Ambulatory Dental Procedures in Children with Intellectual Disability: A Ten-Year Review

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Abstract

Children with intellectual disabilities (ID) are often uncooperative for dental procedures so general anaesthesia is increasingly being used. Our goal was to assess anaesthetic management safety of children with ID proposed for dental procedures at our Ambulatory Unit. We conducted 10 year-long observational retrospective study of 138 children with ID (cases) and 138 without ID. Ages ranged from 4 to 17 years old, with male prevalence. The following were associated with cases: higher ASA and Mallampati scores, non-cooperation in airway assessment, inhalation anaesthesia and laryngeal mask utilization. No statistically significant differences regarding intra and postoperative complications. Children with ID were safely managed in ambulatory setting.

Keywords: Ambulatory Surgery, Children, Intellectual disabilities, Dental procedures, Safety.

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Introduction

Dental health problems are particularly prevalent among children with intellectual disabilities (ID) due to a myriad of factors such as poor oral hygiene or a cariogenic diet(1).

These children are often uncooperative for dental procedures due to their difficult behaviour management (1) and associated fear and anxiety (2), so in many cases they would hardly tolerate treatments under local anaesthesia.

Over the recent years, a growing number of patients require the presence of an anaesthesiologist to accomplish general anaesthesia (3), which has often been preferred in ID patients, anxiety issues, long and complex restorative and operative procedures, allergy or inefficacy of local anaesthetics, among others (2). It provides immediate pain relief and the opportunity to execute all the necessary interventions in the same operative time (3). The use of reversible, short and fast-acting anaesthetic agents, makes it possible to perform these treatments under GA in Ambulatory settings (4), whenever patients' characteristics favour and/or allow it.

There is scarce information on anaesthetic safety and postoperative complications and morbidity following GA in this particular population in Ambulatory Surgery in Portugal. The main goal of this study was to assess anaesthetic management safety of children with ID proposed for dental procedures at the Ambulatory Unit of a Portuguese central hospital compared with children without ID, over a ten year-long long period (January 2009-January 2019).

Methods

Our study was approved by the Ethic Committee of the Centro Hospitalar Vila Nova de Gaia/Espinho. We conducted an observational retrospective study that included 451 children that underwent dental procedures at our Hospital's Ambulatory Unit from January 2009 to January 2019.

From the total number of patients, we found 138 children with intellectual disabilities (International Classification of Diseases (ICD) 11th revision) that were unable to cooperate for the procedures and that were proposed for anaesthetic evaluation by the stomatology department. These were matched with 313 possible controls, based on a 1:1 approach, controlling for gender and age, and 138 children without ID were selected. The allocation of controls was randomized by blocks. Hence, for all male cases of each age block, a random sample of male controls of the same age was selected, reducing possible systematic errors. The same was performed for female cases. Whenever possible, the match was maintained at zero tolerance: no tolerance was allowed for gender and maximum tolerance allowed for age was +/- 1 year.

Groups were reviewed regrading: intellectual disability diagnosis, age, gender, systemic illnesses, American Society of Anaesthesiologists (ASA) Classification, Mallampati score, type of surgery, type of anaesthesia and intubation, anaesthetic drugs used, airway management difficulties, procedure duration and intra and postoperative complications. The information was collected by reviewing the patients' clinical charts regarding the mandatory preoperative anaesthetic consultation, perioperative records and postoperative stomatology consultations.

Statistical data analysis was conducted with SPSS (version 24; IBM Corporation, 2016). Variables were described with means (M) and standard deviations (SD) for quantitative variables, frequencies (n) and percentages (%). Variables association was measured with Chi-square test (X2) or Fisher exact test, when more than 20% of the crosstab cells had frequencies lower than 5. Results were evaluated at the $P < 0.05$ level of significance.

Results

Children' ages ranged from 4 to 17 years old. Demographics after case control matching showed no statistical differences (p=0.606) between cases (M=10.01; SD=3.63) and controls (M=10.25; SD=3.82) regarding age. Gender proportion was 61.6% males and 38.4% females for both cases and controls.

Table 1 shows separate diagnosis for all cases. The most frequent disability was pervasive development disorder/autistic disorder (43.5%), followed by Attention Deficit Hyperactivity Disorder (ADHD) (23.9%) and chromosomic abnormalities (19.6%).

The most common concurrent diagnosis was pervasive development disorder/autistic disorder with chromosomic abnormalities (12.3%).

Systemic diseases were dominant in cases (46.7%) comparing to controls (29.7%) (p=0.004).

As shown in Table 2, dental extraction was the most commonly performed surgery. Patients underwent dental extraction and dental

Table 1 Separate Diagnoses.

Description	n	%
Pervasive development disorder/Autistic disorder	60	43.5
ADHD	33	23.9
Chromosome abnormalities	27	19.6
Epilepsy	22	15.9
Cerebral Palsy	16	11.6
Changes in psychological development/ Educational skills	13	9.4
Mental Retardation	8	5.8
Malformation Syndromes	6	4.3

Table 2 Type of surgery.

	Controls	Cases	p-value
(χ2 test)			
Dental extraction	71 (51.4%)	87 (63.0%)	0.052
Dental extraction and restoration	48 (34.8%)	25 (18.1%)	0.002
Dental restoration	1 (0.7%)	20 (14.5%)	0.001
Mandible lesions extraction	8 (5.8%)	1 (0.7%)	0.036
Labial frenectomy	8 (5.8%)	4 (2.9%)	0.238
Mouth lesions excision	6 (4.3%)	1 (0.7%)	0.120
Complete sialoadenectomy	0 (0.0%)	1 (0.7%)	>0.990
Jugal mucosa biopsy	2 (1.4%)	1 (0.7%)	>0.990
Ulectomy	0 (0.0%)	1 (0.7%)	>0.990
Scaling/polishing	1 (0.7%)	1 (0.7%)	>0.990

restoration more often. We only present the results regarding the combination of dental extraction and restoration, but there were other less prevalent possible combinations of surgeries.

Higher Mallampati scores and non-cooperation in airway assessment were more associated with cases ($p<0.001$) (Table 3). We only found one reported case of predicted difficult airway, however there is a considerable lack of records.

Higher ASA scores were also more associated with cases as shown in Table 4.

All of the reviewed procedures were performed under GA and inhalation anaesthesia was more frequent in cases, as well as laryngeal mask utilization (Table 5). There was not great difference between the two groups regarding the choice of balanced anaesthesia or endotracheal tube use. Difficult airway was documented in 2.9% of the cases (vs 0.7%, $p=0.01$) with absence of records regarding this topic in 36.5% of the controls and 21.7% of the cases.

There was no significant difference between groups in terms of the various types of intravenous non-induction drugs used (Table 6).

Table 3 Airway assessment.

	Controls	Cases	p-value (χ2 test)
Mallampati Scores			
I	100 (72.5%)	68 (49.3%)	<0.001
II	25 (18.1%)	35 (25.4%)	
III	1 (0.7%)	4 (2.9%)	
Non-cooperative	0 (0.0%)	15 (10.9%)	
No records	12 (8.7%)	16 (11.6%)	
Predicted difficulty			
Yes	0 (0.0%)	1 (0.7%)	0.091
No records	13 (9.5%)	23 (16.7%)	

Table 4 ASA Scores.

ASA Scores	Controls	Cases	p-value (χ2 test)
I	95 (68.8%)	0 (0.0%)	<0.001
II	43 (31.2%)	113 (81.9%)	
III	0 (0.0%)	25 (18.1%)	

Table 5 Type of anaesthesia and airway management.

ASA Scores	Controls	Cases	p-value (χ2 test)
Inhalation	26 (18.8%)	43 (31.2%)	0.026
Balanced	68 (49.3%)	66 (47.8%)	
No records	44 (31.9%)	29 (21.0%)	
Airway Intervention			
Orotracheal tube	81 (58.7%)	80 (58.0%)	0.007
Laryngeal mask	7 (5.1%)	22 (15.9%)	
No records	50 (36.2%)	36 (26.1%)	

Table 6 Non-induction drugs.

	Controls	Cases	p-value (χ2 test)
Antiemetics/Anti-reflux	80 (58.0%)	85 (61.6%)	0.539
Anxiolytics / Analgesics / Anti-inflammatories	84 (60.9%)	91 (65.9%)	0.382
Antibiotics	58 (42.0%)	59 (42.8%)	0.903
Respiratory drugs	16 (11.6%)	20 (14.5%)	0.475
Cardiovascular drugs	21 (15.2%)	18 (13.0%)	0.604
Neuromuscular Blocking Reversals	28 (20.3%)	22 (15.9%)	0.348

Concerning induction agents, the combination of fentanyl, propofol and rocuronium was observed in 40.6% of the controls and 22.5% of the cases, whilst the combination of fentanyl and propofol was recorded in 20.2% of the controls versus 26.1% of the cases. Once again, the percentage of "no records" regarding induction drugs is fairly high (31.2% of the controls and 38.4% of the cases).

There was also no significant difference between groups when considering anaesthesia time (p=0.381) with a majority of surgeries lasting from 1 to 2 hours in both controls (45.7%) and cases (46.4%). Only 13 children without ID and 21 children with ID stayed in the operating room for more than two hours and 1 of the controls and 2 of the cases for more than three.

The same was true about intraoperative complications shown in Table 7: none verified in 70.3% of cases (vs 68.8%, p=0.109) with bradycardia as the most common complication in cases (5.8%).

Table 7 Type of anaesthesia and airway management.

	Controls	Cases	p-value (χ2 test)
None	95 (68.8%)	97 (70.3%)	
Bradycardia	1 (0.7%)	8 (5.8%)	
Bronchospasm	4 (2.9%)	4 (2.9%)	0.109
Hypotension	1 (0.7%)	1 (0.7%)	
No records	37 (26.8%)	28 (20.3%)	

There were no registers of middle term postoperative complications (investigated in the postoperative stomatology consultation) in both groups (p=0,035). In 21.9% of the controls and 12.3% of the cases there was no postoperative consultation nor there were no records available.

Discussion

As stated by the American Academy of Paediatric Dentistry (5), deep sedation or general anaesthesia may be extremely useful to perform dental treatments in specific patients with medical, psychological or behavioural conditions.

Normally, a visit to the dentistry/stomatology office is a cause of great anxiety to many children, so it is acceptable to assume that in ID children the scenario wouldn't be different (6). With GA, we facilitate treatment, achieving reduced levels of worry and apprehension and a more optimistic attitude towards this type of procedures in both patients and parents, ensuring a similar level of oral health care when compared to children without ID (5).

To succeed in this mission and assure the best care to these children in ambulatory settings, preparation and preanaesthetic evaluation are paramount (7). In our study, all children were evaluated by a trained anaesthesiologist, weeks prior to the procedure and an individualized anaesthetic plan was developed. In this consultation, patients' demographic features, systemic diseases, allergies, regular medication, ASA classification and airway features were assessed.

As previously reported, our population's age was between 4 and 17 years old. Similar to what has been reported in previous studies by Sitilci et al (2) and Norderyd et al (6), we also verified male prevalence (61.6%) in our research. Although we couldn't totally find an explanation for this result, Sitilci et al (2) point out the fact that male patients usually have superior physical strength and would have been harder to control with only behaviour management techniques, being more commonly proposed for GA.

Regarding systemic illnesses, although we don't specify accompanying diagnosis besides the main intellectual disability diagnose, we report higher ASA scores in ID children. This is congruent with Sitilci et al (2), defending that ID children have frequently other associated illnesses, that could lead to perioperative complications.

We also found higher Mallampati scores and higher rates of non-cooperation in airway assessment in our case group. Airway examination is a hard task in non-cooperating patients and in children with craniofacial abnormalities associated with various syndromes (2). Having said so, Mallampati score alone could be an insufficient tool to predict difficult airway management. The obtained higher Mallampati scores could have been, in some cases, due to insufficient collaboration and mouth opening.

The one predicted difficult airway detected in preanesthestic evaluation was managed in our ambulatory unit by anaesthesiologist choice with adequate preparation and there were no associated complications. The same care was taken when dealing with patients that didn't allow us to evaluate the airway.

When analysing the type of surgeries, both groups most commonly underwent dental extraction alone, followed by extraction and restoration in the same operative time and then solely dental restoration. On the contrary, Mallineni et al (3) reported higher percentage of restorative procedures in special need patients, as was also referred in other previous studies (8,9). Nevertheless, there are conflicting published results on this, with divergences in various paediatric age groups (3). We couldn't find an explanation and were surprised to notice that the combination of extraction and restoration in the same surgery was more prevalent in children without ID, since we believe it would be an advantage for ID children to perform both altogether. Regardless the order, these were the major surgical indications for general anaesthesia in children with and without ID.

The majority of our ID and non-ID children were managed with balanced anaesthesia in very equivalent frequencies. Whenever venepuncture was not successively achieved prior to induction, inhalation was the obvious choice. This is more frequent in children with ID, so we had 31.2% of them submitted to inhalation with sevoflurane (vs 18.8%). Although sevoflurane has been associated with agitation in small children (3), it continues to be the inhalation agent of choice for its tolerable smell, non irritation of the airway and safe profile regarding possible respiratory complications (2). Despite this, our anaesthesiologists favoured intravenous inductions whenever possible.

Invasive airway with an endotracheal tube was also the most common choice in both groups, mainly because of the surgical area and technique, but also related with systemic illnesses that would favour airway protection. Sitilci et al (2) and Mallineni et al (3) also mention nasal intubation as one of the most performed in dental procedures. Considering laryngeal masks, they were used most commonly in ID children. The choice of avoiding muscular relaxants is understandable in ID children in which airway assessment was particularly challenging or with cranial and facial abnormalities, escaping the risks of a "non-ventilate, non-intubate" situation. Having said so, we agree that a laryngeal mask is a good option whenever possible, if we believe there is a low risk of regurgitation and aspiration.

Difficult airway was documented in 2.9% of the cases (vs 0.7%, p=0.01). All of these cases were safely and timely managed without the need for rescheduling surgery or longer hospital stay. In 2008, Rodríguez et al (10) realized that airway management was progressively more complex in increasingly disabled patients. However, similarly to our and SitilciT. et al (2) results, statistically significant differences between groups were not found regarding difficult intubations.

There was also no significant difference between groups in terms of the various types of intravenous non-induction drugs used (antiemetics/anti-reflux, anxiolytics/analgesics/anti-inflammatories, antibiotics, respiratory, cardiovascular and neuromuscular blocking reversals). Although the use of preoperative sedatives in children is

a much debated issue (11), we only found a total of 8 children (4 of each group) requiring intravenous midazolam. Since one of our institution's protocols recommends oral midazolam (0.3-05mg/kg) for agitated children before entering the operation room, we believe there are records missing regarding this matter. This practice allows reduced levels of anxiety and better cooperation with inhalation (2), not only, but specially in children with ID.

It is established that ambulatory surgeries should have a limited time up to about 120 minutes (10), providing optimal use of operating rooms (3). Accordingly, we had a majority of surgeries lasting from 1 to 2 hours with no significant difference between groups, similar to previous revisions (3,10).

Regarding intraoperative complications, our findings were very encouraging as there were not statistically significant differences between groups. In a great majority of the situations, complications were absent. Bradycardia was the most common complication in cases (n=5), analogous with previously described results (2,10). In these cases, cardiac abnormalities were not found in the preanaesthetic visit, which is congruent with cases reported by Sitilci et al (2). It has been shown high incidence of bradycardia when sevoflurane is used for induction, but further studies would have to be performed with ID children, so it is only advisable to remember the possibility of this complication and avoid inhalation in Down Syndrome patients (2). Apart from this, we also had two cases of bronchospasm and hypotension in each group without statistically significant differences between them. On the contrary, Rodríguez et al (10) believe that the cases of bronchospasm of their study were related to the manipulation of more complex airways since they only found it in serious and very serious ID patients.

After the procedures, in post anaesthetic care units, various types of complications can occur: toothache (3), nausea and vomiting (3,12), respiratory depression, prolonged recovery, haemodynamic compromise (2), amongst others. In our study, we didn't find any records of any kind of complications. We trust this is due to three factors: first, there were no serious complications to report; second: we have very strict protocols regarding pain control and postoperative nausea and vomiting prophylaxis; and third: there was a lack of minor complications report. Knowing that we implemented the same protocols for both of the studied groups, we can conclude that we had a majority of uneventful immediate postoperative recoveries. However, further studies are needed in our institution to establish detailed postoperative incidents prevalence in children.

Postoperative stomatology consultation reviews did not unveil any middle term complications (1-3 months) in both groups.

It is of remarkable importance to say that in the majority of the studied variables there is an objectively high percentage of records absence. Although we have noticed an improvement in anaesthetic data registries in the last reviewed years, this is a significant limitation of our study. Future institutional policies will be implemented to improve this practice amongst our health care professionals team.

To conclude, children with ID were safely managed in our ambulatory setting. We provided successful dental health care treatments to a vast number of children, with previous planning and preparation. Equivalent standards of practice in this group of children compared to children without ID were assured.

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