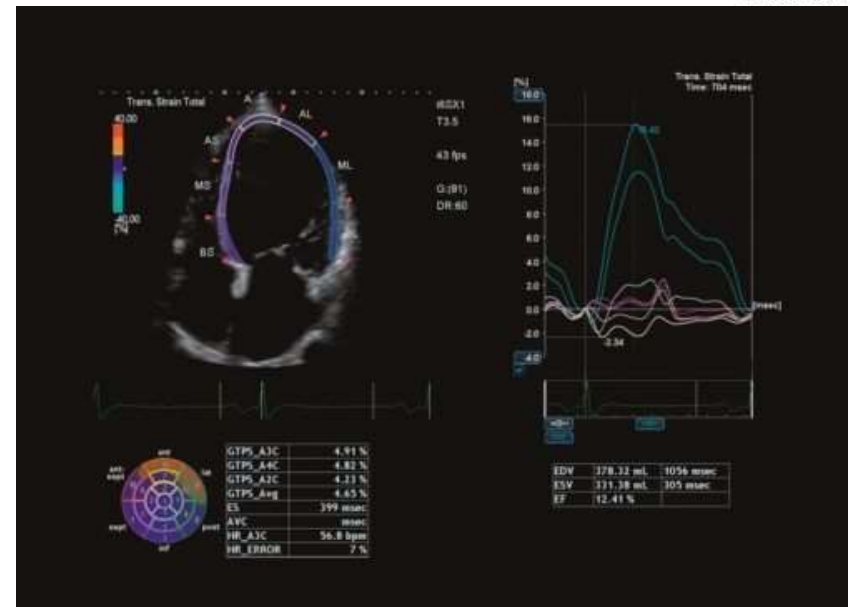
- Auscultation of lungs for any wheeze (obstructive or parenchymal lung disease)
- Heart-signs of PAH (loud P2) and signs of RVH (engorged veins, hepatomegaly, edema) Skin-café au lait spots in NF
- Neurological assessment-pt with pre existing neurological deficit are at ↑risk of spinal cord injury during surg. Also documentation of pre or neurological status is important.

# Preoperative preparation

- Mandatory laboratory investigations
- Spirometry (Pulmonologist consultation)
- Cardiologist consultation (ECHO)
- Neurologist consultation



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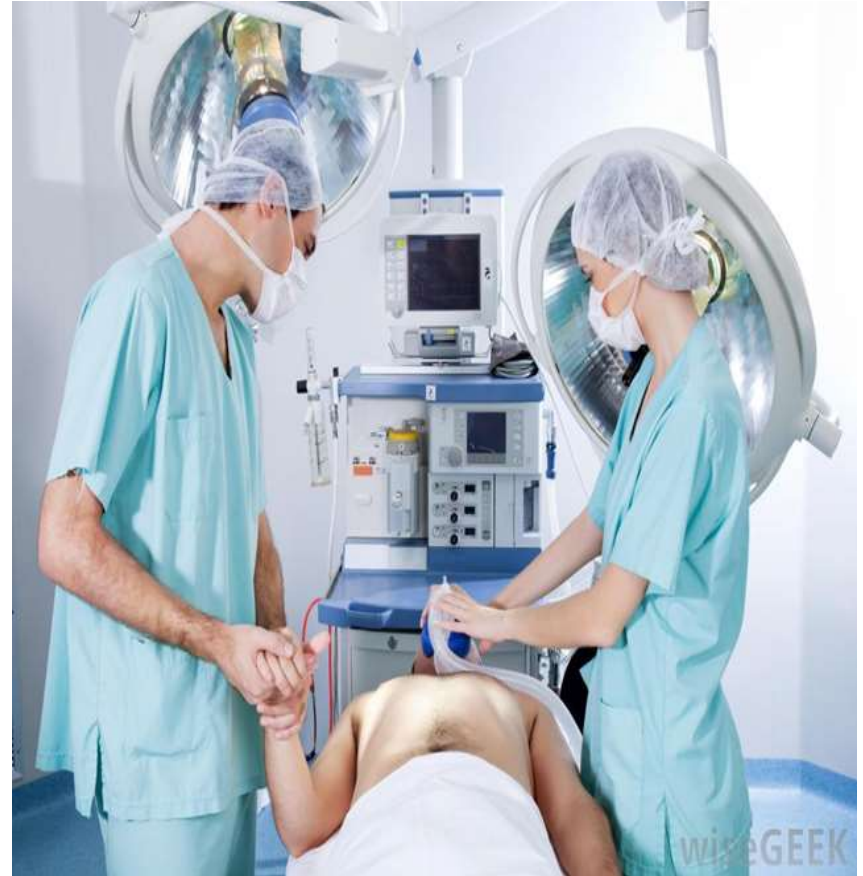
# Doctor's round and Pre-anesthetic preparation

- Evaluation of the patient
- Risks of anesthesia
- Informed consent
- Psychological preparation of the patient
- Detailed explanation of the ortopedic surgery



# Preanesthesia premedication

- Premedication in the ward, with sedative and anxiolytic purpose.
- Preanesthesia follows as well anxiolysis, when sedation decreases intraoperator drug quantity.



# Preparation for difficult airway



# Intraoperative concerns

- Blood loss & replacement
- Hypothermia
- Duration of the intervention
- Prone position complications
- Lung isolation
- Spinal cord injury - monitoring (Wake up test & evoked potentials)
- Venous air embolism

Usually associated with large blood losses 15 to 20 ml/kg

- Factors

- Surgical technique
- Operative time
- Number of vertebral levels fused
- Anaesthetics
- Mean arterial blood pressure
- Platelet abnormalities
- Dilutional coagulopathy
- Primary fibrinolysis





# Preoperative autologous blood donation

- Hb > 11g%, HCT > 33%
- No age / weight limits
- Donate 10-15% of blood volume
- 2 donations (1/week)
- Last donation no less than 72 hours before surgery
- Started 1 month before oral Fe / Erythropoietin supplementation



# Deliberate controlled hypotensive anesthesia

Young healthy patient - mean arterial pressure of 50 to 60 mm Hg

- Adult patient with cardiovascular disease : higher pressures

pressures

- Pre requisites : invasive BP & urine output,
- Techniques:

- high dose inhalational agent
- B adrenergic blockers: esmolol, labetalol
- $\alpha_2$  agonist: dexmetomidine

concern-  $\downarrow$  SC blood flow -  $\uparrow$  chance of Spinal Cord injury

**Tranexamic acid (TXA)** 10 - 12 mg/kg/h



# Hypothermia

- Long duration of surgery
- Transfusion of blood & blood products

## Hazards

- Impaired coagulation
- Wound infection
- Delayed recovery
- Acid/base changes

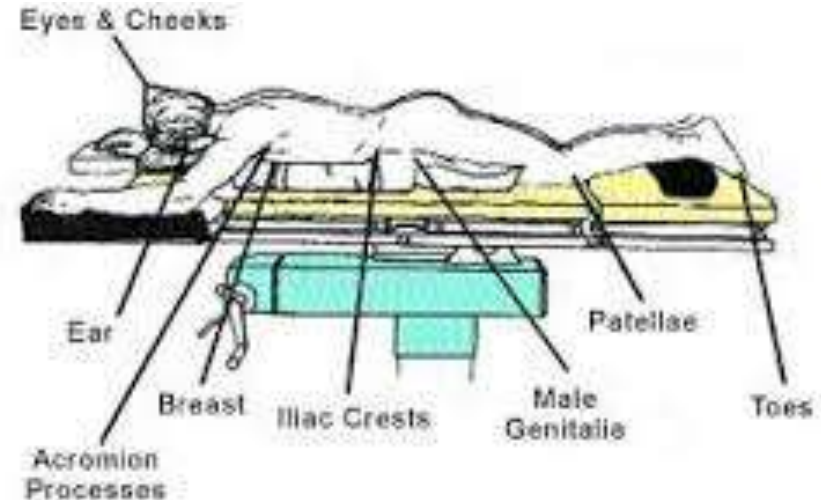
## Prevention

- Monitoring, warm fluids, warming blankets, warm irrigation solutions



# Positioning

- Arms are abducted less than 90 degrees whenever possible (prone “superman” position)
- Pressure points are padded
- Soft head pillow has cut outs for eyes and nose and a slot to permit endotracheal tube exit
- Chest and abdomen are supported away from the bed minimize abdominal pressure and preserve pulmonary compliance
- Eyes checked frequently
- Elastic stockings and active compression devices > lower extremities > minimize pooling of the blood





# Intraoperative Management

Horseshoe shaped adapter

Superior access to airway & visualization of eyes





# Causes of neurological injury

- Direct injury due to instruments
- Spinal cord distraction
- Hypotension
- Ischemic (loss of blood supply)

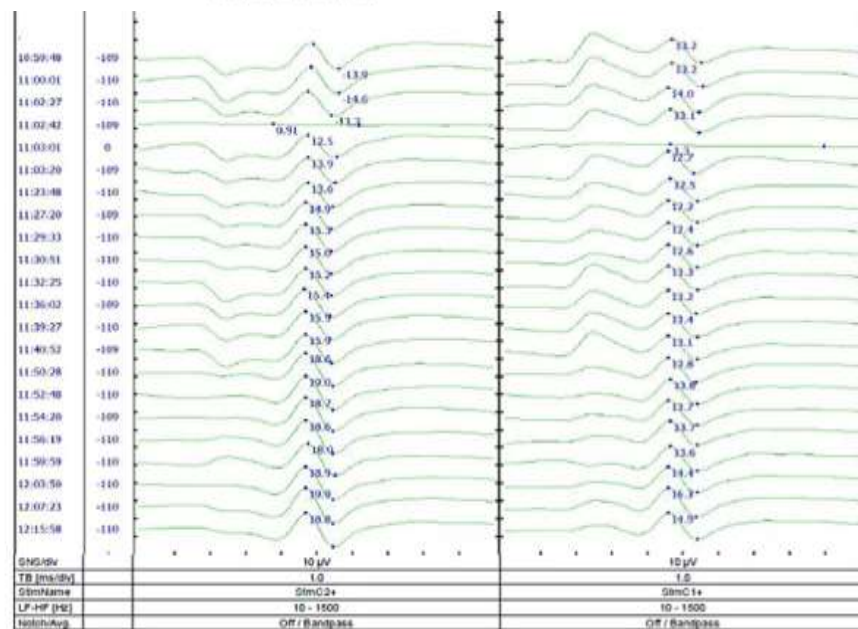
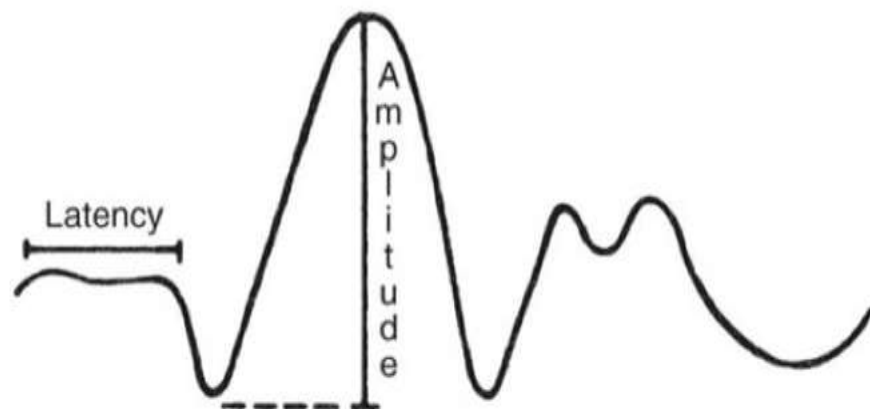


# Spinal cord monitoring

- Wake up test - Gold standard
- Somatosensory evoked potentials(SSEPs) - evaluate posterior/sensory portion of the cord
- Motor evoked potentials(MEPs) & electromyograms - Integrity of anterior motor spinal cord

# Wake up test, SSEP and MEP Monitoring

- Explaining procedure prior to surgery
- Repeat/enact before induction
- Switch off inhalation & MR
- Maintain on opioid
- First asked to grip hand, then move leg
- Preparation to restrain any unwanted movement
- SSEP and MEP Monitoring



# Postoperatively

Pain management  
Pulmonary function  
Post op ventilation  
Hypothermia  
Bleeding & coagulation  
abnormalities



# Pain management (multimodal analgesia)

- Parental opioid (48 hours) continuous infusion/iv - Patient-controlled analgesia (PCA)
- NSAIDs opioid sparing effect



Epidural infusion  
Local anaesthetic + opioid  
infusion



# Optimisation of pulmonary status

- Incentive spirometry
- Coughing and deep breathing should be encouraged
- Bronchodilators therapy if reactive airway disease also present
- Adequate analgesia

## Predictors of post op ventilation - Patient factors

### ◦ Severe restrictive lung disease

Vital capacity < 35%

PEMAX > + 40cm H<sub>2</sub>O

PaCO<sub>2</sub> > 50 mm Hg

Pre existing neuromuscular disease

Obesity

### Surgical factors

◦ Blood loss > 30 ml/kg

Pimax > -40cm H<sub>2</sub>O

PaO<sub>2</sub> < 60 mmHg

Right ventricular failure

Congenital heart disease

◦ Surgical invasion to thoracic cavity



# Conclusion

- In Scoliosis there is involvement of various organ systems.
- Anaesthesia is often needed for corrective orthopedic surgery.
- A detailed preanaesthetic assessment and optimization of the respiratory and cardiovascular systems is important.
- Intraoperative considerations are monitoring, temperature and fluid balance maintenance, positioning, spinal cord integrity monitoring and blood conservation.
- Post operative concerns - intensive care, respiratory care and pain therapy

# MULȚUMESC PENTRU ATENȚIE

