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STUDY OF TIME LAPSE IN FOREIGN BODY ASPIRATION IN RELATION TO CHEST X-RAY AND TYPE OF FOREIGN BODY

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HOW TO CITE THIS ARTICLE:

Salma Shaziya. "Study of time Lapse in Foreign Body Aspiration in Relation to Chest X-Ray and Type of Foreign Body". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 41, October 12, 2015; Page: 7012-7018, DOI: 10.18410/jebmh/2015/957

ABSTRACT: INTRODUCTION: Foreign body aspiration in pediatrics is a potentially fatal accident which will continue until children explore their surroundings with their hand and mouth. Pediatric aspirations will persist until mankind exists. Not all foreign body aspirations are witnessed hence chances of delay in diagnosing an aspiration are high. Delay in diagnosis depends on site and character of foreign body aspirated. The chest x-ray findings and type of foreign body extracted vary depending on the duration the foreign body remains in airway.

OBJECTIVE: To study the X-ray finding in pediatric airway aspiration and its relation to time lapse, the type and site of lodgment of foreign body extracted via bronchoscopy. The type of foreign body in relation to time lapse in aspiration.

MATERIAL AND METHODS: This was a prospective study done in Bapuji child health institute and research center, JJM Medical College, Davangere. History and pre bronchoscopy x-Ray finding were noted for 65 children who were posted for suspicious bronchoscopy from August 2011 to September 2013. 11 children were excluded from study as they showed no foreign body on bronchoscopy. Time lapse in aspiration and seeking medical care was noted. The bronchoscopic findings regarding site of foreign body lodgment and type of foreign body were recorded. The type of foreign body and variation of x-ray picture in relation to time lapse in aspiration were noted. Data collected was analyzed using descriptive statistics. **RESULT:** It was observed that mean age was 28 months. About 80% of the cases were between 1 to 3 years age. 82% (n=53/54) were radio lucent foreign body, only 1.5% (n=1/54) were radio opaque. Site of lodgment of foreign body was right main bronchus in 48% (n=26/54), left main bronchus 46% (n=25/54), tracheal 1.85% (n=1/54), subglottic 1.85% (n=1/54), carinal 1.85% (n=1/54), multiple site i.e. left bronchus +right bronchus+ carinal 1.85% (n=1/54). Groundnut was most common foreign body 40.74% (n= 22/54), Arecanut in 24.07% (n=13/54), tamarind seed in 11.11% (n=6/54), Bengal gram 9.2% (n=5/54), corn seed in 5.5% (n=3/54), rest other organic foreign bodies accounting to 5.5% (n=3/54). Inorganic foreign body like pen cap and safety pin accounting for 3.7% (n=2/54). Chest X-ray taken prior to bronchoscopy showed U/L Obstructive emphysema in 53.7% cases (n=29/54), U/L Collapse 20.37% cases (n=11/54) Consolidation in 18.54% cases (n=10/54), collapse + consolidation 3.7% cases (2/54), Chest X-Ray was normal in 3.7% cases % (n=2/54). When analyzing time lapse in aspiration it was seen 81.81%cases (n=18/54) of aspirated ground nut presented within 1-7 days.72.92% cases (n=10/13), 66.66% cases (n=4/6) of arecanut and tamarind seed aspirations presented >30days post aspiration. Radio opaque foreign body like safety pin, large foreign body a pen cap, and other nuts and pulses presented either <1day or between 1-7 day post aspiration. When analyzing chest X ray in relation to time lapse in aspiration, 65.51%cases(n=19/29) of U/L obstructive emphysema and 90.9%cases (n=10/11) of U/L

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collapse cases presented between 1-7 days duration. 90% cases (n=9/10) of consolidation and 100% cases (n=2/2) of collapse consolidation presented late >30days post aspiration.

CONCLUSION: Groundnut is most common foreign body. Right main bronchus and left main bronchus are equally susceptible sites of foreign body lodgment in pediatrics. U/L Emphysema and collapse are most common X-ray signs with 1-7 days time lapse. Consolidation in chest X-ray is a sign taking >30 days time lapse. Nearly two third of foreign body cases presented within 7 days of aspiration.

KEYWORDS: Bronchoscopy, Foreign Bodies, Time lapse.

INTRODUCTION: History of Foreign body aspirations is as old as mankind. The initial choking episode is not always witnessed posing a challenge in diagnosing it early.¹ Significant advances in emergency airway management and endoscopic technology has definitely reduced the mortality and morbidity, but the occurrence of foreign body asphyxiation incidence has shown no declining trend. It still comprises significant proportion of accidental deaths worldwide.^{2,3} The peak incidence of inhaled foreign bodies in early childhood is related to: The exploring nature of the young child having a tendency to place any object in the mouth. Incomplete chewing of food due to immaturity in dentition i.e. lack of molar teeth until 3-5years of age. Children often involve in play, sudden laughter or fright while eating. Immaturity of mechanism that coordinates swallowing and respiration and glottis closure. High incidence of upper respiratory tract infection makes the young children mouth breathers. Also due to the presence of coughing, the inhalation of food particles may easily occur with sharp intake of breath following a bout of cough.^{4,5,6} The character of foreign body and duration of enlodgement has important bearing on pathologic tissue changes a foreign body can cause.^{7,8} Depending upon the changes brought and duration of stay of foreign body the X-ray picture varies. The duration of stay of foreign body in airway depends upon the intrinsic property of foreign body. Extraction of foreign body using flexible bronchoscopy has been tried but needs a high grade skill and is not cost friendly. A good clinical history and chest x-ray remains an important diagnosing tool and rigid bronchoscopy has still remained the choice procedure in pediatric airway aspiration in India.

MATERIAL AND METHODS: This was a prospective study done in Bapuji child health institute and research center, JJM Medical College, Davangere. History and pre-bonchoscopic x-Ray finding were noted for 65 children who were posted for rigid bronchoscopy for suspicious foreign body aspiration from August 2011 to September 2013. 11 children were excluded from study as they revealed no foreign body post bronchoscopy. Time lapse between foreign body aspiration, development of symptoms and seeking medical care were noted. The type of foreign body removed by bronchoscopy and the X-ray findings in relation to time lapse between aspiration and seeking medical care were recorded. The bronchoscopic findings regarding site of foreign body lodgment and type of foreign body were recorded. The collected data was analysed using descriptive statistics. Ethical clearance obtained and written consent from the parents/ caretakers of children taken.

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RESULTS: Among the 54 cases positive for foreign body: It was observed that Mean age was 28 months 80% cases presenting within 1-3 years age. Only 9.2% cases (n=5/54) presented <24 hours, 55.55% cases (n=30/54) presented 1-7 days' time lapse hence 64.2% cases (n=35/54) presented within 7 days' time lapse. Only 3.7% cases (n=2/54) presented with time lapse of 8-30 days, 31.48% cases (n=17/54) presented with time lapse of >30 days. It was seen that there was asymptomatic phase between 8-30 days and steep rise in cases to 31.48% after 30 days in delayed presentation of foreign body aspiration. It was observed that 82% (n=53/54) were radio lucent foreign body, only 1.5% (n=1/54) were radio opaque.

As in Table 1: Site of lodgment of foreign body was right main bronchus in 48% (n=26/54), left main bronchus 46% (n=25/54), tracheal 1.85% (n=1/54), subglottic 1.85% (n=1/54), carinal 1.85% (n=1/54), multiple site i.e. left bronchus +right bronchus+ carinal 1.85% (n=1/54).

As in Table 2: Groundnut was most common foreign body 40.74% (n= 22/54), Arecanut in 24.07% (n=13/54), tamarind seed in 11.11% (n=6/54), Bengal gram 9.2% (n=5/54), corn seed in 5.5% (n=3/54), rest other organic foreign bodies accounting to 5.5% (n=3/54). Inorganic foreign body like pen cap and safety pin accounting for 3.7% (n=2/54). When analyzing time lapse in aspiration it was seen 81.81% cases (n=18/54) of aspirated ground nut presented within 1-7 days. 72.92% cases (n=10/13), 66.66% cases (n=4/6) of arecanut and tamarind seed aspirations presented >30days post aspiration. Radio opaque foreign body like safety pin, large foreign body a pen cap, and other nuts and pulses presented either <1day or between 1-7 day post aspiration.

As in Table 3: Chest X-ray taken prior to bronchoscopy showed U/L Obstructive emphysema in 53.7% cases (n=29/54), U/L Collapse 20.37% cases (n=11/54) Consolidation in 18.54% cases (n=10/54), collapse+consolidation 3.7% cases (2/54), Chest X-Ray was normal in 3.7% cases% (n=2/54).

When analyzing chest X ray in relation to time lapse in aspiration, 65.51% cases (n=19/29) of U/L obstructive emphysema and 90.9%cases (n=10/11) of U/L collapse cases presented between 1-7 days duration.90% cases (n=9/10) of consolidation and 100% cases (n=2/2) of collapse consolidation presented late > 30days post aspiration.

Site	Number	Percentage
Right main bronchus	26	48.14%
Left main bronchus	25	46.29%
Trachea	1	1.85%
Subglottis	1	1.85%
Carinal	1	1.85%
Lt Br + Rt Br + Carinal	1	1.85%

Table 1: Site of lodgement of foreign body in confirmed cases of aspiration on bronchoscopy

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Relation between time lapse in aspiration and type of foreign body	<1day	1-7days	8-30days	>30days	Total	Percentage %
Ground nut	2	18	-	2	22	40.74
Arecanut	-	2	1	10	13	24.07
Tamarind seed	-	1	1	4	6	11.11
Bengal gram	-	4	-	1	5	9.2
Corn seed	1	2			3	5.5
Fruit gel chocolate	1	-	-	-	1	1.85
Cashew nut	-	1	-	-	1	1.85
Coconut	-	1	-	-	1	1.85
Safety pin	1	-	-	-	1	1.85
Pen cap	-	1	-	-	1	1.85
Total	5(9.2%)	30(55.55%)	2(3.7%)	17(31.48%)	54	100

Table 2: Relation between timelapse in aspiration and type of foreign body

Relation between time lapse in aspiration and chest X-ray Finding	<1day	1-7days	8-30 days	>30days	Total	Percentage %
U/L Obstructive emphysema	3	19	2	5	29	53.7
U/L Collapse	-	10	-	1	11	20.37
Consolidation	-	1	-	9	10	18.51
Collapse +consolidation	-	-	-	2	2	3.7
Normal	2	-	-	-	2	3.7
Total	5(9.2%)	30(55.55%)	2(3.7%)	17(31.48%)	54	100

Table 3: Relation between time lapse in aspiration and chest X-ray finding

DISCUSSION: As a known fact foreign body aspiration in airway can present in acute phase-1 with acute symptoms of cough, choking, breathlessness. It may remain undiagnosed in asymptomatic phase-2 or develop complications insitu resulting in secondary airway obstruction

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in phase 3 presenting as pneumonia, bronchiectasis, or foreign body granuloma.^{9,10} Character of foreign body, history of witnessed aspiration, the site of obstruction will decide the time lapse in seeking medical care in foreign body aspirations. The period the foreign body remains insitu airway causing primary or secondary airway obstruction decides the X-ray picture at admission. Not all aspirations are witnessed only 65-70% aspirations as supported by our study are witnessed.^{1,11} Diagnosing a foreign body aspiration in pediatric age group is based on high index of clinical suspicion. In our study only 64.75 % cases were diagnosed within 7 days' time lapse post aspiration as supported by salah et al 67% and Hussain A M et al 60%.^{12,13} There was an asymptomatic period between 8-30 days and steep rise in cases >30 days post aspiration which was not observed by any other study. 31.48% (one third) cases presented >30 days' time lapse in our study. Groundnut was the most common foreign body in around 40.74% cases, 81.81% cases of groundnut aspiration were diagnosed within 7 days of aspiration this is explained by the irritant nature of peanut kernel, which swells up due to absorption of water, it has organic acids and oils which are released in bronchus, kernals absorb antigenic proteins setting in a chemical bronchitis.¹⁴ 72.92% of arecanut and 66.66% cases of tamarind seed aspiration presented >30 days' time lapse. Arecanut has major constituents of carbohydrate, fat, proteins, polyphenoids (flavanoids and tannins) and alkaloids. There are six alkaloids in arecanut arecoline, nicotine, piperadine, guvacine, guvacholine, arecaidine. These alkaloids stimulate TNF alfa and IL-1,IL-4,causing TH2 response and eosinophilia and set an allergic response.¹⁵ These alkaloids have neurosuppressive activity of gamma aminobutyric acid (GABA) by blocking receptors and inhibiting uptake contributing to euphoria.¹⁶ Though arecanut has so many irritant properties it presented with >30 days' time lapse in 72.92% cases needs evaluation. There were no studies to compare time lapse and type of foreign body related to delayed presentation of arecanut. May be the intrinsic antiinflammatory and neurosuppressive property of arecanut would have delayed the onset of symptoms post aspiration to >30 days. Most studies support the right bronchus to be the most common site of obstruction. The right bronchus is more frequently invaded than the left because of its greater diameter, its lesser angle of deviation from the tracheal axis. The situation of the carina to the left of the mid-line of the trachea. The action of the trachealis muscle. The greater volume of air going into the right bronchus on inspiration.¹⁷

The right main bronchus makes an angle of 25 degree with the vertical and is nearly continuous with trachea, while the left main bronchus is set at an angle of 75 degree.¹⁸

In our study there was equal incidence of both right and left bronchus aspiration as supported by other studies Rajashekharan et al.⁶ Chinski A et al supported the finding saying that the differences between right and left bronchus in younger age group are less pronounced, also children have tendency to aspirate in lying down position. In this position there will be straightening of the angle between trachea and left bronchus.¹⁹ Chest X-ray is important diagnostic tool aiding clinical diagnosis of foreign body aspiration. U/L obstructive emphysema was seen in 53.7%, collapse in 20.37% and consolidation in 18.54% cases in our study as supported by Chick et al (52.5%, 14%, 20%),²⁰ Rajashekaran et al (58%, 8%, 20%).¹¹ and Tomasake et al. 79.2%, 49%).²¹ When analyzing chest X-ray in relation to time lapse in aspiration 65% cases of U/L obstructive emphysema and 90.9% of cases of U/L collapse presented within 7 days post aspiration. 90% cases of consolidation and 100% cases of collapse

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consolidation presented >30 days post aspiration. This relationship of X-ray and time lapse was new to our study. The period until which foreign body stays in situ airway brings about secondary inflammatory response resulting in pathologic changes in chest X-ray. Early X-ray finding shows U/L emphysema as of partial obstruction Ball valve action, or Collapse due to complete obstruction of bronchus and atelectatic alveoli. If foreign body escapes diagnosis initially after asymptomatic phase progresses to chronic phase where secondary inflammatory changes and tissue reaction results in consolidation, collapse consolidation, bronchiectasis, granuloma etc.

CONCLUSION: Groundnut is most common foreign body. Right main bronchus and left main bronchus are equally susceptible sites of foreign body lodgment in pediatrics. U/L Emphysema and collapse are most common X-ray signs with 1-7 days' time lapse. Consolidation in chest X-ray is a sign taking >30 days' time lapse. Nearly two third of foreign body cases presented within 7 days of aspiration.

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Date of Submission: 01/10/2015.
Date of Peer Review: 03/10/2015.
Date of Acceptance: 06/10/2015.
Date of Publishing: 09/10/2015.