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Original Article

A Prospective Observational Study of Anesthetic Complications in Children Undergoing Primary Lip and Palate Repairs

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Abstract

Background: Children coming for cleft lip (CL) and palate repair are at increased risk of pre-, intra-, and post-operative respiratory complications. These anatomical abnormalities associated with CL and palate and increased the risk of airway complications associated with them are studied.

Aim: The aim of the study was to determine the incidence of airway and respiratory complications during CL and palate repair and identify risk factors.

Materials and Methods: After the Institutional Ethics Committee approval and written informed consent, 100 children of ASA Grade I presented with CL /palate/both were enrolled for this prospective randomized observational study, standard induction was employed and intubated with a RAE tube, anesthesia maintained, and appropriate analgesia given. At the end of surgery, children were extubated. All intraoperative or immediate post-operative airway complications were documented.

Results: The most common complication was desaturation (5%) followed by tube disconnection (4%). The incidence of post-operative complications is 7%, airway edema (2%), post-operative nausea and vomiting (5%) occurred, 14.89% of patients who had cleft palate (CP) repair developed complications, 12.25% who had CL repair developed complications, and 50% of patients who had combined lip and palate (CLP) repair developed complications. Complications occurred in 38.4% of patients having CP repair, 15.8% having CL repair, and 50% having CLP repair.

Conclusion: Cleft repair had a high incidence of airway/respiratory complications, and more complications occurred with CP surgery. There is a need to ensure adequately skilled personnel and appropriate monitoring to minimize morbidity.

Key words: Airway complications, Anesthesia, Cleft lip, Cleft palate

INTRODUCTION

Children, especially infants, have a higher incidence of anesthetic-related complications. Due to their peculiar pediatric airway, they are prone to difficult airway management and laryngoscopy as well as other airway complications. Bordet[1] demonstrated that airway complications occurred in 7.87% of children under anesthesia and that the incidence varied with the type of airway device used with laryngeal mask airway having the highest incidence of 10.2%, tracheal tube 7.4%, and facemask 4.7%. Patients for cleft repair are at increased risk of intraoperative airway and respiratory complications. The anatomical defects increase the risk of difficult laryngoscopy and intubation and problems with tracheal tubes occur more frequently. The documented incidence of difficult airway in cleft surgery ranges from 4.7% to 8.4%.[2,3] Various researchers have enumerated factors associated with an increased risk of airway complications in these patients. They include anatomical difficulty in placement of laryngoscope blade,[4] the presence of associated facial deformities, for example, micrognathia[5]

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and the degree of deformity with a higher risk occurring in combined bilateral clefts. The difficulty in laryngoscopy and intubation seen in cleft palate (CP) patients is related to age, being higher in infants. The risk of perioperative respiratory adverse effects is less if tracheal intubation is facilitated by muscle relaxants[6,7] and accidental extubation when positioning the head for surgery is minimized if the tube is placed 1.5 cm above the carina.[8] Recurrent infections of the nasal cavity and respiratory tract due to constant irritation and aspiration increase airway reactivity and may result in laryngeal and bronchospasm.[9] Takemura *et al*.[10] defined perioperative respiratory symptoms (PRC) as the occurrence of laryngospasm or bronchospasm during induction; increased airway secretions and desaturation (<95%) during maintenance and respiratory symptoms observed immediately after extubation. They observed that children with borderline common cold symptoms had a higher incidence of perioperative respiratory complications (23%) during cleft surgeries compared to healthy children with the incidence of 4%. The purpose of this prospective study was to determine the incidence of intraoperative airway and respiratory-related complications during cleft lip (CL) and palate repair and to identify risk factor for their occurrence.

METHODS AND MATERIALS

Hundred patients undergoing CL and/or palate repair were prospectively studied after the Institutional Ethical Committee approval and informed parental consent were obtained. This study was performed according to the declaration. 100 cases of patients undergoing CL and palate repair were prospectively studied during a period of 1½ extending from June 2012 to February 2014. The present series constituted hospital admissions in plastic surgery ward, Government General Hospital. The patients were seen in the preanesthetic clinic by the oral and maxillofacial surgeons and anesthesiologists. Those suitable for surgery were admitted into hospital 2 days before surgery, and all eligible children were included in the study. Patients with respiratory tract infection were treated with appropriate antibiotics, and surgery deferred for 2 weeks in upper respiratory tract infection or 4 weeks in lower respiratory tract. Routine pre-operative fasting guidelines were instituted. No patient received sedative premedication. Standard inhalational halothane induction or intravenous induction using thiopentone or propofol was employed. The trachea was intubated with a RAE tube or armored endotracheal tube for surgeries under deep inhalational anesthesia or muscle relaxants. Standard intraoperative monitoring was employed. Surgical site was infiltrated with adrenaline 3–5 mcg/kg of 1:100,000 solution before the incision was made. Maintenance of anesthesia was with sevoflurane/isoflurane, and a muscle relaxant and ventilation were controlled [Figures 1 and 2]. Appropriate analgesia with IV analgesics or blocks was ensured. At the end of surgery, children were extubated when fully awake with protective airway reflexes. All intraoperative or immediate post-operative airway complications were documented. For the purpose of the study, the following definitions were used – difficult intubation is with more or equal to three attempts at intubation, desaturation is a fall in oxygen saturation to <90%, bronchospasm is wheezing, with prolonged expiratory phase and increase in slope of plateau on capnography tracing, laryngospasm is desaturation of SpO2 <90%, with partial or complete airway obstruction unrelieved by routine airway maneuvers. Data were analyzed using the SPSS for Windows (version 10.1; SPSS Inc, Chicago, IL) statistical software package. Numerical data were expressed as mean ± standard deviation while categorical data were expressed as frequencies. Tests of significance (*t*-test, Chi-square or Fisher's exact test) were used as appropriate. A $P < 0.05$ was considered statistically significant.

RESULTS

The mean age of patients studied was 24.62 months (range 3–180 months) with a median of 20 months, of which mean 15.22 in CL, 35.23 in CP, and 35.25 in combined lip and palate (CLP) [Table 1] which is insignificant. Forty-nine patients (49%) had primary CL repair, 47 (47%) had primary CP repair, and 4 (4%) had CLP repair. Table 2 describes incidence of complications occurred (incidence - 21% of 100 procedures). Some patients developed more than one complication. The most common complication was desaturation (5%), followed by tube disconnection (4%), difficult intubation (4%), tube compression (2%), and laryngeal spasm (1%). The incidence of post-operative complications is 7%, airway edema (2%), and post-operative nausea and vomiting (5%). Table 3 displays the incidence of complications in relation to the surgical procedure. 14.89% of patients who had CP repair developed complications, 12.25% who had CL repair developed complications, and 50% of patients who had CLP repair developed complications. The occurrence of endotracheal tube-related laryngospasm and desaturation occurred in patients who had inhalational induction of anesthesia. Desaturation mostly occurred at intubation. All episodes of laryngeal spasms occurred at induction.

DISCUSSION

This study has demonstrated an incidence (21%) of airway and respiratory complications in cleft surgery. A study from Tokyo observed a 4% incidence of respiratory complications

Table 1: Demographic data in age and weight

Surgical procedure	Age in months (mean±SD)	Weight in kg (mean±SD)
CL	15.22	8.6
CP	35.23	13.45
CLP	31.25	13

CL: Cleft lip, CP: Cleft palate, CLP: Combined lip and palate, SD: Standard deviation

Table 2: Incidence of complications

Complications developed	Number of complication(%)
Desaturation	5
Laryngospasm	1
Difficult intubation	2
Tube compression	2
Tube disconnection	4
Airway edema	2
PONV	5

PONV: Post-operative nausea and vomiting

Table 3: Incidence of complications in relation to surgical procedures

Surgical procedures	Total number of cases	Number of cases developed complications
CL	49	6
CP	47	7
CLP	4	2

CL: Cleft lip, CP: Cleft palate, CLP: Combined lip and palate

in cleft surgeries in infants <6 months, but they did not take into account tube-related factors and intubation difficulties. Fillies[9] demonstrated an 8.6% incidence of respiratory complications in their series of 174 infants. However, they administered atropine pre-induction which could have accounted for their reduced incidence. In addition, oxygen saturation <85% was taken as the definition of desaturation compared to <90% used in the present study.

CL repair is recommended at the age of 3 months to improve cosmetic appearance and parent-child bonding, while CP repair is performed for 9 months to allow for facial growth and speech development. Stephen performed CL repair in neonates and reported no evidence to prove that it was unsafe.[7] A large proportion of patients were older than 1 year because they are kept in hiding due to associated stigma as well as financial constraints.

Some of the African authors have documented this observation. The incidence of critical events in general pediatric anesthesia is documented to be 8.6% in infants which improves to 2.1% in older patients with a statistically significant difference in children <10 kg.[11]

Murat *et al.*[12] reiterated that intraoperative adverse events were more likely in infants <12 months.

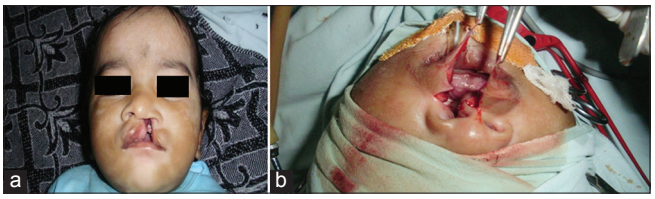

Figure 1: Photographs of cleft lip (a) pre-operative cleft lip and (b) intraoperative cleft lip

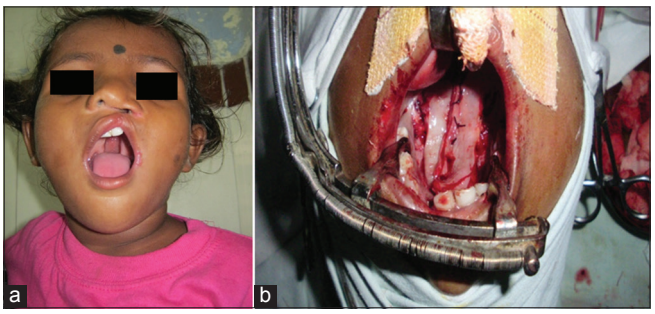

Figure 2: Photographs of cleft palate (a) pre-operative palate and (b) intraoperative palate

Airway and respiratory complications occurring in cleft surgery repair are often due to intubation, tube-related problems, laryngeal and bronchospasm, desaturation, and aspiration. The peculiarity of the infant airway commonly results in difficult airway management and intubation which is aggravated by the existence of CL or palate. The cleft alveolus, protruding maxilla, and high vaulted arch cause difficult placement of the laryngoscope blade because of loss of support which results in obstruction of the view needed for normal intubation.

In this study, the incidence of airway complications was more in patients having CP repair (14.89%) compared to CL repair (12.25%).

Gunawardana[8] reported the occurrence of difficult laryngoscopic view of Cormack-Lehane Grade III and IV, which was found to be 3.0% in patients with unilateral CL, 45.8% in patients with bilateral cleft, and 34.8% in patients with retrognathia.

In the present study, 2% incidence of difficult intubation was recorded. Difficult intubation occurred in a 9-month-old child scheduled for CL surgery during attempts at intubation under deep inhalational anesthesia.

The child was subsequently intubated under muscle relaxation by a consultant grade anesthesiologist. A second case of difficult intubation occurred in a 2-year-old child for CLP repair, and these two cases were probably due to difficulty in inserting the laryngoscope blade or by the presence of micrognathia.

The blade commonly falls into a left-sided cleft when the tongue is being swept to the left side during laryngoscopy and alters the line of vision posing intubation difficulties.[13]

The risk of perioperative respiratory adverse events is less if tracheal intubation is facilitated by muscle relaxation.[14,15] In this study, there is the usage of muscle relaxants for intubation in majority of our patients, which may have accounted for our lower incidence. Muscle relaxants cause relaxation of the head and neck muscles and assist in obtaining a better laryngoscopic view.

Positioning the patient in the optimal sniffing position by the use of a shoulder roll, routine use of optimal external laryngeal maneuver, intubating stylet, and having a senior anesthesiologist intubate the patient are quoted as being contributory toward an easier intubation.[16]

Tracheal tube problems occurred in five patients (6%) in our study, of which there was tube disconnection in four (4%) and tube compression in two (2), disconnections occurred mostly in patients having CP repair.

The introduction of a mouth gag necessary for palatal repair can compress or move the tube. This is easily detected clinically by tight bag and difficulty in ventilation followed by desaturation, and this can also be detected by airway pressure monitoring and capnography tracing which emphasizes the importance of adequate monitoring for early detection. The positioning of the patient for surgery also contributes to tube movement.

Neck extension causes backward movement of the tube away from the carina while flexion can result in endobronchial placement. Poor nutrition and development which characterize CLP patients may influence the calculation for correct placement of the tracheal tube.

Kohjitani *et al.*[17] demonstrated that, if the tracheal tube is placed 1.5 cm above the carina in the neutral head position, it minimizes the chance of accidental extubation when the head is extended.

In this study, there were no accidental extubations as the tube is firmly secured to prevent any movement and tube position is noted and checked after positioning.

The incidence of laryngospasm in our study was 1%.

In Bordet's study, the incidence of bronchospasm and laryngeal spasm in intubated patients was 41%. Infants and small children with CP frequently have running nose, coryza, and upper respiratory tract infections (RTIs) which may predispose to perioperative respiratory complications.[3] In such cases, elective surgery should be deferred for 2–3 weeks so that airway reactivity returns to normal.[18]

Olsson and Hallen[19] found that laryngospasm was more common in infants than in older children and data varied among the anesthesia providers as has in those with pre-operative respiratory infections sample size. All episodes of airway spasm occurred in patients who had an inhalational induction.

This may reflect the younger age group of the children who had inhalational induction compared to those who had an intravenous induction.

The administration of dry gases causes irritation to the airway which predisposes to spasm, especially in patients with already hyperactive airway from recurrent infections. The presence of symptoms of common cold preoperatively significantly increases the risk of PRC.

Mamie *et al.*[15] demonstrated a positive association between airway complications and age <6 years, and Murat *et al.*[12] observed that respiratory complications were greater in infants compared to children aged 1–7 years.

Laryngospasm occurred in one case which was managed successfully by early identification and active treatment. These patients had pre-operative upper respiratory tract infection. Infants and small children with CP frequently have common cold and upper respiratory tract infection which may predispose to perioperative respiratory complications.[3]

Fillies *et al.*,[9] on the other hand, demonstrated a direct correlation between weight and complications with children weighing 4–6 kg having the highest complication rate. We investigated that weight-related complications were similar between different groups and did not vary significantly. Low birth weight was recorded in eight (8%) cases, most of which were CL repair cases. Two of these cases were complicated, one of which had desaturation due to undisclosed and untreated recurrent RTI, and another was tube disconnection.

Our study has emphasized the importance of having skilled personnel, appropriate monitoring equipment, and airway devices available during cleft surgeries to minimize morbidity. The use of muscle relaxation for intubation should be advocated after it has been confirmed that the patient can be manually ventilated by facemask as this would provide adequate intubating conditions and prevent laryngeal spasm.

An oral RAE tube during CP repair would avoid tube compression due to the introduction of a mouth gag.

SUMMARY AND CONCLUSION

Anatomical abnormalities associated with CL and palate increase the risk of airway complications. The aim of this study was to determine the incidence of intraoperative airway and respiratory complications during CL and palate repair and identify the risk factors. In this observational study, in which hundred patients undergoing CL or/and palate repair (CL, CP, CLP) were prospectively studied in a tertiary care teaching institution, in Guntur, the incidence of complications in CP surgeries was 14.87%, CL surgeries was 12.25%, and combined CL and palate surgeries was 50%. Airway complications are relatively common during cleft surgeries. The incidence of airway complication in the present study was 21% and occurred most commonly in patients undergoing primary CP repair. Laryngoscopy and intubation are associated with a number of complications, may become extremely difficult at times, and predispose to perioperative adverse events which can be avoided by strict vigilance, presence of experienced personnel, and mutual understanding between the surgeon and the anesthesiologist.

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