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STUDY THE SENSITIVITY OF COMPUTED TOMOGRAPHY IN INVESTIGATION OF ASPIRATED FOREIGN BODIES

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ABSTRACT

Background: Foreign body aspiration (FBA) is considered a potentially life-threatening event and bronchoscopy represents the cornerstone of both diagnosis and management . Computed tomography(CT) of chest could be appropriated for diagnosis of FBA and might reduce the need for bronchoscopy. **Objective:** The aim of this study was to determine the diagnostic value of CT-scan in diagnosis of tracheobronchial FBA. Patients and Methods: An observational descriptive study (case series) conducted for the period one year (2022-2023) at Tishreen University Hospital in Lattakia-Syria. The study included all patients younger than 18 years who visited Otolaryngology clinic with suspected FBA and underwent to bronchoscopy. Performance of CT-scan was evaluated for some patients. **Results:** Out of 42 cases, 24 were male (57.1%) and 18 were female (42.9%), with mean age of the patients was 3.6±0.9 year. Age group younger than 5 years represented the most frequent group (78.6%). Wheezing (92.9%) and cough (50%) were the most frequent clinical manifestations, with presence of moderate level of FBA suspicion in 23 cases (54.8%) followed by high and low level; (40.4%) and (4.8%) respectively. Cough(p:0.02) and cyanosis(p:0.04) were detected more significantly in severe cases, as well as unilateral radiological findings were observed significantly in moderated and severe cases,p:0.0001. CT-scan was performed in 26 cases(61.9%) which was positive in 24 cases (92.3%) and negative in 2 cases (7.7%). 23 (88.5%) of the patients had a positive CT-scan and bronchoscopy resulting in a sensitivity of 100% , specificity 66.7% , positive predictive value(PPV) 95.8% , negative predictive value (NPV) 100% and accuracy 96.1%.Conclusion: The current study demonstrated that high accuracy of chest CT findings in diagnosis of FBA leads to a low rate of unnecessary bronchoscopy.

KEYWORDS: Bronchoscopy, CT-scan, chest, foreign body aspiration, Syria.

1. INTRODUCTION

Foreign body aspiration (FBA) into tracheobronchial tree is a frequent and serious cause of respiratory problems and considered a potentially life-threatening event which need an emergency recognition and treatment. It commonly occurs in children younger than 3 years of age. According to the Centre for disease control in USA, (FBA) is the fourth most common reason of death in children between 1 and 5years old.[1,2]

Most of aspirated foreign bodies locate in the bronchus whereas larynqqx and trachea are considered the least common locations.

Clinical symptoms vary according to the location and severity of the obstruction, in addition to the patient age, type of the aspirated foreign body, and the time which passed after the aspiration event. (FBA) in children can be suspected if a chocking episode is witnessed by an adult or remembered by the child.

Airway obstruction usually partial, cough is considered the most presenting symptom, followed by dyspnea, and stridor. By chest auscultation we may hear local whizzing, decreased or absent respiratory sound.[3,4]

Diagnosis of (FBA) depends on history, clinical examination. CXR may be useful in diagnosis and thus depends on the nature of aspirated substance whether it is radiopaque, and on the degree of airway obstruction, but normal CXR doesn't exclude the aspiration. Rigid bronchoscope represents the golden standard for the diagnosis and treatment of (FBA) but with the existence of some dangers such as the need for general anesthesia, perioperative complications which include bronchospasm, ventilation disturbances, and airway trauma.[5,6,7]

CT scan represent one of the diagnostic investigations in the patients whose CXR is normal or undefined with a high susceptibility of (FBA). Previous Studies show that CT scan has a sensitivity of 100% and a selectivity of 66-100% in (FBA) diagnosis. ultralow dose CT scan _if available_ is considered a reliable method for (FBA) diagnosis and it can decrease the need for bronchoscope with its morbidity. In our study we assessed the diagnostic value of CT scan in (FBA).[8]

2. Objectives
2.1 Main objective: Delicate defining of (FBA) patients who need bronchoscopic intervention by performing a previous CT scan, and thus avoiding inappropriate intervention.
2.2 Secondary objective: Determined the diagnostic value of CT scan in tracheobronchial (FBA).

3. MATERIALS AND METHODS
3.1 Study design: observational descriptive study (Case series).
3.2 Study Period and Place: The study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery Tishreen university hospital, Lattakia, Syria. One year from 2022 to 2023.

3.3 Study sample: All patients younger than 18 years of age who presented to otorhinolaryngology department with a high suspicion of (FBA) and underwent bronchoscopy.

3.4 Exclusion criteria
3.4.1 Patients older than 18 years of age.
3.4.2 Patients didn't complete their medical form.
According to that we had a sample size of 42 patients.

3.5 Methodologies
- We have taken a full history, past history of any chronic disease, surgery, allergic reaction, medical treatments. clinical examination was conducted.
- Written Informed consent was taken from all the patients for the planned procedure in a perform approved by our institutional ethical committee
- CXR was performed for all patients with determining the findings.
- Patients were divided in two groups

-The first group: patients underwent CT-scan previous to the bronchoscopy.
-THE second group: patients underwent CXR followed by the bronchoscopy without performing CT-scan.

- **We defined**
1. True positivity: positive (FB) on CT scan, and confirmed (FB) by bronchoscopy.
2. False positivity: positive (FB) on CT with negative (FB)by bronchoscopy.

3. True negativity: negative (FB) on CT scan and negative (FB) by bronchoscopy and follow-up visits.
4. False negativity: negative (FB) on CT scan with confirmed (FB) by bronchoscopy or in follow-up visits.

4. Statistical analysis
Data were entered, and analyzed using SPSS version 20.
- Description statistical: for qualitative variables we use frequencies, percentages, and graphics.
- For quantitative variables we use mean, standard deviation, and range.
- Inferential statistical: we use One Way Anova test and chi-square test.
- p-value < 0,05 considered statistically important.

5. RESULTS
Out of 42 cases, 24 were male (57.1%)and 18 were female (42.9%). The age ranged from 11 months to 18 years (mean age= 3.6±0.9 years).33 patients were younger than 5 years of age (78,6%),and 9 patients were older than 5 years (21,4%).

Symptoms varied between patients, 39 patients had whizzing (92,9%), 21 had cough (50%), 9 had stridor (9,5%), 4 cases had cyanosis (4,8%). [table 1].

CT scan was performed for 26 patients(61,9%),it was positive in 24 cases(92,3%) and negative in 2 cases(7,7%).

From the 24 positive CT cases, bronchoscopy was positive in 23(88,5%) and negative in 1 case. The 2 negative CT cases had also a negative bronchoscopy(7,7%).

Bronchoscopy was done for 16 patients without previous CT and it was positive in 9 cases(56,2%), and negative in 7 cases(43,8%).[figure 1].

Table 1: demographic distribution of patients.

Properties	Number (%)
Sex	
Males	24(57,1%)
Females	18(42,9%)
Mean age	3.6±0.9 years
Age	
Younger than 5 years	33(78,6%)
Older than 5 years	9(21,4%)
Symptoms	
Whizzing	39(92,9%)
Cough	21(50%)
Stridor	9(9,5%)
Cyanosis	4(4,8%)
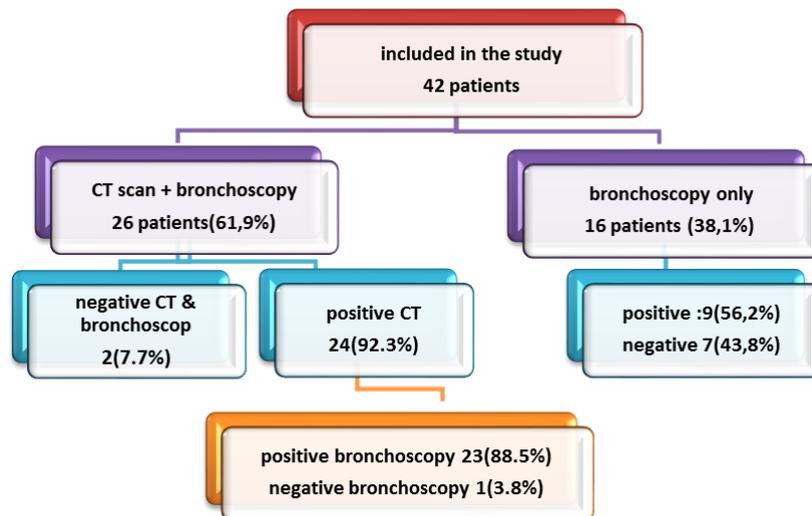
Figure 1: Paragraph that show study patients according to CT scan and bronchoscopy results.

The degree of (FBA) suspicious was defined as low in 2 cases(4,8%), moderate in 23 cases (54,8%), and high in 17 cases (40,4%). In these three groups of suspicious degree, the ratio of male: female was (1:1),(10:13),(7:10) respectively, without any significant differences.

The mean age in these groups was (2.5±0,8) (3,1±1,9) (3,02±1,3) respectively without any significant differences(p-value=0.05).

There were statistically significant differences in the presence of cough and cyanosis between these groups. Cough was observed in (1)(7)(13) cases in the three groups respectively.(p-value=0,02). Cyanosis was observed in (0)(0)(11,8%) in the three groups respectively.(p-value=0,04).

Regarding wheezing and stridor there wasn't any significant difference. P-value=(0,2)(0,09) respectively.

Furthermore, there were significant differences according to the relation between radiologic findings and the degree of (FBA) suspicious. Unilateral findings were observed in 15 cases(88,2%) in high suspicious group, versus 7 cases in moderate suspicious group, and no findings was observed in low suspicious group (p-value=0.0001).[table2]

Table 2: Demographic characteristics and CXR findings according to (FBS) degree.

Variables	High suspicious	Moderate suspicious	Low suspicious	p-value
Mean Age	3,02±1,3	3,1±1,9	2.5±0,8	0,05
Sex				
Male	10(58.8%)	13(56.5%)	1(50%)	0,6
Female	7(41.2%)	10(43.5%)	1(50%)	
Signs & symptoms				
Wheezing	16(94.1%)	21(91.3%)	2(100%)	0.2
Cough	13(76.5%)	7(30.4%)	1(50%)	0.02
Cyanosis	2(11.8%)	0(0%)	0(0%)	0.04
Stridor	3(17.6%)	1(4.3%)	0(%)	0.09
CXR				
Normal	2(11.8%)	16(69.6%)	29(100%)	0,0001
Unilateral findings	15(88.2%)	7(30.4%)	0(0%)	

sensitivity of CT scan in diagnosis (FBA) was 100% , specificity 66.7% , positive predictive value(PPV) 95.8% , negative predictive value(NPV) 100% and accuracy was 96.1%.[table3].

Table 3: Sensitivity & Specificity of CT scan in diagnosis of (FBA).

CT scan	Bronchoscopy		Total
	Neg -	Pos +	
Pos+	1	23	24
Neg -	2	0	2
total	3	23	26

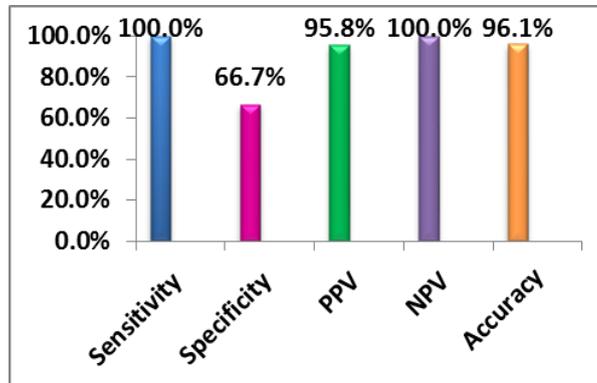| Sensitivity	100% [90-100]
Specificity	66.7%[55-72]
positive predictive value	95.8%[79-99]
negative predictive value	100%[92-100]
Accuracy	96.1% [88-100]

Figure 2: Sensitivity & Specificity of CT scan in diagnosis of (FBA).

6. DISCUSSION

This study was conducted on 42 patients who presented to otorhinolaryngology clinic with a suspicious of foreign body aspiration to the tracheobronchial tree and who …. Inclusion criteria. Most of our patients were younger than 5 years old.

FBA was observed in males more than females without any significant difference and thus may because of the anatomy differences according to sex.

Wheezing was the most common clinical sign ,and it's usually referred to the partial obstruction of trachea, cough was the second most common symptom and it's anormal defense reaction to the presence of (FB).

THE SUSPICIOUS DEGREE OF (FBA) was moderate to severe in most of our patients .also our study showed significant differences in the relation between cough and cyanosis symptoms and the degree of suspicious ,these symptoms were more common in the severe degree group, since cyanosis usually correlate with obstruction degree.

CXR was normal in all patients of low suspicious degree, unilateral radiologic changes were observed in moderate and severe group with statistically significant difference.

CT scan was performed in 62% of patients and we compare its findings with the bronchoscopy results.

An accordance in the positivity of CT & bronchoscopy was found in 88,5% of cases, whereas the accordance n negativity was found in7,7% of cases, with one case showed positive CT with negative bronchoscopy(3.8%).
CT scan showed a high sensitivity & accuracy in (FBA) diagnosis.

A study was conducted by huang et al (2008) [9] during 2 years on 11 patients whose mean age was 2.1 and it showed a higher rate of (FBA) in males(9cass), cough was the most common symptom ,and a positive radiologic finding in 8 cases. CT was performed to all patients and it showed a sensitivity of 100% and that was compatible with our study.

Ahmed et al[10] conducted their study on 87 patients during 1 year. The mean age was 1.1 year in low suspicious group of (FBA) AND 3.6 in high suspicious group. Higher rate of aspiration was observed in men, clinical symptoms were more observed in high suspicious group. CXR was normal in all low suspicious cases, unilateral CXR findings were the most observed in high suspicious group, followed by moderate group. Sensitivity was 91%, specificity 100%, PPV 100%. NPV 97% FOR CT scan in diagnosis of (FBA).

Gibbon et al [11] conducted their study on 133 patients in a period of 4 years. the mean age was 1.8 years with a higher rate of inspiration in males(60,9%). Cough was the most common symptom. CT scan sensitivity was 100%%, specificity 98% IN DIAGNOSIS OF (FBA). In comparison with our study their study had a more specificity(98%) than ours(66,7%).

7. CONCLUSION

The current study demonstrated that high accuracy of chest CT findings in diagnosis of FBA leads to a low rate of unnecessary bronchoscopy.

More studies are needed with a bigger sample size and in more than one medical center, with assessment of the sedation benefits during CT performance in increasing the ability of (FBA) diagnosis.

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