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Significance of Preoperative Clinical and Radiological Assessment in Diagnosing Foreign Body Aspiration in Pediatric Patients.

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Abstract:

Background: Foreign Body Aspiration (FBA) poses a substantial worldwide health issue, with the highest incidence observed among young children, Detecting and managing FBA promptly are crucial to prevent potential complication.

Objectives: To evaluate the significance of preoperative clinical and radiological assessment in diagnosing FBA in comparison with results of rigid bronchoscopy(RB).

Patients and Methods: A cross-sectional study was carried out in Nineveh province, Iraq, spanning a period of 10 months from April 2018 to February 2019. The study focused on patients of pediatric age group who were admitted with suspicion of FBA to Al-Khansaa Teaching Hospital in Nineveh province. The cases who were included are under the age of 14 and had confirmed FBA through rigid bronchoscopy (RB).

Results: Out of forty-four patient, 25 (56.8 %) were males, the average patients age was 4.8 years with a standard deviation of 3.4 years. More than half of cases (54.5%) presented within the first 24 hours after onset of suspected FBA. The most common clinical presentation is the witnessed FBA (93%) (41/44), followed by symptoms like chocking (34%), cough (23%), shortness of breath (11%) and cyanosis (11%). Diminished air entry was the most frequently observed findings in clinical exam (48%), followed by rhonchi in (36%) of cases. The primary CR findings were consolidation in 25% and normal CR in another 25%. Radiopaque FB was successfully identified in CR of seven cases (15.9%) only. Thus, the estimated sensitivity of CR in detecting FB by using RB as gold standard test was 15.9%. Significantly, normal CR were more frequently observed in cases of early presentation. Among the identified FBs, 63.6% were found to be of organic type, while 36.4% were of non-organic type. The sunflower seeds found to represent most frequently encountered FB (34 %). Regarding site of dislodgement of FB, 40.9% of FB were found in the right main bronchus (RMB) and 36.4% were found in he left main bronchus (LMB).

Conclusion: A chest radiograph serves as a valuable asset for pediatric FBA diagnosis. However, its value is optimized when combined with the clinical context to enhance accuracy. Notably, the occurrence of false-negative chest X-rays is significantly linked to early presentations.

Keywords: chest radiography, foreign body aspiration, bronchoscopy, pediatric FB aspiration, foreign body.

Introduction

Foreign Body Aspiration (FBA) poses a substantial worldwide health issue1-3, with the highest incidence observed among young children, primarily between the ages of 1 and 3 years1-4. Detecting and managing FBA promptly are crucial to prevent potential complication3,5-8.

Foreign Body Aspiration can significantly affect a child's health, leading to respiratory distress that may require immediate intervention to ensure open airways and sufficient oxygenation. Conversely, if diagnosis and management are delayed, it can result in long-term respiratory consequences, such as recurrent chest infections, ultimately causing morbidity and even mortality1.

The diagnosis of FBA remains challenging since it may mimic various other common clinical conditions, like asthmatic attacks and chest infection6. The diagnosis of FBA relay on taking proper history and good physical and radiological examinations3,6.

For the definite diagnosis of FBA, the rigid bronchoscopy is the gold standard procedure, it can certify the presence of FB and remove it from the airways as well 1,4, however such diagnosian invasive procedure can carry fatal complication like for example pneumothorax, arrythmia and bronchospasm2,5.

The rigid bronchoscopy(RB) is the gold standard procedure that is used to certify the presence as well to remove the FB from the airways 1,4, RB is however an invasive potentially risky procedure, which may results in serious and fatal complications, like arrhythmia, pneumothorax or bronchospasm2,5. Balancing the benefits of definitive diagnosis and the risks of intervention requires careful interpretation of clinical picture and radiological exams.

The aims of this current study is To assess the importance of preoperative clinical and radiological assessment in diagnosing FBA in comparison with results of rigid bronchoscopy (RB).

Patient and method:

Study design and settings: A cross sectional study done in Ninevah province, for ten months, from April 2018 to February 2019 in Al-Khansaa teaching hospital. Approval from the Ethics Committee for research of Nineveh University was acquired in adherence to ethical considerations.

Sample selection: forty four patients were the studied sample, they were pediatric opatients(of 14 years old or less), with confirmed FBA by RB.

The patients older than 14 years, those with a previous history of any pulmonary diseases or systemic illnesses were excluded from the study.

The studied sample was reviewed in term of demographic data (age and gender), initial symptoms, physical examination and the preoperative CR. The RB findings were as well assessed in form of types of the aspirated FB and the site were it was found within airways.

The chest radiography Examination: The CR was taken in standard views including the PA (postero-anterior) and lateral projection. The patient had to be in either sitting or standing position and the included CR were have to be taken just before doing RB or not more than 24 hours before. In scenarios where multiple chest radiographs were taken prior to the operation, preference was given to the one closest in time to the surgical procedure.

Statistical Analysis: The continuous numerical variables were expressed using measures of central tendency and dispersion in the form of mean, standard deviation, and range. The nominal variables were presented using frequency and percentage. Charts and tables were utilized to illustrate the distribution of various variables. The statistical analysis was conducted using the Student's t-test to compare the means of age between different groups. The Chi-Square test and Fisher's Exact test were employed to analyze relationships or associations among categorical variables. p-Values of 0.05 or less were considered statistically significant. Sensitivity of chest radiography (CR) was assessed by comparing its findings with the results of the standard test, rigid bronchoscopy (RB).

Data were stored using Microsoft Office Excel 16, and the analysis was conducted using IBM SPSS Statistics 22.0.

Results:

The current study involved forty-four patients, ranging in age from 7 months to 13 years old. The mean age was 4.8 years with a standard deviation of 3.4 years. Figure 1 illustrates the age distribution, showing the highest occurrence within the 1-3 years age group.

Among the patients, 25 (57%) were male. The time interval between the assumed FBA and presentation to hospital varied from one hour to around six months. The highest frequency of presentation (24 patients)(54.5%))occurring within the initial 24 hours. Thid trend is shown in Figure 2 below.

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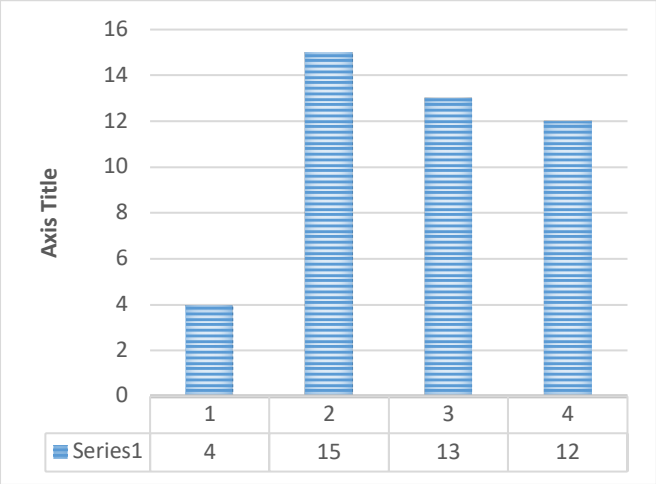


Figure (1): Participants' age distribution.

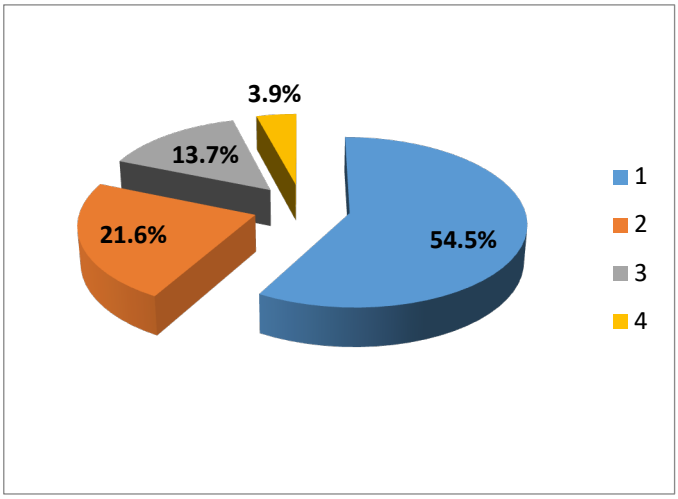


Figure (2): Duration of the presenting symptoms.

Table (1): Patients clinical presentations and findings.

Clinical presentation	Frequency	Percent
History of FB aspiration	41	93%
Chocking	15	34%
Cough	10	23%
Shortness of breath	5	11%
Cyanosis	5	11%
Others*	8	18%
Clinical Findings	Frequency	Percent
Diminished air entry	21	48%
Rhonchi (bilateral/unilateral)	16	36%
Crepitation (bilateral/unilateral)	11	25%
Normal	6	14%
No air entry	1	2%
Drowsiness	1	2%
*Others include halitosis ,vomiting, gagging and noisy breath.		

Among the total of 44 patients, 93% (41/44) exhibited a potentially positive history of foreign body aspiration (FBA). Within this group, 55% (24/44) were confirmed cases of witnessed FBA. An uncertain history of aspiration was noted in 39% (17/44), while a minority of cases in 6.8%(3/44) had no reported history of aspiration. In these instances, suspicion was based on clinical observations and findings.

Chocking is the second most common presenting symptoms accounting for 34% of cases (15/44) of cases, followed by cough at 23% (10/44), and shortness of breath at 11% (5/44). Additionally, 11% (5/44) of the patients showed cyanosis. Other Less frequent presenting symptoms included halitosis, vomiting, gagging and noisy breathing, those were observed in 18% of cases (8/44) as shown in the table 1.

The predominant clinical finding is diminished air entry, observed in 48% (21/44) of cases, followed by bilateral or unilateral Rhonchi, more frequently appearing bilaterally at 36% (16/44). Other clinical presentations are detailed in Table1.

Table (2): Types Of aspirated foreign bodies.

Foreign body types	count	Percentage
Seeds of sunflower	15	0.34
Peanut	5	0.11
Seeds of watermelon	5	0.11
Organic Foreign body of other types*	3	0.07
Needles	4	0.09
Cap of p lastic Pen and Toy Pieces	4	0.09
Beads	3	0.07
Non-organic Foreign body of other types*	5	0.11
Total Cases.	44	100.00

- Including plants like pistachio, nuts and cabbage.
- ** include wires, coins, screws, orifice spud and safety pin.

The inhaled foreign bodies comprised various types, primarily categorized as organic and non-organic. Among them, organic FBs accounted for 63.6% (28/44) of cases, while non-organic FBs represented 36.36% (16/44). Plant seeds were the most common type of inhaled FBs. Further details on the frequencies can be found in Table 2.

The average age for patients with organic FB aspiration is significantly lower than the age for non-organic FB aspiration (3.4 years for organic FB, versus 7.2 years for non-organic FB, (p value 0.000), the organic FBA is seen more frequently in males than female(1.54:1), while the non-organic FBA is seen equally in females and males (1:1) in the studied cases.

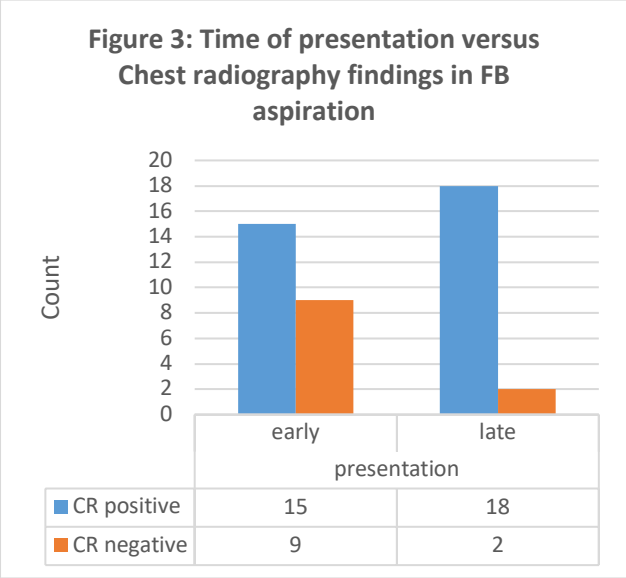
Table (3): Chest radiograph findings in cases of FBA.

CR Findings	Count	Percentage
Unilateral Consolidation	11	25.0
Negative CR	11	25.0
Air trapping (unilateral)	7	15.9
Seen FB (Radio-opaque)	7	15.9
Bronchopneumonia	4	9.1
Collapse	2	4.5
Pneumothorax	1	2.3
Unilateral Consolidation with a Radio-opaque FB	1	2.3
Total cases	44	100.0

Regarding the CR findings, both consolidation and normal CR were equally common, each accounting for 25% of cases. Radiopaque FB were identified in only 7 cases (15.9%). Thus, the sensitivity of CR in detecting radiopaque FB, using bronchoscopic findings as the a standard, was thus 15.9%. Additional CR findings and their corresponding frequencies and percentages are listed in Table 3 .

Significantly higher occurrences of Negative chest radiography results were observed when patients presented within the initial 24 hours following aspiration, as evidenced by a notable distinction (p-value = 0.035) (Figure 3).

Moreover, Negative chest radiographic findings were more prevalent among patients with organic FBA compared to non-organic cases. However, no statistically significant distinction was found in terms of chest radiography findings' positivity between organic and non-organic foreign body cases (p value=1.00) (Figure 4).



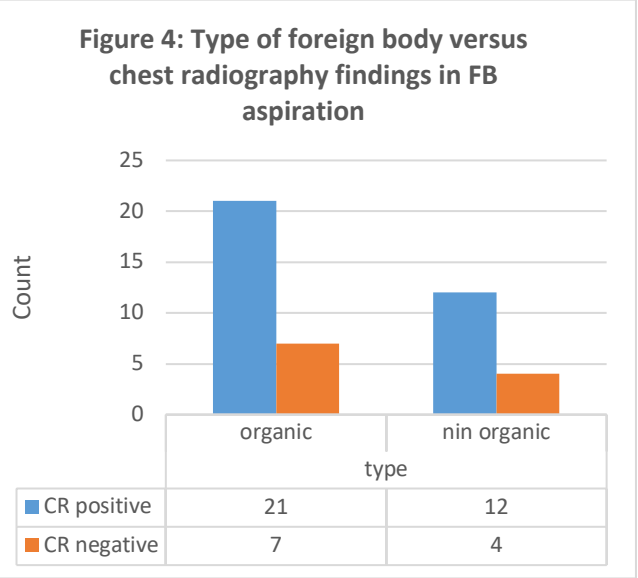


Figure (3): Time of presentation versus chest radiography findings in FB aspiration

Figure (4): Type of foreign body versus chest radiography findings in FB aspiration

Table (4): Site of Foreign body in the respiratory tract.

Site	Count	Percentage
RMB	**18**	**40.9%**
LMB	**16**	**36.4%**
larynx	**3**	**6.8%**
Trachea	**6**	**13.6%**
Bilateral	**1**	**2.3%**
Total cases	**44**	**100.0%**

During Bronchoscopy the most common site for dislodgement of FB was found to be in the RMB accounting for 40.9%(18 out of 44). LMB foreign bodies account for 36.4% (16 out of 44), while laryngeal FB seen in 6.8 % (3 out of 44) and tracheal FB contributed to 13.6 % (6 out of 44) . A single case of bilateral FB amounting for 2.3%) were reported as indicated by table 4.

Discussion:

Foreign body aspiration (FBA) is considered a critical medical emergency with life-threatening implications1. Existing literature has consistently demonstrated that FBA occurs most frequently in young children, particularly those aged less than 3 years old 1,2,9-11 .Our study corroborates these

findings, as we observed the highest incidence of FBA in the age group of 1 to 3 years, accounting for 34.1% of cases.

The vulnerability of young children to FBA can be attributed to several factors, including their natural inclination to explore new objects using their mouths and the absence of molar teeth, which impairs proper chewing 1,11,12. These factors collectively increase the likelihood of ingesting or inhaling foreign objects, leading to potential airway or digestive tract obstruction and subsequent health risks.

Consistent with the previous literature 5,9,13,14, the present study shows that males were more vulnerable to have a FBA in comparison to females (M:F ratio is 1.3:1).

In this present study, approximately half of the patients (54.5% or 24 out of 44) presented early within 24 hours of presumed aspiration. This finding is consistent with previous studies , for instance Bhalodiya et al.13. stated that 60% of the patients presented within 1st 24hours, and Berraies et al.14. in which 47.6% presented within the initial 72hr. Patients who presented very late in the current study were two cases (3.9%), they came 4 months and 7 months respectively after the onset of FBA, they were suffering from a recurrent chest infection and negative history of aspiration. Th RB was hold according to the clinical suspicion, and the FB were found to be a seed of sunflower in one of the cases and a metallic screw in the other case. Compared to the other studies as Berraies et al.14, in which 23% of FBA cases are presented after one month and Saquib et al.15, in which (21.8 %) presented later than 1 month. The incidence of delayed presentation (exceeding one month) in our study appears to be minimal. This observation could potentially suggest that caregivers within our community are vigilant when it comes to young children and possess a heightened awareness of the potential hazards associated with pediatric foreign body aspiration however confirmation of this observation need a further study in a larger sample.

In the present study, FBA history were encountered in 93% of the cases (55%certain and 39%uncertain history). All the cases had at least one symptom of them chocking is the most common symptoms (34%). Cough, shortness of breath and cyanosis followed (34%, 23%,11%), respectively, In earlier literature, the most frequent presentations included various combinations and proportions of cough, choking, and shortness of breath10,13,1 4,16. In the present study, when the history of foreign body aspiration, even if uncertain, was accompanied by episodes of choking, especially in the young age group, predominantly toddlers, it strongly indicated the possibility of foreign body aspiration (FBA). Similar conclusions were drawn by Ayed et al.1 and Tokar et al.1,10.

Previous literature has demonstrated that the three most common clinical examination findings in FBA cases were a normal exam, reduced air entry, and rhonchi 2,13,14. In our study, out of 44 patients, six (14%) exhibited a normal examination, a lower proportion compared to other studies where the occurrence of a normal examination ranged from 24% to 51% in FBA cases 13,14,17. The prevailing clinical finding in our study was diminished air entry (48%), consistent with Sahadan et al. (91%). The subsequent common clinical finding was rhonchi, either unilateral or bilateral (36%) in our study.

Generally, the foreign bodies (FB) can be categorized in term of its consistency as organic type (more commonly encountered, or non-organic type 4,5,9. Our study yielded similar results, with organic FB being more prevalent, with a ratio of 1.75 organic FB to each non-organic FB..

Comparing our findings with the study conducted by Giardi et al. 9, we observed a statistically significant difference in the age groups affected by non-organic FB aspiration compared to organic FB aspiration. Specifically, organic FB aspiration was found to occur in a significantly younger age group than cases of non-organic FB aspiration. The average age for patients with organic FB aspiration is significantly lower than the age for non-organic FB aspiration (3.4 years for organic FB, versus 7.2 years for non-organic FB, the same was found by the forementioned study.

In our community, sunflower seeds are a popular snack, so it is not unexpected that they account for the highest percentage of inhaled organic foreign bodies (34%). Watermelon seeds and peanuts follow closely behind, each contributing to 11% of such cases. Considering these findings, we strongly recommend against serving dried plant seeds to young children, even when they are under direct supervision. Shockingly, out of 15 reported cases of sunflower seed aspiration, 10 incidents occurred while parents or caregivers were directly observing the children. Similar previous studies have also identified plant seeds as the most commonly inhaled foreign bodies 14,15Therefore, it is crucial to exercise utmost caution and awareness to safeguard young children from potential choking hazard.

The existing literature has indicated a higher occurrence of foreign bodies (FB) in the right main bronchus (RMB), which has been attributed to the RMB's wider caliber and smaller angle with the trachea when compared to the left main bronchus (LMB) 12,14.In our study, although we observed a greater frequency of detected FB in the RMB (40.9% or 18 out of 44 cases) compared to the LMB (36.4% or 16 out of 44 cases), the difference between the two groups was found to be small. Additionally, we noted tracheolaryngeal FB in 20.5% (9 out of 44 cases) and a single case of bilateral bronchial FB.

The chest radiograph (CR) findings in cases of foreign body aspiration (FBA) are influenced by various factors, including the type of foreign body (organic or non-organic), and the timing of diagnosis6. These CR findings can be classified into three categories:-Visualization of a radiopaque foreign body due to its radiopaque nature, non-visualization of the foreign body but presence of secondary pulmonary changes and lastly a normal chest radiograph.10.

The most significance in diagnosis lies in detecting a radiopaque FB as it helps greatly in early identification and thereby preventing potential complications of delayed removal10. Regrettably, majority of the inhaled FBs are radiolucent in CR 10,18.Existing literature had shown that the radiopaque FB is seen in different percent ranges between (4.4% to 16.6%)5,6,14 . In our study radiopaque FB is noted in 15.9%, Absence of FB visualization in CR is not a a dependable indicator to rule out the diagnosis..

Existing literature has indicated that normal chest radiographs are encountered in 13.5% to 49% of cases with FBA 5,6,14,16. In our study, a normal chest radiograph was identified in 25% of cases. Notably, the occurrence of a normal chest radiograph was statistically significant when correlated with early presentation (within the first 24 hours). Previous research has suggested that negative chest radiographs are more commonly associated with non-organic foreign bodies6 . However, in the current study, no difference of statistical significant was detected when comparing incidence of chest radiograph negativity across different types of foreign bodies this may be attributed to difference in

the methodology. A further investigation with a larger sample size is recommended to study the relation between FB type and radiological appearance.

Apart from typical chest radiograph abnormalities such as CR and radioopaque foreign bodies, previous research has indicated that common findings in chest radiographs include air trapping, consolidation and collapse. The order of occurrence may vary; for instance, air trapping is the most frequently observed finding in studies by Sattar et al. And Parida et al.5,6, while Bohlydia et al. Found that air trapping and collapse are equally common13. In our study, the most prevalent chest radiograph findings were unilateral consolidation (25%), followed by unilateral air trapping (15.9%), bronchopneumonic shadow (9.1%) and collapse (4.5%). Delayed presentation cases of foreign bodies showed that the most frequent chest radiograph findings were collapse, as demonstrated by Barraise et al.14. In our current study, cases presenting late (after one month) accounted for 4 out of 44 cases, with pneumonic consolidation being the most common finding in three out of four cases and bronchopneumonic shadow in a single case.

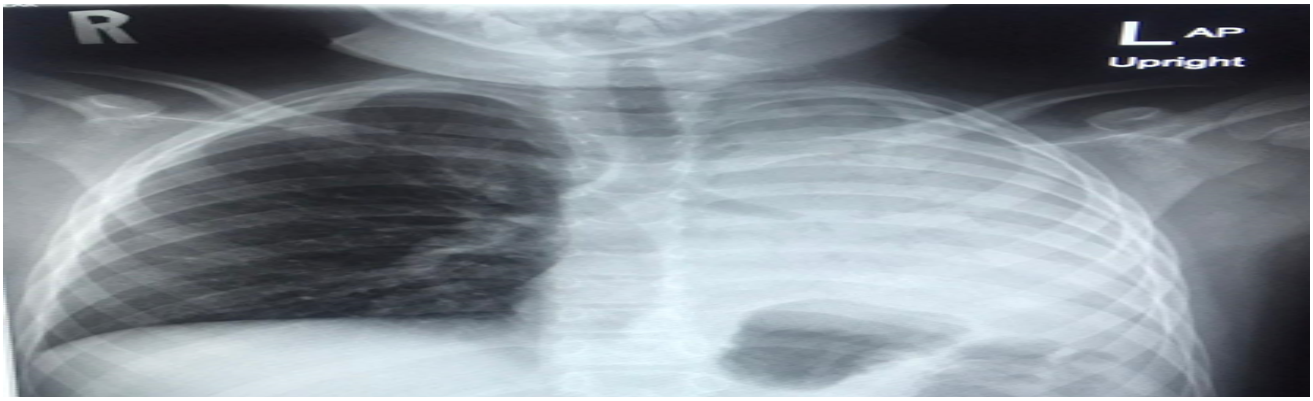


Figure (5): The chest radiograph exhibits an abrupt interruption of the left main bronchus (LMB) air column, leading to the complete collapse of the left lung. This occurrence is attributed to the aspiration of a sunflower seed.

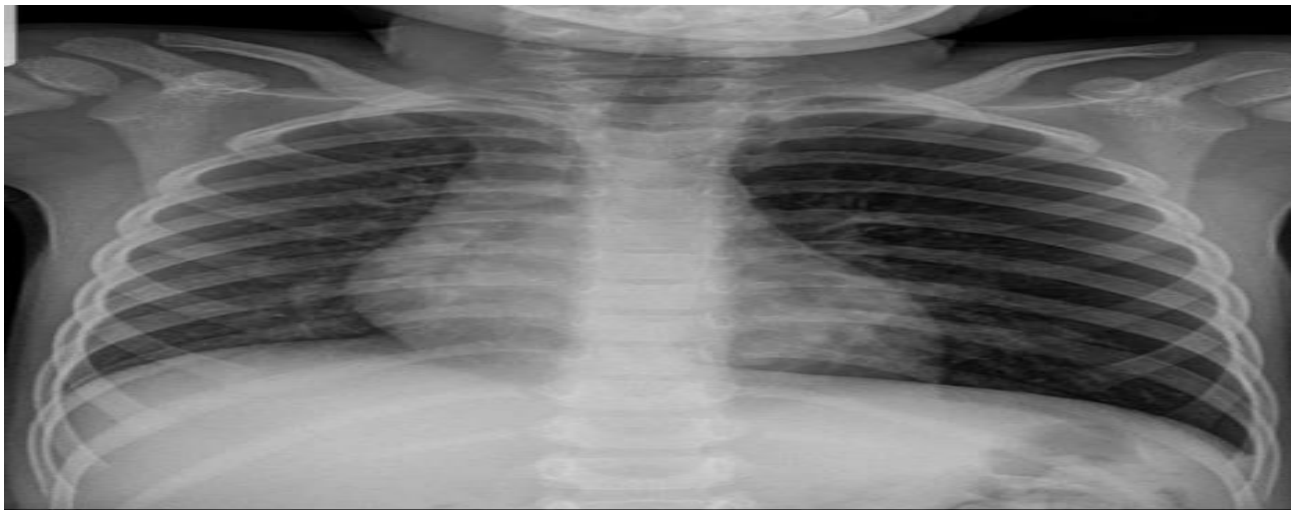


Figure (6): A radiographof chest demonstarating trapping of air in the left lung, rigid bronchoscopy revealed presence of FB at left main bronchus(a bead).

A B C

Figure (7): Chest radiographs - A. posteroanterior (PA) view, B. Lateral view - display a sizeable screw that was aspirated and lodged within the right main bronchus (RMB). C. A photograph captures the extracted screw following rigid bronchoscopy (RB).

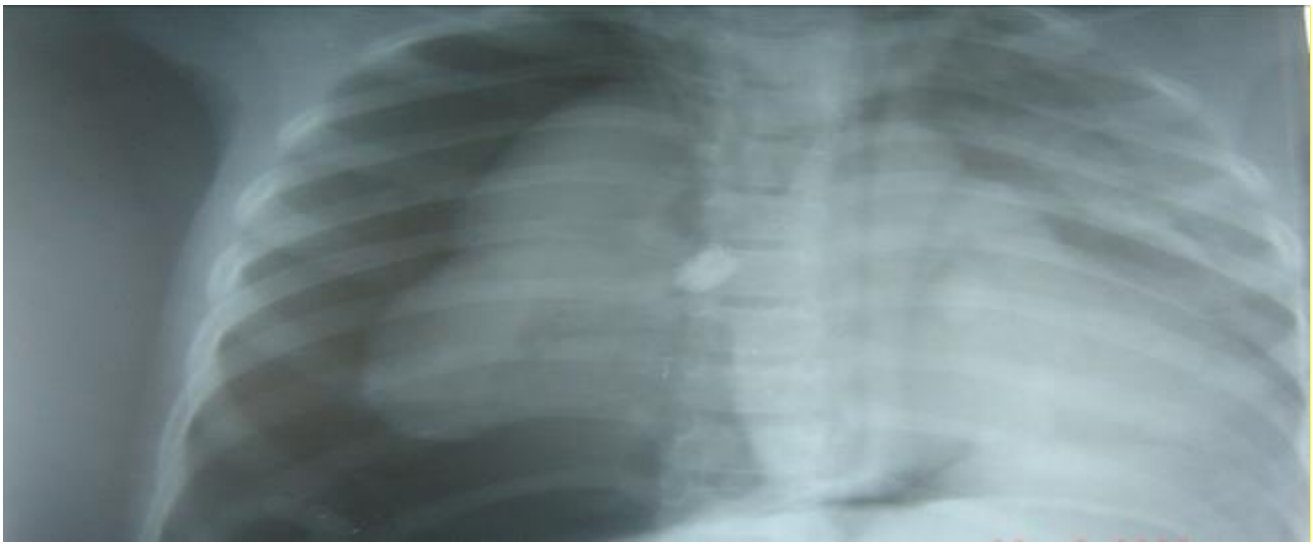


Figure (8): A posteroanterior (PA) chest radiograph reveals a significant tension pneumothorax within the right hemithorax, accompanied by the radiopaque silhouette of an oval-shaped foreign body (a bead) situated within the right main bronchus (RMB).

A B

Figure (9): A. A posteroanterior (PA) chest radiograph depicts an area of air entrapment primarily located in the upper zone of the left lung, along with the presence of a radiopaque shadow observed within the left main bronchus (LMB). B. The foreign body (indicated by the sound of the orifice) extracted through rigid bronchoscopy.

Conclusion:

In cases of suspected foreign body aspiration (FBA) on a chest radiograph (CR), the findings can fall into two categories: a normal CR or an abnormal CR. An abnormal CR may reveal a radiopaque foreign body, which is the only specific but rare finding, or it may show secondary pulmonary changes, or sometimes a combination of both. It is important to note that a negative CR cannot definitively exclude FBA, as it is a common occurrence, especially in the early stages of presentation. A crucial role is played by a chest radiograph in the diagnosis of FBA. Nonetheless, its significance is heightened when interpreted alongside the clinical context to improve precision. The instances of inaccurate negative results in chest radiographs are notably linked to cases of FBA that have presented at an early stage.

Abbreviation:

CR: chest radiography.

FB : foreign body.

FBA: Foreign Body Aspiration .

LMB: Left main bronchus .

RB.: Rigid bronchoscopy.

RMB : Right main bronchus.

References:

1.Ayed AK, Jafar AM, Owayed A. Foreign body aspiration in children: diagnosis and treatment. Pediatric surgery international. 2003 Aug 1;19(6):485-8.

2.Sahadan DZ, Zainudin NM, Kassim A, Zahari Z, Mahadzir M, Daud CZ, Mohammad N. Case series of foreign body aspiration in Paediatric Institute, Hospital Kuala Lumpur. The Medical journal of Malaysia. 2011 Dec;66(5):484-6.

3.Hitter A, Hullo E, Durand C, Righini CA. Diagnostic value of various investigations in children with suspected foreign body aspiration. European annals of otorhinolaryngology, head and neck diseases. 2011 Nov 1;128(5):248-52.

4.Nsaif HS, Laftah RF. Chest X-Ray findings of foreign body aspiration and their relation with type and site of impaction. Journal of University of Babylon. 2015;23(2):862-9.

5.Sattar A, Ahmad I, Javed AM, Anjum S. Diagnostic accuracy of chest x-ray in tracheobronchial foreign body aspiration in paediatric patients. Journal of Ayub Medical College Abbottabad. 2011 Dec 1;23(4):103-5.

6.Parida PK, Shanmugasundaram N, Gopalakrishnan S. Clinico-radiological parameters predicting early diagnosis of foreign body aspiration in children. Kulak Burun Bogaz Ihtis Derg. 2016;26(5):268-75.

7.Silva AB, Muntz HR, Clary R. Utility of conventional radiography in the diagnosis and management of pediatric airway foreign bodies. Annals of Otology, Rhinology and Laryngology. 1998 Oct;107(10):834-8.

8. Oliveira CF, Almeida JF, Troster EJ, Vaz FA. Complications of tracheobronchial foreign body aspiration in children: report of 5 cases and review of the literature. Revista do Hospital das Clínicas. 2002 Jun;57(3):108-11.

9.Girardi G, Contador AM, Castro-Rodríguez JA. Two new radiological findings to improve the diagnosis of bronchial foreign-body aspiration in children. Pediatric pulmonology. 2004 Sep;38(3):261-4.

10.Tokar B, Ozkan R, Ilhan H. Tracheobronchial foreign bodies in children: importance of accurate history and plain chest radiography in delayed presentation. Clinical radiology. 2004 Jul 1;59(7):609-15.

11.Salih AM, Alfaki M, Alam-Elhuda DM. Airway foreign bodies: A critical review for a common pediatric emergency. World journal of emergency medicine. 2016;7(1):5.

12.Kwok MM, Wong A, Paddle P, Goergen S, Rimmer J. Clinico-radiological predictors of positive rigid bronchoscopy findings in children with suspected tracheobronchial foreign body aspiration. Australian Journal of Otolaryngology. 2018 Feb 27;1(2).

13.Bhalodiya N, Supriya M, Patel S. Foreign body aspiration in children: Decisive factors for carrying out bronchoscopy. Indian Journal of Otolaryngology and Head and Neck Surgery. 2006 Oct 1;58(4):337-9.

14.Berraies A, Snen H, Hamdi B, Ammar J, Mestiri T, Kilani T, Hamzoui A. Foreign Body Aspiration in Tunisian Children: Experience of a Paediatric Respiratory Diseases Department. Advances in Paediatric Research. 2015;2:17

15.Saquib Mallick M, Rauf Khan A, Al-Bassam A. Late presentation of tracheobronchial foreign body aspiration in children. Journal of tropical pediatrics. 2005 Jun 1;51(3):145-8

16.Sahin A, Meteroglu F, Eren S, Celik Y. Aspiration of foreign bodies in children: experience of 22 years. Journal of Trauma and Acute Care Surgery. 2013 Feb 1;74(2):658-63.

17. Rizk N, Gwely NE, Biron VL, Hamza U. Metallic hairpin inhalation: a healthcare problem facing young Muslim females. Journal of Otolaryngology-Head and Neck Surgery. 2014 Dec;43(1):21.

18.Mu L, Sun D, He P. Radiological diagnosis of aspirated foreign bodies in children: review of 343 cases. The Journal of Laryngology and Otology. 1990 Oct;104(10):778-82.