Chapter

Anesthesia Considerations in the Perioperative of Patients with Lip and Palate Length

Silvia Peña, Claudia Paulina Reyes, Andres Felipe Beltran and Ofelia Ham

Abstract

There is a high risk of adverse events during anesthetic management in the pediatric population mainly in children under 1 year of age and with greater vulnerability: those undergoing head and neck surgery for involving airway, specifically patients who enter surgical correction of the lip and cleft palate. This pathology can be related in a high percentage to isolated malformations without integrating a specific syndrome or be part of the more than 500 associated craniofacial syndromes such as sequence Pierre Robin, Treacher Collins, and Goldenhar, among others; it is also associated in up to 10% with some heart disease. Factors that are determinants for anesthetic management have been identified in corrective surgery of the lip and cleft palate related to the patient's characteristics such as age and weight, his medical history or associated comorbidities, and the surgical technique. As it is the pathology with the highest incidence in facial malformations that requires surgical treatment, it is necessary to know the anesthetic management alternatives and establish criteria in the different stages of the perioperative period from preanesthetic assessment to postanesthetic care, in order to provide planned approach within the highest safety standards that reduce the risk of adverse events.

Keywords: craniofacial anesthesia and syndromes, anesthesia and cleft lip, cleft palate anesthesia, facial clefts and anesthesia, perioperative management

1. Introduction

Anesthetic management in the pediatric population has a higher risk of adverse events compared to the adult population, mainly in children under 1 year of age due to the anatomical characteristics of the airway that predisposes them to difficulty in ventilation and intubation [1–3].

In order to improve the safety of patients in the perioperative period, studies have been carried out to establish risk factors. The second report of the pediatric perioperative cardiac arrest (POCA) found respiratory complications as one of the main causes of perioperative circulatory arrest [4], observing a high incidence even in the absence of active upper respiratory infection and significantly impacting the economy by increasing hospital stay and costs up to 30%. Laryngospasm, hypoxemia, and bronchospasm were considered as the most common adverse events related to anesthesia [4, 5].

When attempting to identify patients with high risk, greater vulnerability was observed in those undergoing head and neck surgery that involves airway and specifically those of surgical correction of the cleft lip and palate [5–7]. The cleft lip and palate is the most common craniofacial anomaly nomination in Latin America whose incidence in Mexico.

Cleft lip and palate (CLP) is the most common craniofacial anomaly in Latin America whose incidence in Mexico is 1 per 800–1000 live births registered with great medical, psychological, and social repercussions [7].

It is defined as an elongated opening due to fusion failure between the lateral and medial nasal processes with the maxillary process during the fifth to eighth week of embryonic development, the severity of which is in relation to the percentage of interruption [8–10].

There are multiple classifications of orofacial clefts; due to their location, they can be unilateral, bilateral, or midline, and by their description, they are complete, incomplete, or submucosal, and according to structures, they involved the tip of the nose, nasolabial groove, lips, gums, hard palate, soft palate, and uvula [9, 10].

The etiology is heterogeneous due to the interaction of genetic and environmental factors during the early stages of pregnancy such as exposure to tobacco, alcohol consumption, nutritional deficiencies, viral infections, and exposure to phenytoin-like teratogens, valproic acid, thalidomide, and herbicides [8, 11]. Prenatal diagnosis of cleft lip can be performed reliably in the 18–20 weeks of gestation, while the cleft palate is difficult to identify before birth [10].

Bibliographic reviews based on advances in medical technology agree that although surgical repair of cleft lip and palate is not an emergency, it should be done at an early age; the objective is to favor dentition and the development of hearing and language and reduce the incidence of respiratory infections by offering better esthetic and functional results that impact on the quality of life at an individual, family, and social level, with a low morbidity rate and zero mortality [7, 9, 12]. Primary repair of cleft lip and tip of the nose is performed around 3 months of age and that of cleft and maxillary palate at 9–12 months of life [13, 14].

Patient characteristics	**Comorbidities**	**Surgical management**	**Anesthetic management**	**Postoperative management**
Age	Associated syndromes (Pierre Robin, Treacher, Goldenhar)	Surgical technique	Anesthetic technique	Presence of bleeding
Weight	Pneumopathies	Procedure duration	Induction type	Pain management
Type of defect	Heart disease		Airway management	Airway edema
Recurrent respiratory tract infections			Endotracheal tube used	Nausea and vomiting postoperatively
Mishandling of secretions			Maintenance	Postoperative agitation
Anatomical predictors of difficult airway			Extubation technique	

Table 1.
Factors to consider for the perioperative approach of patients with CLP.

Surgical treatment of fissures is a challenge for the plastic or maxillofacial surgeon and for the anesthesiologist. As a historical background, the first references on the management of cleft lip and palate date back to 1847 with John Show who used chloroform as an anesthetic in the repair of lip fissures in 147 patients aged 3–6 weeks; in *The Lancet* magazine of 1850, the cleft lip and palate closure is mentioned in a 7-year-old male with 1-week interval between surgeries, and Magill in 1921 used a catheter for the first time endotracheal with the advent of halothane and the piece in "T" [13].

It is currently known that there are determining factors for anesthetic management in corrective surgery of the lip and cleft palate related to the characteristics of the patient, his medical history or associated comorbidities, and the surgical technique.

As it is the pathology with the highest incidence in facial malformations that requires surgical treatment, it is necessary to know the anesthetic management alternatives and establish criteria in the different stages of the perioperative period from preanesthetic assessment to postanesthetic care, in order to provide planned approach within the highest safety standards that reduce the risk of adverse events (**Table 1**).

2. Preanesthetic assessment

Within the preanesthetic assessment of patients with CLP, it is mandatory to know:

a. Demographic characteristics such as age, sex, and weight.

b. Variety of pathology presentation: cleft lip, cleft palate, cleft lip and palate, and cleft palate with fistula.

c. Presence of difficult airway predictors for interrogation and physical examination.

d. Presence of associated congenital anomalies or craniofacial syndromes.

e. Associated comorbidities such as heart disease, recurrent or active respiratory tract infections, poor management of oropharyngeal secretions, pneumopathies, or obstructive apnea.

The recommended age for surgical repair of cleft lip is 3–6 months, currently tends to be performed in the neonatal period with the implications of anesthetic management of this age group. Cleft palate repair is recommended at 9–12 months with reports up to 18 months [4, 10, 15]. There is evidence in the literature about a risk of complications 5 times greater during anesthetic management of children under 10 kg and under 10 weeks of age. A direct relationship between body weight at the time of surgery and the presence of complications has been observed; in patients weighing 4–6 kg, they occur in 54% and in patients weighing more than 8 kg in 26% [13, 16].

According to the characteristics of the defect, the surgical experience, and the management institutions' protocols, the surgeon will determine the age of repair and the need for a primary or sequential closure in stages with the objective of minimizing distortion in facial growth by very early repairs [10].

The male-female ratio is 2:1 in cases involving lip and 1:2 in cases involving only palate. As for laterality, the ratio is 2:1 left to right [14, 17]; greater risk of difficulty in airway management and secondary adverse events has been observed in patients

with a cleft lip with bilateral defect, and in cases of cleft palate, the difficulty in laryngoscopy and intubation is related to age, at a younger age difficulty [3, 18].

Patients with CLP can present various malformations without integrating a specific craniofacial syndrome; approximately 70% of cases of CLP and 50% of isolated cleft palate are considered non-syndromatic. A higher ratio of malformations has been found in patients with CLP (32%) than 11% in isolated cleft lip or 22% in cleft palate [13, 19].

There are about 500 craniofacial syndromes related to the pathology that increase the probability of difficult airway (8.4%) and the risk of perioperative adverse events; the most frequent are Treacher Collins, Goldenhar, Pierre Robin sequence, and velocardiofacial syndrome [2, 13, 15].

As part of the comorbidities, the literature reports that 5–10% of patients have some congenital heart disease [7, 13]. The possibility of chronic respiratory symptoms such as rhinorrhea, chronic airway obstruction, and sleep apnea [3, 19] is also mentioned.

Given the history of upper airway infection, it is suggested that surgery be deferred for 2 weeks and in lower airway infections for 4 weeks with the objective of reducing risks of adverse events [3].

3. Transanesthetic management

3.1 Monitoring

It is essential to have the basic monitoring for general anesthesia recommended by the current official standards; continuous electrocardiography is included in two leads, noninvasive blood pressure, pulse oximetry, capnography line, and thermal control.

Since hypothermia is one of the most frequently reported adverse events in the literature, thermal control is important throughout the entire transanesthetic [16, 18].

3.2 Anesthetic technique used

In the different bibliographic reviews, there is no consensus on an ideal anesthetic technique or with more preference; the choice will be made based on the characteristics and needs of each patient. There are reports of balanced general anesthesia without neuromuscular relaxation, balanced general anesthesia with neuromuscular relaxation, and intravenous total anesthesia with and without neuromuscular relaxation without significant differences between them [11, 20].

3.2.1 Anesthetic induction

Anesthetic induction is a crucial stage of anesthetic management; through pharmacological measures it provides favorable conditions for airway manipulation, reducing the neurovegetative response to intubation such as hypertension, tachycardia, and increased intraocular or intracranial pressure [21].

Specifically in patients with cleft lip and palate, the use of inhalation induction techniques with sevofluorane or intravenous with propofol is more frequently referred to.

The one made with propofol is characterized by being fast and smooth with the additional advantage of a rapid awakening; in the inhalation with sevofluorane, the advantages lie in halogenated characteristics such as the unpleasant smell, the less irritation of the respiratory tract, the lower solubility in the blood and, in a

secondary way, the lower myocardial depression. Other intravenous inducers such as thiopental, midazolam, and ketamine are mentioned in the literature [3, 22].

Within the opioids indicated for the control of the neurovegetative response, fentanyl or remifentanil use is considered without significant differences [21].

3.2.2 Endotracheal intubation

Endotracheal intubation is a critical moment in the anesthetic management of the pediatric and adult population, specifically in the presence of difficult airway predictors such as cleft lip and palate facial malformations due to the implicit risk of adverse events; situations of difficult laryngoscopy, difficult or failed intubation, laryngospasm, and bronchospasm are reported [21].

It is important to use a technique that provides us with rapid and safe favorable intubation conditions in an adequate time. Some authors evaluate the conditions of intubation through the Helbo-Hansen scale that emerged in 1988, which assesses aspects such as jaw relaxation (complete, tone, tense, or rigid), laryngoscopy (easy, good, difficult, or impossible), vocal cords (open, moving, closing, or closing), cough (absent, poor, moderate, or severe), and limb movements (absent, scarce, moderate, or severe); scores of 1–2 indicate favorable conditions, while scores of 3–4 are unacceptable [21, 22].

There is sufficient evidence that positions propofol as a favorable inducing agent by decreasing airway reflexes and providing adequate conditions for intubation without muscle relaxants; sevofluorane at 8 volume percent facilitates the proper position of the vocal cords in the absence of muscle relaxants, in a period of 180 seconds with low incidence of cough [22].

The use of neuromuscular blockers is controversial. It is a fact that they provide favorable conditions for endotracheal intubation, and according to literature reports, there is a lower incidence of respiratory adverse events when they are used; succinylcholine with rapid onset of action and ultra-short effect but with a risk of adverse effects in the pediatric population positions rocuronium and vecuronium non-depolarizing neuromuscular blockers as an alternative with a slower onset, prolonged effect, and great advantage of pharmacological reversal of rocuronium in a situation of unexpected difficult airway [3, 22]. In contrast, some authors recommend avoiding them due to the high incidence of retrognathia, micrognathia, and glossoptosis that make it difficult to approach the airway from ventilation with a facial mask, laryngoscopy, or endotracheal intubation, emphasizing the existence of other alternatives that offer favorable conditions of intubation such as those mentioned [22, 23].

Any of the techniques can be effective, the decision will depend on the characteristics and needs of each patient [3].

Regarding the choice of endotracheal tube (TET), there is no single criterion; the use of RAE (Ring-Adair-Elwyn) U-shaped tubes is recommended for lip surgery and reinforced tubes also known as spiral-shaped spiral wire reinforcement inside and along the tube wall to reduce your occlusion during palate surgery. Other frequently reported are Oxford or "L"-shaped tubes to avoid couplings [24, 25].

A point that should be considered is the lowest risk of accidental extubation when the TET is placed 1.5 cm above the carina [3].

3.2.3 Airway management

According to different references, the documented incidence of unexpected difficult airway in the pediatric population is low (0.08–1.35%) compared to that of the adult; in children under 1 year of age, it can reach 3.5% and in patients with cleft

lip and palate from 4.7 to 8.4% representing a greater risk of difficulty in airway management and adverse respiratory events [2, 26, 27].

In 2002 Bordet reported an incidence of airway-related complications of 7.87% in children under general anesthesia, varying according to the type of instrumentation used: 7.4% with endotracheal tube and 10.2% with laryngeal mask [3].

The anatomical characteristics of the airway corresponding to the age group and those of the pathology are related to difficulties in the management of the airway at any time during the perioperative period, induction (ventilation, laryngoscopy, intubation), transanesthetic, extubation, or early postanesthetic period with varying severity, requiring pediatric intensive care unit [17].

On the other hand, more than 500 related craniofacial syndromes such as Treacher Collins, Goldenhar, or Pierre Robin sequence increase the probability of difficult airway. Other related syndromes in the literature are Down syndrome, DiGeorge syndrome, and Marfan syndrome [2, 7, 13, 15].

Some researchers have established situations with a higher risk of adverse events during airway management; there is talk of difficult laryngoscopy in the presence of facial deformities such as micrognathia or bilateral complete fissures due to difficulty in positioning the laryngoscope blade altering the line of sight when falling into the left cleft. There is a greater likelihood of risks in patients with cleft lip with bilateral defects, while the difficulty in laryngoscopy and intubation in patients with cleft palate is related to age, being older at a younger age [3, 18].

A larger number of laryngoscopies performed increases the likelihood of adverse events such as trauma and edema of the airway, laryngospasm, and bronchospasm. Airway management in patients with CLP has been studied for more than 70 years, increasing throughout history the indirect devices and techniques for the pediatric population that favor airway manipulation such as laryngeal masks, video laryngoscopes, and fibrobronchoscopies in their different versions; however, direct laryngoscopy without stiletto remains the most widely used method [14].

4. Transanesthetic management

Keeping patients in hemodynamic and ventilatory stability and reducing the risks of adverse events by providing individualized anesthetic management according to the characteristics and needs of each patient are part of our responsibility as anesthesiologists. Adequate anesthetic maintenance is achieved through the use of drugs that provide analgesia, hypnosis, amnesia, neurovegetative protection, and neuromuscular block when necessary [21].

There is no single recommended technique, nor one that offers greater advantage over the others; within the general balanced anesthesia, the most reported technique is inhalation with sevofluorane, as it is considered the least pungent and the one that promotes greater hemodynamic stability. There are also reports of the use of isoflurane with or without a muscle relaxant [3, 18, 20].

The use of anesthetics that provide stability and intra- and postoperative analgesia is recommended, reducing doses of transoperative opioids, and with a lower risk of respiratory depression in the postanesthetic care, dexmedetomidine and ketamine are indicated [28, 29].

Dexmedetomidine, a potent α2-specific adrenoceptor agonist with sedation, anxiolysis, and analgesia properties, has the advantages of not modifying respiratory recovery or extubation times and significantly reducing the risk of postoperative agitation [20].

The adverse events observed in the transanesthetic and related to the endotracheal tube are occlusion, bending or accidental removal by surgical manipulation [18].

There are no criteria already established for the optimal time of extubation; it is an issue that continues to cause controversy. In general terms, extubation is recommended with a patient fully awake and with protective airway reflexes [3, 19].

5. Postanesthetic management

Corrective cleft palate surgery reports an incidence of postoperative adverse events of 13%, the highest in maxillofacial surgery; the main events reported are tongue edema, bleeding, pain, nausea, vomiting, bronchospasm, and agitation or delirium. Vigorous crying is frequent secondary to pain or agitation and when not treated promptly predisposes to wound dehiscence and pulmonary complications with great impact on the costs of delayed recovery and prolonged hospital stay [20, 28].

In 2018, a retrospective study was conducted to identify risk factors related to common adverse events in cleft lip and palate surgery; a relationship of adverse events was found with situations such as multiple attempts at intubation, structural or functional abnormality of the airway, surgery greater than 160 minutes, inexperience of the anesthesiologist, high doses of opioids, and no reversal of the neuromuscular blockade [30].

5.1 Pain management

For many years the idea of immaturity of the nervous system in the pediatric population was defended, reducing the importance of acute and postoperative pain management; at present it is well-known that the structures responsible for pain transmission are formed from the 30th week of gestation [10].

Postoperative pain from cleft lip and palate surgery is considered acute, superficial, somatic, and of significant intensity that causes irritability with vigorous crying [10, 28, 29]. The nerve branches involved depend on the type and location of the defect [10]:

a. Cleft lip

- Intraorbital nerve, maxillary trigeminal branch, innervated upper lip, and skin between upper lip and lower eyelid
- External nasal nerve branch of the ophthalmic, innervates wing, and nasal tip

b. Cleft palate

- Branches of the maxillary trigeminal division
- Lesser palatine nerve; innervates soft palate, nostrils, and uvula
- Major palatine nerve, branch of the pterygopalatine ganglion. Inerva gums, mucous membrane, and hard palate glands
- Nasopalatine nerve, innervates palatine region

There is currently no pain management guide in patients with cleft lip and palate; each institution must, based on its experience and population needs, establish a protocol based on multimodal analgesia. This consists of the infiltration of local anesthetics, nerve blocks, opioid analgesics and non-opioid analgesics, providing sufficient analgesia with a lower risk of postoperative agitation [29]:

a. Infiltration of local anesthetic at the surgical site. The use of long-acting bupivacaine-type AL calculated per kilogram of weight is suggested and consider the possible margin distortion when injected [11, 29].

b. Nerve block. Age-related anatomical variants must be known, for example, the intraorbital stage is located very close to the eye [10, 29]. For lip surgery, the intraorbital stage with 1–2 ml of 0.5% bupivacaine with 1:200,000 epinephrine and 0.25 mm on each side of 0.25% bupivacaine with epinephrine is suggested. In palate surgery, the blockage of the major palatine, minor palatal, and nasopalatine is recommended [10].

c. Opioid analgesics. Opioids are the first option for transoperative analgesia since they favor mild emersion and extubation, reducing the possibility of crying and consequently of trauma and bleeding. Its main disadvantage is the risk of postoperative dose-dependent respiratory depression and undesirable effects such as dizziness, constipation, nausea, and vomiting [10, 29].

d. Non-opioid analgesics. Bibliographic reviews recommend the use of adjuvants such as ibuprofen and acetaminophen in any age group; there is evidence on the decrease in postoperative pain supported by the FLACC scale (pain facies, leg movement, activity, comforting crying) with the administration of acetaminophen at the beginning of anesthesia and in the immediate postoperative period. It can be used as a premedication orally at a dose of 20 mg/kg [10].

Other recommended drugs are those that reduce the risk of respiratory depression such as dexmedetomidine and ketamine [3].

The premise is to provide a state of complete patient well-being through multimodal analgesia; this technique emerged in 1997 and is based on the impact of several drugs at minimum doses on the different nociception mechanisms, with a lower risk of adverse effects. Management must be individualized considering factors such as age and degree of airway commitment [3, 10, 28, 29]

5.2 Management of postoperative agitation

The incidence of agitation during emersion or in the postanesthetic is high (12–13%), with references up to 67%. The mechanism that originates it is not clear and has been related to factors such as psychological vulnerability of the patient (separation anxiety, fear of the unknown), anesthetic technique with halogenates, and surgical stimulation such as the subsequent narrowing of the nasopharyngeal cavity due to closure of the palate; other possible causes are postsurgical stimulation such as pain, hypoxemia, hyponatremia, hypoglycemia, CO_2 retention, urinary retention, postural discomfort, and/or a very rapid awakening.

Clinically it is characterized by alterations in the state of consciousness or behavior, inconsolable crying, bedwetting, nightmares, anxiety, irritability, uncontrollable movements of limbs, and inability to identify objects or people. Drugs with evidence in reducing agitation are fentanyl, midazolam, and dexmedetomidine infusion [31].

6. Discussion

Surgical correction of cleft lip and palate can be offered in various hospital settings from specialized institutions or as part of intensive care programs, so the medical staff responsible for surgical and anesthetic management is obliged to

know the anatomical and physiological characteristics of the age group and pathology, accompanying comorbidities, the different alternatives of anesthetic management according to the needs of each patient, and the potential adverse events at different stages of the perioperative period.

7. Conclusions

Cleft lip and palate is the most frequent craniofacial pathology in Latin America coupled with the greater vulnerability of the pediatric population under 1 year to present perioperative adverse events; the objective of the approach will be to offer a properly planned comprehensive management within the maximum safety standards that reduce the morbidity and mortality of this population group.

Author details

Silvia Peña*, Claudia Paulina Reyes, Andres Felipe Beltran and Ofelia Ham
National Institute of Pediatria, Mexico City, Mexico

*Address all correspondence to: sil75092hotmail.com

References

[1] Takemura H, Yasumoto K, Toi T, Hosoyamada A. Correlation of cleft type with incidence of perioperative respiratory complications in infants with cleft lip and palate. Pediatric Anesthesia. 2002;**12**:585-588

[2] Tay C, Tan G, Ng S. Critical incidents in paediatric anaesthesia: An audit of 10,000 anaesthetics in Singapore. Pediatric Anesthesia. 2001;**11**:711-718

[3] Santhi M, Deepak P, Hari M, Prasad K. A Prospective Observational Study of Anesthetic Complications in Children Undergoing Primary Lip and Palate Repairs. International Journal of Scientific. 2017;5(8):35-39

[4] Ramamoorthy C, Haberkern C, Bhananker S, Domino K, Posner K, Campos J, et al. Anesthesia-related cardiac arrest in children with heart disease. Pediatric 2014; 119: 1 www.anesthesia-analgesia.org 121 Perioperative Cardiac Arrest (POCA) registry. Anesthesia & Analgesia. 2010;**110**:1376-1382

[5] Von Ungern-Sternberg B, Boda K, Chambers N, Rebmann C, Johnson C, Sly P, et al. Risk assessment for respiratory complications in paediatric anaesthesia: A prospective cohort study. Lancet. 2010;**376**:773-783

[6] Tait A, Malviya S, Voepel-Lewis T, et al. Risk factors for perioperative adverse respiratory events in children with upper respiratory tract infections. Anesthesiology. 2001;**95**:299-306

[7] Alarcón A. Cleft lip and palate. Mexican Journal of Anesthesiology. 2010;**33**(1):S76-S78

[8] Dixon M, Marazita M, Beaty T, Murray J. Cleft lip and palate: Understanding genetic and environmental influences. Nature Reviews. Genetics. 2011;**12**(3):167-178

[9] Shkoukani MA, Chen M, Vong A. Cleft lip—A comprehensive review. Frontiers in Pediatrics. 2013;**1**(53):1-10

[10] Hussain R, Abhijit P. Postoperative analgesia for cleft lip and palate repair in children. Journal of Anaesthesiology Clinical Pharmacology. 2016;**32**(1):5-11

[11] Karki S, Rajbanshi L, Ariyal B, Shrestha K. Anaesthesia for cleft lip and palate surgery: Study from a hospital of Eastern Nepal. Birat Journal of Health Sciences. 2017;2(1):127-133

[12] McHeik J, Sfally P, Bondonny J, et al. Early repair for infants with cleft lip and nose. International Journal of Pediatric Otorhinolaryngology. 2006;**70**:1785-1790

[13] Reséndiz Y. Anesthetic management for a patient with cleft lip and palate. Reconstructive Surgery. 2015;**38**(1):245-246

[14] Bunsangjaro P, Thongrong C, Pannengpetch P, Somsaad S, Rojanapithayakorn N, Polsena N, et al. Anesthetic techniques and perioperative complications of cleft lip and cleft palate surgery at Srinagarind Hospital. Journal of the Medical Association of Thailand. 2015;**98**(S7):S158-S163

[15] De Graaff J, Sarfo M, van Wolfswinkel L, van der Werff D, Schouten A. Anesthesia-related critical incidents in the perioperative period in children; a proposal for an anesthesia-related reporting system for critical incidents in children. Paediatric Anaesthesia. 2015;**25**:621-629

[16] Fillies T, Homann C, Meyer U, Reich A, Joos U, Werkmeister R. Perioperative complications in infant cleft repair. Head & Face Medicine. 2007;**3**:9

[17] González O. Ecological study in Mexico (2003-2009) on cleft

lip and/or palate and associated sociodemographic, socioeconomic and pollution factors. Anales de Pediatría. 2011;**74**(6):377-387

[18] Desalú I, Adeyemo WL, Akintimoye MO, Adepoju AAA. Airway and respiratory complications in children undergoing cleft lip and palate repair. Ghana Medical Journal. 2010;**44**(1):16-20

[19] Kwari D, Chinda J, Olasoji H, Adeosun O. Cleft lip and palate surgery in children: Anaesthetic considerations. African Journal of Paediatric Surgery. 2010;**7**(3):174-177

[20] Peng W, Zhang T. Dexmedetomidine decreases the emergence agitation in infant patients undergoing cleft palate repair surgery after general anesthesia. BMC Anesthesiology. 2015;**15**(145):2-7

[21] Escobar N, Olvera G, Martínez T, Silva A. Conditions of endotracheal intubation and hemodynamic effects in Mexican population with different doses of remifentanyl infusion. Mexican Journal of Anesthesiology. 2008;**31**(4):263-270

[22] Karanth H, Raveendra U, Shetty R, Shetty P, Thalanjeri P. Comparative evaluation between sevoflurane and propofol for endotracheal intubation without muscle relaxants in pediatric cleft surgeries. Anesthesia, Essays and Researches. 2018;**12**(2):434-439

[23] Rajan S, Gotluru P, Andews S, Paul J. Evaluation of endotracheal intubating conditions without the use of muscle relaxants following induction with propofol and sevoflurane in pediatric cleft lip and palate surgeries. Journal of Anaesthesiology Clinical Pharmacology. 2014;**30**(3):360-365

[24] Jindal P, Khurana G, Gupta D, Sharma J. A retrospective analysis of anesthetic experience in 2917 patients posted for cleft lip and palate repair. Anesthesia, Essays and Researches. 2013;**7**(3):350-354

[25] Sen J, Sen B. Airway management: A comparative study in cleft lip and palate repair surgery in children. Anesthesia, Essays and Researches. 2014;**8**(1):36-40

[26] Xue F, Zhang G, Li P, et al. The clinical observation of difficult laryngoscopy and difficult intubation in infants with cleft lip and palate. Pediatric Anesthesia. 2006;**16**:283-289

[27] Gunawardana R. Difficult laryngoscopy in cleft lip and palate surgery. British Journal of Anaesthesia. 1996;**76**:757-759

[28] Kayyal T, Wolfswinkel E, Weathers W, Capehart S, Monson L, Buchanan E, et al. Treatment effects of dexmedetomidine and ketamine on postoperative analgesia after cleft palate repair craniomaxillofacial trauma and reconstruction. Craniomaxillofacial Trauma and Reconstruction. 2014;**7**(2):131-138

[29] Carr L, Gray M, Morrow B, Brgoch M, Mackay D, Samson T. Opioid sparing in cleft palate surgery. The Cleft Palate-Craniofacial Journal. 2018;55(33):1-5

[30] Basta M, Fiadjoe J, Woo A, Peeples K, Jackson O. Predicting Adverse Perioperative Events in Patients Undergoing Primary Cleft Palate Repair. The Cleft Palate-Craniofacial Journal. 2018;20(10):1-8

[31] Xu H, Mei X, Xu L. Cause analysis, prevention, and treatment of posoperative restlessness after general anesthesia in children with cleft palate. Journal of Dental Anesthesia and Pain Medicine. 2017;**17**(1):13-20