Editing file

Patient Safety

Objectives:

- Risk and complication of anesthesia.
- How to implement anesthesia safety in operation rooms.
- Error related to complication.
- Factors threatening patient safety in the operation rooms.
- General safety strategies.
- Quality assurance.
- Crucial errors to know and avoid.
- Postoperative pain management.
- Hypothermia sequences.

Color index:

- Red: important /
- Black: content slides
- Gray: extra
- Green: dr. Notes

IMPORTANT

Anesthesia 438 teamwork

Anesthesiology

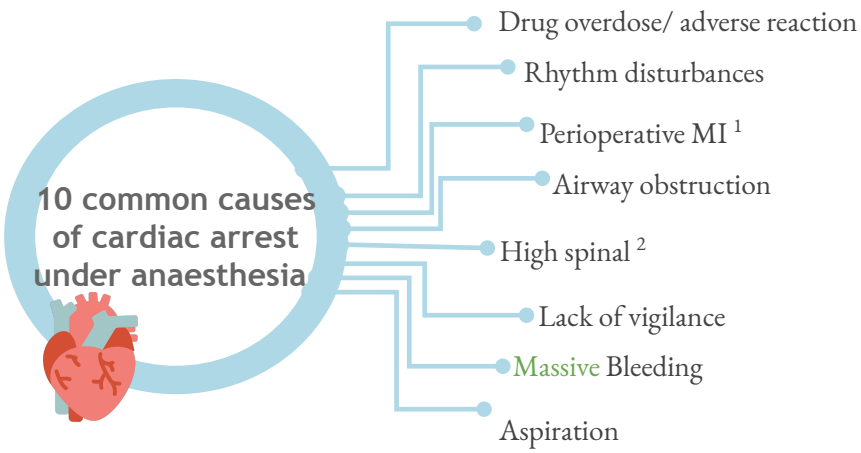
is a high-risk specialty as compared with other specialties in medicine, so you should always be prepared for complications and have plan A, plan B, and plan C ready.

Risk of anesthesia

- Anesthesia may contribute to death in about 1 per 10,000 , to 1 per 200.000 anesthetics
- Some patients suffer serious and costly nonfatal injuries such as permanent neurologic damage (paraplegia and vegetative state)

Complications of anesthesia

Major Complications	Minor complications
– Cardiac arrest if the patient has bradycardia don't induce anesthesia before you make sure you got everything covered – Perioperative MI take very careful preoperative assessment when hx of MI – Aspiration patients fasting 6-8 hours before anesthesia. Do rapid sequence induction in patients with full abdomen (preoxygenate for 3 mins > IV anesthesia > cricoid pressure > muscle relaxant > wait 15 seconds > insert ETT > inflate cuff) – Anaphylaxis perioperatively: check for drug allergies. Intraoperative:stop any medication given if there is bradycardia or hypertension (sometimes hypotension) give epinephrine and antihistamine. – Drug overdose. – Convulsion happens in induction & recovery. So u have to expect it in pt with epilepsy & give them midazolam & mild analgesic agent before they're shifting to recovery room. – Nerve palsy during positioning of the patient. – Organ injury. Avoid hypotension and hypoxia. Any patient with tendency of bleeding have to be checked – Malignant hyperthermia.	– Post-operative nausea, vomiting fasting & antiemetic medication. In the preop assessment we ask the pt if he had problems with N/V in prev surgeries and if yes we should give multimodal antiemetic + hydrate pt + and avoid medications causing N/V like morphine. - Sore throat with multiple attempts of endotracheal intubation – Hemodynamic instability in patients with comorbidities we have to titrate medications and keep vasopressors ready – Pneumonia. Due to aspiration – Delirium in case of elderly advice regional than general anesthesia – Shivering warm the pt properly using fluid warmers, blankets, etc. –Cognitive Defect



1- Specially if the Pt has perioperative hypotension, hypovolemia, anemia, tachycardia, hypoxia
2- Effect cardiac and respiratory centres > causing bradycardia or respiratory arrest, especially with obstetric & cesarean section

How to implement anesthesia safety in OR ?

Standardization
drug dosage, dosing units, concentration, drugs preparation methods workplace design.

Technology [1]
drug identification and delivery system, utilization automated information system

Pharmacy
dedicate pharmacy resource to the OR.[2]

Culture
speak out! recognize and report the errors, learn from adverse events

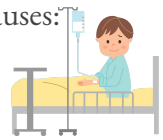
Factors threatening patient safety in the operation rooms

Equipment causes:

- Design flaw
- User error
- Malfunction

strategies : Pre-use checkout

Patient underlying disease causes:



- Hyperthyroidism-thyroid storm [3], diabetes-ketoacidosis, hyperosmolar coma [4]
- Allergic reaction to some drugs

strategies : Preoperative evaluation

Anesthetist causes

Pre anesthesia check

Check patient risk factor: ASA 1,2,3,4,5, e in case of emergency.

01 Airway assessment. [5]

02 Aspiration risk.

03 Allergies.

04 Abnormal investigation.

05 Comorbidity.

06 Medication.

07 Formulate anesthesia plan.

1- Check machine safety features
2- Specially for routine medications
3- You should update yourself with signs, symptoms and management of thyroid storm
4- We have to optimize patients situation before they get in.
5- Predict anticipated Difficult intubation and aspiration risk

Anesthesia accidents

Causes of Accidents

There is rarely a single cause for an accident

System error [1]

- System failures are the main reason for accidents:
  - check anesthetic machine
  - oxygen supply
  - A backup O2 tank mandatory.
  - Never shut down audible alarms
- Emergency ventilation equipment

Equipment failure

Limitation of therapeutic standard

Limitation of available resources

Human error [2]

- Human error contributes to 70 – 80 % of anesthetic incidents
- Human error may involve:
  - Misjudgments
  - Failure to check equipment's
  - Fault with technique [3]
  - Communication problem [4]

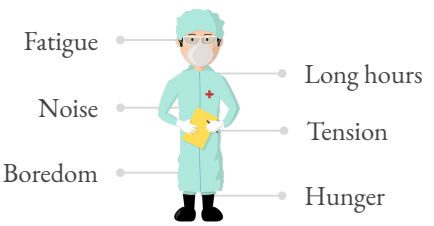
Limitation of supervision

Communication error

Technical accident

Human error (anesthesia and surgeon)

- Anesthetist and Surgeon Human factors affecting performance such as:



- Human error is a strong contributor
  - Deviations from accepted anesthesia practices.
  - A lapse in vigilance and no attention to details.
  - Vigilance lets anesthetists find abnormal signs as early as possible.
  - Vigilance allows the anesthetist to remain aware of surrounding events and signals while performing other tasks.[5]
  - Vigilance lets anesthetist find abnormal sign as early as possible.

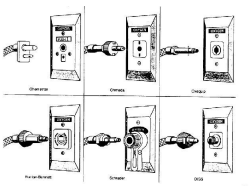
1- We have to improve the system
2- We have to improve the training and education
3- For example if the patient has full stomach you have to use rapid sequence induction technique
4- Most common human cause
5- You administer anesthetics and hear changes in the sounds and monitor the Pt at the same time. You shouldn't stay away from the anesthesia machine or the Pt. Also, you should have direct communication with the surgeon

Safety features in anesthesia machine

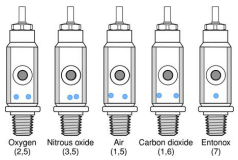
Flowmeters

- Flow delivered through the anesthetic machine is displayed by a bobbin [1] within a rotameter to allow accurate gas delivery Hypoxic guard [2]
- The O2 and N2O control knobs are linked, preventing <25% O2 being delivered when N2O is used.
- Oxygen is delivered distal to N2O within the rotameter, preventing hypoxic gas delivery if the O2 rotameter is faulty or cracked.

Diameter index safety system [3]

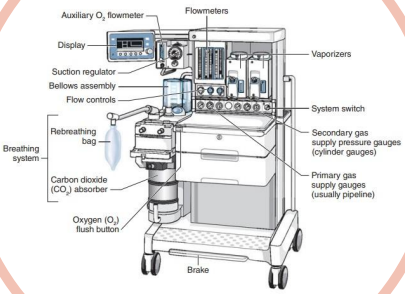


Pin index safety system [4]



Suction

Suction: adjustable negative-pressure- generated suction is used to clear airway secretions/vomit and must be available for all cases.

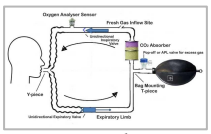


Emergency oxygen flush [5]

when pressed, oxygen bypasses the back bar and is delivered to the CGO (common gas outlet) at >35 L/min

Ventilator alarms

Scavenging system



- Scavenging of vented anaesthetic gases is active, passive or a combination.
- Scavenged gases are usually vented to the atmosphere.
- Scavenging tubing has a wider bore (30mm), preventing accidental connection to breathing circuits

Alarm	Definition	Potential cause
High pressure	Pressure required to ventilate exceeds preset pressure	Pneumothorax, excessive secretions, decreased lung compliance
Low pressure	Resistance to inspiratory flow is less than preset pressure	Disconnected from ventilator, break in circuit [6]
Low exhaled pressure	Exhaled tidal volume drops below preset amount	Leak in system, increased airway resistance, decreased lung compliance or ETT cuff is not inflated
Rate / apnea	Respiratory **rate** drops below presto pressure level. **Apnea** period exceed set time	Client fatigue, decreased RR due to medication
FIO2	Indicate FIO2 drift from prest range	Change in level of consciousness, disconnected from O2 source, break in circuit

1- Bobbin is a small ball that move and rotate when you turn on the gasses
2- e.g. if you turn on nitrous oxide, oxygen will turn on automatically with it so that we don't deliver hypoxic flow
3- Connecting the role gases into the anesthesia machine (central line)
4- Connecting role gases to the cylinder. Each gas has a unique inlet so you can't miss and connect a different gas.
5- Give a high flow of O2, use it when Pt is hypoxic
6- It's important because the Pt is paralyzed, if it's disconnected the Pt will not be breathing

General safety strategies

01 **Prepare a preoperative plan**

- Preoperative visit to the patient to let us know the patient's condition in detail
- Make an anesthesia plan to perform the anesthesia and how to deal with possible crisis

02 **Develop situational awareness**

Use a systematic approach to scanning the machine, monitors, patient, surgical field, and surroundings

➔ If One Vital Sign Is Anomalous, quickly assess the others [1] (urine output, heart rate) while repeating the measurement and observing what is happening on the surgical field.[2]

03 **Verify observations, Cross-check observations, Assess co varying variables**

Review it with a second person.

04 **Implement compensatory responses If something wrong happens urgently,**

first implementing time-buying measures then look for cause. e.g., (increase the fraction of inspired oxygen when oxygen saturation falls; administer intravenous fluids or vasopressors when hypotension occurs).

➔ Then search out any correctable primary cause and treat it appropriately.

05 **Prepare for crisis**

In case any critical events happened (cardiac arrest, malignant hyperthermia or difficult intubation), call for help early.

➔ then use accepted protocols for emergencies and resuscitation (e.g., advanced cardiac life support, malignant hyperthermia protocols).

06 **Enhance teamwork**:

- Enhance teamwork communication, address surgeons and nurses early in the case by names.
- Make requests and delegate tasks clearly and specifically by name (e.g., "Jack, do task X and tell me when task X is completed.").

07 **Compensate for stressors (Anesthesia is a stressful job).**

If you feel very tired, ask for a relief. Reduce various stressors: noise, fatigue, interpersonal tension, etc. optimize the work environment

08 **Learn from close calls Every mistake is an opportunity to learn and Improve.**

Analysis and feedback of adverse events to identify and assess system problems.[3]

1- Tachycardia + Hypotension = Bleeding, Tachycardia + Hypertension = Pain
2- If you have bradycardia, check for BP, check the surgeon if he/she is putting a pressure on the Pt or stretching the Pt's viscera
3- Don't be ashamed of your mistakes, but learn from them. Ask why it happened? How to avoid it? What to do if it happened the next time?

Quality assurance

The aim is to improve the quality of care and minimizing the risk of injury from anesthesia.

Documentation

Any adverse events should be reported truthfully, discussed, analyzed to identify causes and assess system problems. So we can learn and develop patterns to prevent recurrence.

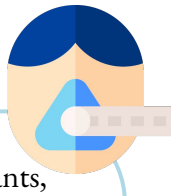
Standards & guidelines

Anesthetists should be aware of their institution's safety policies and procedures. These should include those for monitoring, response to an adverse event, handoff checklist, resuscitation protocols, perioperative testing, and any special procedures or practices for the use of drugs, equipment, and supplies.

Safety training anesthesia providers

- Should obtain training in safety to learn and maintain basic skills.
- Simulation based training techniques.

Crucial errors to know and avoid



Airway errors

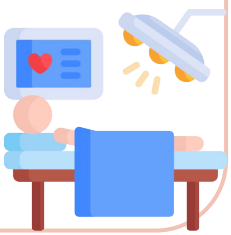
Patients receiving general anesthesia have no spontaneous respiration due to use of muscle relaxants, their respiration is controlled by machine via endotracheal tube.
- So we must ensure oxygen supply and avoid accidental extubation during surgeries (prone surgery) and transport.
- Once it happens, It can cause severe hypoxia and directly threaten the patient's life.

How to avoid it:
• Check the system and guarantee it to function well
• Verify the position of endotracheal tube by auscultation for breath sounds bilaterally and detecting ETCO2 with proper fixation
• Closely observe the vital signs
• Be careful when position the patient in prone position

Procedure error

● Inadvertent intravascular injection of local anesthetics during a nerve block can cause neurologic and cardiac toxicity.
● Avoid epidural hematoma (Hx of coagulopathy)
● Air embolism: with insertion or removal of central line.

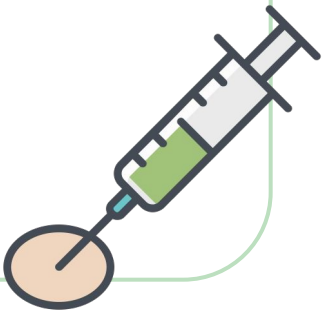
How to avoid it:
• Adequate preoperative evaluation
• Follow standards guidelines
• Vigilance



Medication error [1]

Examples: – Administration of undiluted potassium by rapid intravenous infusion can cause ventricular fibrillation and cardiac arrest.
– Neostigmine given without an antimuscarinic drug can cause asystole, severe bradycardia and atrioventricular block and can be fatal.[2]
– Succinylcholine can cause severe hyperkalemia and dysrhythmias, may trigger malignant hyperthermia.
– Medications to which a patient is allergic can cause anaphylaxis.
– Administering the wrong blood can cause an incompatibility reaction that can be fatal.

How to avoid it:
- Be Familiar with the medication you use
- Know clearly its indications and contraindications.
- Administer the medication strictly according to instructions.
- Know the patient's history of allergy ,Cross-check blood type.
- All electrolyte concentrate should stored out OR
- Label high alert medication and keep it isolated from routinely used medication



Basic medication safety

- Label all syringes
- Eliminate look like ampoules
- Read label before administration
- Distinctive drug labels [3]
- Color coding
- Barcoding

Human error: most common / All drugs should be clearly labeled; cross check before administration

Standards and protocols

Standards for basic anesthetic monitoring:

1. Qualified anesthesia personnel should be present in the room throughout the course of all general anesthetics, regional anesthetics, and monitored anesthesia care
2. Continually evaluate the patient's respiration, circulation and temperature.

ASA standard monitor [4]

Guidelines for action after an adverse anesthesia event

The anesthesiologist involved in an adverse event should do the following:

01 Provide for continuing care of the patient.

02 Notify the consultant anesthesia in charge .

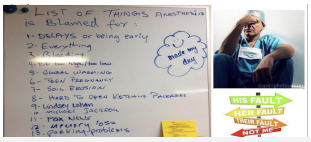
03 Not discard supplies or tamper with equipment [5]

04 Document events in the patient record (including the serial number of the anesthesia machine).

05 Stay involved with the follow-up care.

06 Submit a follow-up report to the department quality assurance committee.

07 Document continuing care in the patient's record.



Avoid blame culture - develop help centre

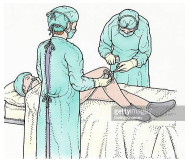
1- Don't prepare so many medications.
2- We have to administer glycopyrrolate with neostigmine to reduce side effects
3- Read what's written (the name of drug), it's not enough to depend only on the color.
4- 5 things to monitor: heart rate, BP, temperature, etCO2, SpO2
5- Don't throw any drug you used, so if anything happens we will still have samples to detect the reason.

Post operative pain

Multimodal analgesia [1]

Regular analgesia technique not PRN

PRN=per request



Greater use of regional anesthesia technique

Preemptive preventive analgesia [2]

Identify problematic patients [3] and formulate management plan

Why opioid free analgesia?

Because opioids lead to:

PONV → delay of start feeding

Bladder bowel function

Sedation delay mobilization & patient discharge & pulmonary complication [4]

Immunosuppressive effects infection cancer recurrent /mets

Inadequate analgesia persistence post-op pain into chronic pain.

1- First start with paracetamol and NSAIDs then go for opioids
2- Intravenous drugs, peripheral nerve block, or fascia block
3- Like sickler patients
4- Pulmonary embolism

Hypothermia: perioperative morbidity/mortality

Consequence of hypothermia

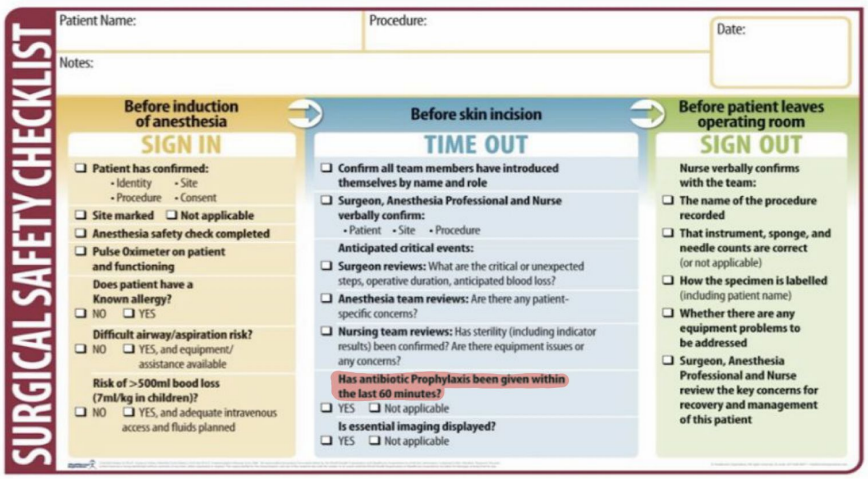
- Shivering/oxygen requirement increased → myocardial oxygen supply demand
- Infection → Directly depress immune function, Vasoconstriction → reduced tissue oxygen-predispose to infection
- Delay wound healing and induce bleeding
- Depressed Cardiac function and risk for arrhythmias
- Delay recovery from anesthesia

Postoperative infection-anesthetic role

- Antibiotic prophylaxis [1]
- Avoid hypothermia
- Hand hygiene
- Aseptic precautions for invasive procedures
- Fluid balance and blood transfusion
- Oxygen –avoiding hypoxia/hyperoxia

WFSA

The goal is to provide highest standard of care and safety any setting International Task Force on Anaesthesia Safety Approved by: In World Federation of Societies of Anaesthesiologists (WFSA)



1- 60 mins before skin incision, and you have to confirm it during time out in surgical safety checklist

Anesthesia considerations for COVID-19

• Protection which should be worn whenever patient is in the operating or procedure room for care of patients with suspected or positive COVID-19 receiving anesthesia in perioperative locations.
• Hand hygiene and personal protective equipment, eye protection which should be worn whenever patient is in the operating or procedure room

Lower

Lower threshold for planning elective or semi-elective intubations in relevant cases [1]

If general anesthesia is not required, the patient should continue to wear a surgical mask throughout the procedure.

Wear

Designate

Designate the most experienced anesthesia professional available to perform intubation to minimize the number of attempts as is appropriate for the clinical situation.

Use disposable equipment (laryngoscope handles and blades)..

Use

Ensure

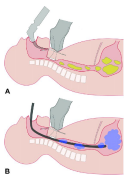
Ensure a high quality HMEF (Heat and Moisture Exchanging Filter) rated to remove at least 99.97% of airborne particles 0.3 microns or greater is placed between the endotracheal tube and reservoir bag during transfers to avoid contaminating the atmosphere.

•Avoid awake fiberoptic intubation unless specifically indicated.
•Atomized local anesthetic will aerosolize the virus.
•Consider using a video-laryngoscope to improve intubation success when the intubation appears challenging

Avoid

Perform

Perform rapid sequence induction (RSI) or a modified RSI as clinically indicated to avoid spread of airway Droplets



•Apply the double glove technique during airway management. Re-sheath the laryngoscope immediately post intubation (double glove technique)
•Seal ALL used airway equipment in a double zip-locked plastic bag. It must then be removed for decontamination and disinfection

Apply

1- Postpone any covid positive patient procedures

Lecture Quiz

answers: 1 (A) 2 (B) 3 (B) 4 (B) 5(C)

Question 1:A 25 year old patient, intraoperatively, the patient became tachycardic, decreased O2, temperature increased to 113F. The anesthesiologist identified it as Malignant Hyperthermia. Which of the following was given to the pt to trigger it?

A. Sevoflurane.
B. Amiodarone.
C. Dantrolene.
D. Lidocaine.

Question 2: Which is the most common human/personal error that causes accidents in anesthesia?

A. Technical accident.
B. Communication error.
C. Limitation of supervision.
D. Equipment failure.

Question 3: You're operating on a trauma patient, once you intubated him the high pressure alarm goes off, which is the most likely cause in this case?

A. The preset pressure is too low.
B. Pneumothorax.
C. Ventilator malfunction.
D. Circuit problems.

Question 4: In safety features of anesthesia machine, the pin index system is used to prevent which of the following?

A. Incorrect connection of gas pipeline to the machine inlet.
B. The incorrect gas cylinder connection.
C. Barotrauma.
D. Mixing of two inhalational anesthesia agents.

Question 5: in a paediatric case of orchiopexy, the nurse asked the anaesthetist when to administer an antibiotic before the start of surgery?

A. One day before
B. 2 hours before
C. During the last hour
D. No need

Explanation File

Good Luck

Team Leader:

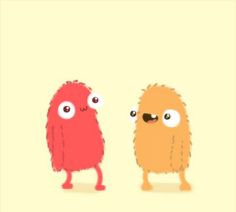
Rema Almutawa

This lecture was done by:

- Renad Almutawa — Jude Alkhalifah
- Rawan Alzayed — Amirah AlZahrani

Renad Almutawa — Elaf Almusahel

Quiz Editor Reviewer note taker

We did it 

Thanks for All team members to make such an amazing work...

And special thanks goes for our golden members:

Renad Almutawa✨ & Elaf Almusahel✨

Team Leader:

Rema Almutawa 🫰