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General Anaesthesia in Pediatric Dentistry

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ABSTRACT

Management of uncooperative children in the dental office has been a challenge to the profession which can be overcome by rendering treatment under General Anaesthesia. Oral Rehabilitation of children under General Anaesthesia is beneficial but one must keep in mind the physiological differences as child is not a miniature adult. This paper focusses on these differences, benefits and principles of General Anaesthesia in children.

Key words: Pediatric Dentistry, General Anaesthesia in children.

INTRODUCTION

The Practice of painless dentistry can be attributed to the introduction of anaesthesia, prior to which oral pathological conditions and their treatment were associated with pain and suffering, deterring the patients from seeking the required attention. In the present day scenario, Local Anaesthetic agents have become a part of essential armamentarium in the dental office. But the administration of Local Anaesthesia to children may be challenging and the Pediatric dentist may be forced to think about alternatives such as General Anaesthesia.

Population of patients, due to their need for extensive treatment, acute situational anxiety, classified as uncooperative and lack age-appropriate behaviour, immature cognitive functioning, disabilities, or medical condi-tions, would benefit from deep sedation or general anaesthesia. (1)

General anaesthesia (2)

General Anaesthesia is a state of medically induced unconsciousness or coma with the loss of protective reflexes and the absence of pain following administration of one or more general anaesthetic agents.

Objectives of GA (3)

- Provide safe, efficient, and effective dental care
- Eliminate anxiety
- Reduce untoward movement and reaction to dental treatment
- Aid in treatment of the mentally, physically, or medi-cally compromised patient
- Eliminate the patient's pain response

Indications of general anaesthesia in pediatric dentistry

Patients for whom general anaesthesia has been the choice of management technique include (4)

- Patients unable to cooperate with certain physical, mental or medically compromising disability
- Patients with dental restorative or surgical needs for whom local anaesthesia is ineffective – acute infections, allergy, anatomic variations
- The extremely uncooperative, fearful, anxious, physically resistant or

uncommunicative child or adolescent for whom there is no expectation that behaviour will improve
- Patients with extensive orofacial and dental trauma
- Patients requiring immediate comprehensive oral and dental needs
- Patients requiring dental care for whom the use of general anaesthesia may protect the developing psyche and/or reduce medical risks.

Many of these children may not be able to access dental services appropriate to their needs if GA is not available.

Benefits of general anaesthesia (3)

Research indicates that GA has additional benefits to children and families, including:
- Improvement in the quality of life
- Facilitating dental access for very young patients, patients with special health care needs and/or patients with a high degree of dental fear or anxiety.
- Providing an enhanced opportunity for parent and child education on positive oral health behaviours which can lead to positive behavioural changes and improved oral health.

The use of ga for dental restorations can lead to improved quality of life (3,5)

Provision of dental treatment under GA for uncooperative, young children with dental needs has significant positive effects on quality of life for both these children and their families. Oral health related quality of life is measured in relation to how the mouth and teeth affect physical, psychological and social well-being and daily activities such as eating, chewing, swallowing, speaking, playing, learning, happiness, embarrassment, and social interactions

According to parental satisfaction surveys, children who underwent dental rehabilitation under GA demonstrated improvements in pain relief, improvement in the health status as well as in their ability to eat and sleep.

Parents have also reported improved social function, including more smiling, improved school performance, and increased social interaction. Comprehensive dental rehabilitation pro-vided under GA has resulted in catch-up growth, such that children with a history of caries no longer differed in percen-tile weights from comparison patients.

Parental acceptance of GA over more physical management techniques has increased dramatically, because of expecta-tions of safety and compassionate treatment of their child.

Improved positive oral health behaviours and oral health outcomes (3,5)

Some research has indicated that parents and children are more likely to engage in positive oral hygiene behaviours after the child has undergone dental rehabilitation under GA.

Very young chil-dren who have been treated under GA have been found to be more likely to exhibit positive behaviour at subsequent recall appointments than those treated under conscious sedation

Although evidence indicates that certain children who undergo extensive treatment for early childhood caries exhibit new lesions within two years, it would appear that the completion of restorative services under GA provides a “window of opportunity” where both parents and children are receptive to positive oral health messages and are willing to implement suggestions provided by their oral care team. It is thought that the GA experience has an intense emotional effect on parents, which may serve as a motivator to make immediate but short-lived changes in oral health behaviors.

Parents and children may be more receptive to guidance re-lated to positive oral care during the time immediately follow-ing the provision of dental treatment under GA. Therefore, increased preventive services such as anticipatory guidance, coaching/instruction and motivational interviewing tech-niques may serve to enhance these positive results.

Paediatric physiology (6)

" *Child is not a miniature Adult"* There are certain marked Characteristics in the Pediatric physiology which have to be taken into consideration while administering General Anaesthesia to the child patient. These are:

Respiratory System (6)

Several anatomic features of the Pediatric respiratory tract predispose the young patient to obstruction and collapse of both the large and small airways. The upper respiratory tract of the child is prone to obstruction at several sites –

- The narrow nasal passages
- tongue/oral cavity disproportion
- decreased airway diameter
- A tightly clamped mask over the nares,
- a mouth pack depressing the oral cavity floor
- a retractor posteriorly displacing the tongue
- Edema associated with upper respiratory tract infection

Bronchospasm, laryngospasm, acute subglottic edema with stridor, intraoperative and perioperative hypoxia, atelectasis, post intubation croup are certain complications that can be reported after the child with respiratory infection undergoes surgery with intubation. So it is advocated to postpone the procedure until the child is free of symptoms for about a week.

Differences in the chest cage (6)

Anatomic differences in the chest cage can also predispose the child to respiratory problems. They are:

- Chest wall is more elastic
- Lower ventilation pressures are needed to expand the lungs
- Sternum is less rigid providing lesser support to ribs and intercostal muscles
- Ribs are more horizontally placed making intercostal muscle retraction inefficient and diaphragm as the main respiratory muscle. So limitation of diaphragmatic excursion such as supine position is to be avoided as this promotes gastric organ pressure on the diaphragm. A 20 – 30^0 head up position is indicated.
- Children have a greater proportion of alveolar surface area to lung size and so greater rate of alveolar ventilation (AV) per unit area but the functional residual capacity (FRC) and volume of gas exchanged is less than the adult. The AV/FRC ratio is almost 5 times that of adult and it means that children react more rapidly to inhaled gases such as nitrous oxide and halothane and can be adequately anaesthetized with low gas concentrations than that required for the adult. So children are at higher risk of overdose effects of inhalants such as hypotension, bradycardia and hypoventilation. So monitoring the vital signs is very important in children.

Cardiovascular parameters (6)

- Heart rate is an important determinant of cardiac output and drop in heart rate results in decreased cardiac output and hypotension. Decreased cardiac output may increase the rate of inhaled anaesthetic uptake which can depress CNS. This depression reduces central vasomotor tone causing vasodilatation which worsens hypotension.
- Parasympathetic tone is more marked and this predisposes the patient to bradycardia due to vagal stimulation which may occur with simple manoeuvres such as defecation, bladder distention, pressure on the eyeballs, application of throat packs and tracheal intubation. So children are premedicated with atropine or other parasympathetic blocking agent.
- To minimise the effect of hypotensive response children should be well hydrated before the procedures.

Body fluids and blood (6)

- About 80% of the infant body weight is water any water soluble drug is to be administered at higher levels to attain therapeutic concentrations.
- Protein bound drugs are to be administered at lower levels due to deficiency of plasma proteins (serum albumin and plasma globulin.)

General principles of general anaesthesia(7)

Patient assessment (7)

The initial screening of patients for general anaesthesia should be performed as for any other anaesthetic. The airway is to be examined and a thorough medical history is to be taken

The clinical setting (7)

GA must be carried out in a 'hospital setting' with adequate 'critical care facilities'.

Equipments, monitors and drugs (7)

All standard equipments, gadgets, monitors and drugs for anaesthesia and resuscitation should be available and checked before administering anaesthesia. This includes anaesthesia machine, vaporizers, oxygen, nitrous oxide, breathing circuits (adult and paediatric), nasal and facial masks, oral and nasal airways, different laryngoscopes with all sizes of blades, all range of nasal and oral tracheal tubes, independent suction apparatus, etc. SAFE (Short acting fast emergence) agents. Peripheral arterial oxygen saturation, ECG, non-invasive blood pressure and capnography (when tracheal intubation is performed) should always be done.

The anaesthesiologist should be clinically vigilant and continuously monitor colour of lips and mucosa, and movements of chest and reservoir bag. The alarms of monitors should never be switched off. All resuscitation drugs and equipments, including defibrillator should be immediately available.

Staffing standards (7)

The anaesthesiologist must have a dedicated assistant (operating department assistant or practitioner, nurse or dental nurse) with recognised training in this role and no other contemporaneous responsibilities. Because the dentist also requires assistance, a minimum of four people are required for any procedure under general anaesthesia. Until consciousness returns, a patient recovering from general anaesthesia must be appropriately protected and monitored continuously in adequate recovery facilities. Such monitoring should be undertaken by the anaesthesiologist or a dedicated individual who is appropriately trained.

Pre-anaesthetic preparation (4,7)

The patient and the parent are to be explained about the anaesthetic and dental procedure and the following dietary instructions are to be given:

- Clear fluids such as water, juices without pulp, carbonated beverages are allowed up to 2 hours preoperatively.
- Breast milk upto 4 hrs preoperatively
- Infant formula upto 6 hrs prior to the procedure
- Nonhuman milk upto 6 hrs before the procedure
- A light meal upto 6 hrs before the procedure
- It is permissible for routine medications to be taken with a sip of water

The reasons for these recommendations are:

- Emesis during or immediately after the sedative procedure can result in aspiration of the stomach contents leading to laryngospasm or severe airway obstruction
- As the sedative agents are administered by the oral route, drug uptake is maximised when the stomach is empty

A proper consent should always be taken. The patient must be accompanied before and after the surgery and supervised by an adult for 24 hours.

Premedication (7)

This is not usual, but may be used in children with especially challenging behaviour. Chloral hydrate (50- 100mg.kg), trimeprazine (2mg.kg) or midazolam (0.5–0.75 mg.kg) may be given orally.

Induction of anaesthesia (7)

In small children, gaseous induction using sevoflurane (with parental presence) is often easiest. If sevoflurane is not available halothane is preferred over isoflurane that is irritant and can lead on to coughing and laryngospasm. Desflurane offers the advantage of reduction in recovery time. A pulse oximeter and ECG should be placed before the child goes to sleep. A cannula must be inserted once the child is asleep. Propofol is agent of choice for intravenous induction and it ensures clear headed recovery and good anti-emesis Ketamine has delayed recovery characteristics and induces dysphoria.

Airway for exodontia (7)

The type of airway chosen depends on the surgery, and it is vital to liaise with the surgeon. The surgeon inserts a gauze pack from one buccal sulcus to the other in order to prevent too much mouth breathing and aspiration of tooth fragments. A gag or bite-block is positioned on the side opposite the extractions to open the mouth.

The transparent neonatal mask has significant advantages: the external nares can be seen with a transparent mask so that it is possible to check that they are not obstructed, and misting of the mask may indicate breathing.

Adenotonsillar hypertrophy can compromise the nasal airway and nasopharyngeal airways have been shown to significantly improve airway patency and reduce episodes of airway obstruction.23

Airway for conservation (7)

Operations for dental conservation and periodontal procedures tend to take longer and to involve quantities of water being squirted into the mouth. They should therefore be performed with an endotracheal tube and pharyngeal pack in place to prevent aspiration, which can otherwise occur even with a cuffed tube. It is usual to intubate nasally. An LMA makes the surgery difficult because it leaves little space for the dental drill and suction.

Maintenance (7)

For short operations it is often easier to use a technique involving spontaneous respiration of inhalational agent, nitrous oxide and oxygen, which gives flexibility and rapid recovery. Using 50% inspired oxygen concentration is beneficial and has been shown to decrease the incidence and severity of hypoxaemic episodes. Incremental doses/continuous/ target controlled infusion of propofol can be used for maintenance of anaesthesia.

Recovery (7)

Initially, patients are best nursed in left lateral position with a degree of head-down tilt to encourage drainage of any blood and secretions away from the larynx and administered 100% oxygen. Thorough but gentle oropharyngeal suctioning is done. The LMA or endotracheal tube should not be removed until the cough reflex has returned. Removal of the LMA while the child is still deeply anaesthetized has been associated with lower oxygen saturations in dental patients. Oxygen supplementation ameliorates the severity of desaturation but does not prevent it. The patients are monitored in the recovery area for at least 30 minutes before returning to dental clinic. No oral fluids are given for 2-3 hours to avoid vomiting and aspiration.

Postoperative analgesia (7)

The main problem is the psychological trauma of waking up uncomfortable in a strange place. It is important that the parents are present, and the administration of paracetamol 10-15 mg.kg is usually all that is needed. Analgesia may be given rectally (paracetamol or diclofenac suppositories) during the operation.Ibuprofen or paracetamol may be given orally in liquid form in recovery. Non-steroidal analgesics are effective, and it has been shown that oral diclofenac given on admission is as effective as rectal diclofenac given peroperatively.

Post – operative instructions (5)

Post-operative Instructions for General Anesthesia are:

1. Please monitor your child throughout the day following surgery.
2. Do not allow your child to return to school or attend activities following the surgery.
3. Please assist child with walking to the car and to the bathroom. Usually children are drowsy following sedation to prevent them from tipping and falling.
4. It is important that he/she drink liquids throughout the day. Start by giving small amounts of water or clear juices. A couple of hours later begin giving child food, if tolerated. Do not encourage eating too soon because your child's stomach may be upset.
5. You may give your child Children's Ibuprofen every 4-6 hours if needed To reduce the soreness, discomfort, and possible swelling following the treatment.
6. If your child had local anesthetic (numbing), then the child has to be closely watched to prevent him/her from sucking, pinching, or

biting his/her lips, cheeks, and tongue.

7. Brushing has to begin the night of the surgery. A wet washcloth may be used instead of a toothbrush to wipe the teeth and gums.
8. If child received any stainless steel crowns his/her gums will be especially sore, because they fit below the gums. Avoid sticky foods until the crowns fall out
9. If child had tooth-colored fillings or sealants placed he/she needs to avoid sticky foods and candy, because the fillings can pop out.
10. If he/she had tooth colored crowns placed on his/her front teeth they cannot bite on with their front teeth. He/she will need to cut these types of foods and chew them with his/her posterior teeth.
11. If some teeth are removed it is important to avoid spitting, or using a straw for 24 hours. If the area begins to bleed again then have your child bite down on gauze for 15-20 minutes and the pressure will stop the bleeding.

Fitness for discharge (4,7)

Patients should be clinically observed to be alert, oriented, able to stand and walk unassisted, and haemodynamically stable. There should be no obvious surgical complications. Discharge criteria include – Mcdonald

- Cardiovascular function is satisfactory and stable
- Airway patency is to be uncompromised
- State of hydration to be adequate. Patient should start clear fluids
- Patient should be able to talk if applicable
- Patient should be able to sit if applicable
- Patient can ambulate with minimal / no assistance
- If the patient is very young or disabled, the presedation level of responsiveness or the level as close as possible for that child is to be achieved
- Responsible individual / Adult is available

Prevention (8)

This group of children is still highly predisposed to greater caries incidence in later years. More aggressive preventive therapies may be required to prevent the future development of carious lesions in these children who have undergone oral rehabilitation under general anaesthesia

CONCLUSION

Oral Rehabilitation of child patient under General Anaesthesia can be considered as a “double edged sword” where the clinician has to weigh the pros and cons and should resort for treatment under general anaesthesia where all other behaviour guiding techniques will not be applicable.

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