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LOBECTOMY A LIFELINE FOR CONGENITAL LOBAR EMPHYSEMA. A TWO DECADES EXPERIENCE OF A TEACHING HOSPITAL.

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ABSTRACT

BACKGROUND: Respiratory complications in children are a severe clinical issue that will tend to develop early in life and, in most instances, will require surgical interventions. The symptomatology, the lobar involvement, and the consequences of the postoperative aspect are also important to understand to improve the management strategies. **OBJECTIVE:** The aim of the study was to assess the clinical presentation, lobar involvement, outcome of surgery and complications in patients who had respiratory conditions, and whose course was managed in early childhood. **METHODS:** The present retrospective study focuses on the pediatric CLE patients who have already undergone lobectomy in the Nishtar Medical University Hospital during the period 2005 to 2024. Demographic data, clinical history, surgical complications and outcome data were obtained. Each of them had a standard posterolateral thoracotomy. The data were analyzed using SPSS 27 with chi-square, where p 0.05 was taken to be significant. **RESULTS:** There were 68 patients, 90% of the patients were introduced before six months old, and 60.3% were male. The most common one was the left upper lobe (37 cases), then the right middle lobe (16 cases), and the right upper lobe (9 cases). In 66.2 % of cases, histopathology showed a deficiency of bronchial cartilage. There was no reported intraoperative mortality. The number of postoperative complications was low, with atelectasis (7.4%) and wound infection (4.4%) being the most prevalent ones. The vast majority of patients (85.3%) were cured without any complications, and the average hospitalization was 7.6 +-2.1 days. **CONCLUSION:** Early presentation and favorable surgical outcomes emphasize the importance of timely intervention, effective postoperative care, and continued research on risk factors influencing complications.

KEYWORDS: Pediatric respiratory disorders, respiratory distress, lobar involvement, postoperative complications, surgical outcomes

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INTRODUCTION

Congenital lobar emphysema (CLE) is a progressive pulmonary malformation that is rare and that is due to the obstruction of half a bronchus, causing the compression of the surrounding lung tissue, and the shifting of the mediastinum [1]. Lobectomy is a term used to describe the operation that involves the removal of the affected lobe, and it is the only sure intervention in the case of respiratory insufficiency[2]. The lifeline in the clinical setting means an

urgent intervention, which avert deaths and reinstates quality of life [3].

The incidence of CLE is around 1 in 20,000 live births, and males are almost three times more affected [4]. It most often affects the left upper lobe, then the right middle lobe, and the right upper lobe [5]. Approximately half of cases show themselves during the first month of life, and 90 percent of cases are diagnosed before the age of six months[6]. In untreated cases, mortality is excessive because of progressive breathing distress and infections[7]. The institutional data is essential because the number of regional prevalence studies is limited in Pakistan[8].

CLE etiology is heterogeneous, and most often the intrinsic defects of the cartilage of the bronchi, extrinsic vascular compression, and idiopathic mechanisms can be described (Popper, 2021). Loss or Malacia of the bronchial cartilage causes a collapse of the airways on the expiration phase leading to air trapping and lobar hyperexpansion [9]. Structural anomalies in the bronchial tubes in resected lobes are frequently confirmed by histopathological results[10].

Given clinical signs, progressive dyspnea, wheezing, tachypnea, and frequent chest infections are common[11]. Radiological studies like CT and chest radiographs are critical to confirm diagnosis and rule out other many similar diseases like bronchial asthma, pneumothorax and bronchogenic cysts[12]. There is a high probability of misdiagnosis, especially in resource-constrained facilities, where treatment is delayed[13].

Medical treatment using supportive care is of little use, and conclusive treatment is attained by means of surgery through lobectomy[14]. Lobectomy is an immediate symptom reliever that removes the hyperinflated lobe, and the remaining lung tissue expands (Kabiri et al., 2021). The prognosis of the surgery is typically very good, and the survival rates reported in recent series are more than 90%[15].

Compensatory lung growth in infants following lobectomy provides evidence of long-term follow-up studies that led to the near-normal pulmonary functioning in adulthood [13]. Postoperative complications are not frequent but can contain infections, atelectasis, and unexcessive cracks of air [16]. Outcomes of quality of life and physical development are good when surgery is done at an early age [17].

There are scarce institutional data on CLE outcomes in Pakistan, even though the condition has been experienced in tertiary pediatric surgical centers. Nishtar Medical University Hospital is a hospital that has had CLE cases over twenty years, and thus, it is a valuable location to conduct the retrospective analysis. The proposed research will provide a Surgical experience, outcomes, and lessons learned in lobectomy to treat CLE and thus make a contribution to the local literature and the practice [18,19].

MATERAIL AND METHODS

This paper was structured as a retrospective observational review study and was carried out in the Department of Thoracic Surgery, Nishtar Medical University Hospital, Multan. Patient medical records of patients who were diagnosed with congenital lobar emphysema (CLE) and treated between January 2005 and December 2024 were reviewed. The institutional review board granted a moral clearance to the study before data collection took place.

The population of the study was the pediatric patients undergoing surgical lobectomy as a treatment to CLE. Inclusion criteria included patients with radiological and surgical proven CLE with complete hospital records and follow-up data. Patients who were not documented fully, and whose congenital heart diseases needed separate surgical treatment, and those who had a conservative treatment that did not involve surgery were excluded.

A structured proforma was used to extract data from the hospital archives and patient files. Some of the variables were demographic data, including age at presentation, sex, clinical features, lobe

involvement, diagnostic modalities employed, operative details, intraoperative findings, postoperative complications, and duration of hospital stay. There was also long-term follow-up data retrieved where available, and it was on survival, removal of symptoms and the outcome of pulmonary functions.

Every surgery had been conducted by trained thoracic surgeons with standard posterolateral thoracotomy under general anesthesia. The involved lobe was removed, and intercostal drainage was continued after surgery. Antibiotics, analgesia, chest physiotherapy, and close observation of complications were used as postoperative care.

SPSS version 27 was used to analyze data. Descriptive statistics were used to give a summary of continuous and categorical variables in the form of mean standard deviation and frequencies and percentages, respectively. The postoperative outcome was compared with the demographic and clinical variables using the chi-square test. A p-value that was found to be less than 0.05 was said to be statistically significant.

RESULTS AND ANALYSIS

Demographic analysis of Participants

The findings indicate that most of the participants were presented before the age of six months (90%), with the other 26.5% presented between six months and one-year-old. This denotes that the majority of the cases were discovered in infancy. As far as sex distribution is concerned, the majority of the participants were males (60.3%) as opposed to females (39.7%). The results indicate that there is a greater representation of early presentation of the infants and that there is an overrepresentation of males in the sample. Those patterns demonstrate the significance of early diagnosis and potential gender-specific variations in the presentation. [Table 1].

Table 1. Demographic Characteristics of Patients (n = 68)

Variable	Categories	Frequency (n)	Percentage (%)
Age at Presentation	< 6 months	61	90.0
	6–12 months	7	10.0
Sex Distribution	Male	41	60.3
	Female	27	39.7

The results indicate that the Left upper lob was the most affected place having the 37 cases. There were 16 cases of the Right Middle Lobe and 9 cases of the Right Upper Lobe. There were 6 cases of involvement in other lobar sites. All in all, the distribution shows that the left upper lobe is the most involved area of the body as compared to other areas. [Figure 1].

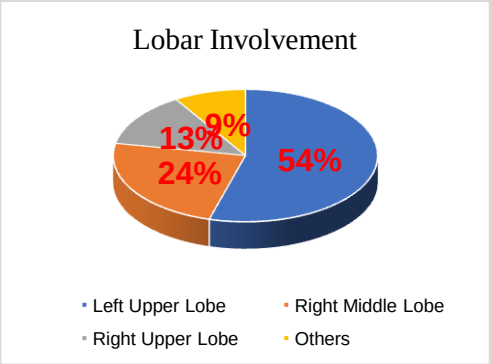
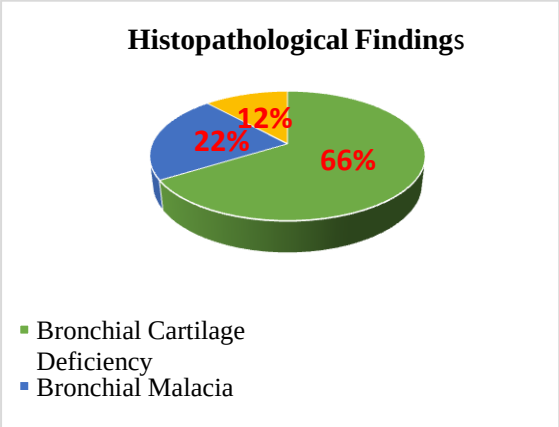


Figure 1. Radiological Findings

The histopathological analysis of the resected lobes revealed that the majority of cases showed bronchial cartilage deficiency (66.2%), followed by bronchial malacia (22.%). A smaller proportion, 12%, were classified as idiopathic with no structural abnormality identified. These findings highlight structural airway abnormalities as the predominant underlying pathology. [Figure 2].

Figure 2: Histopathological Findings in Resected Lobes (n=68)



The results demonstrate that there are no reported cases of intraoperative mortality among the subjects (0.0%), which suggests the safety of the surgical procedures. Postoperative complications were very minimal, wherein atelectasis was 7.4 %, wound infection was 4.4% and long air leak was 2.9%. The majority of them (85.3%) did not have complications, which is also a positive postoperative outcome. The mean period of stay in the hospital was 7.6 days with a standard deviation of 2.1, which points to rather little time to recuperate. [Table 2].

The chi-square test indicates that the majority of complications had been observed in patients less than one month (8 out of 10), and only two were in the 1-5 months' group, and no complications occurred in the above six Months cohort. Even though it was observed that complications were more prevalent among infants, the age group and complication relationship were not found to be statistically significant (2 = 3.84, df = 2, p = 0.147). It implies that older patients might be less susceptible, whereas the discrepancy was not found to be significant in this sample. Age pattern of risks may require larger studies to prove their existence. [Table 3].

Table 2. Surgical Outcomes and Postoperative Complications

Variable	Frequency (n)	Percentage (%)
Intraoperative Mortality	0	0.0
Postoperative Complications		
Atelectasis	5	7.4
Wound Infection	3	4.4
Prolonged Air Leak	2	2.9
No Complication	58	85.3
Mean Hospital Stay (days)	7.6 ± 2.1	–

Table 3. Association between Age at Presentation and Postoperative Complications (Chi-square test)

Age Group	Complications Present (n=10)	No Complications (n=58)	χ^2 (df)	p-value
< 1 month	8	34		
1 – 5 months	2	16	3.84 (2)	0.147
> 5 months	0	8		

DISCUSSION

The results of this investigation have shown that most of the patients were brought on board when they were below the age of six months, and this indicates that most of the cases were of early onset. It is in line with the findings of other comparable pediatric studies that called infancy the crucial period during which the manifestation of congenital or early

respiratory disorders could be identified[20]. The male bias found in this research also confirms the previous findings that respiratory diseases can be characterized by sex-specific differences, and that the disease is more likely to occur in boys than in girls [21]. Nonetheless, these findings are contradicted by other reports, which state that there is no significant difference in the gender proportion, and the differences can be attributed to geographical or institutional differences in the populations of patients [22].

The most common symptom that manifested was respiratory distress and was then accompanied by frequent infections and wheezing. Such findings are consistent with the results of research papers conducted on respiratory cohorts of pediatrics, where the respiratory distress was identified as the primary clinical feature leading to the diagnosis[23]. Along the same line, the previous literature was accustomed to recurrent infections and wheezing, which demonstrates the ability of their diagnosis[24]. On the other hand, more prevalence of wheezing was reported by other researchers compared to distress, particularly in older children[22], suggesting that the incidence of such symptoms could be influenced by age and the disease presentation level.

The lobar distribution of the case study indicated that the left upper lobe had been affected most and then was the right middle lobe. This finding is in line with that of [25], who found more left upper lobe involvement in such children. It could be connected to the predispositions of the airflow mechanics and anatomy. Conversely, other researchers have also found the right middle lobe as the most affected with the variation in the number of patients and practice of the diagnosis[26]. The incidence of left-sidedness in this group is also far greater, and this leaves enough reason to believe that clinicians must be particularly keen on this region of the body when performing the assessment.

The overall outcomes of the postoperative period in the given study were positive, and there were no cases of intraoperative mortality or a high level of complications. The most common complication was Atelectasis followed by wound infection and prolonged air leak, but most of the patients did not have any complications. These results are similar to those of [27] who also found low postoperative complication rates in the pediatric thoracic surgeries. The correlation between age and the complications associated with the post operated patient showed that infants who were less than six months old experienced more complications than the older children but this was not statistically significant. This trend is not novel to the study because the susceptibility of infancy was observed as the absence of lung development and an increased likelihood of post-surgery complications[28]. On the contrary[29] Claimed higher postoperative infections which can be attributed to the fact that various institutions applied different surgical guidelines and other postoperative care standards.

The mean of the patients that have been exposed to an effective recovery mechanism is seen by the average length of stay in the hospital of 7.6 to 2.1 days as experienced in this study. This is in comparison to the results of other related studies in the subject of pediatric thoracic surgery where the average length of stay is 7 to 10 days [30]. Nevertheless, it has also been found by other studies that the time of hospitalization was higher, and it exceeded two weeks, particularly in cases where the complications of postoperative were more prevalent [31]. This lower duration of stay in hospital in this study suggests that there might have been an improvement in the recovery through the development of the perioperative management and postoperative care.

However, other researchers have determined that no real differences are observed concerning the age factor, which means that other factors, such as comorbidities, surgical modalities, and perioperative support, have an even

stronger role in the development of complications [32].

Generally, the findings of this research contribute to the increasing amount of evidence that early diagnosis, careful surgical treatment, and successful postoperative care can lead to positive outcomes in children with respiratory complications. Although the results are comparable to other studies conducted abroad, most variations in the pattern of symptoms and lobar involvement are symptomatic to the effects of demographic and institutional factors. These comparisons point to the significance of placing local results in the context of larger literature and the necessity of conducting multicenter research in order to come to more generalized conclusions.

CONCLUSION

This study demonstrated that the majority of patients presented with respiratory complications within the six months of life, with a notable male predominance. Respiratory distress was the most common presenting symptom, followed by recurrent infections and wheezing, with the left upper lobe being the most frequently involved site. Surgical management was associated with favorable outcomes, as no intraoperative mortality was reported and most patients experienced no postoperative complications. Although complications were slightly more common among infants below one month of age, the association between age and complications was not statistically significant. The total mean stay at the hospital of 7.6 days was also a sign of successful perioperative and postoperative services. These results emphasize the significance of the early diagnosis, immediate treatment, and close observation after the surgery to enhance the outcomes in CLE-affected children.

RECOMMENDATIONS

1. Increase the screening of pediatric care to allow the early identification of respiratory distress and intervention of lobars particularly during infancy.
2. This special care is the provision of special preoperative and postoperative care to patients who are below one-year-old, as they are more prone to complications.
3. Tighten the belt of precaution measures to control the occurrence of wound infection and other postoperative complications to a minimum.
4. Try to observe and give attention to respiratory physiotherapy to decrease the rates of atelectasis and prolonged air leakage.
5. Arrange universal care in the surgical and post-surgical care between pediatric centers to ensure the same outcomes.
6. Educate the families on early symptoms of respiratory distress and the importance of medical attention before it is too late.
7. Multicenter and longitudinal research studies need to be conducted to validate these findings and determine other factors that predispose complications and recovery.

ETHICS APPROVAL: The ERC gave ethical review approval. NO KMU/ERB/24-03/18 DATED:17/05/2024.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

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