

Research Article

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A Study on Prevalence Clinical and Radiological Features of Tracheo Bronchial Foreign Body and It's Correlation With Bronchoscopic Findings and It's Complications in Children Admitted in Bchi Davangere

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HIGHLIGHTS

1. Study on tracheobronchial foreign body prevalence.
2. Clinical features observed in affected children.
3. Radiological findings correlated with bronchoscopy.
4. Complications associated with foreign body ingestion.
5. Research conducted at BCHI Davangere hospital.

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ABSTRACT

Tracheobronchial foreign body aspiration is a common yet potentially life threatening condition in children, often requiring prompt and accurate diagnosis to prevent serious complications. A study conducted between August 2022 and June 2024 at BCHI Davangere examined 95 children aged 6 months to 18 years with suspected foreign body aspiration. Most cases (65.3%) involved children aged 1-3 years, with a slight male predominance (56.8%). Cough was the most prevalent symptom, reported in 90.5% of cases followed by dyspnea in 64.2%. Groundnuts were the most commonly aspirated foreign body found in 32.6% of cases, and the right main bronchus was the most frequent site of obstruction (40%). Bronchoscopy, which was performed in 18.9% of cases, had a high diagnostic yield of 81.1%, underscoring its value in confirming the presence of foreign bodies when clinical and radiological findings alone are insufficient. The study revealed that while symptoms such as cough and dyspnea are common, they may not always reliably indicate the presence of an aspirated object, as clinical and chest X-ray findings had low sensitivity in identifying foreign bodies. As a result bronchoscopy remains a crucial diagnostic tool in suspected cases ensuring timely and effective removal of the aspirated object. Additionally the study emphasizes the need for increased awareness and preventive measures particularly in rural communities to reduce the occurrence of foreign body aspiration in children. Proper education for parents and caregivers about the dangers of small objects like groundnuts and the importance of supervision can significantly lower the risk. Overall the combination of clinical assessment radiological imaging, and bronchoscopy is essential for managing tracheobronchial foreign body aspiration, ensuring better outcomes for children.

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INTRODUCTION

Foreign body aspiration (FBA) has been a concern since ancient times, presenting a significant challenge to pediatricians even today. One of the primary difficulties is that the initial choking episode is often not witnessed leading to delayed recognition. In many cases, the residual symptoms, such as coughing or wheezing, can easily be mistaken for common respiratory illnesses like asthma or bronchitis. This delay in diagnosis contributes to both increased morbidity and in some cases, mortality in children, particularly those under three years of age [1,2].

Young children are especially vulnerable to foreign body aspiration due to several developmental factors. Their immature swallowing function combined with the lack of molars leads to ineffective chewing, making it easier for food or small objects to be swallowed accidentally. In addition their natural tendency to explore their environment by putting objects in their mouths coupled with a lack of awareness about the dangers of eating while playing, further increases the risk of aspiration. Studies indicate that most cases occur in children between the ages of one and three with the peak incidence between one and two years old. Commonly aspirated objects in younger children include peanuts, seeds, and food particles while older children are more likely to aspirate non food items like coins, small toy parts or pen caps [3,4].

The symptoms of foreign body aspiration can vary depending on the size and location of the object, as well as the time elapsed since the aspiration occurred. The classic triad of coughing wheezing, and diminished breath sounds is often cited as key indicators but this triad is not always present. Instead the presentation may vary ranging from sudden onset coughing and choking to more subtle and delayed signs such as persistent cough recurrent respiratory infections or even failure to thrive. In severe cases the foreign body can cause life-threatening airway obstruction leading to immediate respiratory distress [5,6].

Anatomically foreign bodies tend to lodge more frequently in the right main bronchus (RMB), as it is more in line with the trachea creating a straighter path from the larynx. However foreign bodies can also lodge in the left bronchus or even the trachea itself. The clinical presentation is typically divided into three stages. The first, acute stage is characterized by coughing, choking and gagging immediately after aspiration. If the object is not expelled or

removed, the child may enter a second, asymptomatic phase during which symptoms temporarily subside. The third stage is the chronic phase where complications arise. In this phase children may develop recurrent infections wheezing failure to thrive or more severe complications such as lung abscesses or bronchiectasis [7,8].

Imaging particularly chest radiographs, can aid in diagnosing FBA but they are not always definitive. Over 50% of tracheal foreign bodies and about 25% of bronchial foreign bodies are radiolucent meaning they do not show up on X-rays. This makes clinical suspicion crucial in cases where the history or symptoms suggest aspiration even if the radiograph appears normal [9].

Bronchoscopy is the gold standard for both diagnosing and treating foreign body aspiration. This procedure allows for direct visualization and removal of the foreign object from the airway. While early intervention via bronchoscopy can effectively reverse pulmonary pathology caused by foreign body obstruction delays in treatment can lead to severe complications. Long-standing or occult cases of FBA can result in irreversible damage such as bronchiectasis lung abscesses, or even death. Other serious complications include bronchopleural fistula atelectasis and recurrent pneumonia, all of which underscore the importance of prompt recognition and treatment [10,11].

The importance of prevention cannot be overstated. Since young children are most at risk educating parents and caregivers about the dangers of small objects, certain foods and unsafe eating practices is critical. Simple measures such as keeping small items out of reach cutting food into small manageable pieces and encouraging children to sit while eating can significantly reduce the risk of aspiration. Public awareness campaigns and pediatric guidance play vital roles in fostering a culture of prevention emphasizing the adage "prevention is better than cure [12,13]."

Foreign body aspiration remains a significant cause of morbidity and mortality in children. The challenge lies not only in the diagnosis but also in the prevention of such events. Through public education clinical vigilance and timely medical intervention the risks associated with foreign body aspiration can be minimized improving outcomes for children affected by this potentially life threatening condition [14,15].

The primary objective of this study is to investigate the correlation between the clinical triad and radiological features with bronchoscopic findings in cases of airway foreign body aspiration. Secondary objectives include examining the age and sex distribution seasonal variations, duration of hospital stay types of

aspirated foreign bodies, sites of obstruction, and associated signs and symptoms in these cases. Additionally the study aims to assess the validity of histories concerning witnessed foreign body aspiration compared to bronchoscopic confirmation and to explore complications arising from the foreign body itself as well as any complications related to the bronchoscopy procedure.

expressed as mean ± SD. The student t-test was used

MATERIAL AND METHODS

This Non randomised prospective observational study was conducted at the Department of Paediatrics, at Bapuji child health institute, J.J.M. Medical College, Davangere, August 2022 to June 2024. Ethical approval has been obtained from the Ethical Approval Committee of Bapuji Child Health Institute and Research Center and Chitageri Government Hospital, Davangere.

Study Population:

The study population consisted of children aged 6 months to 18 years who met specific inclusion criteria including a history of witnessed foreign body aspiration, recurrent respiratory tract infections after ruling out other causes, sudden onset respiratory distress in previously healthy children,

RESULTS

A study of 95 subjects found 77 cases with foreign bodies confirmed via bronchoscopy. All underwent chest X-rays upon admission. The largest age group affected was 1 to 3 years (65.3%), with more males (55.8%) and rural residents (56.8%). The mean

signs and symptoms indicative of foreign body aspiration radiological evidence of a visualized foreign body or related complications, and those who had a foreign body removed via bronchoscopy. Conversely, children exhibiting similar symptoms due to conditions clearly indicating a pathology other than foreign body aspiration as well as those unable to undergo rigid bronchoscopy due to factors such as unstable neck, cervical spine abnormalities, or restricted temporomandibular joint motion, were excluded from the study.

Data Analysis:

Statistical analysis was conducted using SPSS Statistical Package for Social Sciences) version 21. Data entry was performed in an Excel spreadsheet where descriptive statistics were calculated for both explanatory and outcome variables employing mean and standard deviation for quantitative variables and frequency and proportions for qualitative variables. For inferential statistics the Chi-square test was utilized to assess associations among qualitative variables while diagnostic accuracy tests were applied to determine the sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of X-ray findings, with a significance level set at 5%.

symptoms included cough (90.5%) and dyspnea (64.2%), while fever wheeze, and stridor were less frequent. Clinical signs showed respiratory distress in 41.1%, and decreased air entry was most common in the right lung (45.3%). Rhonchi and crepitus were observed in 27.4% and 30.5%, respectively.

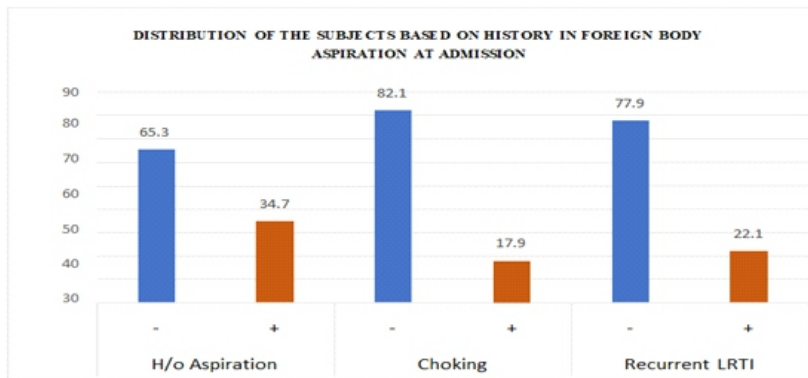


Figure 1: Distribution of Subjects Based on History Inforeign Body a Spiration at Admission

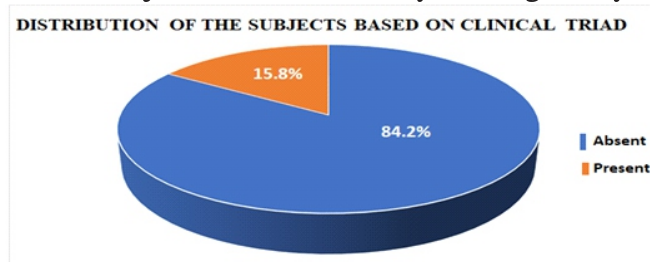


Figure 2: Distribution of the Subjects Based on Clinical Triad

The study analyzed 95 subjects, with 22.1% requiring respiratory support and 77.9% not needing it. Radiological findings revealed obstructive emphysema in 37.9% of individuals, while 62.1% did not have it. Collapse was present in 29.5% of cases, and 70.5% were unaffected. Consolidation was seen in 14.7%, while the majority (85.3%) did not exhibit this condition. Interestingly, 43.2% had normal radiological results, while 56.8% showed abnormalities.

The study categorized 95 individuals into two groups based on the nature of the procedure, with 65.3% classified as "Emergency" cases and 34.7% as "Elective." Bronchoscopy was performed on all 95 individuals, revealing positive findings in 81.1% of the cases, while 18.9% showed no foreign body presence. These results highlight a higher incidence of emergency interventions and positive bronchoscopy findings in the study population.

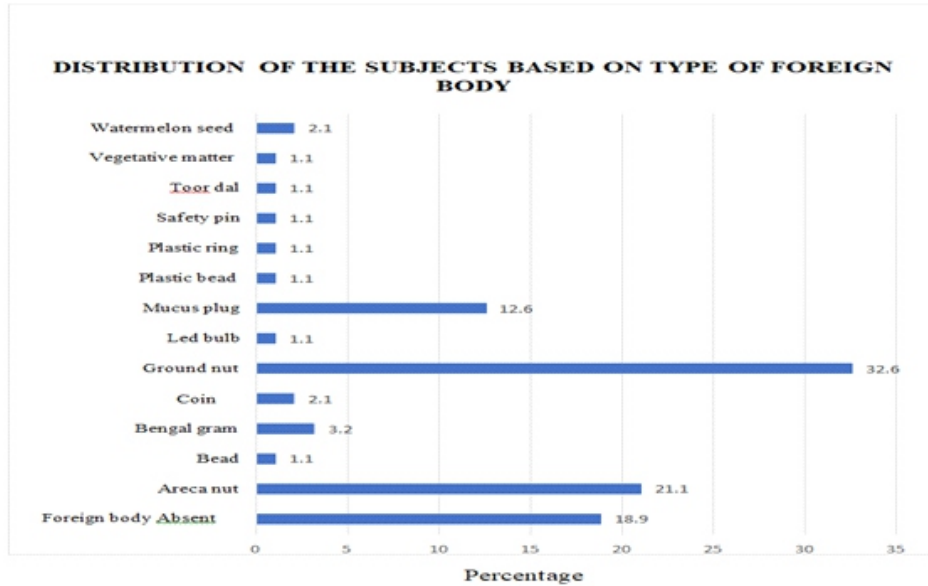


Figure 3: Distribution of the Subjects Based on Type of Foreign Body

The study of 95 individuals revealed that foreign bodies were most commonly located in the right bronchus (40%), followed by the left bronchus (25.3%). In 20% of cases, no foreign body was present. Fewer cases involved both bronchi, the main bronchus, or the trachea. Complications due to foreign bodies were noted in 41.1% of cases, while 58.9%

experienced no complications. Regarding bronchoscopy (BS) procedures, complications occurred in only 3.2% of cases, with the vast majority (96.8%) showing no complications. These findings emphasize the significance of foreign body location and the generally low complication rate from BS procedures.

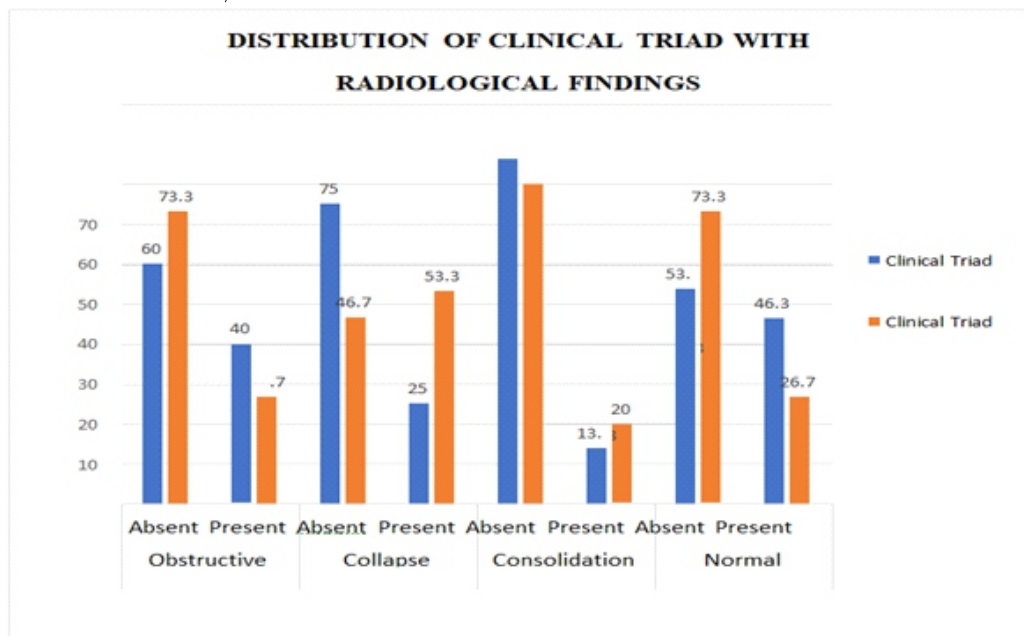


Figure 4: Association of Clinical Triad With Radiological Findings

Table 1: Association of Clinical Triad with Bronchoscopy

Bronchoscopy		Clinical triad		Total
		Absent	Present	
Absent	Count	16	2	18
	%	20.00%	13.30%	18.90%
Present	Count	64	13	77
	%	80.00%	86.70%	81.10%
Total	Count	80	15	95
	%	100.00%	100.00%	100.00%
Chi-square value-0.366				
p value-0.545				

The statistical analysis compares the diagnostic effectiveness of a clinical triad against bronchoscopy. Sensitivity of the clinical triad is low at 16.88%, meaning it correctly detects only a small number of actual cases, while its specificity is high at 88.89%, indicating it is good at identifying non-cases. With a disease prevalence of 81.05%, the positive predictive value is 86.67%, signifying that most individuals with a positive test truly have the disease. However, the negative predictive value is low at

20.00%, meaning a negative result is unreliable for ruling out the disease. The accuracy of the clinical triad is limited at 30.53%. Despite this, the chi-square test shows no significant association between the triad and bronchoscopy results ($p = 0.545$), suggesting that the clinical triad's presence or absence does not substantially influence the likelihood of bronchoscopy being performed. Overall, the triad's diagnostic utility in this context is minimal.

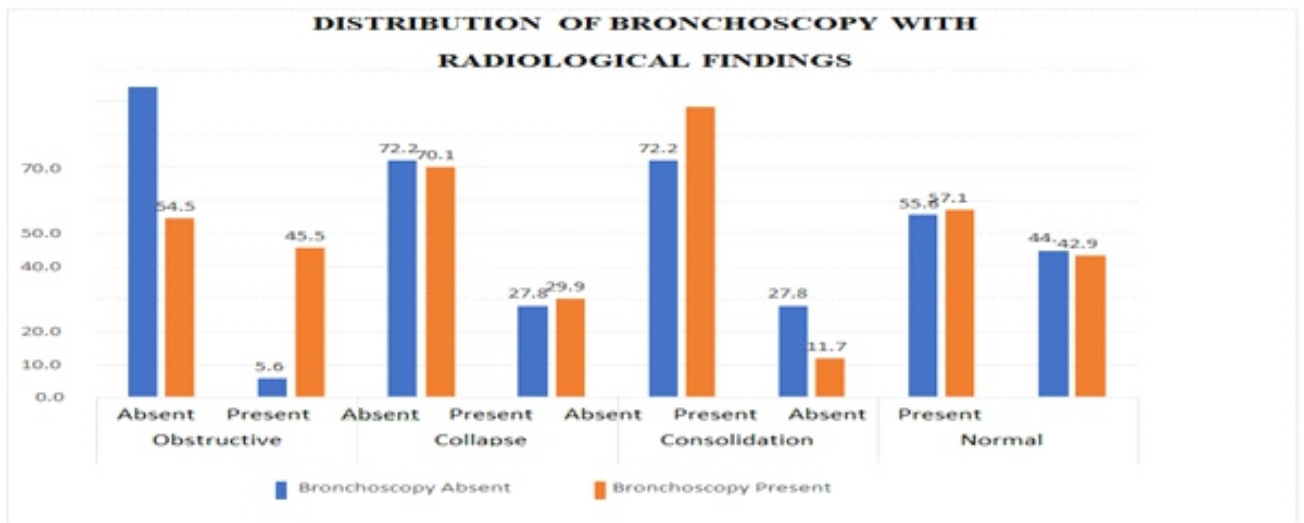


Figure 5: Association of Bronchoscopy with Radiological Findings

TABLE 2: Association of Bronchoscopy with X-ray Finding

X-ray findings		Bronchoscopy		Total
		Absent	Present	
Absent	Count	10	50	60
	%	10.5%	52.6%	63.2%
Present	Count	8	27	35
	%	8.4%	28.4%	36.8%
Total	Count	18	77	95
	%	100.00%	100.00%	100.00%
Chi-square value-0.552				
p value-0.458				

The statistical analysis evaluates the effectiveness of X-ray findings compared to bronchoscopy in diagnosing a condition. The sensitivity of X-ray is 35.06%, meaning it detects about a third of true cases, while specificity is 55.56%, indicating moderate accuracy in identifying non-cases. The positive predictive value is relatively high at 77.14%,

meaning most individuals with positive X-ray results have the disease. However, the negative predictive value is low at 16.67%, making negative X-ray results unreliable for ruling out the condition. Overall accuracy is limited at 38.95%, suggesting X-ray findings alone are not highly effective in diagnosis.

Table 3 : Association of Bronchoscopy with Complication Due to Foreign Body

Complication/tForeignBody		Bronchoscopy		Total
		Absent	Present	
Absent	Count	17	39	56
	%	94.4%	50.6%	58.9%
Present	Count	1	38	39
	%	5.6%	49.4%	41.1%
Total	Count	18	77	95
	%	100.00%	100.00%	100.00%
Chi-squarevalue-11.56				
pvalue-0.001				

Table 4 : Distribution Based on CT Scan

CTScan	Frequency	Percentage
Absent	93	97.9
Present	2	2.1
Total	95	100

Table 5: Association of CT Scan with Bronchoscopy

RadiologicalFindings			Bronchoscopy		Total	Chi-square value	pvalue
			Absent	Present			
CTScan	Absent	Count	16	77	93	8.74	0.003*
		%	88.9%	100.0%	97.9%		
	Present	Count	2	0	2		
		%	11.1%	0.0%	2.1%		
	Total	Count	18	77	95		
		%	100.0%	100.0%	100.0%		

Table 6 : Association of CT Scan with Cinical Triad

CTScan		Clinicaltriad		Total	Chi-squar evalue	pvalue
		Absent	Present			
Absent	Count	78	15	93	0.383	0.536
	%	97.5%	100.0%	97.9%		
Present	Count	2	0	2		
	%	2.5%	0.0%	2.1%		
Total	Count	18	77	95		
	%	100.0%	100.0%	100.0%		

Table 7: Association of History of Aspiration with Bronchoscopy

H/oaspiration		Bronchoscopy		Total	Chi-square value	pvalue
		Absent	Present			
Absent	Count	12	50	62	0.019	0.89
	%	66.7%	64.9%	65.3%		
Present	Count	6	27	33		
	%	33.3%	35.1%	34.7%		
Total	Count	18	77	95		
	%	100.0%	100.0%	100.0%		

The statistical analysis examines the effectiveness of bronchoscopy in detecting a history of aspiration. Sensitivity is moderate at 35.06%, while specificity is higher at 66.67%, indicating a reasonable ability to rule out cases without aspiration. The positive predictive value is high at 81.82%, meaning a positive

DISCUSSION

A total of 95 cases underwent bronchoscopy in our study, of which 77 cases were confirmed to have a foreign body. The age distribution showed that children aged between 1 and 3 years accounted for a significant 65.3% of the cases, aligning closely with findings from previous studies (60% and 65.38%). Notably, 89.6% of our cases involved children under the age of 6 years, consistent with other research indicating that 84% and 84.5% were similarly categorized. This high incidence among younger children can be attributed to their exploratory behavior, characterized by the tendency to place objects in their mouths. Additionally, their developing chewing and swallowing skills, combined with their playful nature during meals often accompanied by crying or laughter may further increase the risk of foreign body aspiration. Parents' reactions, such as reprimanding or distracting children during feeding, could also exacerbate this risk [16].

In terms of sex distribution, our findings indicate that 55.8% of the aspiration cases were in boys, supporting results from other studies that reported male predominance in foreign body aspiration, with ratios ranging from 1.5:1 to 2.7:1. Our study's male to-female ratio of 1.2:1 is in line with these earlier findings. The tendency for boys to be more adventurous and curious, along with cultural practices that might promote riskier behavior in males such as exposure to crunchy foods and less supervision could explain this trend. Geographic analysis showed that foreign body aspiration was more common in rural areas (56.8%) compared to urban settings (43.2%), corroborating earlier studies that reported similar trends.

result reliably indicates aspiration. However, the negative predictive value is low at 19.35%, making negative results less dependable. The overall accuracy is 41.05%, showing moderate effectiveness. A chi-square test (p-value: 0.89) suggests no significant association between a history of aspiration and bronchoscopy outcomes.

This disparity may be due to children in rural environments being less supervised and more engaged in adventurous play than their urban counterparts [17].

Regarding the history of witnessed aspiration, our study found that 34.7% of cases had a positive history at the time of admission, which is lower than the figures reported in previous studies (76%, 47%, and 22.7%). This emphasizes the need for thorough assessments in cases of suspected aspiration, even when no eyewitness accounts are available. The types of foreign bodies identified varied, with groundnuts being the most commonly aspirated object in our study (32.6%), although this is significantly lower than the 86% reported in earlier studies. Arecanut was also notable, with 21.1% of cases involving this item, particularly in specific studies. These variations may reflect differences in dietary habits and cultural practices, underscoring the need for medical practitioners to consider local contexts when addressing foreign body aspiration [18].

Symptoms reported at admission showed cough as the most prevalent, with 90.5% of our cases presenting this symptom. This aligns closely with findings from other studies, highlighting the importance of cough as a key indicator in foreign body aspiration cases. The incidence of breathlessness varied significantly, with 64.2% reported in our study, contrasting with lower percentages in previous research. The presence of wheeze and fever also exhibited significant variability, indicating the need for careful clinical assessment and consideration of these symptoms when diagnosing when diagnosing foreign body aspiration. Our study highlighted acute cough wheeze and unilateral decreased air entry as critical clinical features for

diagnosis [19].

Examining the clinical triad at admission, only 16% of our cases presented with the triad of symptoms, indicating a notable decrease from earlier studies. This suggests a potential shift in the clinical presentation of foreign body aspiration cases over time or perhaps improvements in diagnostic practices. The signs of foreign body aspiration also varied among studies, with unilateral decreased air entry being the most significant sign reported in our research (78%). This contrasts with lower percentages from earlier studies, suggesting a higher prevalence of this sign in our cohort, emphasizing the importance of recognizing this symptom during clinical evaluations [20].

Analyzing the site of lodgement during bronchoscopy revealed the right main bronchus as a common site consistent with other studies although our findings showed a lower prevalence (40%) compared to previous reports. The left main bronchus was less frequently involved in our cases (25.3%). This data indicates the need for clinicians to maintain a high index of suspicion regarding the right bronchus during evaluations of suspected foreign body aspiration.

Radiological findings at the time of admission indicated a rising trend in obstructive emphysema cases (37.9%) across studies, while the incidence of lung collapse has shown a decreasing trend. The prevalence of normal radiological findings also increased in our study (43.2%), suggesting advancements in diagnostic imaging techniques. However the variation in radiological findings emphasizes the importance of thorough evaluations and the need for practitioners to consider all diagnostic avenues, including bronchoscopy for confirming foreign body aspiration [21].

When validating chest X-ray findings for diagnosing foreign body aspiration, our study reported a sensitivity of 35.06%, lower than previous studies, while the specificity was comparatively higher at 55.56%. This indicates that while chest X-rays may identify some cases of aspiration their reliability as a diagnostic tool is inconsistent prompting the necessity for additional diagnostic approaches. The complications associated with foreign body aspiration and bronchoscopy revealed a 1.3% incidence of cardiopulmonary arrest in our study alongside ventilation complications at 3.89% and a higher rate of severe respiratory distress (9.09%). These complications highlight the risks associated with foreign body aspiration and the importance of careful monitoring and management during bronchoscopy

procedures [22].

Additionally, the relationship between the history of aspiration and bronchoscopy findings indicated no statistically significant association, suggesting that a history of aspiration does not reliably predict bronchoscopy outcomes. Similarly, the association between chest X-ray findings and bronchoscopy results showed no significant correlation, emphasizing the need for comprehensive evaluations in cases of suspected aspiration. Our study found that only two cases required a CT scan, indicating that routine use of this imaging modality may be unnecessary for diagnosing foreign body aspiration when bronchoscopy can be employed effectively. CT scans were reserved for cases with recurrent pneumonia to identify retained foreign bodies indicating a tailored approach to diagnostics [23,24].

Our study provides valuable insights into the demographics, clinical presentations, and outcomes associated with foreign body aspiration in children. The findings suggest trends in age, sex distribution, types of foreign bodies, and complications that are critical for clinicians to consider in diagnosis and treatment. By recognizing the variations in clinical presentations and employing a multidisciplinary approach to diagnosis, healthcare providers can enhance the management and outcomes of children with foreign body aspiration [25].

CONCLUSION

The study confirms previous research, showing a significant trend of foreign body aspiration in children aged 1 to 3 years, especially in boys and rural areas, reflecting behavioral and environmental influences. Groundnut is the most common aspirated object, with arecanut also frequently noted due to cultural dietary habits. Sudden onset cough is identified as a key symptom, though other symptoms vary. The right main bronchus is a common lodging site for foreign bodies, and there's an increasing prevalence of unilateral decreased air entry. While the association between the history of aspiration, the clinical triad, and radiological findings with the bronchoscopic findings did not yield statistically significant p-values, it is imperative to recognize the intrinsic value of patient history, clinical features, and chest X-ray findings. A slightest of suspicion of foreign body aspiration should lead to undergo bronchoscopy procedure. These elements, although valuable, should not be the sole determinants in the decision-making process for performing bronchoscopy. While the absence of aspiration history does not guarantee negative bronchoscopy results, CT scans are reserved for specific cases. The findings highlight the need for enhanced awareness and preve-

ntive measures, particularly in rural settings.

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