

Safety in anesthesia

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Anaesthesiology: A High risk Speciality



Anesthesiology is a high-risk specialty as compared with other specialties in medicine

Why?

Objective

- Risk of anesthesia
- Complication of anesthesia
- How to implement anesthesia safety in OR
- Error related to complication
- factors threatening patient safety in the operation rooms
- General safety strategies
- Quality assurance
- Crucial errors to know and avoid
- Post operative pain managements
- Hypothermia sequences

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)

Complication of anesthesia

- Major Complications

- cardiac arrest
- Perioperative MI
- Aspiration
- Anaphylaxis
- Drug overdose
- Convulsion
- nerve palsy
- Organ injury
- Malignant hyperthermia

- Minor complications

- Postop nausea, vomiting
- Sore throat
- Hemodynamic instability
- Pneumonia
- Delirium
- Shivering
- Cognitive defect

10 common causes of cardiac arrest under anaesthesia

Drug overdose/ adverse reaction

Rhythm disturbances

Peri-op MI

Airway obstruction

High spinal

Lack of vigilance

Bleeding

Aspiration



How to implement anesthesia safety in OR

- Standardization drug dosage , dosing units , concentration , drugs preparation methods workplace design
- Technology :drug identification and delivery system, utilization automated information system
- Safety features of anesthesia machine
- Pharmacy : dedicate pharmacy resource to the OR
- Culture: recognize and report the errors, learn from adverse events

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Factors threatening patient safety in the operation rooms

- Equipment Causes:
 - Design flaw
 - User error
 - Malfunction
- Strategies: pre-use checkout

Check resources? Before starting Anaesthesia



Patient

- Causes Underlying diseases:
 - hyperthyroidism-thyroid storm, diabetes-ketoacidosis , hyperosmolar coma
 - Allergic reaction to some drug
- Strategies
 - Preoperative evaluations

PRE ANESTHESIA CHECK

➤ *check patient risk factor*

ASA 1,2,3,4,5, e in case of emergency

- *Airway assessment*
- *Aspiration risk*
- *Allergies*
- *Abnormal investigation*
- *Comorbidity*
- *Medication*
- *Formulate anesthesia plan*



Causes for Accidents

- There is rarely a single cause for an accident

Error related to complication

- System error
 - Equipment failure
 - Limitation of therapeutic standard
 - Limitation of available resources
- Human error
 - Limitation of supervision
 - Commination error
 - Technical accident

System error

- System failures are the main reason for accidents
 - check anesthetic machine
 - oxygen supply
 - A backup O2 tank
 - Never shut down audible alarms (very important)
- Emergency ventilation equipment

Human error

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

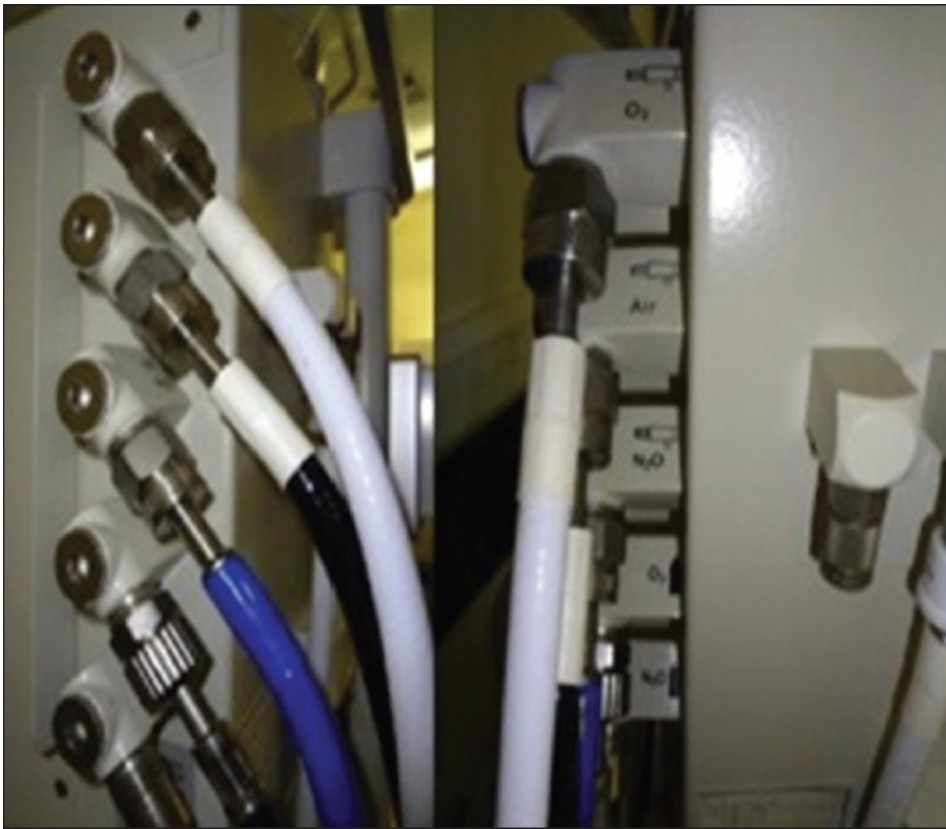
Human error (anesthesia and surgeon)

- Anesthetist and Surgeon Human factors affecting performance such as :
 - fatigue, noise, boredom, long hours, hunger, tension
- 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
 - Vigilance lets anesthetist find abnormal sign as early as possible

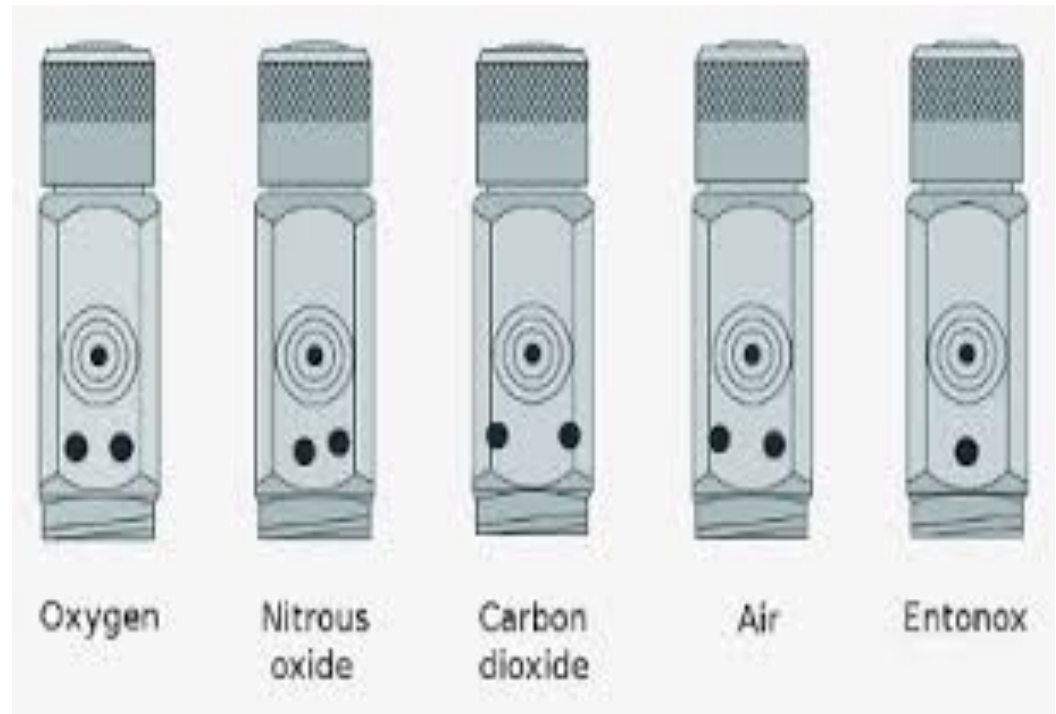
Safety feature of anesthesia machine

Safety anesthesia work station

Diametre index safety system

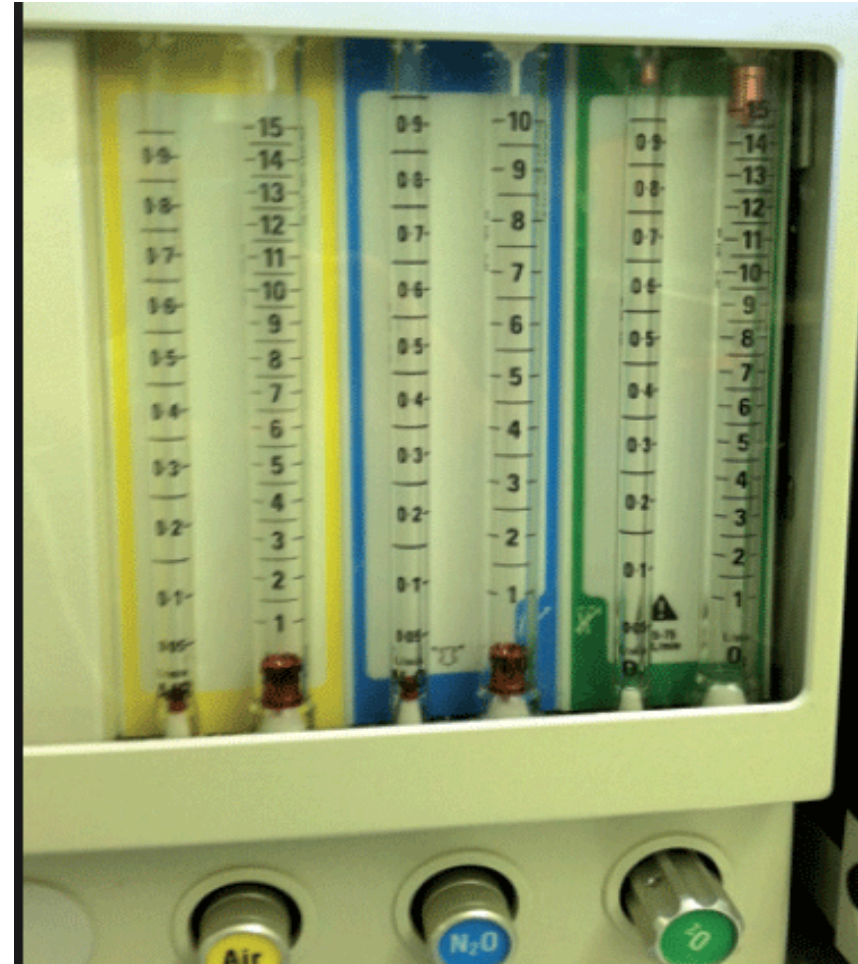


Pin index safety system



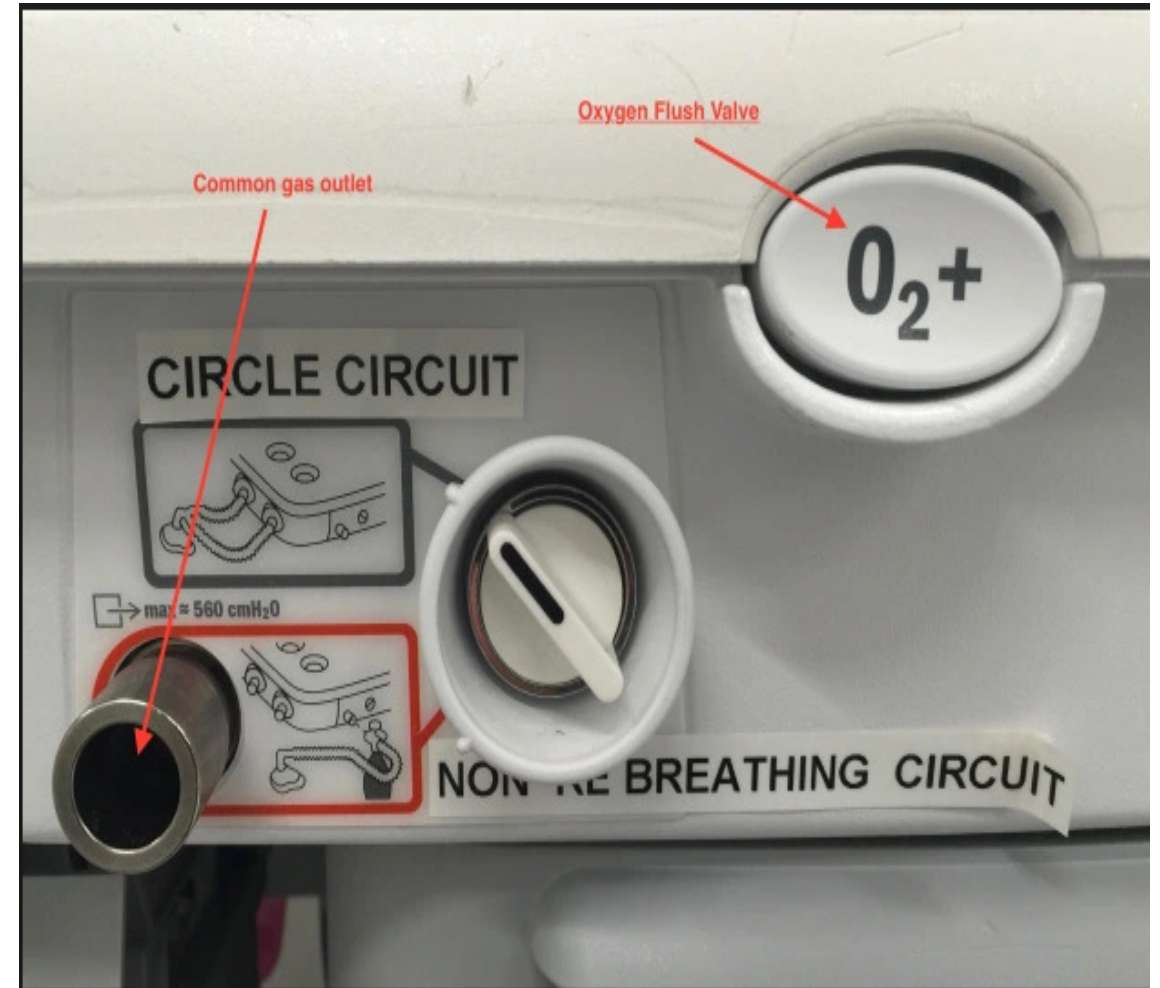
flowmeters

- flow delivered through the anesthetic machine is displayed by a bobbin within a **rotameter** to allow accurate gas delivery
- **Hypoxic guard**
 - 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.



Emergency oxygen flush

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



Suction

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



VENTILATOR ALARMS

ALARM	DEFINITION	POTENTIAL CAUSE
1. High pressure	•Pressure required to ventilate exceeds preset pressure	Pneumothorax, excessive secretions, decreased lung compliance.
2.Low pressure	•Resistance to inspiratory flow is less than preset pressure.	Disconnected from ventilator, break in circuit.
3.Low exhaled volume	•Exhaled tidal volume drops below preset amount.	Leak in system, increased airway resistance, decreased lung compliance
4.Rate /apnea	•Respiratory rate drops below preset level. Apnea period exceeds set time	Client fatigue, decreased R.R due to medication.
5. FIO2	•Indicates FIO2 drift from preset range.	Change in level of consciousness, disconnected from O2 source, break in circuit.

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

General safety strategies

A. 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

B. 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 while repeating the measurement and observing what is happening on the surgical field.

C. Verify observations, Cross-check observations, Assess co varying variables Review it with a second person

General safety strategies

D. Implement compensatory responses

If something wrong happens urgently,

- first implementing time-buying measures. 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

E. 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).

General safety strategies

F. 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.”).

G. 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

I. 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

Quality assurance

- The aim is improving the quality of care and minimizing the risk of injury from anesthesia.
 - A. 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.
 - B. Standards and 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.
 - C. 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

- A. Airway errors , patients receiving general anesthesia have no spontaneous respiration due to use of muscular relaxants, their respiration is controlled by machine via endo-tracheal 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 life.

How to avoid

- Check the system and guarantee it to function well
- Verify the position of end tracheal tube by auscultation for breath sounds bilaterally and detecting ETCO₂ with proper fixation
- Closely observe the vital signs
- Be care when position the patient in prone position

B. Medication errors

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.
- 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

- Be Familiar with the medication you use
- know clearly its indications and contraindications.
- Administrate 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

Medication

- λ Human error: most common
- λ All drugs should be clearly labelled; cross check before administering



ANESTHESIA LABELS A Division of Anes PACS		RE-ORDER AL200 1-800-657-8099 FAX 605-322-4566	
VECURONIUM CONC. _____ DATE _____	GLYCOPYRROLATE CONC. _____ DATE _____		
FENTANYL CONC. 50mg/ml DATE _____	NEOSTIGMINE CONC. 5mg/ml DATE _____		
PROPOFOL CONC. 10mg/ml DATE _____	CONC. _____ DATE _____		
LIDOCAINE CONC. _____ DATE _____	EPHEDRINE CONC. _____ DATE _____		
ROCURONIUM CONC. 50mg/ml DATE _____	MIDAZOLAM CONC. 5mg/ml DATE _____		
ATROPINE CONC. _____ DATE _____	SUFENTANIL CONC. _____ DATE _____		
SUCCINYLCHOLINE CONC. 50mg/ml DATE _____	NEOSYNEPHRINE CONC. _____ DATE _____		
CONC. _____ DATE _____	PANCURONIUM CONC. 5mg/ml DATE _____		

Basic medication safety

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

Procedure errors

- 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

- Adequate preoperative evaluation
- Follow standards guidelines
- Vigilance

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

Continually evaluate the patient's respiration ,circulation and temperature

Standard monitoring recommended by ASA



Guidelines for action after an adverse anesthesia event

- The anesthesiologist involved in an adverse event should do the following:
 1. Provide for continuing care of the patient.
 2. Notify the consultant anesthesia in charge .
 3. Not discard supplies or tamper with equipment.
 4. Document events in the patient record (including the serial number of the anesthesia machine).
 5. Stay involved with the follow-up care.
 6. Submit a follow-up report to the department quality assurance committee.
 7. Document continuing care in the patient's record

LIST OF THINGS ANESTHESIA is Blamed for :

- 1- DELAYS or being early
- 2- Everything
- 3- Bleeding
- 4- BP too high/too low
- 5- GLOBAL WARMING
- 6- TEEN PREGNANCY
- 7- SOIL EROSION
- 8- HARD TO OPEN KETCHUP PACKAGES
- 9- Lindsey Lohan
- 10 Michael JACKSON
- 11- FOX NEWS
- 12- MEMORY loss
- 13- PARKING problems



Avoid blame culture
Develop Help Culture

Post operative pain

- **Multimodal analgesia**
- **Preemptive analgesia**
- **Greater use of regional anesthesia technique**
- **Regular analgesia technique not PRN**
- **Identify problematic patient 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

- immuno-suppressive effects, infection , cancer recurrent /mets
- Inadequate analgesia persistence post-op pain into chronic pain

Hypothermia: peri-operative morbidity/mortality

Consequences 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

^λ Bleeding / transfusion: Depressed platelet and coagulation

Depressed Cardiac function and risk for arrhythmias

Delay recovery from anesthesia

Postoperative infection-Anesthetic role

- Antibiotic prophylaxis
- Avoid hypothermia
- Hand hygiene
- Aseptic precaution for invasive procedures
- Fluid balance , blood transfusion
- Oxygen –avoiding hypoxia/hyperoxia



Anesthesia Considerations for COVID 19

- It is important to consider the following key recommendations 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

Anesthesia Considerations for COVID 19

1. Lower threshold for planning elective or semi-elective intubations in relevant cases
2. If general anesthesia is not required, the patient should continue to wear a surgical mask throughout the procedure.
3. Designate the most experienced anesthesia professional available to perform intubation to minimize the number of attempts as is appropriate for the clinical situation.
4. Use disposable equipment (laryngoscope handles and blades).
5. 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.
6. 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.
7. Perform rapid sequence induction (RSI) or a modified RSI as clinically indicated to avoid spread of airway droplets.
8. 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



The goal is to provide highest standard of care and safety in
any setting

International Task Force on Anaesthesia Safety

Approved by:

World Federation of Societies of Anaesthesiologists

(WFSA)

SURGICAL SAFETY CHECKLIST

Patient Name:

Procedure:

Date:

Notes:

Before induction of anesthesia

SIGN IN

- Patient has confirmed:
 - Identity
 - Site
 - Procedure
 - Consent
- Site marked Not applicable
- Anesthesia safety check completed
- Pulse Oximeter on patient and functioning
- Does patient have a Known allergy?
 - NO
 - YES
- Difficult airway/aspiration risk?
 - NO
 - YES, and equipment/assistance available
- Risk of >500ml blood loss (7ml/kg in children)?
 - NO
 - YES, and adequate intravenous access and fluids planned

Before skin incision

TIME OUT

- Confirm all team members have introduced themselves by name and role
- Surgeon, Anesthesia Professional and Nurse verbally confirm:
 - Patient
 - Site
 - Procedure
- Anticipated critical events:
 - Surgeon reviews: What are the critical or unexpected steps, operative duration, anticipated blood loss?
 - Anesthesia team reviews: Are there any patient-specific concerns?
 - Nursing team reviews: Has sterility (including indicator results) been confirmed? Are there equipment issues or any concerns?
- Has antibiotic Prophylaxis been given within the last 60 minutes?
 - YES
 - Not applicable
- Is essential imaging displayed?
 - YES
 - Not applicable

Before patient leaves operating room

SIGN OUT

- Nurse verbally confirms with the team:
 - The name of the procedure recorded
 - That instrument, sponge, and needle counts are correct (or not applicable)
 - How the specimen is labelled (including patient name)
 - Whether there are any equipment problems to be addressed
 - Surgeon, Anesthesia Professional and Nurse review the key concerns for recovery and management of this patient

Thank you

