Minimum monitoring standards during anaesthesia
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SECTION I: The Anesthesiologist

All anesthetic procedure shall be provided by a trained & qualified anaesthetist, possessing an anesthetic qualification of Postgraduate Diploma (D.A) or Degree (M.D or D.N.B) in Anaesthesiology recognized by Indian Medical Council for the purpose.

It may be noted that providing anesthesia has its own morbidity and mortality. In the interest of the patient and his outcome, it should be ensured that only qualified anesthetist, who is well trained and qualified to provide anaesthesia, who is aware of problems and solutions concerning anaesthesia shall only provide anesthesia to the patient. The practice of any other persons (by Surgeon himself or nurse or technician) giving anesthesia is considered harmful and hence strongly be discouraged.

The hospital management shall be responsible for employing or providing a qualified anesthetist for surgical procedures for providing anaesthetic care.

The hospital management should ensure that only trained and qualified anesthetist provide anesthesia in their hospital. Any anesthetic mishaps occurring during anesthesia provided by any other person shall be legally the responsibility of the hospital management.

The hospital management shall provide an assistant to the anesthesiologist, who may be a trainee anesthesiologist or a nurse or an anesthetic technician well versed in anaesthetic procedures.

Should any anesthetic mishaps occur, the anesthesiologists should have a separate assistant available for help. In major hospital, a junior anesthesiologists or a postgraduate trainee in anesthesia may be available. If having junior anesthesiologist is not feasible, a nurse or anesthetic technician who is trained or has technical qualification in anesthetic procedure should be available for help.

The anesthetist providing anesthesia for a patient shall be present throughout the surgical procedure and shift the patient to the post-operative ward or Intensive care as necessary and be available till his condition is stable.

As anesthesia is associated with rapid changes in patient condition, qualified anesthetist should be available throughout the surgery, to monitor the patient. Should a temporary absence of the primary anesthetist is necessary, he should handover the patient to be monitored by either another anaesthetist or anesthetic trainee or any other trained assistant. In extreme circumstances, if a single handed anesthetist has to leave the patient for a
lifesaving emergency, then the surgeon should stop operating and should take the responsible for monitoring the condition till the main anesthetist returns.

If anesthesia is being provided from a hazardous environment such as radiation, there should be appropriate monitoring devices available so that patient condition can be monitored from remotely.

The anesthesiologist should provide same care as required during General Anesthesia, for Regional anesthesia or for sedation and monitored anesthesia care.

Though utmost care is given while patient is given general anesthesia, often there is some laxity in care during regional or monitored anesthesia care. It should be noted that rapid changes may occur during these procedures as well. Hence patients under regional or monitored anesthesia care should also be monitored as recommended for General anesthesia.

The anesthetist should maintain and record the monitored data in the anesthetic record system accurately and frequently.

It is recommended that the monitored data should be recorded at intervals not longer than five minutes in rapidly changing situations and no longer 10 minutes in stable patients.

Section II: Monitors and Monitoring the Patient

Oxygenation

During anesthesia, it is mandatory for all patients to be monitored for Oxygenation, Ventilation, and Circulation both clinically and with appropriate monitors.

For every patient undergoing anesthesia, it is mandatory to be monitored for Oxygenation Oxygenation of the patient should be monitored clinically by observation for absence of cyanosis and pink color of the skin and mucous membrane and operating field and absence of cyanosis. There must be adequate, illumination of the patient for proper observation of color. It is mandatory for Oxygenation to be further monitored by Pulse Oximetry, which displays both the saturation and heart rate in bold form. The pulse oximetry should have variable pitch pulse tone and low oxygen alarm which is audible clearly. Display of pulse plethysmography by the pulse oximeter is strongly recommended.

It is mandatory for all patients to receive an assured Inspired Oxygen concentration of at least 25%. This may be ensured by appropriate Anesthetic machine, which has Oxygen or hypoxic guard set to minimum of 25% of Oxygen. These anesthetic machine should also be fitted with oxygen failure device and oxygen failure alarm.

When anesthetic machine, which do not have a hypoxic guard and oxygen failure device is to be used, the Inspired Oxygen Concentration should be monitored with an Oxygen analyzer.
appropriately fitted in the inspiratory portion of Anesthetic Circuit. The Oxygen analyzer should also have audible alarms for low oxygen in the circuit.

**Ventilation**

For every patient under anesthesia, it is mandatory to monitor Ventilation- spontaneous or controlled.

Ventilation of the patient either spontaneous or controlled ventilation should be monitored clinically by observation of chest movement of the patient which should be synchronous thoraco-abdominal respiration, movement of the reservoir bag and auscultation of the breath sounds.

In addition to clinical observation, it is mandatory for ventilation to be monitored by analysis of expired carbon-dioxide level with Capnograph, and maintain the End-tidal Carbon-dioxide at appropriate level of ventilation desired. Display of Capnograph is strongly recommended. It is also strongly recommended to monitor Expired Tidal or minute volume of the patient by appropriate volume measurement reading.

It is mandatory whenever Endotracheal tube or Laryngeal mask Airway is inserted, the correct positioning should be checked by quantitative analysis of Carbon-dioxide by capnograph and End-tidal Carbon-dioxide reading. The monitoring should be continued till the endotracheal tube or laryngeal mass airway is removed.

Whenever mechanical ventilation is instituted on a patient, it is mandatory that there should be an audible alarm system available to detect disconnection of patient from mechanical ventilatory system.

All patients under regional or monitored anesthesia should be monitored for respiration clinically. It is however, strongly recommended that the respiration be monitored by expired carbon-dioxide monitoring.

**Circulation**

For every Patient under anesthesia, it is mandatory for Circulatory Functions to be monitored.

It is mandatory that every patient subjected to anesthesia shall be monitored by continuous tracing of Electrocardiogram. The ECG monitoring should be continued into the post-operative or recovery ward till he is discharged to the ward.

It is mandatory to have a defibrillator available in the operation theatre, kept charged and ready for use in case of cardiac arrest.

It is mandatory for every patient to be monitored clinically by palpation of pulse at appropriate places frequently. The pulse rate may be recorded from palpation or from ECG or pulse-oximeter monitors.
It is mandatory for every patient undergoing anesthesia to be monitored for blood pressure. It shall be mandatory for blood pressure to be monitored with a Non-invasive Blood Pressure monitor. They shall be recorded frequently not longer than five minutes.

It is mandatory for every patients at high risk for anesthesia (ASA Grade III and above) patients, who are hemodynamically unstable, those requiring inotropic support, and for surgeries with expected blood loss more than 20% of the body weight, shall have blood pressure monitored by an Continuous intra-arterial pressure tracing.

For patients undergoing surgery in the above category it is strongly recommended to monitor Central venous Pressure by any appropriate method.

**Section III: Additional Monitoring Recommendations**

Patients having prolonged surgery defined as more than 2 hours, High risk for anesthesia, patients with extremes of age (Pediatric and Geriatric age group), and patient undergoing major surgery, with expected blood loss more than 20% of blood volume may be monitored with additional monitoring devices.

It is strongly recommended that the above group of patients (3.1) shall be monitored for core body temperature by nasopharyngeal or oesophageal or rectal probes.

It is strongly recommended that body warming devices should be used to maintain near normal temperature in the above category of patients (3.1)

It is strongly recommended that the above group of patients (3.1), and patients with neuromuscular diseases, receiving neuromuscular blocking muscle relaxants, shall be monitored for degree of neuromuscular block by a neuromuscular stimulator.

**Section IV: Monitoring the Equipment**

The hospital management shall be responsible for procurement, maintenance servicing, and calibration of monitoring and other anesthetic equipments. They should procure the equipments in adequate numbers.

The concerned anesthesiologists shall be familiar with the setup, proper use and trouble shooting of the equipments. For more complex equipments, the anesthesiologist should be appropriately trained regarding its usage before equipment or monitor is out to use.

The anesthesiologist should check all the anesthetic equipments and monitors before connecting them on the patient. Alarm setting should be appropriately set for upper and lower limits and ensured that they are working properly before commencing anesthesia.
In children and other uncooperative patients, who may not allow to place monitors to be placed before anesthesia, patients may be induced anesthesia and monitors connected as soon as possible. Till then, clinical monitoring of pulse and auscultation shall be carried out. Anesthesiologist must maintain a proper anesthetic record of drugs and dosages, along with monitors used for recording vital signs.

Section V: Monitoring during Transportation to Post-operative Recovery Ward
All patients who have received anaesthesia shall be monitored continuously till he recovers from anesthesia and all reflexes are active.
Patients, while transferring to the post-operative recovery area shall be accompanied by the responsible Anesthesiologists, or his assistance with adequate knowledge and experience, till the patient is handed over to a responsible person in the recovery room, and a brief summary of case and proper instructions is explained to the person in charge.
Patient should be shifted only when his hemodynamic status is stable.
Patient should be continued to be monitored with ECG, Pulse Oximeter and NIBP or invasive arterial monitoring as needed.
If a patient requires mechanical ventilation during transport, he should also be monitored with a capnograph for End-tidal CO2 monitors, and disconnection alarm for ventilator such as airway pressure monitoring.
Should the patient require transfer to another part of the hospital or outside, the standard of monitoring should be same as detailed above applicable for post-operative recovery ward area.

Section VI: Monitoring in the Post-operative Recovery Ward
Every patient shall be monitored in the Post-operative recovery area with continuous monitoring of ECG, Pulse Oximeter and NIBP or Invasive Arterial monitoring.
A post-operative recovery chart shall be maintained by recovery ward staff detailing level of consciousness, hemodynamic status, and respiration. They shall be charted at least every 15 minutes and earlier, if any changes are noted towards deteriorating condition of the patient.
Patient shall be transferred out of recovery or post-operative ward, only when the patient has completely recovered from the effect of all anesthetic drugs and clinical condition of the patient is stable.
If the clinical condition of the patient is not stable, he should be transferred to appropriate Intensive Care Units further management.

Section VII: Monitoring during Regional Anesthesia and Sedation

All patient undergoing surgery under regional anesthesia or sedation shall be monitored as required under general anesthesia.

In all cases a minimum monitoring with ECG, Pulse Oximeter and NIBP is mandatory.

All care and observations should be recorded at least every 10 minutes, if the vital signs are stable, and every 5 minutes or earlier, if vital signs are unstable.