

Guidelines for minimal mandatory monitoring for paediatric anaesthesia

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INTRODUCTION

According to the United Nations Convention on the Rights of the Child (UNCRC) a child is a human being below the age of eighteen years. According to the Census of India a child is any person below the age of fourteen years and 39% of India’s population is below fourteen years. The 0 – 18 year-old population is 472 million out of the total population

1.21 billion.¹ India's ratio of child to adult is much higher than developed countries (Europe – 20%, India >39%) therefore there is a need for proper planning of their perioperative care during surgeries and anaesthesia.

In the light of sufficient evidence, highlighting that the use of monitors like the pulse oximeter (SpO₂) and end tidal carbon dioxide (ETCO₂) level, has resulted in the reduction in anaesthesia related morbidity and mortality, the Indian Association of Paediatric Anaesthesiologists (IAPA) considers it essential and extremely important to continuously monitor paediatric patients undergoing anaesthesia.^{3,4} Since the incidence of mortality and morbidity is much higher for neonates and children, it becomes essential to emphasize the need of minimum mandatory monitoring in this age group.⁵

The IAPA highlights that it is vital to continuously monitor the patient throughout a procedure requiring anaesthesia or sedation by an experienced anaesthesiologist.^{6,7} In addition, it is recommended that for special circumstances *e.g.*, major surgery in infants or a sick child should be performed under the supervision of a paediatric anaesthesiologist.⁸ The presence of a vigilant anesthetist is the most vital minimal monitoring in the step towards elimination of the anaesthesia related morbidity and mortality.⁹

The IAPA proposes the following guidelines for the paediatric perioperative anaesthesia environment. Vital and desired monitoring are differentiated and identified so as to give safe anaesthesia and perioperative care to children especially newborn and infants within the practical limitations we face in our country. These guidelines are a guide and the decisions for the individual patients are to be finally taken by the anesthesiologist in the patient's best interest.

AIM

To ensure safe and optimum anaesthesia management for every child in our country, with the aim of reducing anaesthesia related morbidity and mortality.

DEFINITIONS

Mandatory Monitoring:¹ Crucial; high priority; mandatory monitoring which must be established for safe anaesthesia practice.

Desirable Monitoring:³ Monitors which leads to improved outcomes by fine tuning the anaesthesia management.

Experienced Anaesthesiologist:⁴ An anaesthesiologist with at least 3 years of post-degree experience in anaesthesia and who are keeping them selves updated by regular reading and paediatric anaesthesia practice.

Paediatric Anaesthesiologist:⁵ Specialists in paediatric anaesthesia are defined as anaesthesiologists who have an extra training of at least one

year experience in a specialized paediatric center and who care for different age groups in the paediatric population, at least 30 cases/month or the equivalent to 2.5 days/week. They usually work in specialized centres. These paediatric anaesthesiologists are expected to keep up to date and ensure competence in resuscitation, anaesthesia, pain management, emergency paediatric medicine and initial stabilization of the children requiring intensive care.

GUIDELINES

A. Anaesthesiologist

The presence of an appropriately trained and experienced anaesthesiologist is the main determinant of patient safety during anaesthesia.¹ Most of the critical incidents happen due to human error and therefore it is essential to compliment clinical information with the help of monitors.^{2,3}

An anaesthesiologist of appropriate experience as defined earlier should be available at all times while the patient is anaesthetized. The same standard should be maintained for sedation, local or regional anaesthesia. The anaesthesiologist must ensure that all appropriate equipment has been checked before use. Monitoring for MRI or imaging should also be continuous, either across a glass door or from a place where the child can be observed at the same time as the monitoring is going on.

It is essential for an anaesthesiologist to reverse the anaesthesia, wake the child up and then shift the patient to recovery for observation and monitoring. If a shift system is in place, a hand over of all the information related to patient r verbally apart from documentation should be given to the next anaesthesiologist. The hand over should include information about medications, events and special issues related to the patient. The child should be monitored by the anaesthesiologist continuously till transfer to the recovery room and handed over to a recovery nurse and doctor available to handle emergencies. All patients should be discharged to the ward or home from the recovery room by a doctor.

Documentation

Legible, clear data documentation of all perioperative events including vital signs at 5 min intervals during the intraoperative period should be maintained.

B. Equipment

It is essential to use the devices to the best of their abilities and all the information given by the devices are looked at and documented. The alarms should be adjusted to the individual case. The alarms should have both visual and audible alert. Ventilators should have alarms set

for peak airway pressure, disconnections and leaks for different age groups.

Monitoring Devices

Monitoring devices are used to compliment the clinical observations and help in reducing undesirable events. The following monitoring devices are needed for safe conduct of anaesthesia for children.

Mandatory (monitoring required for safe anaesthesia, lack of which may lead to morbidity and mortality)

- Heart rate (HR)
- Non-invasive blood pressure (NIBP)
- Electrocardiogram (ECG)
- Pulse oximeter (SpO₂)
- Precordial stethoscope
- End tidal carbon dioxide monitoring (EtCO₂)
- Temperature monitoring

Desirable Monitoring (required for the better outcome but lack of which will not compromise the safety of the child)

- Airway gases: oxygen, carbon dioxide and anaesthetic gases
- Plateau pressure
- Mean airway pressure
- Pressure Volume loops

- Peripheral nerve stimulator (if neuro muscular blocking agent is used)

Mandatory Monitoring for Regional Blocks and Sedation Procedures

- HR
- NIBP
- ECG
- SpO₂
- Precordial stethoscope
- Temperature monitoring
- Respiratory rate

Special Cases

Depending on the type of surgery and individual child's need, special monitoring like intracranial pressure monitoring, cardiac output monitoring, invasive blood pressure monitoring, central venous pressure monitoring, thromboelastogram (TEG), transesophageal echocardiography (TEE), biochemical markers etc. should be established.

Major surgeries should be conducted in hospitals with the provision of expertise and availability of intensive care monitoring for sick children, for better outcomes.

When to place the monitors?

It is desirable to establish complete minimal mandatory monitoring if possible, prior to induction of anaesthesia. If not possible, it is essential to at least have a pulse oximeter prior to inhalational induction and establish the rest of the monitors. However, for sick patients and neonates, it is vital to establish all the monitors prior to induction.

C. Monitoring in the PACU¹

All patients should be monitored clinically for level of consciousness and vital signs by a trained nurse with the help of monitors including a SpO₂, NIBP and temperature. If required, ECG, EtCO₂ and provision for invasive monitoring should be available. Resuscitation equipments must be available in recovery. A defibrillator should be available in OR complex as well as the PACU.

In an otherwise stable patient, monitoring can be repeated after 15 minutes and documentation maintained by the PACU staff.² The child should be transferred out of the PACU only when he/she is hemodynamically stable, awake and pain free. Sign out by anaesthesiologist should be mandatory once the patient is ready for discharge from the PACU.

D. Anaesthesia in Remote Locations

The same standards of monitoring should be maintained in terms of anaesthesiologist, equipment and documentation.

E. Transfer within the operating room (OR), within the hospital, out of the hospital

I. From OR to post anaesthesia care unit (PACU): Once the child is stable, the child should be monitored clinically during transfer from the OR to the PACU by an anaesthesiologist and handed over to a recovery nurse. Instructions regarding the intraoperative events, drugs which need to be continued in the ward should also be given. The transfer trolley should have provision for oxygen supplementation.

II. From OR to intensive care unit (ICU) / imaging area / within the hospital¹

1. The child should be stable.
2. Vital signs to be monitored throughout the transfer. Use of invasive monitoring only if required.
3. An anaesthesiologist with appropriate knowledge of the patient's condition should accompany the child.
4. If the child is on a ventilator, the endotracheal tube (ETT) should be carefully secured and tidal volume, airway pressure, SpO₂ and RR monitored when possible.

F. The safety line for age group (Lakshman Rekha)

It is essential to define the lowest age at which a child can be anaesthetized by a general anaesthesiologist safely. This is essential

since the physiology and pharmacology of children differ significantly from adults. In addition, anaesthetic morbidity and mortality is higher in neonates and infants.¹⁻³ For better outcomes the physiology, pharmacology and psychology of the child should be better understood. Therefore, the IAPA strongly recommends that children below the age of 3 years scheduled for minor or major surgery should be anaesthetized by a paediatric anaesthesiologist.⁴

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