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Paediatric Dentistry

General Anaesthesia: A boon in Paediatric Dentistry

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Abstract

The purpose of this study is to discuss the scope of general anaesthesia in paediatric dentistry. This article includes the indications, contra indications and the various guidelines undertaken while considering general anaesthesia for paediatric patients. We started the review with the history of general anaesthesia and how it started with the aim of achieving painless dentistry. Nowadays the scope of general anaesthesia ranges from extensive dentistry to children with medical conditions in need of dental treatment. Preoperative evaluation is mandatory when selecting a case for general anaesthesia. The success of general anaesthesia is affected by factors which include patient information (pre and post operative instructions) and premedication. Since the AAPD recognizes that there exists a patient population for whom routine dental care using non-pharmacologic behaviour guidance techniques is difficult, hence general anaesthesia can be considered a viable approach.

Key Words

General anaesthesia, paediatric dentistry, paediatrics.

Introduction

Dental patients with "special needs" can encompass a wide range of disabling conditions including intellectual disability, dementia, physical limitations, movement disorders, behavioural disorders, and chronic medical conditions. Many of these individuals can be treated in routine dental settings with special accommodations or with minimal interventions that are well within the scope of most dental professionals.[1]

The American Academy of Paediatric Dentistry (AAPD) has issued Guidelines on the elective use of sedation and general anaesthesia for paediatric patients (2006). The guidelines include a list of indications for the use of General Anaesthesia with this population. The first indication is for "patients who are unable to cooperate due to lack of psychological or emotional maturity and/or mental, physical or medical disability".[2]

The AAPD also states that General Anaesthesia is indicated for patients who are extremely fearful, anxious or not communicative, or in instances where it may protect the "developing psyche." In terms of procedures (rather than patient types), the AAPD states that General Anaesthesia is appropriate for significant surgical procedures, for instances when local anaesthetic is ineffective due to acute infection, anatomic variation or allergy, or for patients needing immediate comprehensive care.[2]

In an additional Guideline paper, the AAPD proposes that alternative behaviour management techniques should be considered prior to the decision to utilize General Anaesthesia.[3]

Some patients with special needs do, however, require interventions that go beyond the scope of routine behaviour management techniques. These techniques can include desensitization, anti-anxiety medications, therapeutic immobilization, sedation, and general anaesthesia General Anaesthesia.

History of Dental Anaesthesia [4]

The subspecialty of paediatric anaesthesia has come a long way since its origin in Jefferson, Georgia, when Dr. Crawford Long administered the first documented ether anaesthetic to an 8-year-old boy for a toe amputation on July 3, 1842. Thus began the practice of paediatric anaesthesia in the hands of an observant rural physician. Dr. Long, however, did not publish his anaesthetic practice until three years after William T.G. Morton, a dentist performed the first demonstration of ether anaesthesia at Massachusetts General Hospital.

Early developments in the modern history of anaesthesia started in search for painless dentistry. Horace Wells, dentist and mayor of Hartford, Connecticut, USA, witnessed the analgesic effect of nitrous oxide while attending a 'laughing gas travelling show' in his hometown.

In 1844, Wells asked his colleague to extract his troublesome wisdom tooth under the influence of nitrous oxide. Painless dentistry was born. However, when Wells failed to successfully demonstrate the use of N_2O Harvard in 1845, he was ostracised by the medical community. Wells thought that it could be used for pain control in dentistry and found it effective.

For nearly 20 years, chloroform and ether remained the only anaesthetic agents available, and progress consisted mainly of developing methods of administration, comparing advantages and dangers, and simply studying how to keep children asleep and still for longer periods of time.

The 1980s and '90s were transformative years that established paediatric anaesthesia as its own formal subspecialty, with training programmes, textbooks, journals and subspecialty organizations.

The entire scenario in the operating room evolved enormously, with anaesthesiologists setting multi - computerized monitors and infusion pumps, with numerous syringes loaded and coded, and with a large cabinet within reach that holds drugs and other equipment for all possible occasions.

Children often receive an oral sedative, and anaesthesia is induced with minimal resistance, often with a parent present. Multiple medications are delivered by the intravenous route, generally measured by micrograms per kilogram. The ventilator is set at a prescribed rate and tidal volume or inspiratory pressure, and surgeons are allowed to approach and drape the patient, erecting a high sterile shield between themselves and the anaesthesiologist. Charting is often automated[5].

The evolution of paediatric anaesthesia continues at an ever-faster pace. Dental treatment performed under GA allows a total oral rehabilitation in a single course, including a full mouth prophylaxis treatment, operative dental restoration, pulp therapy, tooth extraction,

stainless steel crown reconstruction, and preventive resin restoration[5].

Indications for Paediatric Dental Anaesthesia:

Approximately 2 % to 5% of paediatric patients will require general anaesthesia for their dental care to be successfully completed. Dummett lists the following indications for the administration of general anaesthesia to the paediatric patient [6] :

1. Extensive dental needs in uncooperative children who resist all means of conventional management procedures including premedication and restraints.
2. Extensive dental needs in the young, immature and pre communicative child whose behaviour deters dental needs.
3. Multiple pulpally involved teeth in a child with cardiac disease where immediate treatment is indicated for the sake of the child's health.
4. Extensive dental needs in patients with severe physical or sensorial disabilities (e.g., deafness or blindness), with whom communication cannot be achieved.
5. In children with blood dyscrasias who may need transfusions.
6. Extensive dental needs in children with mental retardation whose behaviour deters dental treatment and impairs dentist – patient communication.

Before deciding to use general anaesthesia, at least two attempts should be made to treat the patient in the dental office using sedation techniques. Sedation combined with local anaesthesia is a highly effective means of managing most patients.

When attempts using these procedures have been unsuccessful and signs of progressive improvement in behaviour and cooperation have been demonstrated, general anaesthesia should be considered.

Potential risks and complications

Patient factors

Patients who undergo dental treatment under general anaesthesia are usually children, those with special needs and the highly anxious and phobic adolescent or adult. Problems in children are the common presence of airway infections and adeno -tonsillar hypertrophy. The first general anaesthetic that children receive is usually for a dental procedure. This inherently holds potential risks, such as the unmasking of allergies or rare pharmacogenetic conditions, i.e., malignant hyperthermia. Anaesthesia in a child requires the anaesthetist to know all the specific paediatric anaesthetic issues, in addition to considerations specific to dental anaesthesia.

Mentally challenged children and adults present unique anaesthetic challenges. A gentle approach and the presence of a parent, guardian or supervisor are essential.[1] Institutionalised patients have a higher incidence of hepatitis B. In addition to challenging communication and co-operation, the following are common and should not be overlooked: very poor oral hygiene, oesophageal reflux, physical abnormalities, malnutrition, epilepsy and cardiac abnormalities.[7]

Surgical factors

The anaesthetist must know the maximum safe dosages of local anaesthetics commonly used in theatre for local dental anaesthesia. The dental surgeon must inform the anaesthetist of his intention to infiltrate locally. The maximum dose has to be verified by the anaesthetist. Adrenaline/nonadrenalin in a local anaesthetic, when administered in large dosages, may exacerbate dysrhythmias in the presence of halothane (especially adrenaline). The duration of surgery may vary from 1 to 2 minutes for the extraction of one or a few primary teeth to hours for extensive dental conservation surgery. An estimation of the duration of surgery is essential to an anaesthetic plan.

Approach to paediatric general dental anaesthesia

Preoperative Assessment:

A review of pertinent medical records, a physical examination, and patient survey or interview should be performed as part of preoperative evaluation. The history, examination, and interview should include pertinent assessment of gastroesophageal reflux disease, dysphagia symptoms, or other gastrointestinal motility disorders, potential for difficult airway management, and metabolic disorders (e.g., diabetes mellitus) that may increase the risk of regurgitation and pulmonary aspiration. Ideally, children should be examined preoperatively in the presence of a parent or caregiver. The assessment should determine the suitability of day-case anaesthesia, focusing on medical conditions, social circumstances and nature of the procedure. Valid informed consent has to be obtained under all circumstances.

Paediatric Pharmacokinetics

In comparison to adults, infants and young children respond differently to anaesthesia medications due to many factors, including body composition, protein binding, body temperature, distribution of cardiac output, and functional maturity of the liver and kidneys[8,9].

Difficulties in risk assessment in special-needs patients [10]:

- Limited or lacking medical and/or surgical history
- Limited or lacking medical work-up
- Unco-operative behaviour
- Lack of support systems, often making postoperative care less optimal
- Lack of adequate presurgical work-up:
  - o extent of surgery difficult to estimate
  - o difficult estimation of duration of anaesthesia
  - o surprise adverse events more likely.

Patients should be informed of fasting requirements and the reasons for them, sufficiently in advance of their procedures. Verification of patient compliance with fasting requirements should be assessed at the time of the procedures. When the fasting recommendations are not followed, the practitioner should compare the risks and benefits of proceeding, with consideration given to the amount and type of liquids or solids ingested.

Preoperative Fasting Status[11]:

a) Clear Liquids

Both the consultants and ASA members strongly agree that for otherwise healthy infants (younger than 2 years), children (2–16 years), and adults, fasting from the intake of clear liquids at least 2 hours before elective procedures requiring general anaesthesia, regional anaesthesia, or sedation/analgesia (i.e., monitored anaesthesia care) should be maintained.

Examples of clear liquids include, but are not limited to, water, and fruit juices without pulp, carbonated beverages, clear tea, and black coffee. These liquids should not include alcohol. The volume of liquid ingested is less important than the type of liquid ingested.

b) Breast Milk

It is appropriate to fast from intake of breast milk at least 4 hours before elective procedures requiring general anaesthesia, regional anaesthesia, or sedation/analgesia (i.e., monitored anaesthesia care).

c) Infant Formula

It is appropriate to fast from intake of infant formula at least 6 hours before elective procedures requiring general anaesthesia, regional anaesthesia, or sedation/analgesia (i.e., monitored anaesthesia care).

d) Solids and Nonhuman Milk

It is appropriate to fast from intake of a light meal or nonhuman milk 6 hours or more before elective procedures requiring general anaesthesia, regional anaesthesia, or sedation/analgesia (i.e., monitored anaesthesia care). The Task Force notes that intake of fried or fatty foods or meat may prolong gastric emptying time. Additional fasting time (e.g., 8 hours or more) may be needed in these cases. Both the amount and type of food ingested must be considered when determining an appropriate fasting period. Because nonhuman milk is similar to solids in gastric emptying time, the amount ingested must be considered when determining an appropriate fasting period.

Premedication

Chronic medications must be continued on the day of surgery and as soon as possible thereafter, particularly in the special-needs patient. Sedative premedication is often not necessary and should be used only for specific indications in day-case patients. A short-acting benzodiazepine is ideal when necessary. The constant presence of a parent, from admission to induction, is usually all that is needed in paediatric cases.

Intranasal midazolam (0.2 - 0.3 mg/kg) is an option in children in whom a rapid onset of sedative action is required. The anxious adult patient needs to be sedated preoperatively, keeping the possibility of delayed postoperative recovery in mind. The most common oral dose used in children is 0.5 mg/kg and ranges from 0.25 to 0.75-1 mg/kg. Short-acting oral midazolam is again the agent of choice (for the average adult 7.5 - 15 mg orally, 1 - 2 hours preoperatively).

In conventional teaching antibiotic prophylaxis is needed in patients with cardiac valve lesions, an endocarditis history and most cases of congenital cardiac defects. However, the current NICE (National Institute for Health

and Care Excellence) guidelines advise against antibiotic prophylaxis for dental procedures in endocarditis-susceptible people [12].

Phases of general anaesthesia:

Induction Phase:

General anaesthesia can be induced with either inhalation or intravenous (IV) medications. In most instances, the volatile anaesthetic agents are preferred in children over IV medications because they do not require IV access. IV medications are used to induce anaesthesia in children only in rare circumstances (e.g., the patient is at risk for malignant hyperthermia [MH]). However, once the child is asleep and IV access is established, children commonly receive IV anaesthesia medications.[13,14]

Anaesthesia can be both induced and maintained with either boluses or continuous infusions of IV anaesthetic agents. IV anaesthetic agents include barbiturates, opioid narcotics, benzodiazepines, and miscellaneous products (e.g., ketamine, propofol). Inhalation induction begins with the patient inhaling, through a face mask, a high gas flow (5 to 7 L/min of oxygen), which is usually mixed with nitrous oxide. Once a state of euphoria is reached (60 to 90 seconds), a volatile inhalation agent is typically added into the inhaled gas mixture. This combination, leading to unconsciousness within 30 to 60 seconds, allows the child to continue breathing spontaneously.[13]

Maintenance Phase:

This phase is the period between induction and emergence. During this time, the child should be asleep, unaware of pain, unresponsive either with motion or hemodynamic responses to painful stimuli, and homeostatically supported. Anaesthesia is usually maintained with nitrous oxide, an inhalational anaesthetic, and a narcotic for intraoperative analgesia. A benzodiazepine can be added to the regimen either during premedication or intraoperatively to supplement hypnosis and amnesia. Neuromuscular blockers are used when muscle paralysis is needed[13].

Reversal Phase:

The volatile inhalation agents rapidly leave the lungs during ventilation and thus do not require other products to reverse their actions. However, certain neuromuscular blockers commonly need to be reversed with an acetyl cholinesterase inhibitor[11]. Generally, the effects of other agents (e.g., narcotics, benzodiazepines, IV hypnotics) used in general anaesthesia may be prolonged but do not usually need to be reversed[14].

Complications associated with general Anaesthesia:

Complications associated with general anaesthesia can be divided into four basic categories: postoperative nausea and vomiting (PONV), oral trauma, thermoregulation issues, and cardio respiratory complications[15,16] PONV is the most common problem associated with general anaesthesia. An estimated 40% to 50% of children experience PONV after receiving general anaesthesia. PONV can occur in the immediate postoperative period, one to two hours postoperatively, or several hours after surgery.

The stress and trauma of surgery and the proemetic effects of the anaesthetic agents and narcotic analgesics most likely cause PONV[15] Numerous products exist that can prevent and/or treat PONV. The serotonin antagonists (e.g., ondansetron, dolasetron, granisetron) are considered to be first-line drugs for PONV. They can be used to treat and/or to prevent PONV [15].

Oral trauma is relatively common after general anaesthesia. The insertion or removal of the endotrachael tube can irritate the throat, causing a sore throat and/or hoarseness. In rare instances, dental trauma can also occur due to the insertion and/or removal of the tube.[16]

Preventing over sedation:

The American Academy of Paediatrics Committee on Drugs (COD) notes that children tend to be particularly susceptible to over sedation with anaesthesia. Consequently, provision for safe sedation in children requires skill and organization of resources to prevent severe negative patient outcomes. Pulse oximeter is considered the single most helpful monitoring device for detecting impending life-threatening events[17].

Postoperative medicaments:

Extraction of deciduous teeth and pulp therapy procedures are not painful postoperatively. The presence of a parent at emergence from anaesthesia or soon thereafter is extremely helpful in counteracting the stress caused by waking up uncomfortably in a strange environment. A loading dose of 20 mg/kg oral paracetamol is often all that is needed, with follow-up if necessary.

Discharge criteria for day-case dental anaesthesia:

- Fully awake with normal muscle strength
- Stable and satisfactory cardio-respiratory parameters
- Availability of an escort home
- Home support
- No bleeding
- Pain under control
- Nausea and vomiting under control

Conclusion

The need for extensive treatments in patients with acute situational anxiety, uncooperative behaviour, immature cognitive functioning disabilities or medical conditions; the advantages of treatment under general anaesthesia outweigh its minor disadvantages.

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