

UNIVERSITY OF MEDICINE AND PHARMACY IN CRAIOVA

**RESPIRATORY LUNG FUNCTION CHANGES IN  
TRACHEOBRONCHIAL MECHANICAL OBSTACLES  
TO CHILD**

Abstract of Ph. D. Thesis

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### KEYWORDS:

tracheobronchial foreign bodies, dyspnea, bronchoscopy, aspiration syndrome

## **I. BACKGROUND**

### **Importance of the issue and the reasons for choosing the theme of the thesis**

Aspiration of a foreign body is accidentally reach the pharynx and larynx of hard objects (fish bones, buttons, blades of grass , food, needles) in the airways producing a state of asphyxia life threatening for the children.

One of the major emergencies in children is the pathology of tracheobronchial foreign bodies which, following mobilization unpredictable developments can cause asphyxia. This paper aimed to study the diagnostic and therapeutic aspects suspected tracheobronchial foreign body in children.

Diagnosis is difficult in cases where the initial stage was not observed or was minimized by parents , so it is necessary to exclude other conditions , maintaining a high degree of suspicion especially in the age group 1-4 years and when symptomatology train or recurrent . If the diagnosis is uncertain, trachea-bronchoscopy decision is difficult, due to the exploration risks <sup>[1]</sup> .

When penetration syndrome was not informed, recurrent respiratory symptoms flare alternating with periods of apparent health , infectious and symptomatic treatment with repeated delays in diagnosis and specific treatment complications can occur without some permanent sequelae followed by structural changes and the development of fibrosis and sclerosis primary chronic pneumonia .

Develop working hypotheses assumed able to explain the delay in detection of cases of disease diagnosis and therapeutic response study revealed descriptive biostatistics. Therefore, the study group was investigated regarding etiopathogenic characteristics, diagnostic and therapeutic performance.

I watched variables that confer specific anatomical diagnosis and treatment plan, and also to quantify the benefits of a diagnostic algorithm for patients with tracheobronchial foreign body.

## **II. AIMS AND OBJECTIVES.**

The major problem of this research is the pathology of tracheobronchial foreign bodies. Past experience proves the existence of patients with tracheobronchial injury does not respond adequately to treatment performed or the rate of recurrence and the development of complications is greatly increased which ultimately tracheobronchial foreign body is detected. I decided to pursue anatomical variables which give specific diagnosis and treatment plan in relation to modern and classical imaging investigations to quantify the benefits of a diagnostic algorithm for patients with tracheobronchial foreign body.

The objectives of the paper are:

- Research how etiopathogenic order variants influence tracheobronchial pathology - establishing cause-effect links;
- Correlation with pathology imaging and monitoring therapeutic response;
- Reconsideration of diagnostic methods specific pediatric and ENT specialty for accurate and early diagnosis and effective treatment of tracheobronchial foreign bodies.
- Knowledge of the risk of side effects, complications, deteriorating quality of life for patients, and to take appropriate preventive measures.
- Reporting our experience to date data from the literature;
- Development of a diagnostic algorithm adapted to situations etiopathogenic may raise suspicion of tracheobronchial foreign body in patients who lost or neglected detection anamnesis initial episode of foreign body aspiration.

## **III. MATERIAL AND METHODS**

I performed a retrospective and prospective study on 106 cases with tracheobronchial foreign body suspicion hospitalized and treated in the ENT Clinic of Craiova County Hospital in a 5 year period (2006-1010). The study lot was investigated for age, sex, clinical and paraclinical (radiological) aspects, the nature of the foreign body, its localization, the treatment and evolution of the cases. The removal of foreign body was performed under general anaesthesia by rigid endoscope.

I followed up post-operatively in the group of patients studied and highlighted possible correlations. The results were analyzed statistically using Microsoft Excel 2007 software following etiologic and therapeutic clinical correlations.

## **IV. RESULTS**

Out of the 106 cases, following tracheobronchoscopy, the diagnosis was confirmed in 77 cases (72.64%). There were 3 (2.84%) cases in which the tracheobronchoscopical exploration

could not be performed, the patients, receptively the legal guardians having written denied the exploration, secondary to their fear of the patient's regarding the vital risk that the exploration involves. Out of the 26 (24.52%) unconfirmed cases of tracheobronchial foreign bodies there were 0 cases (0%) below 1 year, 15 cases between 1-3 years (57.69%), 7 cases between 4-6 years (26.92%), and 4 cases between 7-14 years (15.38%), with limits between 12 months and 10 years. In the unconfirmed cases the sex ratio was F/M = 11/15. The hospitalization period was 1-3 days in 19 cases (73.07%) and 3-6 days in 7 cases (27.93%).

The study lot with TBFB was divided into 4 age groups 0-12 months (toddler with natural or artificial nutrition), 1-3 years (small child), 4-6 years (preschool), 7-14 years (scholars). Out of the confirmed cases of tracheobronchial foreign bodies there were 8 cases aged below 1 year ( 10.39%), 49 cases between 1-3 years (63.63%), 9 cases between 4-6 years (11.69%) and 11 cases between 7-14 years (14.29%) with limits between 7 months and 14 years.

Analyzing the sex distribution of the lot with bronchoscopical confirmed TBFB we observe a higher frequency of foreign body inhalation in the male gender – 53 males, which corresponds to a 68.83 % opposed to 24 girls, respectively a 31.17 %. Regarding the environment of origin, 35 of patients respectively 45.45 % are from rural area, and 42 patients respectively 55.55% are from urban area. From the time of the foreign body aspiration and the request for medical help there was a variable time interval to each case as it is show in the table :

Table no.1 Distribution by moment of presentation

<b>MOMENT OF PRESENTATION</b>	<b>ABSOLUTE FREQUENCY</b>	<b>RELATIVE FREQUENCY</b>
<b>FIRST HOUR</b>	10	12,98%
<b>FIRST 24 HOURS</b>	55	71,42%
<b>1-7 DAYS</b>	7	9,09%
<b>OVER 7 DAYS</b>	5	6,49%

The penetration syndrome (88.31%) manifested trough brutally installed suffocation accesses, explosive cough series, suprasternal in drawing and anxiety , accompanied or not by vomiting, is extremely evocative and coincides with the foreign body inhalation. Clinical and statistical analysis of the study lot revealed the most frequent symptom to be the cough in a 96.10 per cent (74 cases), followed by dyspnea with 81.81 % (63 cases ) and cyanosis in 58.44% (45 cases).

The pulmonary examination revealed: diminished vesicular murmur in 49 cases (63%); absent vesicular murmur in 12 cases (15%); sonorous rhoncy in 16 cases (21%); sibilant rhonchy in 22 cases (29%); without modification 4 cases (5%). In the study lot, the most frequent radiological sign encountered was emphysema – 21 cases (27%) followed by atelectasis – 14 cases (18%), micro nodular opacities – 5 cases (6.5%), normal radiological aspect 20 cases (26%); there were no X-Radiographies performed in 6 cases (7.8%).

The most frequent localization of the foreign body was at the level of the right bronchial tree (38 cases representing 49.35%), followed by the left primitive bronchi (18 cases representing 23.37% and trachea with 9 cases representing 11.68 % of the analyzed patients). A number of 12 patients representing 15.58 % of the patients studied presented multiple foreign bodies. Distribution of the study cases by the nature of the foreign bodies is presented in Table no.2.

Table no.2 The prevalence of various inhaled foreign bodies in the study lot

<b>INHALED FOREIGN BODIES</b>			
<b>ORGANIC</b>		<b>AN-ORGANIC</b>	
<b>VEGETAL</b>	<b>ANIMAL</b>	<b>METAL</b>	<b>NON-METALIC</b>
<b>62</b>	2	9	4
<b>80,51%</b>	2,6%	11,69%	5,19%

The confirmed patients in the study lot were hospitalized for a mean of 4.74 days (from one to 12 days ). Within the limits of 1-3 days there were hospitalized about 2/3 of the patients – 54 (70.12%), from 4 to 7 days – 19 patients (24.67%) and above 8 days – 4 patients (5.19%).

## **V. DISCUSSIONS**

One of the major paediatric emergencies is represented by the tracheobronchial foreign bodies, which, through their unpredictable evolution after their mobilization, can lead to asphyxia.

The corroboration of data obtained after the anamnesis, clinical and para-clinical examinations and tracheobronchoscopy, the diagnostic was confirmed in 77 patients (72.64%) and in 26 cases (22.92%) the diagnostic was unconfirmed after the exploration. The high percentage of unconfirmed cases is due on the one hand to the exploration of those cases in which the anamnesis is suggestive for the diagnosis (the presence of an asphyxia episode), in which case the

tracheobronchoscopy is mandatory, but on the other hand is due to those cases of pneumonia and broncho-pneumonia with prolonged evolution, with unfavourable response to treatment.

Out of the unconfirmed cases, in 16 of them (61.53%) the diagnostic was acute bronchitis, one case (3.84%) the diagnostic was acute rinopharyngitis and in 3 cases (11.52 %) the diagnostic was pneumonia. The presence of a pre-existing condition, prior to the suspicion of TBFB suspicion, makes the diagnostic much more difficult, the risk of the bronchial exploration is greatly increased, the decision on the intervention remaining to be taken by the E.N.T specialist with experience in this type of pathology, based on a full paediatric examination and attentive radiology interpretation<sup>[2]</sup>.

The age group most affected was that of 1-3 years, with 63.63 % in according with others<sup>[3]</sup>. This aspect can be explained trough the intervention of several favouring factors regarding foreign body aspiration such as : the reflex defence mechanisms are not yet fully synchronized ( insufficient coordination between the acts of mastication ,deglutition and respiration); the increased curiosity on the surrounding environment, expressed trough a peak exploratory activity; the children's tendency, within this age group, to put up to their mouths the toys or food items with which they come into contact; their tendency to run or play during alimentation ;the pshicomotric lability which in turns triggers laugh or cry accesses; the increased reactivity of the body, that is rapidly triggering the body's defence mechanisms : coughing, sneezing, frenoglotis mioclonia<sup>[2,3]</sup>.

Analyzing the age group most affected and the confirmation of the diagnostic, we observed that for the 0-1year age group there were no wrong diagnostics. For the 1-3 years age group, the rapport of 15/49 ( 30.6%) between unconfirmed and confirmed cases, is much lower than for the 4-7 years group age ( 7/9 - 77.77%), this thing meaning a higher degree of parental attention within this age group, whit the allowance of a higher degree of liberty for the children and thus a lack of adult supervision in the 4-7 year age group, without capturing the moment of the inhalation, therefore the difficult anamnesis and probably the higher percentage of unconfirmed cases following the endoscopic exploration. Over 7 years, the 4/11 report between unconfirmed and confirmed cases (36.36%) is well within the general limits, the children being already older and when left unattended, they can relate more accurately by themselves the moment of the incident.

Given the high number of children left unattended (31.17%), the following are to be considered: the obligatoriness of adult supervision of the young children, existing even some

recommendations regarding the food safety, the type of allowed foods at different biological ages. It is necessary to respect the directives of hygiene items and also of the toys, according to the age.

The sex distribution of the study lot showed a higher frequency of the foreign body aspiration at the male gender in percent of 63.83% compared to the female gender (31.17%). Comparing the data obtained, with the specialty literature data, we observe the predominance of the foreign body aspiration to males, and this is due to the slower maturation of the nervous tracts which are coordinating the three defence mechanisms, and to the fact that, in general, males are more restless and harder to be supervised<sup>[1,2,4]</sup>.

Most of the children included in the study lot were presented to the clinic within 24 hours of the inhalation incident. The cases with over 7 days from the inhalation incident(5% vs 2-23% interval published by others<sup>[2,5]</sup>) are involving the following discussions: the parents ignored the penetration syndrome, appreciating it as a passing incident, without consequences; on the first consultation, the medic ignored the penetration syndrome, related by the parents.

In 68 cases (88.31%) the detailed anamnesis was able to reveal the penetration syndrome. Its absence may lead to delay in diagnosis<sup>[1,4]</sup>. Penetration syndrome had a sensitivity of 88.31% and a specificity of 11.53%. Compared with the reports of other authors within the values found sensitivity and specificity superior to lower values.

The entering of the foreign body occurs during the inspiration. Thus, laughter, fear, crying, surprises provoked during the inspiration time, are favouring the entrance of the foreign body. Other authors found it in various proportions (49% Baharloo<sup>[6]</sup>). In the other 9 cases there were suspected other pulmonary affections (infected asthma, pneumonia), the bronchoscopic examination certifying the diagnostic. In the study lot, 3 patients did not present at the internment any symptoms or clinical signs. Generally it is considered that there are no signs and symptoms that indicate the presence of certain TBFB<sup>[1]</sup>.

Emphysema was the characteristic most frequently found in children, in agreement with the majority of authors<sup>[6,7,8]</sup>. In the study conducted emphysema had a sensitivity of 27.27% and a specificity of 92.30%. The percentage of atelectasia grows with the temporisation of the diagnostic, which allows the full obstruction of the airways<sup>[7]</sup>. 20% of the X-Radiographies were normal. The proportion of the normal X-Rays varies between 8 and over 80%, depending on the location of the foreign body and time for onset<sup>[3,4,6,7]</sup>.



No matter the age group of the analyzed children, the most frequent localization of the foreign body was the right common bronchi, because anatomically, it is more in the tracheal axis than the left common bronchi, it also has a higher calibre, the suction force of the right lung is greater and carina is on left side <sup>[9]</sup>.

Because of the diversity of the respiratory foreign bodies, it is difficult to realize a classification. One possible classification would be grouping them into: organic, an-organic and endogenous (fragments of ganglion caseum, fragments from vomiting, hydatid membranes, etc) foreign bodies. In the study lot we observed the net predominance of vegetal organic foreign bodies (80.52%), the peanut core occupying the first place (25 cases), followed by the sun flower seeds (19 cases) and walnut core (8 cases), rising the gravity of the analyzed cases, because the volatile oils that they contain are rapidly producing bronchial lesions and therefore the necessity for their immediate emergency extraction and supportive treatment following the endoscopic procedure<sup>[2]</sup>. Also highly dangerous is the bean encountered in the clinical-statistical study in 3 cases, and the corn grain encountered in 3 cases, which trough their rapid swelling as a consequence of impregnation, completely obstruct the airways, two of cases requiring tracheotomy for extraction. Malik found more frequently watermelon seeds, more common it seems in the Middle East, unlike peanuts, more common in the West, secondary to regional alimentary habits<sup>[5]</sup>.

Delaying of the diagnostic of tracheobronchial foreign body increases the risk of complications and their gravity<sup>[3,5]</sup>. The temporisation of the proper treatment can also be attributed to a wrong diagnostic due to the multitude of pathological entities with who they can be mistaken with, and thus the children arrive late in the E.N.T specialty service, after they were preliminary hospitalized in the paediatric sections (8 cases – 10.38%) or after ambulatory treatments ineffective and inadequate to the diagnostic.

We observed a longer hospitalization time in the cases that were presented late to the doctor (over three days), in those cases with vegetable tracheobronchial foreign bodies, in those with complications risen during the hospitalization and also in those with associated pathology.

The hospitalization duration in the unconfirmed cases had values similar to those of the confirmed patients (73 vs 70 % for 1-3 days, 27 vs 24 % for 3-6 days), partly because of pre-existing affections which coincided with a foreign body inhalation episode, or because of complications occurred after the tracheobronchial exploration.

## VI. CONCLUSIONS

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- The tracheobronchial foreign bodies enter the airways in the majority of cases through inhalation, causing dramatic clinical presentations and representing a major medical emergency.
- The high percentage of cases denied after bronchoscopy met in the age group 4-7 years, compared to other age groups is probably secondary to a higher degree of freedom given to the children, and also to the less attentive adult supervision.
- Mandatory supervision of young children by adults is needed, there are even recommendations on food security, the type of food allowed biological age. Legislation and all of them would lead to at least the awareness of risk of aspiration by adults supervising the children to reduce the incidence of this disease.
- Foreign bodies were found at any age, the peak incidence during the study that we conducted we met in the age group 1-3 years at a rate of 63.63%.
- Penetration syndrome ( 88.31% ) is extremely evocative and coincides with foreign body inhalation.
- In the study conducted emphysema was the most common feature of lung exam, with a sensitivity of 27.27% and a specificity of 92.30%.
- PaO<sub>2</sub> value at presentation is an accurate indicator of the degree of obstruction and hence the severity of the case, but also as a prognostic factor.
- In the group studied is observed predominance of vegetal organic foreign bodies (80%) increasing severity of cases analyzed because the volatile oils they contain bronchial lesions produce rapid hence the need for their extraction procedure of urgency and subsequent supportive treatment endoscopic intervention.
- Presentation patient over 3 days after onset is associated with prolonged hospitalization over 7 days is highly statistically significant ( two - tailed P value is less than 0.0005 )
- I found a greater duration of hospitalization in cases that were presented to the doctor late ( three days) in those with tracheobronchial foreign bodies of vegetal origin, those with complications occurring during hospitalization ( tracheotomy, hypoxic coma ) and in cases with associated pathology.
- Delay effective treatment may be due to an erroneous diagnosis due to multiple pathologic entities that may be confused, so children get the latest ENT specialist services are by prior admissions to pediatric wards ( 8 cases -10.38% ) or inefficient and inadequate patient treatment.

- Complications of foreign bodies have a severity proportional to the time between aspiration and extraction ( two-tailed P value is less than 0.0004 ) .

- Evolution and prognosis aspiration of tracheobronchial foreign body depends on the precocity of diagnosis and therapeutic intervention, thus any suspicion will be followed by tracheo- bronchoscopic exploration (diagnostic and therapeutic method ) .

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