Premedication and complications of anesthesia
1. Anamnesis
   - previous anesthesias
   - previous diseases
   - family history
   - medication
   - smoking
   - alcohol
   - allergy
Preoperative assessment II.

2. Routine physical dx

3. Special tests
   - urine
   - blood cell count, Hgb
   - chemical (ions, enzymes, etc.)
   - chest X-ray, ultrasound
   - ECG
   - lung function tests
   - hemostasis
4. Risk stratification

- ASA classification: I-IV
- Assessing intubation difficulties (Mallampati score)
- Goldman index (risk stratification for patients suffering from heart disease and undergoing non-cardiac surgery)
- BMI
- Infections
Goals of premedication

- Decreasing anxiety
- Decreasing secretion
- Potentiation of hypnotic effect of anesthetics.
- Decreasing PONV
- Amnesia
- Decreasing gastric volume
- And its pH
- Decreasing vagal reflexes
- Decreasing sympatho-adrenal reflexes
Decreasing anxiety

• Detailed information about the procedure and risks

• Psychotherapy

• Anxiolytic
Decreasing secretion

• It was of importance before (aether-narcosis)
• New drugs usually do not increase secretion

Should atropin be used for this purpose?
Sedation

- Sedative ≠ anxiolythic
- Sedative should be used for premedication purposes only in child anesthesia.
Decreasing PONV

• Most frequent cause is opioid use

• May be prevented by additional oxygen

• Antiemetic
Amnesia

- Sometimes it is really useful (especially in child anesthesia)
- Benzodiazepines
- Propofol
• Gastic emptying: metoclopramide

• Decreasing gastric content pH: H$_2$-receptor blocker, omeprazol
Decreasing vagal reflexes - anticholinergic drugs

- Traction of orbital muscles
- Repeated use of succinyl choline
- Induction with halothane, especially in children
- Use of propofol in patients with low heart frequency.
Decreasing sympathico-adreanal responses

• Avoidable:
  – HT
  – IHD

Characteristic time point: intubation

• Beta-blocker or clonidine
Benzodiazepines

- Long-term
- Medium-term
- Short-term effect
Butyrophenons (droperidol)

- Neuroleptic
- alfa-receptor blocker
- Antiemetic
- Long-term duration, delayed awakening
Fenotiazines

- Central antiemetic
- Sedative
- Anxiolytic
- H2-receptor antagonist
- Alfa-adrenerg antagonist
- Anticholinergic
- Potentiating opioid effect
- Side effect: extrapyramidal movements, tachycardia, hypertonia (postop.)
Anticholinergic drugs-effects

• Decreasing salivation

• Potentiation of sedative and amnetic effect (especially if used in combination with Mo)

• Prevention and treatment of reflex bradycardia
Anticholinergic drugs-side effects

- CNS toxicity: agitation
- Lower esophageal sphincter tone decreases: GER
- Tachycardia
- Mydriasis
- Fever
- Physiological deadspace increases
- Mucous membrane dryness
Other drugs used in premedication

- Thrombosis prophylaxis
- Antibiotics (single-shot)
- Treatment of underlying illnesses (DM, hypertension, epilepsy, etc.)
Complications of anesthesia

• In 9% of the patients at least 1 of them
• Increase in risk:
  – Duration of surgery
  – Age
  – Urgent surgery
Most frequents are:

- Cardiac arrhythmias
- Hypotension
- Drug side effects
- Improper mechanical ventilation
Cardiovascular complications I.

- **Bradycardia:**
  - **Cause:**
    - Drug side effect
    - Surgical manipulation
    - Hypotermia
    - Metabolic disturbances
  - **Treatment:** atropin, catecholamins

- **Tachycardia**
  - **Cause:**
    - improper anesthesia or analgesia
    - hypoxia, hypercapnia,
    - hypovolaemia
  - **Treatment:** treat the cause!
Arrhythmias

• Most frequent causes:
  – *Cardio-respiratory*: hypoxia, hypotension, hypo-hypercapnia, myocardial ischemia
  – *Metabolic*: catecholamine-effect, hypo-and hyperkalemia, malignant hyperthermia
  – *Surgical*: Increase of vagal tone, direct cardiac stimulation, dental surgery
  – *Drugs*: vagolythic, sympathomimetics, halothane, enflurane, digoxin
Hypotension

- MAP= below 60 mmHg
- If decrease of systolic BP reaches 25% (especially in previous HT)
- In coronary artery diseases diastolic BP is important (coronary perfusion)
Causes of hypotension

• Cardiorespiratory:
  – Hypovolemia: improper preoperative fluid load, gastrointestinal fluid loss, bleeding
  – Obstruction: embolia, aorto-caval compression, pericardial tamponade
  – Rise in intrathoracal pressure: IPPV/PEEP, PTX
Causes of hypotension 2.

- **Myocardial**
  - Decreased contractility: drug effect, acidosis, ischemia, AMI
  - Arrhythmia
  - Pericardial tamponade

- **Drugs:**
  - Absolute or relative overdose
  - central regional block
  - Allergic reaction (drug, colloid, blood)
  - direct histamine release
Frequent causes of hypovolemia

• Preoperative:
  – bleeding: trauma, gynecological, gastrointestinal, rupture of large vessels
  – Gastrointestinal: vomiting, fistulas, diarrhoea
  – Other: diuretic, fever, burn

• Intraoperative:
  – bleeding,
  – Insensible perspiration,
  – Drainage of bowel, ascites
  – Loose to the 3rd space.
Causes of hypertension

- Previous hypertension
  - Not known
  - Pregnancy-induced
  - Stopping antihypertensive treatment

- Increased sympathetic tone
  - Improper analgesia
  - Improper depth of anesthesia
  - Airway manipulation
  - Hypercapnia

- Drug-overdose:
  - epinephrin
  - ephedrin
  - Ketamin

- Other: hypervolemia, aortic clamp, pheochromocytoma, malignant hyperthermia
Myocardial ischemia

- Myocardial oxygen consumption is higher than available amount of O2.
  - Hypertension: increases afterload: oxygen consumption increases
  - Hypotension: decreases oxygen consumption
  - Tachycardia (most important): decreases diastolic filling time + increases myocardial O2 consumption
Emboli

• Gas

• Thrombi
Gas embolism

- **Head-neck surgery:**
  - ENT: sinus, mastoidal surgery
  - Neurosurgery: sitting position, posterior fossa.

- **Insufflation techniques:**
  - laryngoscopy
  - hysteroscopy
  - arthroscopy
  - thoracoscopy

- **Orthopedics:**
  - arthrography
  - TEP surgery

- **Thoracic surgery**
- **Other:** intravenous cannulas, epidural injection
Thromboembolism

- Immobility
- Malignancy
- Smoking
- Trauma
- Pelvic and extremity-surgery
- Oral contraceptives
- Thromboembolism in previous history
Thromboembolism-risk stratification

- **Low risk:**
  - Surgery shorter than 30 min.
  - No risk factor
  - Younger than 40

- **Medium risk:**
  - Surgery longer than 30 min.
  - At least 1 risk factor
  - Age above 40

- **High risk:** all other
Respiratory complications

- Hypoxemia
- Hypercapnia
- Hypocapnia
- Airway obstruction, laryngospasm, bronchospasm
- PTX
- Intubation complications
- Aspiration of the gastric contents
Causes of hypoxemia

- **Low FiO2 of the inspired gas**
  - Improper oxygen supply
  - Flowmeter problem
  - Breathing circuit problem

- **Hypoventilation**
  - Problem with the respirator (failure, improperly set MV)
  - Breathing circuit blocked or leakaged
  - Tracheatube (blocked, oesophageal intubation)

- **Ventilation-perfusion insufficiency**
  - Patient:
    - Ventilation failure: endobronchial intubation, increased secretion, atelectasis, PTX, bronchospasm, aspiration, pulmonary edema
    - Perfusion disturbance: embolisation, low CO
  - Other: methemoglobinemia, malignant hyperthermia
Hypercapnia

- **Causes:** improper CO$_2$ elimination, or increased production

- **Elimination failure:**
  - Hypoventilation
  - Improper fresh gas flow
  - Increased alveolar dead space
  - Exhausted absorbent soda lime

- **Increased production:**
  - fever
  - sepsis
  - malignant hyperthermia
  - hyperthyreosis
  - shivering
Hypocapnia

- Caused usually by hyperventilation
- Consequences:
  - hypokalemia
  - Decreased CBF and ICP
  - Decrease in CO
Obstruction of the airways-causes

- **Equipment causes:**
  - Breathing circuit: valve failure, block
  - Tracheatube: compression, luminal closure, cuff herniation, esophageal or endobronchial intubation

- **Patient-related:**
  - oropharynx: tissue, secretum, edema, tumor
  - trachea: tracheobronchitis, compression (surgical intervention, bleeding, thyroid gland), stricture
  - bronchi: secretum, bronchospasm, tumor, surgical manipulation
Laryngospasm

• **Occurrence:**
  – During intubation (most frequent)
  – Incision, surgical manipulation (sign of improper anesthetic depth)

• **Predisposing factors:**
  – Depth of anesthesia is not sufficient at the time of laryngoscopy and intubation
  – Secretum or blood within the pharynx
  – Irritative inhalational agent
  – Administration of barbiturates
Bronchospasm

• **Predisposing factors:**
  – Atopic constitution (blond, white skin)
  – asthma
  – Airway infection
  – Smoking

• **Other evoking factors:**
  – Improper depth of anesthesia during intubation
  – Administration of beta-blockers
  – Drugs inducing histamine-release
Pneumothorax: causes during narcosis

- **Traumatic**: chest injury

- **Iatrogenic**: subclavian-jugular cannulation, brachial plexus block, intercostal block, neck-thorax surgery, barotrauma

- **Spontaneous**: bullas, emphysema, asthma
Warning signs of PTX during narcosis

- Unexpected tachycardia
- Hypotension
- Cyanosis
- Mechanical ventilation is handared or possible on high pressures only.
Intubation problems

- Endobronchial intubation
- Esophageal intubation
- Difficult intubation
Frequent causes of difficult intubation 1.

- **Aneshtetist-related**
  - Appropriate preoperative assessment missing
  - Improper preparation to intubation
  - Unexperienced
  - Wrong technique used

- **Equipment**
  - Does not work
  - Not available (intubation bronchoscop)
  - No trained assistant available.
Frequent causes of difficult intubation 2.

- **Patient-related:**
  - **Congenital:** Down, achondroplasia, micrognathy,
  - **Acquired:**
    - Jaw movement is restricted: trauma, fibrosis, rheumatoid arthritis, spondylosis ankylopoetica, tumor
    - Cervical movements restricted: cervical spondylosis, fracture, Bechterew, etc.
    - Airways: edema, abscess, compression, stricture, tumor, foreign body, laryngeal nerve lesion
    - Other: obesity, gravidity, acromegaly
Factors predisposing to difficult intubation

- Short neck
- Irregular position of the teeths
- High palatal arch
- Restricted mobility of the jaw
- Micrognathy
- Short atlanto-occipital distance
Aspiration of the gastric content

- Intraabdominal diseases causing decreased motility and gastric emptying
- Decreased laryngeal reflexes: elderly, sedated
- Difficult intubation
- Urgent surgery
- Gravidity
Hiccup

- Intravenous induction: ethomidate, metohexital
- Vagal stimulation, if depth of anesthesia is insufficient
- Prevention: atropin
- Treatment: deeper anesthesia, metoclopramide
CNS

- Insufficient depth of anesthesia
- Perioperative ischemia
What is depth of anesthesia?

• **Pain:** measurement is very subjective even in an awake patient
• **Level of consciousness, reaction ability, recall:** higher cortical function
• **Autonomic reactions:** breathing, BP, pulse, sweating
Memory, recall

• Able to recall the phases of anesthesia
• Able to react to commands without being able to remember thereafter
• Recall is only possible in hypnosis
The recall is dependent on

- Type of anesthesia, dose administered, combinations
- Intraoperative stimulus:
  - Surgical
  - Verbal (splendid or bad)
  - Visual
- Psychic constitution
Intraoperative cerebral ischemia

• **Forms:**
  – Minimal, focal deficit
  – Stroke
  – Diffus cortical damage

• **Causes:**
  – hypotonia
  – Intraoperative bleeding (rare)
Temperature alterations during anesthesia

- Hypothermia (core temperature: below 36 ºC)

- Hyperthermia (above 37.5 ºC or the increase is >2 ºC /h)
Causes hypothermia

• **Decreased heat production:**
  – Effect of anesthetics on hypothalamus
  – Anesthetics decreases metabolic rate
  – Anesthetics decreases shivering

• **Decreased heat loss:**
  – Vasodilatation
  – Low environmental temperature (air conditioning)
  – Exporative heat loss: mechanical ventilation, sweating, open cavities (especially abdominal and thoracic)
Consequences of hypothermia

- Metabolic rate decreases (1 °C -10%)
- CO decreases
- Affinity of Hgb to oxygen increases - tissue oxygenation decreases
- Severe hypothermia:
  - metabolic acidosis,
  - oliguria,
  - haemostasis disturbance (increased blood loss),
  - decreased elimination of drugs (prolonged effect)
- Postoperative shivering increases: oxygen consumption increases, myocardial work increases
Hyperthermia

• **Causes:**
  – Sepsis
  – Drug effects
  – Excessive catecholamine-release
  – Thyroid hormones
  – Malignant hyperthermia

• **Consequences:**
  – CO increases
  – Oxygen demand increases
  – Minute ventilation increases
  – Acidosis

• **Treatment:** cooling (surface and intravenous fluid)
Complications related to anesthetic medication

- Hypersensitivity-allergic reaction
- Idiosynchrasy
- Interactions
- Other:
  - Improperly chosen drug
  - Improper dosage
  - Unexpected side effects
Physical injuries

- Peripheral nerve damage
- Damage of teeths
- Corneal drying
- Heat and electrical damage: contact failure, electrical cauter, heating devices
- Compressions
Side effects related to device

- Breathing circuit
- Vaporizer
- Soda lime
- Monitors
- BP measurement cuff
- Infusion pumps and perfusors