

## Original Article

# Comparison of Patients with and without Intellectual Disability under General Anesthesia: A Retrospective study

T Sitilci, S Demirgan<sup>1</sup>, C Akcay, N Kahraman, BG Koseoglu, MA Erdem, AB Cankaya

Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul University, Istanbul, <sup>1</sup>Department of General Anesthesia, Düzce Public Hospital, Düzce, Turkey

ABSTRACT

**Background and Purpose:** We analyzed and retrospectively compared patients with and without intellectual disability (ID) who underwent oral surgery under general anesthesia at Istanbul University, Faculty of Dentistry, Department of General Anesthesia, between October 2012 and June 2013 with regard to the following categories: Demographic features, American Society of Anesthesiologists (ASA) classification, Mallampati score, type of anesthetic drug used during the operation, type of intubation used, any difficulties with tracheal intubation, presence of systemic diseases, and recovery times after ending general anesthesia. **Materials and Methods:** A total of 348 patients were selected from the Department of Maxillofacial Surgery and the Department of Pedodontics who underwent surgery with general anesthesia. Medical histories of all patients were taken, and their electrocardiography, chest X-rays, complete blood count, and blood clotting tests were checked during a preoperative assessment. Mallampati evaluations were also performed. Patients were grouped into ASA I, II, or III according to the ASA classification and were treated under general anesthesia. **Results:** There was no significant difference between normal and intellectually disabled patients in terms of gender, Mallampati scores, intubation difficulties, mean anesthetic period, time to discharge, or postoperative nausea and vomiting. Epilepsy and genetic diseases in intellectually disabled patients were significantly more common than in non-ID (NID) patients. However, the frequency of diabetes and chronic obstructive pulmonary disease in NID patients was significantly higher than in the intellectually disabled patients. **Conclusion:** Dental treatment of intellectually disabled patients under general anesthesia can be performed just as safely as that with NID patients.

**KEYWORDS:** Dentistry, general anesthesia, intellectually disabled patients, nonintellectually disabled patients

Acceptance Date: 27-01-2016

## INTRODUCTION

Despite modern technology, dental treatment continues to induce fear and anxiety in many patients. It has been reported that dental anxiety is the fifth most common cause of frequent anxiety.<sup>[9,11]</sup> General anesthesia is used to control pain and anxiety in medical and dental practice. General anesthesia is relatively safe and works rapidly, but there is always a risk for error, and the extra attention required for patients receiving general anesthesia can be exhausting for physicians. General anesthesia is frequently used for oral and maxillofacial surgical operations that are so broad or prolonged that they cannot be performed using local anesthesia. General anesthesia is preferred for patients with intellectual disabilities (IDs), anxiety problems, or

psychological disorders and for those in whom sedation has been unsuccessful. It is also often used for patients undergoing restorative and operative dental procedures, for patients who are allergic to local anesthetics, in cases where local anesthetics are ineffective, in cases with a very strong emetic reflex, and in those cases where dental diseases are accompanied by systemic diseases.<sup>[3,4]</sup>

ID, also called as intellectual development disorder and formerly known as mental retardation (MR), is a

**Address for correspondence:** Dr. T Sitilci, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul University, Istanbul 34093, Turkey.  
E-mail: [tsitilci@istanbul.edu.tr](mailto:tsitilci@istanbul.edu.tr)

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**For reprints contact:** [reprints@medknow.com](mailto:reprints@medknow.com)

**How to cite this article:** Sitilci T, Demirgan S, Akcay C, Kahraman N, Koseoglu BG, Erdem MA, Cankaya AB. Comparison of patients with and without intellectual disability under general anesthesia: A retrospective study. *Niger J Clin Pract* 2017;20:438-44.

Access this article online	
Quick Response Code: 	Website: <a href="http://www.njcponline.com">www.njcponline.com</a>
	DOI: 10.4103/1119-3077.204372

condition that emerges during the developmental period in which general mental functions are below normal, and adaptive behaviors are inadequate.<sup>[33,38]</sup> As of 2013, (update) the term “MR” was still used by the World Health Organization (WHO), but it is expected that the term “MR” will be replaced with “ID.”

The WHO reported that patients with ID constituted 3% of the world population.<sup>[7]</sup> The risk of infection in ID patients is higher than in healthy individuals due to odontogenic infection risk, poor oral hygiene, and immune system inhibition.<sup>[5]</sup> Commonly, patients with ID are not cooperative, and thus, general anesthesia is required for their dental therapy and even for oral examinations.<sup>[21,27]</sup> As a result, oral and dental therapies for such patients are commonly done under general anesthesia.<sup>[29]</sup>

A significant number of ID cases also have central nervous system diseases such as epilepsy, poor motor control, stroke, and spasticity. Muscular and skeletal anomalies in the head and neck may make it difficult to obtain airway patency. The following problems, which are routinely seen in ID patients, may make the application of general anesthesia difficult and can even cause problems until patient discharge: Scoliosis (which impacts lung function), muscle coordination problems and contractures, neurological diseases, cardiovascular system diseases, accompanying metabolic diseases, and other difficulties due to genetic syndromes.<sup>[1]</sup>

The aim of this study was to analyze and retrospectively compare characteristics of patients with and without intellectually disabilities who underwent surgery with general anesthesia at Istanbul University, Faculty of Dentistry, Department of Dental General Anesthesia, between October 2012 and June 2013 in the following categories: Demographic features, American Society of Anesthesiologists (ASA) classifications, Mallampati scores, type of anesthetic drug used during the operation, type of intubation used, any difficulties with tracheal intubations, presence of systemic disease, recovery times, and any complications due to general anesthesia.

## MATERIALS AND METHODS

Our study included 348 patients who were treated at the General Anesthesia Unit of the Faculty of Dentistry, Istanbul University, between October 2012 and January 2014. The following criteria were taken into consideration when grouping the patients:

- Inability to cooperate due to ID or any other reason
- A prior attempt for sedation was unsuccessful due to dental phobia or strong emetic reflexes of the patient
- Presence of systemic diseases accompanying the dental problem(s).

Based on these criteria, patients were divided into ASA Groups I, II, or III and were treated under general anesthesia.

According to routine practices in our department, the medical histories of all patients who underwent surgery with general anesthesia were taken, and their electrocardiography, chest X-rays, complete blood count, and blood clotting tests were checked during a preoperative assessment. Systemic examinations and Mallampati evaluations were performed.

Patients were taken to our clinic on the day of their surgeries. Venipuncture was performed in non-ID (NID) patients and in ID patients who did not have serious cooperation limitations. The latter group of patients received intravenous midazolam (Roche, Switzerland) 15 min prior to their admission to the operating room for premedication purposes. The patients who rejected venipuncture received oral midazolam (Roche, Switzerland) 30 min prior to the operation.

Induction of general anesthesia in patients who had an intravenous cannula was performed with intravenous pentothal sodium or propofol, fentanyl (Vem ilaç, Turkey), and rocuronium (Schering-Plough, United States). Induction of anesthesia in patients who could not undergo venipuncture was performed via inhalation of 8% sevoflurane and a 50% N<sub>2</sub>O/O<sub>2</sub> gas mixture using a face mask. Then, intravenous cannulas were inserted, and fentanyl (Vem ilaç, Turkey) and rocuronium (Schering-Plough, United States) were administered after venipuncture.

Nasotracheal or orotracheal intubation was performed according to the surgery to be performed and the anatomical status of the airways. After endotracheal intubation, anesthetic maintenance was achieved with 1–2% sevoflurane in a gas mixture with 50% N<sub>2</sub>O/O<sub>2</sub>. Patients who underwent surgery or tooth extraction received intravenous lornoxicam (Nycomed, Turkey) or paracetamol (Atabay Pharmaceuticals, Turkey) as an analgesic and metoclopramide (Recordati, Turkey) as an antiemetic, if no contraindication existed.

At the end of the procedure, the patients received atropine (Traphaco, Vietnam) and neostigmine (Adeka ilaç, Turkey) for muscle recovery. The impact of rocuronium was eliminated with sugammadex (Merck Sharp Dohme, United Kingdom) in patients with muscular diseases, obesity, anatomical problems in the upper respiratory tract, or difficult intubation because the use of neostigmine and atropine may be insufficient or contraindicated for recovery. Patients were observed in the post anesthetic care unit after extubation and discharged when they reached a Modified Aldrete Scoring System (MASS) score  $\geq 9$ .

In this study, statistical analyses were performed using the Number Cruncher Statistical System 2007 software (NCSS, LLC, Kaysville, UT, USA). We used descriptive statistics (means, standard deviations) to evaluate the data. In addition, we used a one-way analysis of variance for intergroup comparisons, Tukey's multiple comparison test for subgroup comparisons, an independent groups *t*-test to compare binary groups, and a  $\chi^2$  test and Fisher's exact to compare qualitative data. Results were evaluated at the  $P < 0.05$  level of significance.

## RESULTS

Of 348 the cases treated at the General Anesthesia Unit, 186 were NID patients (NID, 53.4%) and 162 were ID (46.6%). The average age of all patients was  $20.48 \pm 16.14$  years. Of the NID patients, 87 were female and 99 were male. Of the ID patients, 54 were female and 108 were male. There were significantly more males than females in the ID group, but there was no significant difference in the proportions by sex in the NID group [Table 1] and [Table 2].

Of the NID patients, 50 (26.9%) were classified as ASA II due to additional disease, and six (3.2%) were classified as ASA III. Of the ID patients, 92 (56.8%) were classified as ASA II and six (3.7%) as ASA III. There was a significantly higher number of ID patients classified as ASA II when compared with NID patients [Table 3].

General anesthesia was used in 168 (48.3%) of the patients due to an inability to cooperate due to IDs and/or psychiatric diseases, 122 (35.1%) received general anesthesia due to dental phobias or strong emetic reflexes that could not be eliminated with sedation, and 58 (16.7%) underwent general anesthesia due to co-occurring systemic diseases that could not treat under local anesthesia.

**Table 1: Ratio of intellectually disabled to nonintellectually disabled (normal) patients**

	<i>n</i> (%)
Normal	186 (53.4)
Intellectually disabled	162 (46.6)
Total	348 (100)

**Table 2: Gender ratio between intellectually disabled patients and nonintellectually disabled patients**

	Men (%)	Women (%)	<i>P</i>
Normal	99 (47.8)	87 (61.7)	0.011
Intellectually disabled	108 (52.2)	54 (38.3)	
Total	207 (100)	141 (100)	

Based on the preoperative Mallampati evaluation, 31 (8.9%) patients were classified as Mallampati 3, 16 of these patients were in the NID, and 15 were in the ID group. There was no significant difference in Mallampati scores between the ID and NID patients.

Difficult intubations occurred in five (1.4%) patients; two of these were NID, and three were ID patients [Table 4]. There was no significant difference between NID patients and ID patients in the frequency of difficult intubation. Of the patients, 309 (88.8%) received nasotracheal and 39 (11.21%) received orotracheal intubation. No significant difference was observed between NID and ID patients in terms of intubation method.

Bradycardia developed during anesthetic induction in only two (0.6%) patients, both of whom were ID patients. However, this was not statistically relevant.

In the operating room, the mean anesthetic period was  $65.3 \pm 36.6$  min. No significant difference was observed between NID and ID patients in terms of anesthetic period [Table 5].

When we examined the relationship between the induction agent and the intraoperative periods of patients

**Table 3: The ratio of intellectually disabled patients to nonintellectually disabled patients by the American Society of Anesthesiologists classification**

	Nonintellectually disabled (%)	Intellectually disabled (%)	<i>P</i>
ASA I	130 (69.9)	64 (39.5)	0.0001
ASA II	50 (26.9)	92 (56.8)	
ASA III	6 (3.2)	6 (3.7)	
Total	186 (100)	162 (100)	

ASA=American Society of Anesthesiologists

**Table 4: Difficult intubations in intellectually disabled patients and nonintellectually disabled patients according to the American Society of Anesthesiologists classification**

	Normal (%)	Intellectually disabled (%)	<i>P</i>
Difficult intubation			
Negative	184 (98.9)	159 (98.15)	0.544
Positive	2 (1.1)	3 (1.85)	
Total	186 (100)	162 (100)	

**Table 5: Comparison of discharge time in intellectually disabled patients and nonintellectually disabled patients**

	<i>n</i>	Mean $\pm$ SD	<i>P</i>
Discharge time			
Nonintellectually disabled	186	119.3 $\pm$ 36.4	0.176
Intellectually disabled	162	114.5 $\pm$ 29.4	

in the operating room, we found that the operative period for the group with sevoflurane was shorter than for patients induced with pentothal and propofol. There was no statistically significant difference between anesthesia periods in patients who used propofol versus those who used pentothal. Similar results were also found in MASS evaluations [Table 6].

Patients were discharged after reaching a MASS value  $\geq 9$ . The mean discharge period was  $117.1 \pm 33.4$  min, and this did not differ significantly between the NID and ID patient groups [Table 7].

During the postoperative period and before discharge, postoperative nausea and vomiting (PONV) developed in 17 (4.9%) individuals [Table 8]. Nine of these cases were NID and eight were ID patients. Thus, there was no significant difference in PONV incidence. We evaluated the relationship between induction agent and PONV; 10 patients were induced with sevoflurane, one with propofol,

and six with pentothal. We found no significant difference in PONV according to induction agent [Table 9].

With regard to patients' diseases in addition to the dental problems, the most frequently seen diseases were epilepsy (18.1%), COPD (7.8%), and genetic diseases. The frequency of epilepsy and genetic diseases was significantly higher in ID than in NID patients. However, the frequency of diabetes and COPD was significantly higher in NID than in ID patients.

## DISCUSSION

Dental treatment under general anesthesia is a modern and humanistic method that is often required due to poor cooperation, contraindications, or the insufficiency of local anesthesia and long duration of treatment. Nearly, all such cases are managed as ambulatory procedures.<sup>[29]</sup> The preferred method of anesthesia for ambulatory procedures should adequately suppress intraoperative stress, maintain the patient's hemodynamic stability during the operation, and allow a short recovery period.<sup>[39,42]</sup>

Ambulatory dental treatment under general anesthesia has advantages that should not be understated for both NID and ID patients, given a good preoperative assessment, preparation, and choice of an optimal anesthetic agent. Ambulatory general anesthesia has many advantages, including low cost and the possibility of including several therapies in one session, and it has fewer undesired effects on patients and their families than standard treatment may have.

In this study, the ID group included significantly more men than women, consistent with previous reports. One reason for this lies in the difficulty of restraining and restricting male patients due to their physical strength.<sup>[14,43]</sup>

Before the induction of general anesthesia, ID and NID patients frequently require premedication to reduce anxiety and ensure smooth anesthetic induction, as well as to separate them easily from their families.<sup>[35]</sup> An ideal sedative drug for premedication should have a rapid start and stop of action and should not result in a delay of induction, waking, or recovery phases. Premedication drugs can be administered via oral, intranasal, intramuscular (IM), or rectal routes. The oral method is painless, is easily and safely applicable, has a short onset of action and a short period of action, has less potential

**Table 6: Discharge time according to induction agent used in general anesthesia**

	<i>n</i>	Discharge time (min)
Sevoflurane	191	109.1±28.7
Pentothal	111	128.1±36.4
Propofol	46	123.7±35.6
<i>P</i>	348	0.0001
<b>Tukey's test</b>		<b><i>P</i></b>
Sevoflurane/pentothal		0.0001
Sevoflurane/propofol		0.017
Pentothal/propofol		0.717

**Table 7: Average discharge time of surgery patients**

	<i>n</i>	Minimum	Maximum	Average	SD
Discharge time	348	45	300	117.1	33.4

SD=Standard deviation

**Table 8: Average number of patients with postoperative nausea and vomiting**

	Nonintellectually disabled (%)	Intellectually disabled (%)	<i>P</i>
PONV			
Negative	177 (95.2)	154 (95.1)	0.966
Positive	9 (4.8)	8 (4.9)	

PONV=Postoperative nausea and vomiting

**Table 9: Postoperative nausea and vomiting incidence according to induction agent used in general anesthesia**

	Sevoflurane (%)	Pentothal (%)	Propofol (%)	Total (%)	<i>P</i>
PONV (negative)	181 (94.8)	105 (94.6)	45 (97.8)	331 (95.1)	0.656
PONV (positive)	10 (5.2)	6 (5.4)	1 (2.2)	17 (4.9)	
Total	191 (100)	111 (100)	46 (100)	348 (100)	

PONV=Postoperative nausea and vomiting

for side effects, and allows rapid recovery.<sup>[22,23]</sup> Midazolam (85%), ketamine (4%), transmucosal fentanyl (31%), and meperidine (2%) are often preferred as sedative drugs.<sup>[22,28]</sup> Orally administered midazolam is an effective preanesthetic medication because there is a high degree of cooperation with the inhalation induction of anesthesia.<sup>[8]</sup> Oral midazolam (Roche, Switzerland) 0.75 mg/kg was given to our patients who did not receive an iv cannula 30 min prior to entering the operating room, and all of these patients could then be taken into the operating room with no problem. Midazolam is easy to administer. It will be easy and comfortable both to the doctor and the patient to achieve sedation without the need for cooperation of the ID patient. It will also help to reduce the anxiety of the ID patient.<sup>[6]</sup>

Because of its bad taste, oral midazolam can be mixed with fruit juice prior to administration.<sup>[15]</sup> Based on our experience and published studies stating that 5–10 mL fluid intake before general anesthesia is not a risk factor for aspiration, the drug was mixed with sour cherry juice.<sup>[37]</sup> During induction, no vomiting was observed. Although oral sedation among all sedation methods is easy to administer because it needs cooperation and a chance of positive aspiration new methods which are more safer and not needing cooperation with the patient should be refined.

Sevoflurane has many features of an ideal inhalational agent. It has low blood-gas solubility and allows uncomplicated and rapid induction of and emergence from anesthesia.<sup>[2,10]</sup> We prefer sevoflurane to minimize possible risks during intubation because it does not irritate the airway.<sup>[26]</sup> Sufficient time must be devoted to postoperative recovery. As it is in compatible with the current literature sevoflurane was tolerated well in both ID and NID patients and no respiratory disturbances were seen.<sup>[41]</sup>

An evaluation of airway patency is necessary to determine the intubation technique to be used and to preclude perioperative complications. However, examination of the airway may be less effective in ID patients.<sup>[4,40]</sup> Opening the airway can be difficult in some ID patients due to craniofacial anomalies associated with some genetic syndromes, growth of anatomical structures in the oral cavity and pharynx, obesity, diseases that limit cervical movement, and frequently seen upper respiratory tract diseases.<sup>[24]</sup> In our study, difficult intubations occurred in five cases: Three ID and two NID. No statistically significant difference was found between the levels of disability and Mallampati scores, consistent with the literature.<sup>[3,25]</sup> All of these cases were intubated with a Fastrach laryngeal mask airway (LMA). We did not have to terminate the anesthesia of any patient. We

note that the Mallampati score alone is not a sufficient indicator of difficult intubation in ID patients, and if it is impossible to make an advanced airway assessment, the operation must begin with the necessary equipment for each case. We advise that great care is taken during the induction of patients, and a muscle relaxant should not be administered without ensuring sufficient ventilation with a mask.

Nasotracheal intubation is the most frequently used intubation method in dental procedures because it decreases the dental operation time.<sup>[30]</sup> In this study, 309 (88.8%) patients were intubated by the nasotracheal route, and 39 (11.2%) by the orotracheal route. We had to use orotracheal intubation in patients with anomalies in the nasal airway because the intraoral location of the intubation tube would not block the working area and would shorten performance time. Nasotracheal intubation has some complications such as epistaxis, trauma, and infections. To avoid such complications, LMA is evaluated but there is still no noninvasive intubation way with no disturbances is adopted to routine usage.

When choosing muscle relaxant drugs, succinylcholine appears to be an ideal agent, with a rapid onset and stop of action. However, it has some side effects, such as myalgia, anaphylaxis, malignant hyperthermia, and cardiac rhythm disorders.<sup>[18]</sup> Thus, rocuronium (Schering-Plough, US), which is a nondepolarizing agent with medium effectiveness time, was preferred as a muscle relaxant. The use of sugammadex (Merck Sharp Dohme, UK), a specific antidote to rocuronium, was effective in our study. Rocuronium and sugammadex were used particularly in waking patients with muscle weakness, insufficient airway-protecting reflexes, or anatomical problems in their airways and in cases with difficult intubation.<sup>[17]</sup> Especially in ID patients if further investigations could not be performed, rocuronium or vecuronium is suitable for neuromuscular blockade. Because in patients with normal renal functions, sugammadex is used if management of difficult airway is needed. Besides by the help of sugammadex anesthesia ends up safely; therefore, invasive intubation is not needed especially in elective cases such as dental treatments. When planning anesthesia, the possibility of difficult airway management has to be evaluated and to avoid the late complications of neuromuscular blockers, drugs which have specific antidotes should be used.

ID patients generally have other accompanying systemic diseases. Therefore, they are open to many complications. It has been reported that a high incidence of bradycardia may develop independent of congenital heart disease during anesthetic induction with sevoflurane. Our study identified bradycardia in two ID patients (0.6%). This

was not statistically significant and was much lower than the rates published previously.<sup>[20]</sup> These patients do not have any cardiac diseases in their preoperative history. Bradycardia ended up in a short time and did not cause any hypotension or arrhythmia. No other anesthetic complication occurred. In ID patients, bradycardia complication of sevoflurane anesthesia always has been kept in mind and precautions has to be taken. Because of this is an expected risk, if it is possible IV induction drugs should be used in the patients who have Down syndrome.

A study in which the recovery profiles of sevoflurane and propofol were compared reported that sevoflurane may be the preferred anesthetic drug due to its short recovery period, particularly during short-term operations.<sup>[31]</sup> Another study reported no difference between sevoflurane and propofol in terms of eye opening and discharge periods, but patients in whom sevoflurane was used responded to orders earlier and recovered in a shorter time frame.<sup>[13]</sup> When we compared the periods for which our patients stayed in the operating room in terms of induction agent, we found that the period for the group who received sevoflurane was shorter than that for patients induced with pentothal and propofol. We also found that there was no statistically significant difference in this regard between pentothal and propofol.

During postoperative follow-up, no side effects (e.g., respiratory depression, prolonged recovery, and hemodynamic disorder) were encountered, with the exception of nausea and vomiting. Nausea with vomiting is an expected complication of sevoflurane use. A study in which sevoflurane and propofol were compared in an ASA I adult patient group who were preparing to undergo outpatient knee surgery reported nausea-vomiting in 32% of patients in the sevoflurane group and 18% of patients in the propofol group during a follow-up of 24 h.<sup>[32]</sup> Nausea-vomiting was reported in 10 of 91 patients in a study in which sevoflurane was used for induction and maintenance in patients receiving pediatric dental treatment under general anesthesia.<sup>[19]</sup> In our study, although no statistically significant difference was found, when 17 patients with PONV were examined, we found induction with sevoflurane in 10 patients, with pentothal in six, and with propofol in only one. This result is consistent with the literature.

ID patients have been reported to be at higher risk of recurrent PONV after general anesthesia.<sup>[36]</sup> However, in our study, nine cases with PONV were in the NID group, and eight in the ID group; there was no statistically significant difference between the groups. Based on this finding, ID may not be a risk factor for PONV, and this problem, when it appears, may be related to the more

frequent use of sevoflurane for induction in ID patients. It has also been stated that propofol should not be used as an induction agent among ID patients with PONV risk factors<sup>[16]</sup> and that the PONV incidence in ambulatory surgery units is between 3.5% and 4.6%.<sup>[12]</sup> In this study, the PONV incidence was 4.9%, similar to previously reported values. This result may also be associated with the metoclopramide (Recordati, Turkey) that we used intravenously for prophylactic purposes after the completion of the surgical operation.

None of our patients experienced pain requiring analgesic medicine during the postoperative period. We believe that this was associated with the administration of local anesthesia to reduce bleeding in the operative area, which also contributed to pain control during the operation.

## CONCLUSION

Dental treatment of intellectually disabled patients under general anesthesia can be performed just as safely as that with NID patients. A good preoperative assessment, appropriate premedication, and preparation of equipment for outpatient anesthesia and the correct indication for dental treatment are required.

“The authors have declared that no competing interest exists.”

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Bettelli G, Giulietti MP, Bitelli G, Iseppi D, Caproni G, Saetti A, *et al.* Handicapped patients. General anesthesia or sedation?. *Dent Cadmos* 1990;58:78-80.83-6, 89-93
- Bordes M, Cros AM. Inhalation induction with sevoflurane in paediatrics: What is new?. *Ann Fr Anesth Reanim* 2006;25:413-6.
- Borland LM, Colligan J, Brandom BW. Frequency of anesthesia-related complications in children with Down syndrome under general anesthesia for noncardiac procedures. *Paediatr Anaesth* 2004;14:733-8.
- Butler MG, Hayes BG, Hathaway MM, Begleiter ML. Specific genetic diseases at risk for sedation/anesthesia complications. *Anesth Analg* 2000;91:837-55.
- Cortiñas-Saenz M, Martínez-Gómez L, Roncero-Goig M, Saez-Cuesta U, Ibarra-Martín M. Results of a major ambulatory oral surgery program using general inhalational anesthesia on disabled patients. *Med Oral Patol Oral Cir Bucal* 2009;14:e605-11.
- Enever GR, Nunn JH, Sheehan JK. A comparison of post-operative morbidity following outpatient dental care under general anaesthesia in paediatric patients with and without disabilities. *Int J Paediatr Dent* 2000;10:120-5.
- Escribano Hernández A, Hernández Corral T, Ruiz-Martín E, Porteros Sánchez JA. Results of a dental care protocol for mentally handicapped patients set in a primary health care area in Spain. *Med Oral Patol Oral Cir Bucal* 2007;12:E492-5.

8. Feld LH, Negus JB, White PF. Oral midazolam preanesthetic medication in pediatric outpatients. *Anesthesiology* 1990;73:831-4.
9. Fiske J, Davis DM, Frances C, Gelbier S. The emotional effects of tooth loss in edentulous people. *Br Dent J* 1998;184:90-3.
10. Fredman B, Nathanson MH, Smith I, Wang J, Klein K, White PF. Sevoflurane for outpatient anesthesia: A comparison with propofol. *Anesth Analg* 1995;81:823-8.
11. Guckes AD, Smith DE, Swoope CC. Counseling and related factors influencing satisfaction with dentures. *J Prosthet Dent* 1978;39:259-67.
12. Gupta A, Wu CL, Elkassabany N, Krug CE, Parker SD, Fleisher LA. Does the routine prophylactic use of antiemetics affect the incidence of postdischarge nausea and vomiting following ambulatory surgery?: A systematic review of randomized controlled trials. *Anesthesiology* 2003;99:488-95.
13. Gupta A, Stierer T, Zuckerman R, Sakima N, Parker SD, Fleisher LA. Comparison of recovery profile after ambulatory anesthesia with propofol, isoflurane, sevoflurane and desflurane: A systematic review. *Anesth Analg* 2004;98:632-41.
14. Ide M, Aoyagi Y, Hoshi M, Moriyasu K, Takano F, Asada Y. A survey of the actual status of the dental treatment under general anesthesia at a paediatric dentistry clinic of a university dental hospital. *Jpn J Ped Dent* 2003;41:694-9.
15. Isik B, Baygin O, Bodur H. Effect of drinks that are added as flavoring in oral midazolam premedication on sedation success. *Paediatr Anaesth* 2008;18:494-500.
16. Yumura J, Nakata E, Miyata M, Ichinohe T, Kaneko Y. Risk factors for nausea and vomiting after day care general anesthesia in mentally challenged patients undergoing dental treatment. *Bull Tokyo Dent Coll* 2011;52:113-8.
17. Kawasaki E, Mishima Y, Ito T, Ito A, Takaseya H, Kameyama N, et al. Anesthetic management of a patient with Rett syndrome associated with trismus and apnea attacks. *Masui* 2012;61:96-9.
18. Kayhan Z. Muscle relaxant drugs. *Clinical Anesthesia 2*. Press. Istanbul Logos Publishing; 1997. p. 152-4.
19. König MW, Varughese AM, Brennen KA, Barclay S, Shackelford TM, Samuels PJ, et al. Quality of recovery from two types of general anesthesia for ambulatory dental surgery in children: A double-blind, randomized trial. *Paediatr Anaesth* 2009;19:748-55.
20. Kraemer FW, Stricker PA, Gurnaney HG, McClung H, Meador MR, Sussman E, et al. Bradycardia during induction of anesthesia with sevoflurane in children with Down syndrome. *Anesth Analg* 2010;111:1259-63.
21. Maestre C. The use of general anaesthesia for tooth extraction in young handicapped adults in France. *Br Dent J* 1996;180:297-302.
22. McCann ME, Kain ZN. The management of preoperative anxiety in children: An update. *Anesth Analg* 2001;93:98-105.
23. McGraw T, Kendrick A. Oral midazolam premedication and postoperative behaviour in children. *Paediatr Anaesth* 1998;8:117-21.
24. Michalek P, Hodgkinson P, Donaldson W. Fiberoptic intubation through an I-gel supraglottic airway in two patients with predicted difficult airway and intellectual disability. *Anesth Analg* 2008;106:1501-4.
25. Mirón Rodríguez MF, García-Miguel FJ, Becerra Cayetano A, Cojo Del Peces E, Rueda García J, Gilsanz Rodríguez F. General anesthesia in mentally disabled patients undergoing dental surgery. *Rev Esp Anestesiología Reanimación* 2008;55:137-43.
26. Moore JK, Moore EW, Elliott RA, St Leger AS, Payne K, Kerr J. Propofol and halothane versus sevoflurane in paediatric day-case surgery: Induction and recovery characteristics. *Br J Anaesth* 2003;90:461-6.
27. Murray JJ. General anesthesia and children's dental health: Present trends and future needs. *Anesth Pain Control Dent* 1993;2:209-16.
28. Naqash I, Nisa W, Zargar J, Farooqi A. Midazolam premedication in children: Comparison of nasal and sublingual routes. *J Anaesthesiol Clin Pharmacol* 2004;20:141-5.
29. Nunn JH, Davidson G, Gordon PH, Storrs J. A retrospective review of a service to provide comprehensive dental care under general anesthesia. *Spec Care Dentist* 1995;15:97-101.
30. Onçag O, Cökmez B, Aydemir S, Balcioglu T. Investigation of bacteremia following nasotracheal intubation. *Paediatr Anaesth* 2005;15:194-8.
31. Orhon ZN, Devrim S, Celik M, Dogan Y, Yildirim A, Basok EK. Comparison of recovery profiles of propofol and sevoflurane anesthesia with bispectral index monitoring in percutaneous nephrolithotomy. *Korean J Anesthesiol* 2013;64:223-8.
32. Raeder J, Gupta A, Pedersen FM. Recovery characteristics of sevoflurane-or propofol-based anaesthesia for day-care surgery. *Acta Anaesthesiol Scand* 1997;41:988-94.
33. Rosa's Law". Washington DC: US GPO. 2010; Available from: <https://www.gpo.gov/fdsys/pkg/PLAW-111publ256/content-detail.html>. Last retrieved on 2013 Sep 13.
34. Savanheimo N, Sundberg SA, Virtanen JI, Vehkalahti MM. Dental care and treatments provided under general anaesthesia in the Helsinki Public Dental Service. *BMC Oral Health* 2012;12:45-
35. Shah S, Shah S, Apuya J, Gopalakrishnan S, Martin T. Combination of oral ketamine and midazolam as a premedication for a severely autistic and combative patient. *J Anesth* 2009;23:126-8.
36. Shiki A, Ishihara Y, Ogata K. Analysis of factors associated with postoperative vomiting in day care anesthesia for dental treatment – Using nitrous oxide oxygen sevoflurane anesthesia. *J Jpn Dent Soc Anesthesiol* 2002;30:166-72.
37. Splinter WM, Stewart JA, Muir JG. The effect of preoperative apple juice on gastric contents, thirst, and hunger in children. *Can J Anaesth* 1989;36:55-8.
38. Colin T. General Learning Disability. Available from: <http://www.Patient.co.uk>. Last accessed on 2013 Jan 25
39. Viitanen H, Tarkkila P, Mennander S, Viitanen M, Annala P. Sevoflurane-maintained anesthesia induced with propofol or sevoflurane in small children: Induction and recovery characteristics. *Can J Anaesth* 1999;46:21-8.
40. Walker RW, Darowski M, Morris P, Wraith JE. Anaesthesia and mucopolysaccharidoses. A review of airway problems in children. *Anaesthesia* 1994;49:1078-84.
41. Welborn LG, Hannallah RS, Norden JM, Ruttimann UE, Callan CM. Comparison of emergence and recovery characteristics of sevoflurane, desflurane, and halothane in pediatric ambulatory patients. *Anesth Analg* 1996;83:917-20.
42. White PF, Tang J, Wender RH, Yumul R, Stokes OJ, Sloninsky A, et al. Desflurane versus sevoflurane for maintenance of outpatient anesthesia: The effect on early versus late recovery and perioperative coughing. *Anesth Analg* 2009;109:387-93.
43. Yasuda J, Aywata K, Ohyama Y, Tanabe S, Nishitonge K, Harada J, et al. Clinical study of dental treatments under general anesthesia for disabled – Statistical survey in our hospital during the past 10 years. *J Jpn Soc Disabil Oral Health* 2001;22:1-7.