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General Anesthesia for Individuals with Intellectual Disabilities: A Clinical Guidance for Oral Healthcare Professionals

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ABSTRACT

Individuals with intellectual disability tend to have higher prevalences of oral diseases compared to the general population, but they experience difficulties accessing oral healthcare services. The use of general anaesthesia is frequently needed to provide adequate dental treatment, particularly in individuals with extensive dental disease and in those with moderate to severe intellectual disability who cannot tolerate dental treatment under local anaesthesia. The provision of dental care under general anaesthesia requires adequate background and preparation, as well as thoroughness throughout its implementation. This review aims to provide an overview for oral healthcare professionals about the dental treatment of individuals with intellectual disability under general anaesthesia.

Keywords: General anesthesia, Intellectual disability, Dental treatment, Special need patients, Oral healthcare.

1. Introduction

Individuals with intellectual disability (IWID) have higher prevalences of tooth loss, dental caries, and periodontal disease compared to the general population, but they have difficulties accessing oral healthcare services (1). These oral diseases cause significant dental pain, discomfort, and poor oral functioning (2). Research has shown that poor oral health is linked to cardiovascular diseases, metabolic syndromes, and respiratory diseases (3).

There are several barriers to dental care of IWID, such as mental illnesses, social and physical disabilities that complicate delivering routine dental care and maintaining good oral health. Therefore, general anaesthesia (GA) is often required to deliver dental treatment for IWID, particularly in patients who cannot tolerate dental treatment under local anaesthesia.

GA is defined as a state of controlled and reversible

loss of consciousness associated with amnesia and absence of sensation that is achieved by potentiating the action of inhibitory neuro-transmitter channels (4). Dental treatment under GA is a complex procedure involving four phases: 1) pre-anesthetic patient assessment; 2) administration of GA drugs (i.e., induction and maintenance phases of GA); 3) provision of dental treatment; and 4) recovery, emergency, and post-GA medications. This review aims to provide an overview for oral healthcare professionals about the dental treatment of IWID under GA.

2. Pre-anesthetic Patient Assessment

IWID are usually referred by the community dental services and general medical/dental practitioners to secondary dental services without an indication about the dental treatment needs or the fitness for GA. Therefore, pre-anesthetic assessment (i.e., new patient

clinic) is required before any intended dental treatment under GA. The pre-anesthetic assessment includes both medical and dental assessments.

2.1 Pre-anesthetic Medical Assessment

Pre-anesthetic medical assessment is essential to evaluate the pre-anesthetic operative status and to determine the suitable environment to deliver the planned treatment (i.e., surgical suite, day case, or main theatre with critical care facility). It involves performing necessary investigations and evaluating the patient's mental capacity and ability to understand the proposed treatment and obtain necessary consent forms (5). During the pre-anesthetic medical assessment, patients and/or parents are informed about the anesthetic technique, methods of pain relief, anesthetic risks, and pre-anesthetic instructions (6). Properly conducted pre-anesthetic medical assessment has been shown to reduce the number of complications post-GA (7). Pre-anesthetic medical assessment is totally within the anesthetist's responsibility, and involves three essential components: 1) recording current medications and previous GA; 2) examining the functional capacity and assessing GA risk; and 3) performing the necessary laboratory investigations (8).

IWID often use medications to control certain behaviors, minimize anxiety and irritability, and control seizures. Therefore, any potential interaction with GA drugs should be documented during the pre-anesthetic medical assessment, and necessary modifications to drug dosage or regimen should be prescribed. IWID might also present with a history of previous GA for

various surgical or diagnostic procedures. The pre-anesthetic medical assessment should therefore include specific questions about history of previous procedures under GA, including any pre-/post-anaesthesia difficulties or complications (9).

IWID should have a comprehensive medical assessment (10), such as the assessment of the metabolic equivalent of task (MET), a clinical tool used to assess functional capacity. It is defined as the resting metabolic rate; that is, the amount of consumed oxygen at rest (approximately 3.5 mlO₂/kg/min). Patients with MET <4 are considered to have poor functional capacity and are at high risk of perioperative complications, while patients with MET >4 are considered to have adequate functional capacity and are at low risk of perioperative complications (10).

There are different risk scales for pre-anesthetic medical assessment. The classification of the American Society of Anesthesia (ASA) is a commonly used tool to determine an individual's overall well-being, but its validity for assessing the risk of GA is questionable (11,12).

Other risk clinical tools that can be considered during the pre-GA medical assessment include the Surgical Outcomes Risk Tool (SORT) (13), Acute Physiology and Chronic Health Evaluation (APACHE) (14), Physiology and Operative Severity Score for enumeration of Mortality and Morbidity for surgical patients (POSSUM) (15), and Goldman Scales for cardiac risk assessment (15). The pre-anesthetic medical examination also involves assessment of the airway and difficulty of intubation using the Lemon Law (Table 1) (16,17).

Table 1: The Lemon law for airway assessment

Evaluation Criteria

L = Look extremely (facial trauma, large incisors, beard or moustache, large tongue)

E = Evaluation of the 3-3-2 rule (incisor distances/3 finger breadths, hyoid-mental distance/3 finger breadths, and thyroid to mouth distance/2 finger breadths),

M = Mallampati Classification (18):

Class I: Complete visualization of the soft palate

Class II: Complete visualization of the uvula

Class III: Visualization of only the base of the uvula

Class IV: Soft palate is not visible at all.

O = Obstruction (presence of any condition, such as epiglottitis, peri-tonsillar abscess, trauma).

N = Neck mobility (limited neck mobility).

Depending on the medical history and review of

systems, relevant investigations are usually requested

during the pre-anesthetic medical assessment visit. The National Institute for Health and Care Excellence has published guidelines regarding the required pre-operative tests for patients requiring surgery under GA (i.e., full blood count, coagulation profile, kidney and liver functions, electrocardiogram, lung function, and arterial blood gas) (19).

2.2 Pre-anesthetic Dental Assessment

The pre-anesthetic dental assessment aims to evaluate the dental treatment needs, discuss the proposed treatment plan with patients/parents, and provide the pre-anesthetic instructions. It also involves evaluation of the patient's mental capacity and ability to understand the proposed treatment, in addition to performing intra- and extra-oral examinations. During the pre-anesthetic dental assessment, the dental team takes a full history regarding the patient's medical status, social circumstances, and the type and severity of the intellectual disability. Performing extra- and intra-oral examinations and taking dental radiographs might be limited in patients with moderate to severe intellectual disability. The use of anxiolysis, at this stage, might help perform adequate examinations (i.e., sensibility tests, basic periodontal examination, and intra-oral radiographs) to assess the severity of dental diseases and determine the dental treatment needs (20).

Additionally, the pre-anesthetic dental assessment visit involves discussion about the potential need for pre-medication, clinical holding, and a hoist or sling for patient transfer (21). IWID require assessment of their mental capacity; otherwise, a best of interest discussion between dental operators and the patient's carers or parents should be considered (5). It is crucial to discuss the treatment plan with the patients/parents and determine all possible unpleasant treatments, such as dental extraction (surgical *versus* non-surgical) for any teeth that might be restorable under local anaesthesia and/or conscious sedation techniques, but not under GA (22). Patients have to understand the limitations of dental treatment under GA. For example, advanced treatment, such as non-surgical root canal treatment for molar teeth and dental prostheses, is considered time-consuming and sometimes difficult to perform correctly under GA (20).

3. Administration of GA

On the day of surgery, the dental, anesthetic, and nursing teams should meet briefly to introduce themselves and clarify their roles, responsibilities, and actions. The briefing involves a thorough description of listed cases, including the patient's name, medical history, types and duration of procedures, relevant clinical information, equipment requirements, and anticipated difficulties. Furthermore, issues or requirements regarding the equipment and decontamination issues should be clarified, and it is recommended to clarify who will be working in each case and in what capacity.

The clinical team (nurses, dentists, and anesthetists) should check the patient's medical status, revise the treatment plan, check the signed consent form, and ensure the pre-operative anesthetic instructions that have been followed before starting dental treatment under GA.

The depth of anesthesia is determined based on surgery and patient-related factors, such as the site of the procedure, the type of surgery, surgical access requirements, and the degree of anticipated pain.

Guedel's classification defines four phases/stages of GA: induction (after administration of the induction agent and before loss of consciousness), excitement (period after loss of consciousness), surgical anesthesia (period where skeletal muscles relax), and overdose (when too much anesthetic medication is given) (23). The surgery should be performed during the surgical anesthesia phase.

GA induction involves the use of injectable and/or inhalation agents to achieve a transition from the fully awake state to the anaesthetized state (24,25). Short-acting opioids are usually given with the induction drugs to reduce their dose and smooth the induction process (26). The induction agents work from 2 to 7 minutes, allowing for spontaneous recovery of consciousness. The maintenance of the unconscious state is achieved during the induction phase with either inhaled volatile agents with/without nitrous oxide or continuous infusion of intra-venous agents, such as propofol (27). Table 2 shows induction agents used during GA.

Table 2: Types of anesthetic agents used during the induction phase of general anesthesia

| Intra-venous agent | Inhalation agent | Intramuscular agent |
|---|--|--|
| Fastest onset of anaesthesia in 30-45 seconds | Longer onset of action/time up to 3 minutes | Suitable for patients with severe intellectual disabilities and poor cooperation |
| | For patients with needle phobia or difficult intra-venous access | Potentially distressing route of administration |
| | Suitable for patients with intellectual disabilities | |

Sevoflurane, isoflurane, and desflurane are the most commonly used drugs for maintenance of GA (28) delivered *via* vaporizers on an anesthetic machine (29). The level of maintenance is calibrated by measuring the inhaled and exhaled concentrations of the volatile agent (29). Propofol infusion is commonly used intra-venously to maintain the level of anesthesia (30). The desired level of maintenance depends on patient-and surgery-related factors, and the drug concentration is

adjusted using the infusion pump. Adjunctive utilization of nitrous oxide with oxygen can be used for maintenance; however, it is insufficient to produce GA alone (31). Nitrous oxide is a potent analgesic agent with minimal effect on the cardiorespiratory system (32). The intra-venous technique minimizes the exposure to emetogenic volatiles used during inhalation and consequently reduces the risk of post-GA systemic effects (Table 3) (33,34).

Table 3: The systemic effects of general anesthesia on the body

| System | Volatiles, Propofol, and Thiopentone | Ketamine |
|-------------------------------|--|---|
| Cardiovascular | Decreases cardiovascular dynamics | Increases cardiovascular dynamics |
| Respiratory | Loss of airway reflexes and tone with the presence of transient apnoea, specifically with propofol | Airway reflexes and tone are maintained due to the bronchodilatation effect |
| Gastrointestinal | Propofol prevents or reduces nausea and vomiting, while volatiles increase the potential for nausea and vomiting | Increases the potential for nausea and vomiting |
| Central nervous system | Provide a hypnotic effect | Increases hallucinations with the emergence of delirium |

Additionally, intra-venous maintenance of anesthesia has a rapid recovery with minimal hangover effect; so, it is a suitable technique for day procedures and patients with intellectual disabilities (35).

Airway management is an essential element of any dental treatment under GA to maintain a patent and secure airway, ensure adequate ventilation, prevent soiling of the airway from blood, debris, and irrigation fluid, and ensure adequate access to the mouth for safe and effective dental treatment (36). The airway can be maintained using tracheal intubation (i.e., nasal or oral) or by using a supraglottis airway device (i.e., laryngeal mask airway; LMA) (37).

Tracheal intubation requires laryngoscopy to insert, while LMA is inserted blindly above the glottis. LMA compromises access to the mouth, as it remains in the surgical field (38), with the risk of dislodgement (39) and obstruction, and it is not suitable for patients with intermittent positive pressure ventilation (IPPV) (40). However, LMA requires less time to insert and can be left in place during recovery (41), which helps improve efficiency. Muscle relaxants are usually required to facilitate intubation and mechanical ventilation, but are not required with LMA (42). The authors advise considering using nasoendotracheal intubation due to its suitability for oral procedures under GA.

Muscle relaxants act by blocking the neuro-muscular transmission at the neuro-muscular junction. For example, depolarizing drugs with a duration of action of five minutes, such as suxamethonium, or non-depolarizing drugs with a duration of action of 30 to 45 minutes, such as atracurium and rocuronium, are typically used.

Placement of the throat pack is a common practice after tracheal intubation to prevent fluid and debris from the mouth from entering the esophagus/lungs (43). Insertion and removal of the throat pack must be notified to all staff, clearly documented, and marked visually using a sticker. An unidentified and retained throat pack can cause complete airway obstruction post-operatively (40).

Cardiorespiratory monitoring during GA is essential

to ensure normal hemodynamics and is achieved by monitoring machines that should be attached to the patient before induction and continued until recovery. In an uncooperative IWID, monitoring equipment can be attached as soon as possible after the induction of GA (44). Monitoring equipment that should be available during GA includes pulse oximetry, non-invasive blood pressure, electrocardiogram, airway gases and pressure monitors, and thermometer (44).

4. Dental Treatment under GA

Once the patient is anesthetized and the airway is maintained, the dental team can start the planned dental procedures. Table 4 summarizes recommendations regarding the provision of dental treatment under GA.

Table 4: Dental considerations that can be followed under general anesthesia

| Type of dental treatment | Recommendations |
|--|--|
| At the beginning of the day and before starting the treatment | <ul style="list-style-type: none"> • Team briefing following World Health Organization guidelines • Making clear plan using a board • Dentists have the option to work sitting or standing, but bearing in mind the bed height, a step can be used if the bed is too high |
| Restorative treatment | <ul style="list-style-type: none"> • Dental loupes can be used • It is advisable to perform the conservative treatment on the same side due to better visual access • Bleeding and saliva are considered major issues, as they affect the marginal seal of restoration; therefore, some dentists prefer to use a rubber dam, but this may be time-consuming under GA • Local anaesthesia with adrenaline helps reduce bleeding • Using a single-step etch and bond technique provides a fast and easy solution • Posterior teeth can be treated with either amalgam or composite • Buccal access restoration in the anterior teeth helps facilitate easy access for restoration, and often can leave more of the enamel palatal wall, which makes checking occlusion easier |
| Periodontal treatment | <ul style="list-style-type: none"> • Non-surgical periodontal therapy and root planning should be delivered effectively, recording the basic periodontal examination |
| Radiographic examination | <ul style="list-style-type: none"> • The radiographic team should be informed if the dental radiographs are required or have been taken during the assessment under GA • A pack of gauze to support intraoral radiographs should be always considered |
| Endodontic treatment | <ul style="list-style-type: none"> • European Society of Endodontology guidelines can be followed for teeth requiring root canal treatment under GA (45) |
| Prosthetics treatment | <ul style="list-style-type: none"> • Immediate dentures are usually provided after upper anterior teeth extraction or full clearance to reduce bleeding after the extraction, and achieve better appearance and tolerance of dentures |
| Dental extraction | <ul style="list-style-type: none"> • Dental operators should try to prevent post-operative bleeding using resorbable sutures, hemostatic agents, topical tranexamic acid, and local anaesthesia |

5. Recovery, Emergency, and Post-GA Medications

After completing the planned dental treatment, the dental team should be careful to remove all debris, amalgam remnants, and tooth particles from the mouth

before removing the throat pack. Using suction at the end of the surgery is important to eliminate this debris and remove saliva and blood that have accumulated in the oropharynx area (46). Once the mouth is clear of debris and

fluids, the throat pack should be removed and documented. The National Patient Safety Agency found that some surgeons forgot to remove throat or pharyngeal packs (N=32) after the surgery in the United Kingdom between November 2003 and July 2007 (47). Therefore, all staff in the theatre team should be informed when a throat/pharyngeal pack is used (40) to ensure removal of the throat/pharyngeal pack before extubating, as it can obstruct the airway and complicate recovery (47).

If muscle relaxants were used during the intubation stage, a reverse neuro-muscular blockade should be used to reverse the effect (42). Patients with nasal or oral intubation should be extubated when awake (i.e., spontaneous ventilation with adequate tidal volume) and protective airway reflexes are returned to normal, while patients with LMA can be transferred to the recovery room while still sedated (41).

In the recovery room, the vital signs are monitored regularly, and appropriately trained nursing staff ensure safety and manage immediate anesthetic and/or surgical complications, such as vomiting, dehydration, coughing reflexes, oxygen desaturation, and hypotension (48). Analgesics and antiemetic drugs are usually given, especially in patients who underwent dental extraction or have a history of vomiting after GA (48).

Not all post-anesthetic side effects are avoidable (49). Common side effects affect one in 10 to one in 100 patients, such as feeling sick, vomiting, sore throat, dizziness, feeling faint, shivering, headache, chest infection, itching, aches, soreness, pains, memory loss, backache, confusion, bruising, and bladder problems. Uncommon side effects affect one in 1000 to one in 10,000 patients, such as breathing difficulty, neuropathy, damage to teeth, lip, tongue, and eyes. Rare side effects affect one in 10,000 to one in 100,000 patients, such as allergic reactions to drugs, equipment issues, and death (one in 100,000). The causes of death with the administration of GA are aspiration, reduction of oxygen, poor management of respiratory depression, severe allergic reaction to drugs, and equipment issues (49).

6. Special Considerations for IWID with Obesity

Obesity causes several abnormal physiological changes that affect the body; hence, it is associated with

multiple morbidities (50). It is classified by the WHO using the body mass index (BMI) (51). IWID with obesity are at increased risk of various medical conditions, including diabetes, cardio-vascular disease, breathing disorders, hypertension, gastro-esophageal reflux disease, and fatty liver cirrhosis (52). Additionally, the presence of obstructive sleep apnea may indicate more complicated airway management during GA (53). Therefore, the STOP-Bang scoring model is recommended (54). However, IWID can be safely managed as day cases by expert staff with appropriate resources, and the absolute level of BMI should not be used as the sole indicator for suitability for day case surgery (55). In 1992, the Royal College of Surgeons recommended that patients with a BMI of greater than 30 kg/m² should be excluded from day procedures (56). However, in 2002, the National Health Services Modernization Agency raised the limit to at least 35 kg/m² and up to 40 kg/m² for many procedures (57). It has now become common practice to accept day surgery patients in whom management would not be altered by inpatient admission. The fifth edition of the British Association of Day Surgery directory of recommended day surgery and short-stay surgical procedures was published in June 2016 (58) and contains over 200 procedures categorized by surgical specialty, assigning each procedure to one of four treatment options (i.e., procedure room, day case, under 23-hour stay or under 72-hour stay).

7. Conclusion

GA offers the dentist an opportunity to deliver safe, quality dental care to IWID who cannot tolerate dental treatment under local anesthesia, or those with extensive dental disease. The provision of dental care under GA requires adequate background and preparation, as well as thoroughness throughout its implementation.

Conflict of Interests

The authors have no conflict of interests to declare.

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