



**Anesthesia of the extraction of foreign bodies from the upper airways:  
Anesthetic procedures for the extraction of foreign bodies inhaled**

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**ABSTRACT**

*Inhalation of foreign body is a major cause of death by domestic accidents among children, mostly among those under three years old. Asphyxia is the main immediate risk. Respiratory effects may occur if the extraction time is extended. The seriousness of this incident has been significantly reduced due to advances in instrumentation and anesthesia. The purpose of this study was to investigate the epidemiological criteria, clinical, paraclinical, therapeutic, and anesthetic procedures for the extraction of foreign bodies inhaled at the University Hospital of Children ABDERRAHIM Harouchi in Casablanca. This is a retrospective study in Pediatric Resuscitation service during the years 2015-2016, and which permitted the recruitment of 42 cases of foreign body extracts under general anesthesia, let an incidence equal to 3,66%. The foreign body of the airways was frequent between 6 months and 3 years old children (73,80%). The diagnosis was based on the research of penetration syndrome that was present in 88,09% of the cases. The thorax radiography was normal in 50% of the cases and the foreign body was radio-opaque in 11,90% of the cases. The choice treatment was the extraction of the foreign body by rigid bronchoscopy under general anesthesia although it is as difficult and risky one. The operation may know severe complications: hypoxemia by hypoventilation, laryngospasm, bronchospasm and disorders of cardiac rhythm in particular, that the anesthesia is partially the origin. Accurate preoperative evaluation of the patient was necessary. The anesthetic management was classic that the best is the use of intravenous products with short delay and duration of action (Propofol, succinylcholine). The ventilation was manually assisted for all the patients. A careful respiratory supervision during the waking up was obligatory. The nature of the foreign body was dominated by peanuts (32,6%) with predominance of bronchial localization (71,74%). Finally, we must insist on the diagnosis and the precocious extraction of a foreign body in order to avoid in the long term aftereffects. We must also reinforce the prevention and the education of the parents, by training them into Heimlich's exercise, to ensure proper vigilance and obviously a reduction in the incidence of this serious accident.*

**Keywords:** Anesthesia-airways-foreign body-respiratory distress of the child.

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**INTRODUCTION**

Inhalation of foreign bodies (EC) in the airway is a frequent domestic accident, especially in the 1-3 year age group. It can lead to immediate life-threatening or long-term complications and respiratory

sequelae, leading to the early diagnosis and early EC extraction. The penetration syndrome remains the key clinical element for early diagnosis and rigid bronchoscopy under general anesthesia remains the only examination that confirms the diagnosis and extracts the foreign body. This extraction is a real challenge for the anesthesiologist because of the need for proper oxygenation and ventilation maintenance with sufficient depth of anesthesia to prevent complications secondary to endoscopic maneuvers.

The objective of this study is to evaluate the epidemiological, clinical, paraclinical and therapeutic aspects as well as the anesthetic modalities of the extraction of foreign bodies of the airways in the child through a series of 42 cases selected within the a multi-purpose pediatric resuscitation service at the Casablanca Children's University Hospital.

### MATERIAL AND METHODS

It is a retrospective study including 42 cases of extractions of foreign bodies over a period of 2 years (2015-2016), carried out in the department of anesthesia and multifunctional pediatric resuscitation at Casablanca Children's Hospital.

Includes all children 1 month to 15 years of age undergoing bronchoscopy under general anesthesia for diagnosed or suspected inhaled foreign body extraction. Excludes all cases requiring local anesthesia as well as children in whom the records were not exploitable.

The data were collected by a pre-established mining record containing epidemiological, clinical, radiological, therapeutic and evolutionary data filled from the medical records and the operational reports.

The folders have been corrected as a multiparametric database using Microsoft Excel software. Quantitative and qualitative variables were expressed in number, mean and percentage. Extreme values were also reported. Statistical analysis was carried out using SPSS 21 software.

### RESULT AND DISCUSSION

The incidence of foreign bodies that were diagnosed was 0.044% or 42 cases. The mean age of hospitalized patients was 39 months with extremes ranging from 6 months to 15 years. Children aged between 6 months and 3 years accounted for 73.8% of cases, with a sex ratio of 1.47 (male predominance). The mean weight of the patients was 14.45 Kg with extremes ranging from 7 Kg to 46 Kg. The consultation period was greater than one month in 4 patients (9.53%) and less than 24 H in 20 patients (47.61 %).

**Table I:** Distribution of Patients by Admission Times

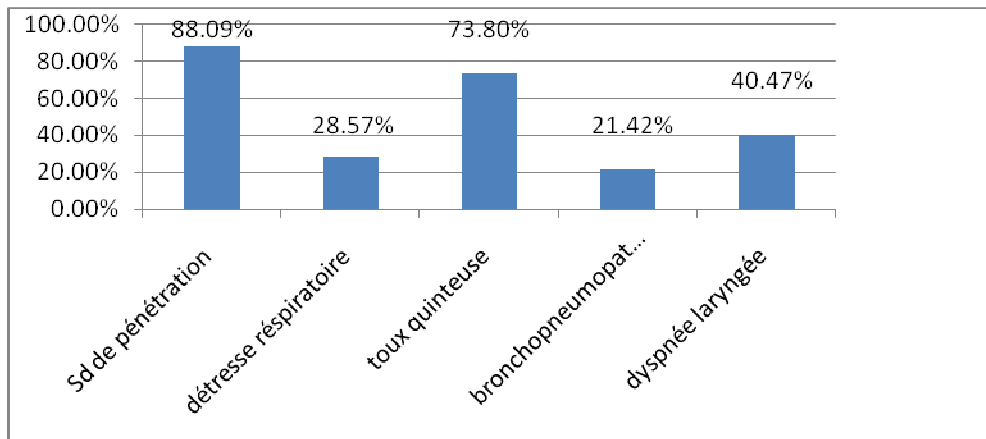
| Deadline for admission | Percentage (%) |
|------------------------|----------------|
| <24 h                  | 47.61          |
| 24-1semaine            | 33.33          |
| 1semaine-1mois         | 9.53           |
| > 1 month              | 9.53           |

It was noted that the penetration syndrome was associated with other symptoms in 78.57% of cases, whereas it was isolated in 9.52% of the cases.

In our series, symptomatology was dominated by cough in 73.80% of cases with respiratory distress

in 28.57% of cases.

Patients who had recurrent bronchopulmonary diseases for hospitalization were 21.42% (9 cases).



**Figure 1:** Distribution of patients according to the context of hospitalization

As for the physical examination data, it was abnormal in 85.72% of the cases. The table below summarizes the results of the physical examination.

**Table II:** Distribution of patients according to clinical examination data

| Clinical signs              | Number of employees (n) | Percentage (%) |
|-----------------------------|-------------------------|----------------|
| Polypnoea                   | 27                      | 64.30          |
| Sibilant Rails              | 9                       | 21.42          |
| Snoring rales               | 12                      | 28.57          |
| Decreased vesicular murmur  | 13                      | 30.95          |
| Cornage                     |                         |                |
| Cyanosis                    | 9                       | 21.42          |
| Normal clinical examination | 9                       | 21.42          |
|                             | 6                       | 14.28          |

Chest X-rays were normal in half of the cases, whereas in the rest of the cases, the presence of obstructive emphysema, atelectasis, systematized opacities, bronchial dilation or CE radio opaque (11.90%).

**Figure 2:** Opaque radio foreign body in a child aged 4 years and a half.



**Figure 3:** Foreign body radio opaque (vice metal of 4cm) in a child aged 2 years and a half.



EC extraction was programmed in 90.48% of the cases, whereas four patients (9.52%) had an EC extraction by the Magill forceps under laryngoscopy given the CE laryngeal localization. Patients

were treated with a broad-spectrum antibiotic-based corticosteroid at a dose of 1 to 2 mg / kg / day by the general route. All extractions were performed under general anesthesia (GA). The young preoperative was respected in 90.48% of the cases.

After preoxygenation, the induction was sevoflurane low inhalation in 85.72% and 14.28% based on halothane. All patients underwent intravenous anesthesia with use of propofol as a hypnotic and fentanyl as a morphine. Curare (Rocuronium) was administered in 21.42% of patients with full stomach induction or when extraction was difficult. Maintenance of anesthesia was based on sevoflurane in 85.72% of patients, while halothane was used in 14.28% of children.

Patients who were manually ventilated intermittently between attempts to extract the EC accounted for 78.58%. At the end of the bronchoscopy, 21.42% of the cases required intubation-controlled ventilation until awakening, of which 14.28% of cases required transfer to intensive care ventilated after a complication. Perendoscopic incidents and accidents were variable, with 7.14% of patients experiencing bronchospasm, desaturation (SpO<sub>2</sub> between 94% and 87%) was recalled in 14.28% of patients, while one patient experienced severe desaturation (SpO<sub>2</sub> between 80% and 30%) with haemodynamic repercussion (bradycardia). This bradycardia was around 60 beats per minute in 11.90% of children, one of whom had cardiac arrest. The last incident was pneumothorax of great abundance suffocating, found in 4.76% of the patients, one of which was bilateral.

**Table III:** Nature of foreign bodies

| Nature of the Foreign Body | Number | Percentage |
|----------------------------|--------|------------|
| Organic                    | 26     | 61,90 %    |
| Plants :                   |        |            |
| - Olive core               | 1      | 2,38 %     |
| - Nut piece                | 1      | 2,38 %     |
| - Sunflower seed           | 5      | 11,90 %    |
| - Peanut                   | 12     | 28,57 %    |
| -Corn                      | 1      | 2,38 %     |
| -White Bean                | 1      | 2,38 %     |
| - Piece of almond          | 2      | 4,76 %     |
| Animals :                  |        |            |
| - Chicken bones            | 2      | 4,76 %     |
| - Fish bone                | 1      | 2,38 %     |
| Inorganic                  | 10     | 23,80 %    |

|                   |   |        |
|-------------------|---|--------|
| - Plastic whistle | 2 | 4,76 % |
| - Pen cap         | 2 | 4,76 % |
| - Pin             | 2 | 4,76 % |
| - Metal body      | 3 | 7,14 % |
| - Pierre          | 1 | 2,38 % |

The total number of ECs extracted was 36 because 6 bronchoscopies were white.

The foreign body was located at the right axis in 64.28% of the cases, in the left axis in 26.20%, in the hull in 2.38% and in the glottis in 7, 14%.

After extraction, the immediate course was good in 69.04% of the patients. One patient had a cardiorespiratory arrest following severe bronchospasm, two patients had pneumothorax of great abundance, one of them was bilateral, three patients (7.14% of the cases) presented a bronchial spasm with four cases of awakening delays.

Whereas medium-term progression was marked by the persistence of atelectasis in 4.76% of the patients.

For patients hospitalized for resuscitation (16.66% of cases), the duration of hospitalization varies from 2 days to 22 days and an average duration of 5 days. Two patients were hospitalized for pneumothorax of high abundance. Three patients were hospitalized for severe bronchospasm, one of which died.

Only one patient experienced bronchoscopic failure due to horizontal pin blocking at the hull. Attempts to extract it caused a bilateral pneumothorax, requiring surgical management by thoracotomy.

Only one case in our patients (2.17%) died as a result of cardiorespiratory arrest caused by severe bronchospasm.

#### **Comment:**

The incidence of foreign bodies of the airway varies widely, it is estimated in France to 4 / 10,000 young children (1) (<4 years) with a male predominance (2).

Traissac and Mounier-Kuhn define three other clinical possibilities: the penetration syndrome is "unreported", most often due to the fact that the penetration syndrome is common to all the sites, absence of the entourage, the penetration syndrome is discrete in the form of coughing fits and last when the penetration syndrome is surgical, testifying to a foreign body obstructive, it is in the form of a major asphyx syndrome, which can lead to death, in the absence of maneuvers of extreme urgency (3).

In practice, we are faced with two clinical contingencies: the absolute urgency is the case of the asphyxiated child presenting a respiratory distress table (4), or the relative urgency when the patient's condition is preserved . The problem arises when the EC is old the incidence of complications increases with the delay diagnosis: 70% complications for a diagnosis delay between 15 and 30 days, 95% for a delay of more than 30 days [37], with bronchiectasis as a major complication [5].

A study carried out in Tunis between 1984-1997 by Boussetta found that the mean admission time was 13 days and that only 8.1% of the cases were hospitalized before 24 hours [6.7]. A study in

India by Arvind Sehgal between 1997 and 2000 on 75 children shows that 15% of patients are admitted 15 days after inhalation of the EC and that some patients are treated with antibiotics and bronchodilators before suspecting the EC [8,9].

Diagnosis is most often made on the following indirect signs [10,11]: A study by Girardi of 133 children with CEVA found hyperinflation or emphysema with atelectasis on the same hemithorax on chest x-ray in 18% of cases [11]. Several series found an absence of radiological signs in 6 to 38% of cases [12]. It is radiopaque only in 2% to 20% of cases [8,9]. In total, approximately 50% of children present the association of clinical signs, radiological and penetration syndrome [13].

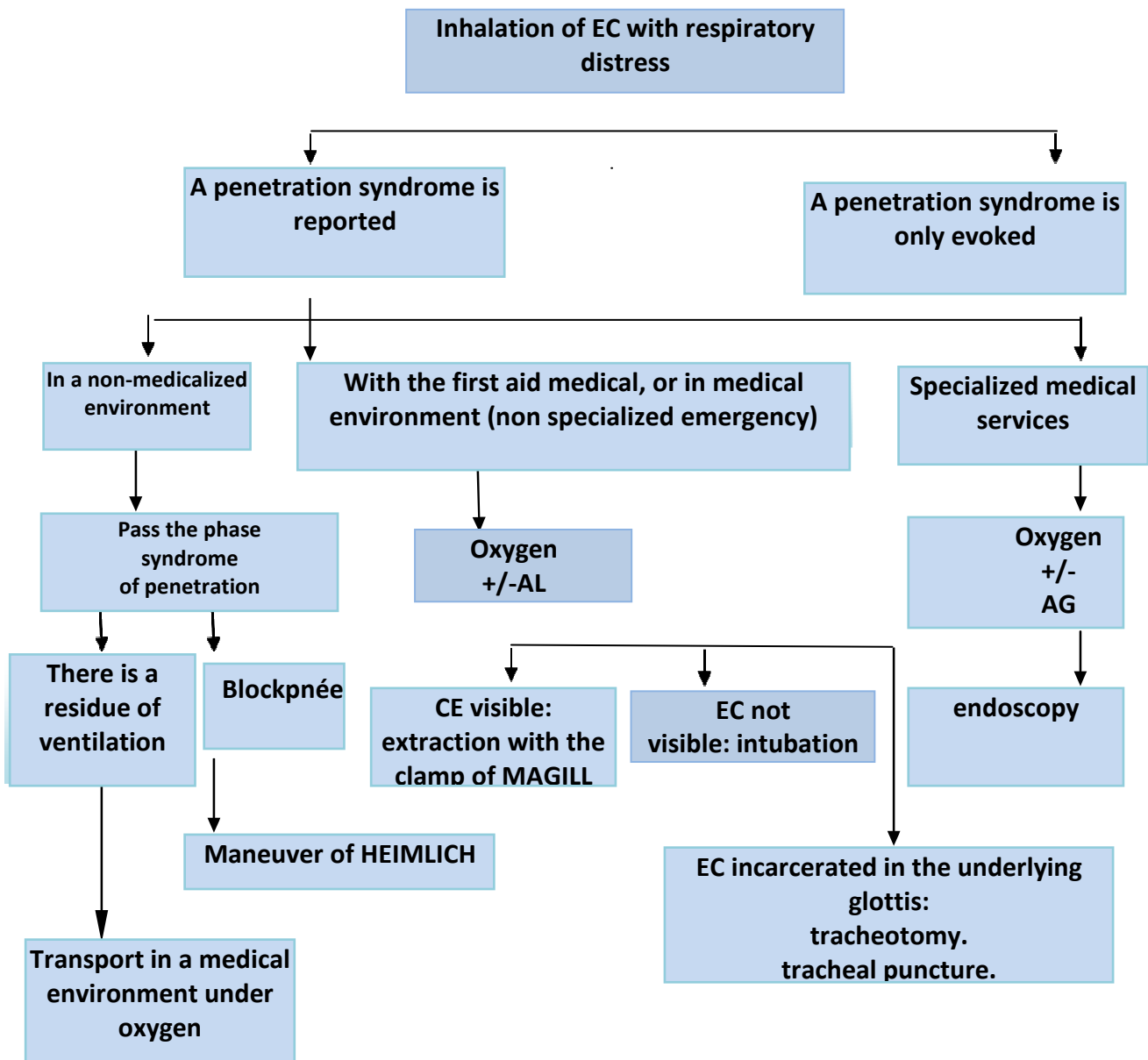


Figure 4: Decision tree CAT in front of an EC with respiratory distress (14).

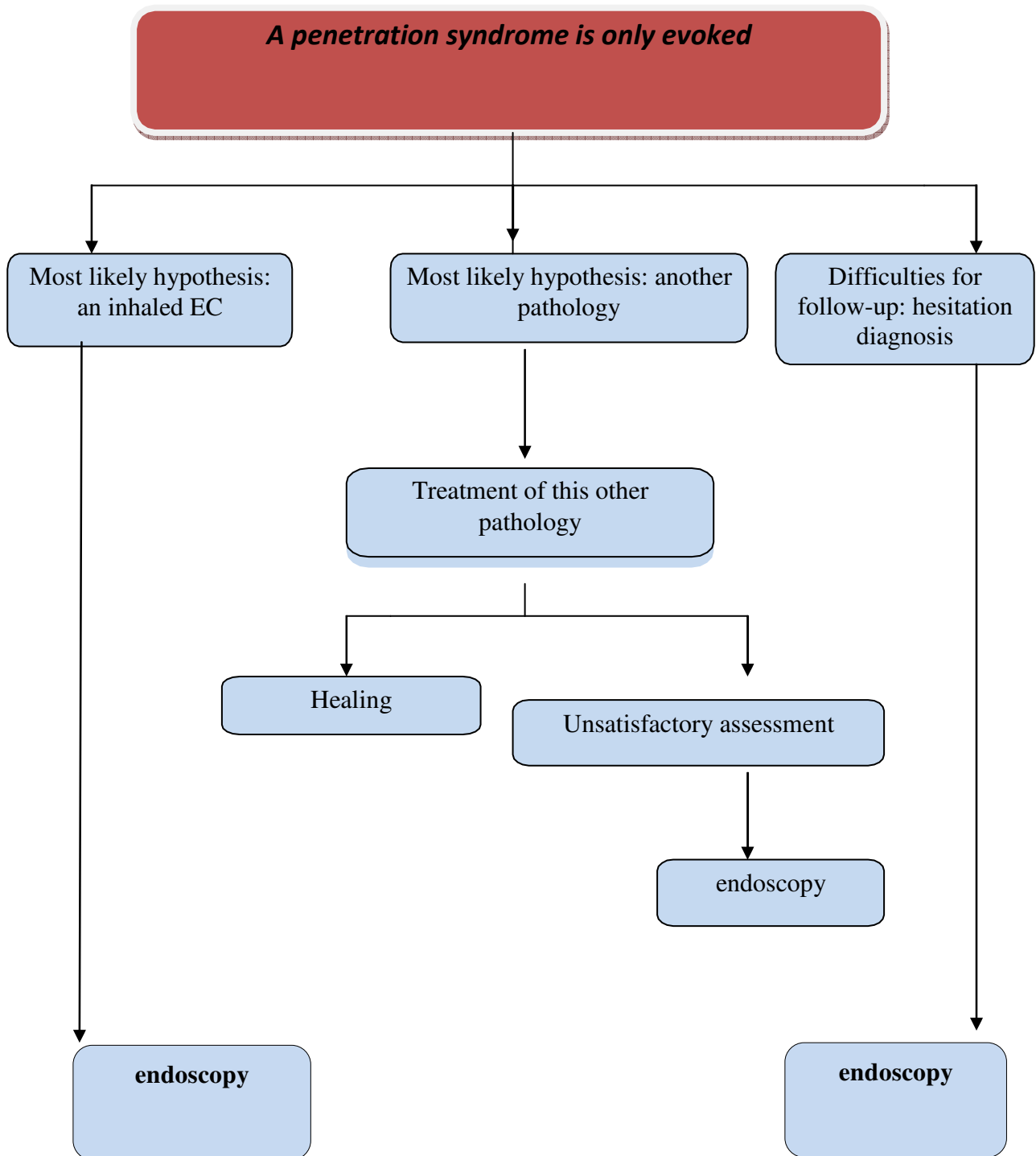


Figure 5: Decision tree: inhalation of the suspected CE (patient with little or no symptom) (14)



Once an indication of bronchoscopy is made, close collaboration throughout the gesture between the anesthesiologist and the endoscopist is essential (15). At least two anesthetists must be present, one of whom must be a pediatric anesthetist if the child is less than one year old. [16] The priority objectives of the anesthesiologist are to ensure adequate oxygenation and ventilation at all times. preventing laryngospasm or bronchospasm, and preventing heart rhythm disorders and blood pressure changes.

Outside the full stomach, induction is done to the mask. Local anesthesia of the glottis is systematic. In most cases, curarisation is not necessary.

Ventilation under general anesthesia during the endoscopy procedure for EC extraction is via the rigid bronchoscope (14).

Concerning anesthetic induction, the study of the members of the society of pediatric anesthesia (pediatric anesthesia) finds that most anesthesiologists prefer induction to the mask without cricoid pressure (sellick maneuver ) and more than anesthesiologists are experienced the more they prefer induction induction [17]. A study by Meretoja finds that sevoflurane is associated with fewer incidents and accidents compared to halothane when used for bronchoscopy and gastric fibroscopy in children. [18] Some authors use propofol associated with a curare of short action for induction in the case of a full stomach [19]. Propofol administered as a bolus remains the best anesthetic technique for children who undergo bronchoscopy because it allows spontaneous ventilation and rapid wake up [20].

The local anesthesia of the vocal cords and the trachea is adjoined to general anesthesia. Lidocaine 1% has two advantages for this application [54,18], doses greater than 4mg / kg are used without complications but the dose must be reduced for patients under 2 years of age.

There are no studies that have shown the superiority of one mode of ventilation or the other. The arguments in favor of spontaneous ventilation included a lower risk of migration more distally from the EC than with positive pressure ventilation, which can lead to difficulties in extraction and the possibility of obstructing the airway [56 ]. In addition, spontaneous ventilation allows continuous ventilation during surgery and rapid VA control after EC extraction. [54] The disadvantage of spontaneous ventilation is that the depth of anesthesia required to allow the insertion of instruments into the VA decreases the heart rate and ventilation during the introduction of the bronchoscope leading to hypoventilation [58,54]. Concerning positive pressure ventilation, the advantage of using the technique for muscle relaxants is that the VA are immobilized which facilitates the extraction of the CE. The technique of anesthesia with myorelaxants allows an anesthetic equilibrium because a decrease of the anesthetic effects on the cardiac rhythm is described. In addition, positive pressure ventilation may reduce atelectasis, improve oxygenation, and control the increase in VA resistance that occurs during the introduction of the bronchoscope [58,54]. Another prospective study comparing spontaneous ventilation with controlled ventilation is that of Soodan made at the Indian Institute of Medical Sciences between 1998 and 2000 on 36 children with inhaled EC [75]. This study concluded that keeping a deep anesthesia with spontaneous ventilation during rigid bronchoscopy for extraction of inhaled EC is an impossible thing and that controlled ventilation with a muscle relaxant or anesthesia inhalation brings a regular and adequate depth of rigid bronchoscopy anesthesia.

The jet ventilation is a mode that ensures effective gas exchange by allowing optimal visibility and easy access for instruments at VA level [5], it can be performed either directly at the level of the rigid bronchoscope or a catheter (nasotracheal, for example). The Jet ventilation was postponed for EC extraction in adults [76]. But it is not widely evoked in children. This may be due to the

slightest experience with this technique and that jet ventilation exposes the risk of dissemination of EC fragments and a significant increase in the intra-pulmonary pressures responsible for barotrauma as the bronchoscope and its optics obstruct the exit of volumes insufflated into the lungs [77; 78; 70].

Laryngospasm is a more child-specific complication (7.9 / 1000 anesthesia of any age, 17/1000 anesthesia of children between

0 and 9 years) [32]. The occurrence of bronchospasm during the induction or maintenance of anesthesia is most often due to irritation by the rigid bronchoscope of a tracheobronchial mucosa previously rendered inflammatory by the presence of CE. [56,58,22,79]. The risk of desaturation increases with bronchoscopy, therefore monitoring of arterial oxygen saturation (SaO<sub>2</sub>) is essential [81]. The rhythm disorders are most often bradycardia and can go as far as cardiac arrest. The most frequent mechanism is the insufficient anesthesia noted by Rolf in a series of 402 patients [82].

The nature of CEVA varies from country to country. It depends on the eating habits of the populations in question. However, most of these are plant CEs (on average 80% according to all statistics), and more rarely toys [32, 36, 11, 38, 83]. In Europe and the United States, peanuts (50% of cases: "apéritif" pathology), hazelnuts and other nuts, carrot fragments or apples are the most commonly implicated [84]. Large or angular foreign bodies with irregular edges may become entangled at the entrance of the larynx in infants under one year of age. These objects account for about 12% of foreign bodies [12]. The tracheal EC, found in 3 to 13% of cases [11, 39, 85], are favored by a history of tracheomalacia, anterior tracheal surgery, or if the coughing efforts of the patient are too weak.

Bronchial EC is the most frequent and accounts for about 90% of cases [32,11]. Localization at the level of the right bronchial tree is more frequent. In the literature, it is reported that in 79.7% of cases, the foreign body was bronchial with an incidence of 53.1% on the right and 26.6% on the left.

The short-term evolution is mainly respiratory, represented by laryngeal edema or pulmonary edema occurring after the "obstacle lifting" of an obstructive bronchial CE. Long-term sequelae may occur in particular bronchial dilation. A series of 75 children in 1984 showed that the risk of complications multiplies by 3 if the foreign body stays more than 7 days in the bronchi [86]. Thus, the frequency of residual clinical disorders increases from 13 to 18%, that of radiological abnormalities from 30 to 75%. Abnormalities of perfusion and above all of ventilation in scintigraphy would persist even on the balance sheet one year after the extraction of the CE.

## CONCLUSION

Inhalation of a foreign body in a child is a medical emergency that exposes the child to a risk of complete airway obstruction. The penetration syndrome, being the key element of the diagnosis, must be systematically investigated before any respiratory distress, but its absence does not eliminate the inhalation of the foreign body. Therapeutic management rests essentially on the realization of an endoscopy tracheobronchial, under general anesthesia. It is always a high risk anesthesia, often involving the young child. It is imperative that it is taken care of by an experienced team, in a specialized environment. Thus close collaboration between the anesthesiologist and the surgeon is essential in order to prevent the various potentially serious complications that unfold. The choice of the technique of anesthesia and the ventilatory mode remain a matter of experience.

In order to avoid this type of accident, prevention plays an important role and involves both parents

and anyone who is in contact with the young child. It is essentially based on the information of the latter on the recognition of a penetration syndrome and its potential severity, as well as their training on the conduct to be taken in case of inhalation of a foreign body.

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### REFERENCES

- [1] CAMBOULIVES J, PAUT O, MARTI JY. Anesthésie du nourrisson et de l'enfant. Encycl MédChir Anesth-Réanim 36-A-20, **1996** :25p.
- [2] Mise K, JurcevSavicevic A, Pavlov N, Jankovic S. Removal of tracheobronchial foreign bodies in adults using flexible bronchoscopy: experience 1995–2006. Surg Endosc **2009**;23:1360–4.
- [3] Hong SJ, Goo HW, Roh JL. Utility of spiral and cine CT scans in pediatric patients suspected of aspirating radiolucent foreign bodies. Otolaryngol Head Neck Surg **2008**;138:576–80.
- [4] Veras TN, Hornburg G, Schner AM, Pinto LA. Use of virtual bronchoscopy in children with suspected foreign body aspiration. J Bras Pneumol **2009**;35:937– 41
- [5] Buu NT, Ansermino M. Anesthesia for removal of inhaled foreign bodies in children. Paediatr Anaesth **2005**;15:533
- [6] Fidkowski CW, Zheng H, Firth PG. considerations of tracheobronchial foreign bodies in children: a literature review of 12,979 cases. Anesth Analg. **2010** Oct;111(4):1016-25
- [7] Cohen S, Avital A, Godfrey S, Gross M, Kerem E, Springer C. Suspected foreign body inhalation in children: what are the indications for bronchoscopy? J Pediatr **2009**;155:276-80
- [8] Suffocation chez les enfants de moins de 15 ans 1999-2001. Institut de veille sanitaire **2003**.
- [9] Fidkowski CW, Zheng H, Firth PG. considerations of tracheobronchial foreign bodies in children: a literature review of 12,979 cases. Anesth Analg. **2010** Oct;111(4):1016-25
- [10] El Koraichi et al. Bronchoscopie rigide pour extraction d'épingle chez l'enfant à l'hôpital d'enfant de rabat, Maroc Revue de pneumologie clinique (**2011**) 67,309-313
- [11] J. Naud, C. Picard .Corps étranger dans les voies aériennes de l'enfant 51e Congrès national d'anesthésie et de réanimation(Elsevier, Paris).(2009)
- [12] El Koraichi et al. Bronchoscopie rigide pour extraction d'épingle chez l'enfant à l'hôpital d'enfant de rabat, Maroc Revue de pneumologie clinique (**2011**) 67,309-313
- [13] DEVICTOR D, CHEVRET L. Détresse respiratoire aiguë du nourrisson, de l'enfant et de l'adulte : corps étranger des voies aériennes supérieures. 2ème partie : chez le nourrisson et l'enfant. Rev Prat **2003** ; 53, 15 :1723-173
- [14] RIMELL F.L, THOME A, STOOL S, REILLY S, RIDER G, STOOL D, WILSON C.M. Characteristics of objects that cause choking in children. JAMA **1995**; 274, 22: 1763-1766.
- [15] Bronchoscopic removal of foreign bodies in adults: experience with 62 patients from 1974–1998. Eur Respir J **1999**;14:792–795.[CrossRef].
- [16] FRANÇOIS M, THACH T, MAISANI D, PREVOST C, ROULLEAU P. Endoscopie pour recherche de corps étranger des voies aériennes inférieures chez l'enfant : à propos de 668 cas. Ann Otolaryng (Paris) **1985**; 102 :433-441.

- [17] KARAKOÇ et al. Foreign body aspiration: what is the outcome? *Pediatric Pulmonology* **2002**; 34:30-36.
- [18] YILDIZELI et al. Effects of intrabronchial foreign body retention. *Pediatric Pulmonology* **2002**; 33:362-367.
- [19] ARVIND S, VARINDER S, JAGDISH C, MATHUR N.N. Foreign body aspiration. *Indian Pediatrics* **2002**; 39:1006-1010.
- [20] MARTINOT A, DESCHILDRE A, BRICHET A, LECLERC F. Indications de l'endoscopie bronchique en cas de suspicion de corps étrange trachéo- bronchique de l'enfant. *Rev Mal Respir* **1999** ; 16, 4 bis :673-678.