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ORIGINAL ARTICLE

Assessment of Incidence of Aspiration Pneumonia in Infants with Cleft Palate

TAJ MUHAMMAD[1], FARMAN ULLAH[2], RIDA NAZ[3]
[1]*Assistant Professor, Department of Pediatrics, Gomal Medical College Dera Ismail Khan*
[2]*Associate Professor, Department of Pediatrics, Gomal Medical College Dera Ismail Khan*
[3] *Regional Blood Centre, Dera Ismail Khan*
Correspondence to: Rida Naz, Email: dr.ridaanaz@gmail.com

ABSTRACT

Background: A cleft lip (CP) is characterized by a split in upper lip, which may extend into the nose. These abnormal fissures can cause difficulties with nutrition, hearing, speaking and recurrent respiratory and ear infections.

Objectives: The study assessed the complications associated with the cleft palate in infants and the incidence of aspiration pneumonia.

Methods: The study was conducted in tertiary care hospitals and pediatric clinics at District Dera Ismail Khan, from February 2021 to September 2022, comprising 141 CP patients.

Results: The incidence of CP was seen 7.90% in District Dera Ismail Khan, which was higher in males (68.08%) than in females (31.91%). The mean age of the study group was 4.35+3.12, with birth weight and weight at the time of assessment being 3.85+1.78 and 23.78+15.19, respectively. Their mean maternal age and weight at the time of delivery were 32.91+9.07 and 61.65+21.56, respectively. A significant proportion ($p<0.05$) suffered from aspiration pneumonia (64.53%), while 19.85% of the patients had complained of recurrent pneumonia due to CP. Other complications included chest infection (43.26%), ear infection (8.51%), nasal obstruction (31.91%), vomiting during feeding (26.95%) and regurgitation of milk and other food materials (12.05%). Ten CP patients died (7.09%) due to the complications associated with this disorder.

Practical implications: For infants with orofacial clefts, the incidence of LRTIs is potentially high, thus accumulated breastfeeding length might mediate the connections of CP.

Conclusion: It was concluded that CP was significantly associated with pulmonary defects and caused fatal LRTIs in the affected population, especially in breastfeeding infants.

Keywords: Cleft palate; Ear infections; Fetal defects; Genetic Disorders; Pulmonary infections.

INTRODUCTION

An orofacial cleft is a gap or split in either the upper lip or the palate of the mouth or sometimes both. It occurs when there is a failure of the fusion of the facial processes properly during the early stage of pregnancy. This is a genetic ailment and happens between the 5th and 9th weeks of pregnancy [1]. It is basically the failure of frontonasal and maxillary prominence fusion during development [2]. An instance of orofacial clefts occurs roughly once per 700 live births, making it a common congenital condition. The incidence rate of this congenital abnormality is higher (0.14%). Cleft lips and palate are examples of orofacial clefts, which are disorders brought on by a lack of forms during embryogenesis. Orofacial clefts can be divided into three groups since cleft lip and cleft palate can develop together or separately: cleft lip, cleft palate only (CP), and cleft lip and palate [3].

Lower respiratory tract infections (LRTIs), primarily pneumonia and bronchiolitis, have long been major public health issues. Nasopharyngeal closure dysfunction, nasal regurgitation, and a decline in oral suction are all brought on by cleft palate. Aspiration pneumonia is further triggered by insufficient airway protection while swallowing [3-4]. There is a high risk of aspiration pneumonia in infants while feeding [5]. Infants with facial malformations typically have poor nutrition, a high incidence of LRTI, recurrent ear infections, irregular dentition, hearing loss and pulmonary aspiration. Prior to the infant's CP repair, they must be 10 pounds in weight, have age of 10 weeks, with 10g/dL hemoglobin levels [6].

The best surgical procedure for CP is still up for debate. According to the peculiarities of the fissure and the patient's overall condition, which combined determine the complexity of the case, several surgical approaches are employed to occlude the entire fissures of the palate depending on the surgeon and the patient. There are numerous methods for correcting a complete cleft palate, but there is no agreement on the best one. The type and size of the fissure, the surgical technique, the length of time required for repair, and the experience of the practitioner are accountable for the correction of CP. Additionally, functional and personal factors like the patient's general health and velopharyngeal occlusion should also be taken into account [7].

Although newborns with orofacial clefts have been identified as having risk factors for LRTIs, there appears to be a scarcity of epidemiological evidence demonstrating this association. A study of the Western Australian Register of Developmental Anomalies found that infants with cleft palate aged 0–2 years had an increased risk of hospitalization for any acute LRTIs [3].

The presence of a cleft palate may reduce the duration of breastfeeding and increase the risk of respiratory infections. Moreover, newborns with orofacial clefts are frequently born underweight. Due to reduced immunological function caused by growth restriction, these infants may be hospitalized with pneumonia [2].

There have been very few researches in Pakistan on the particular incidence of aspiration pneumonia associated with CP deformities; therefore, this research was conducted to assess the complications associated with the cleft palate in infants and the incidence of aspiration pneumonia with cleft palate.

MATERIALS AND METHODS

Study Period and Location: The study was conducted in tertiary care hospitals and pediatric clinics in District Dera Ismail Khan, Khyber Pakhtunkhwa Pakistan from February 2021 to September 2022.

Study Design: The current study comprised the participation of 141 pediatric patients affected with cleft palate. The age, gender and other demographic parameters of the patients were recorded on the approved questionnaire. Head size, tongue size, neck movement, dentition type and severity of the oral defects were measured. All the children with complete as well as incomplete cleft palate were included in the study.

Statistical Analysis: All the variables were examined for correlation to each other based on statistical significance with a confidence level of 95%. Chi-Square Fisher's Exact test was applied to investigate the difference between study groups and the significance between study group means for the subjected categories along with the ANOVA test for different parameters across the treatment groups.

Ethical Approval: After counseling and educating the parents, informed permission was acquired for including their children in the

study group. The ethical approval was acquired from the Ethical Review Committee of District Health Office, Dera Ismail Khan.

RESULTS

The research was carried out in tertiary care hospitals and pediatric clinics at District Dera Ismail Khan, Khyber Pakhtunkhwa Pakistan from February 2021 to September 2022 and recorded the prevalence of 7.90% in the study area during this period. The study comprised 141 child patients presented to these hospitals and clinics with complaints of LRTI and other complications associated with CP. The incidence of CP was seen higher in male (68.08%) children than in females (31.91%) (Figure 1). The demographic characteristics of the CP-affected children were also measured and it was found that the age range of the presented children was 1-8 years with a mean of 4.35+3.12, their birth weight (2.1-4.5 Kg) and the weight at the hospital (8-37 Kg) at the time of assessment of their medical conditions was 3.85+1.78 and 23.78+15.19, respectively. Their mean maternal age and weight at the time of delivery were 32.91+9.07 and 61.65+21.56, respectively (Table 1). Overall prevalence of 7.90% was recorded in District Dera Ismail Khan (Table 2).

The patients and their parents were questioned regarding the history and incidence of aspiration pneumonia and a significant proportion ($p<0.05$) of them suffered from aspiration pneumonia (64.53%), while 19.85% of the patients had complained of recurrent aspiration pneumonia due to CP (Table 3). Other complications in children affected with CP were studied and it was found that a significantly higher ratio of the patients ($p<0.05$) was suffering from a chest infection (43.26%), ear infection (8.51%), nasal obstruction (31.91%), vomiting during feeding (26.95%) and regurgitation of milk and other food materials (12.05%) (Table 4). Ten patients of them had died of CP (7.09%) due to the complications associated with this disorder (Figure 2).

Table 1: Demographic characteristics of CP-affected children

S. No	Demographic variable	Range	Mean+ Standard Deviation
1	Child age (Years)	1-8	4.35+3.12
2	Childbirth weight (Kg)	2.1-4.5	3.85+1.78
2	Child's current weight (Kg)	8-37	23.78+15.19
3	Mother's age at delivery (Years)	20-41	32.91+9.07
4	Mother's weight at delivery (Kg)	43-98	61.65+21.56

Table 2: Prevalence of cleft palate in children in Dera Ismail Khan

S. No	No. of presented pediatric patients	Patients with cleft palate	Prevalence (%)
1	1784	141	7.90

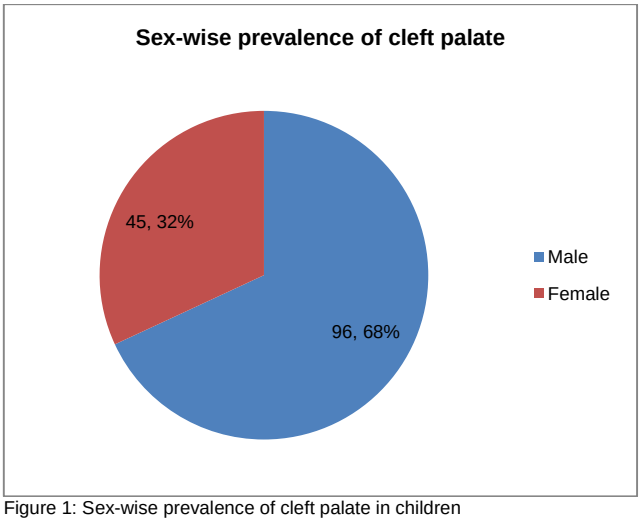

Figure 1: Sex-wise prevalence of cleft palate in children

Table 3: Incidence of aspiration pneumonia in CP-affected children

S. No	Disease	Number (n)	Frequency (%)	p-value
1	Affected with aspiration pneumonia	91	64.53	0.00001*
2	Recurrent aspiration pneumonia	28	19.85	

*indicated that the value is significant at $p<0.05$

Table 4: Other complications in children affected with CP

S. No	Complication	Number (n)	Frequency (%)	p-value
1	Chest infection	61	43.26	0.00001*
2	Ear infection	12	8.51	
3	Nasal obstruction	45	31.91	
4	Vomiting during milk feeding	38	26.95	
5	Regurgitation	17	12.05	

*indicated that the value is significant at $p<0.05$

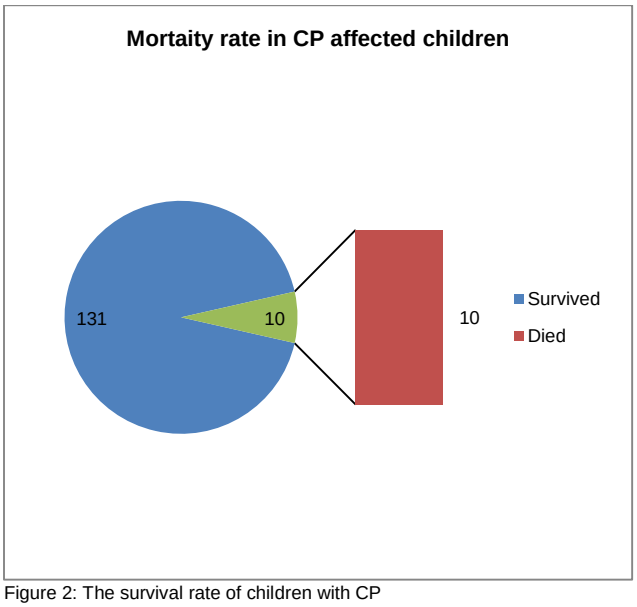

Figure 2: The survival rate of children with CP

DISCUSSION

Aspiration pneumonia refers to pulmonary complications caused by the improper ingestion of endogenous or exogenous substances into the lower airways. Aspiration pneumonia requires a breakdown of the natural defenses that protect the tracheobronchial tree, in addition to pulmonary problems resulting from the aspiration event. Our findings revealed that a significantly high ($p<0.05$) number of CP-affected children were affected with aspiration pneumonia (64.53%), and 19.85% had recurrent aspiration pneumonia due to CP. Other complications found were chest infections (43.26%), ear infections (8.51%), nasal obstruction (31.91%), vomiting during feeding (26.95%) and regurgitation of milk and other food materials (12.05%). Moreover, we found 7.90% prevalence rate in District Dera Ismail Khan. Similar results were reported in a study that 35% of the children with CP were diagnosed with aspiration pneumonia. Individuals with complete and incomplete cleft palates had comparable rates of the condition 39% versus 27%. Aspiration pneumonia was frequently observed in infants with cleft palate [8]. Our findings were strongly supported by a study reporting that children with cleft deformities were predisposed to airway and pulmonary difficulties. During cleft palate repair, the incidence of perioperative respiratory problems was substantially higher than with cleft lip repair [6]. A similar nature study determined the causes of early and late postoperative problems and their prevention in CP. Surgical repair of the lip was typically performed in 3rd month of infancy and surgical repair of

the palate was typically performed between 8 and 18 months. The study included 250 different types of orofacial cleft surgeries performed under general anesthesia. The most serious complication was the death of one patient owing to airway obstruction. Moreover, scar development and lip notch were common complications of lip surgery. As a result of velopharyngeal incompetence and the flood of food into the airway, chest infections were also common [1].

In agreement with our results, a very low prevalence of LRTIs was observed in the control group (6.0%), while, the incidence of LRTIs among newborns was highly elevated with CLP (11.9%), CL (14.3%) and CP (5.5%), and the incidence was further provoked with breastfeeding [3]. The proportion of newborns with low birth weight was significantly greater among CLP and CL cases compared to CP patients [9]. A study revealed that greater alterations in nasal bacterial makeup were observed than in saliva. Thus, it was referred to that the bacteria were involved in oral–nasal transfer as O-N bac. The intersection sets of O-N bacs from CP children, CP adolescents, and postoperative adolescents as TS O-N bacs with time–character, including Veillonyces, Streptococcus, Alloprevotella, Rothia, Gemella, Actinomyces and Neisseria were involved These bacteria comprised the core of the nasal bacterial network in CP patients, and a number of them were associated with infectious illnesses. Hence, CP resulted in severe changes to the oral and nasal flora. TS O-N bacs migrating from the oral to the nasal may be the linchpin in CP patients' nasal flora dysbiosis [10]. However, it was also suggested that by closing the aberrant fissures, cleft palate surgery can restore the normal anatomy and function of the oronasopharynx [11-14].

Our findings regarding the complications were supported by a study that the possibility of hazards and complications during general anesthesia for cleft lip repair and palatoplasty is three times greater in children than in adults [15-17].

The prevalence of cleft palate was discovered in different countries, which were highly coinciding to our results, for instance; The incidence of cleft lip in South Asia and North Africa, the illness prevalence among neonates was 12.8/10 000 and 12.2/10 000, respectively [18]. Another research by the International Clearinghouse for Birth Defects Surveillance and Research found that the average prevalence of the condition in Japan from 2007 to 2011 was 21.67/10 000 [19], which was decreased in 2016 to 20,2/10 000 [20].

CONCLUSION

Cleft palate is a genetic ailment and it significantly predisposes the affected children to respiratory maladies, pulmonary infections, or LRTIs. A high incidence of aspiration pneumonia and recurrent pneumonia was observed in the children affected with CP, especially the breastfeeding infants showed a significant association. As the disease showed case fatality and mortality index as well, therefore, the government should necessarily establish specialized centers at large scale for the surgical corrections and management of CP patients.

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