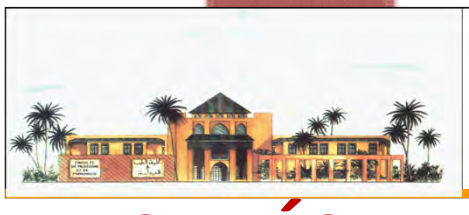


ROYAUME DU MAROC
UNIVERSITE CADI AYYAD
FACULTE DE MEDECINE ET DE PHARMACIE
MARRAKECH

ANESTHÉSIE POUR EXTRACTION DE CORPS ETRANGER BRONCHIQUE CHEZ L'ENFANT

Pr S.YOUNOUS
chef de service d'anesthésie réanimation pédiatrique
CHU Mohamed VI Marrakech

Introduction

-Cause accidentelle majeure de morbi-mortalité chez l'enfant

-Engage le pronostic vital: intérêt de la bronchoscopie

-Complications liées:

- Au corps étranger
- À la bronchoscopie

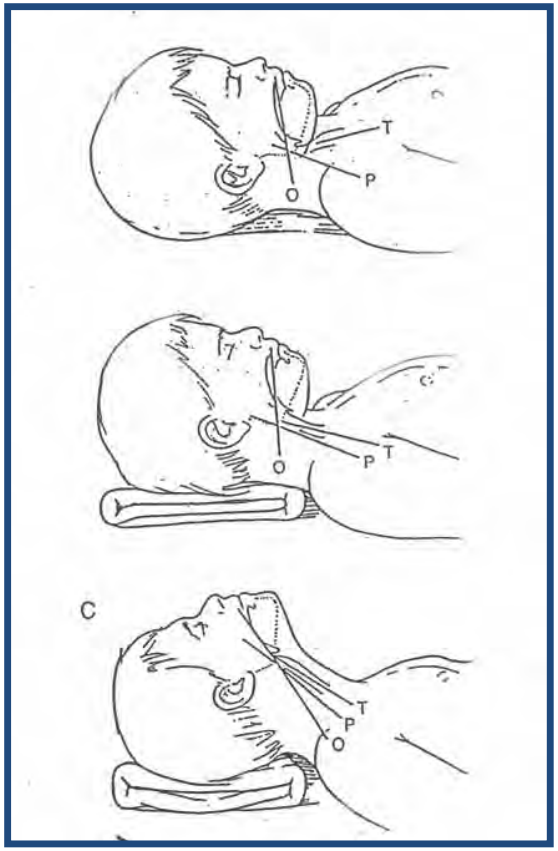
-Complications mineures ou majeures [1]/ précoces ou tardives

Collaboration entre AR et chirurgien

1) Williams A, George C, Atul PS, Sam S, Shukla S. An audit of morbidity and mortality associated with foreign body aspiration in children from a tertiary level hospital in Northern India. Afr J Paediatr Surg 2014; 11: 287–292.

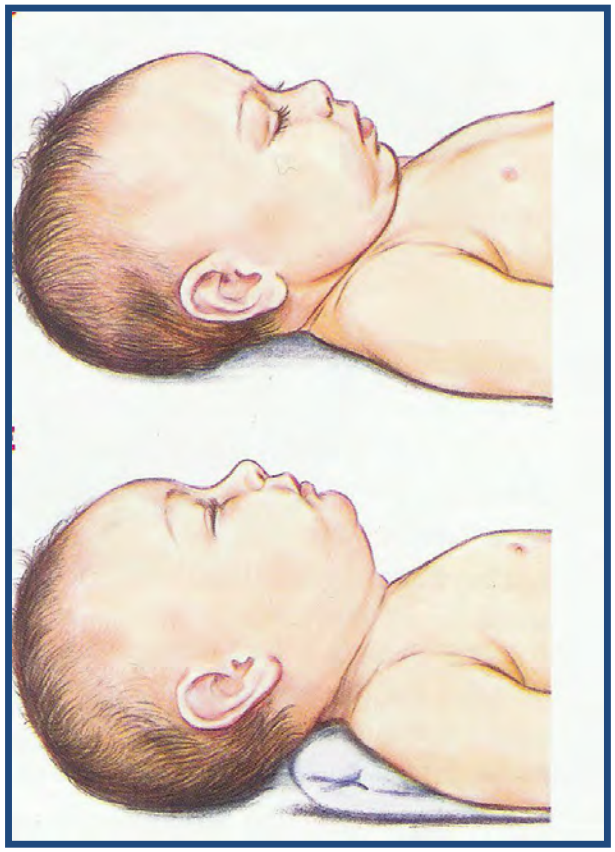
Comment positionner?

Alignement > 2 ans



- Pharynx
- Trachée
- Œsophage

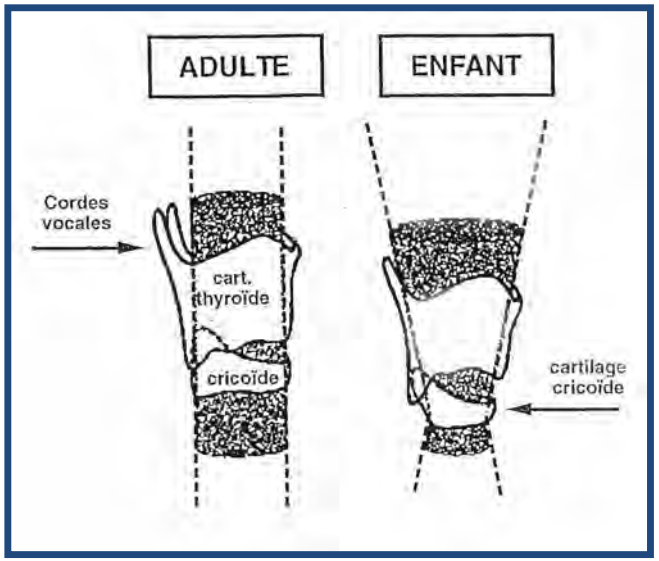
< 2 ans

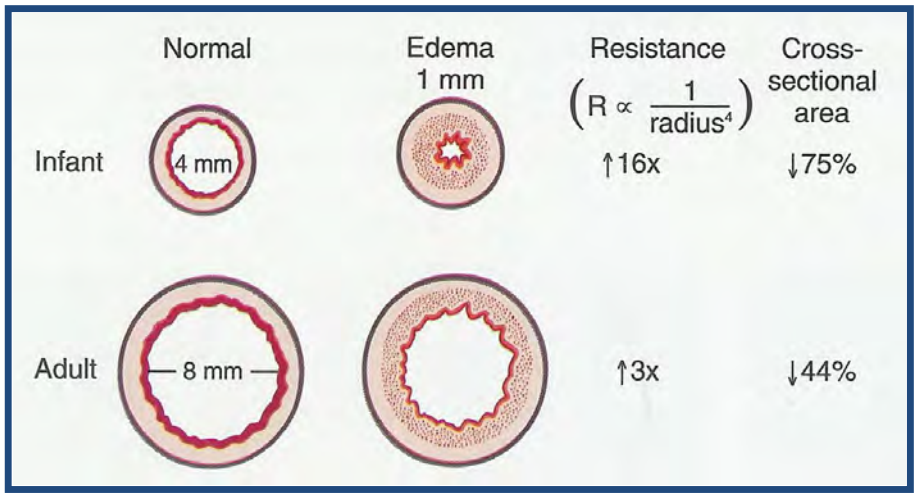


Région sous-glottique

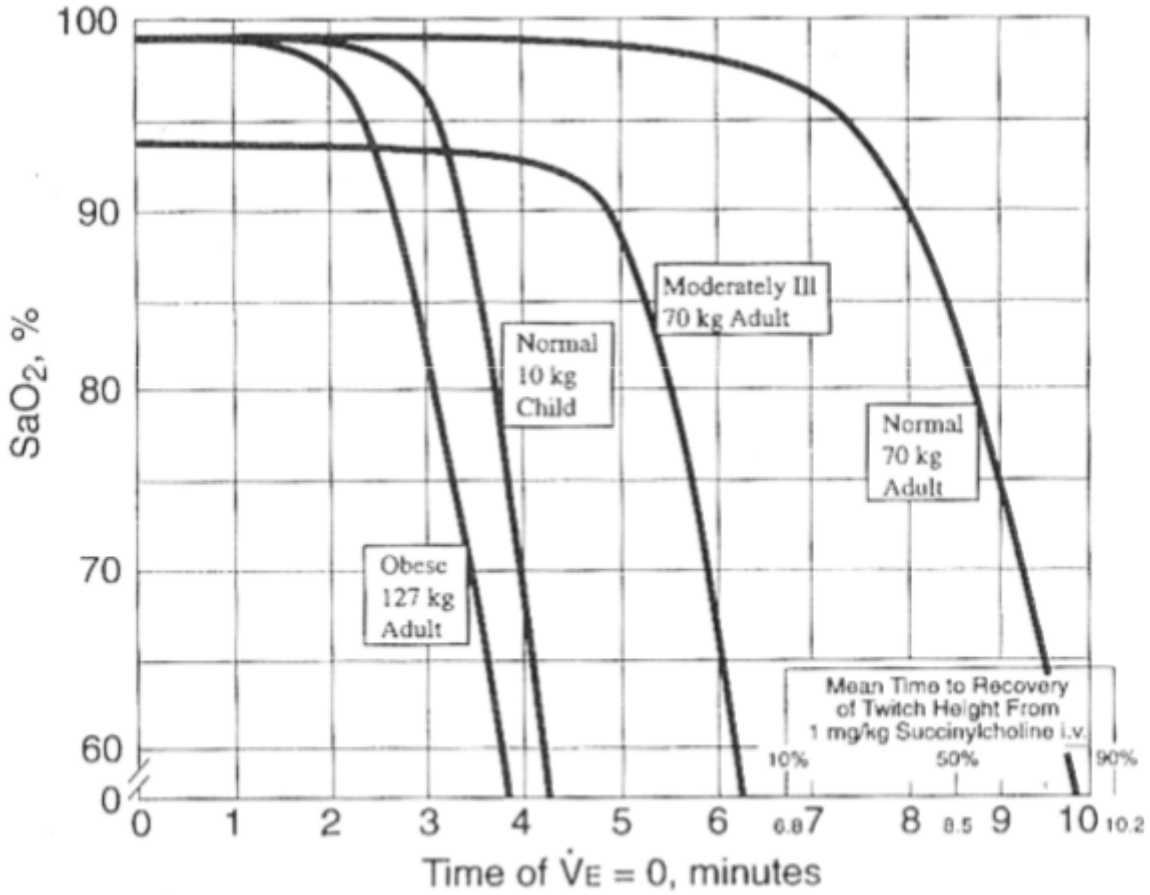
Partie la plus étroite chez l'enfant

- Cartilage cricoïde
- Résistances inversement proportionnelles au r^4





L'enfant: un être assez intolérant à l'apnée…



PHYSIOLOGIE CARDIO-VASCULAIRE

- Douleur; Hypoxie= Bradycardie
-Débit cardiaque= chrono-dépendant

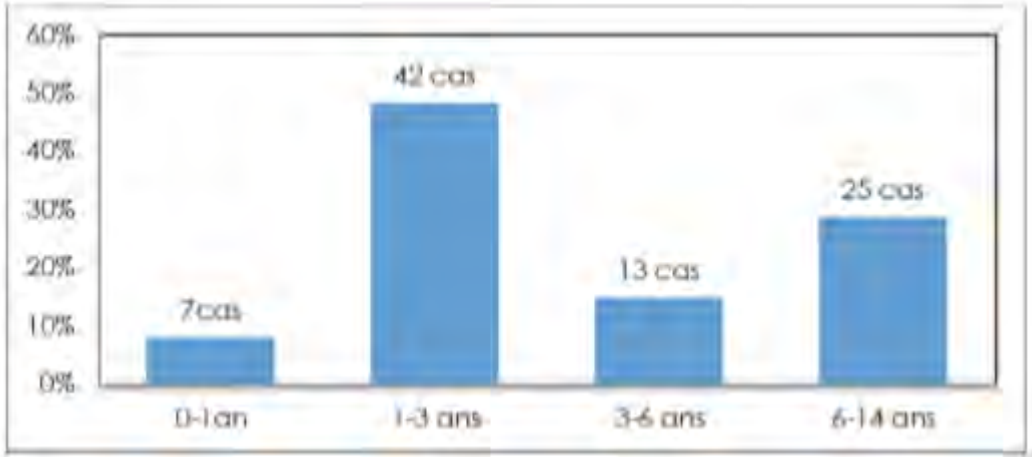
ACR

Série Hôpital d'enfant CHU Med VI

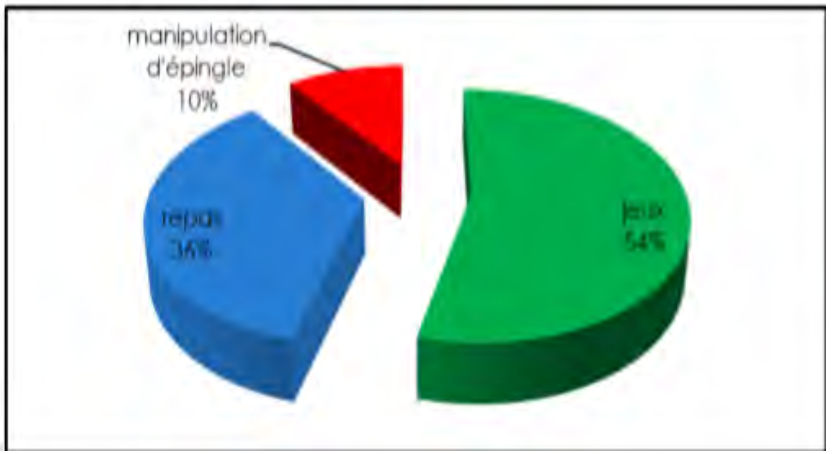
-Deux ans: 2014 à 2016

-Service des urgences et de réanimation Pédiatrique

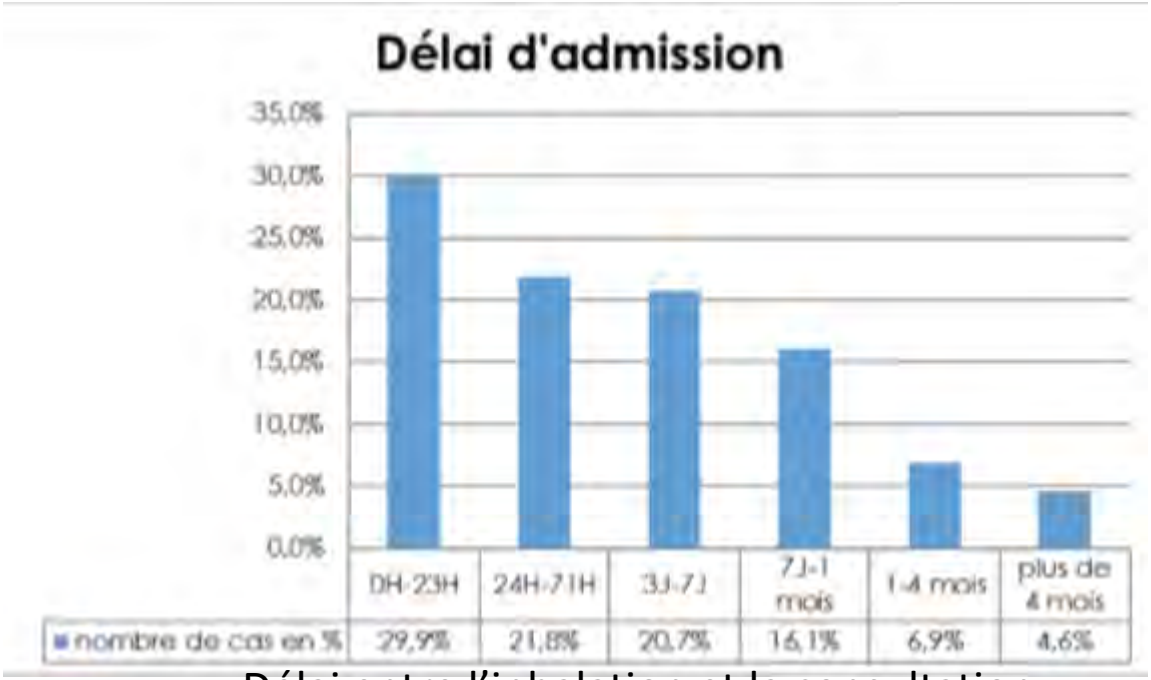
-87 enfants



Répartition des malades selon l'âge

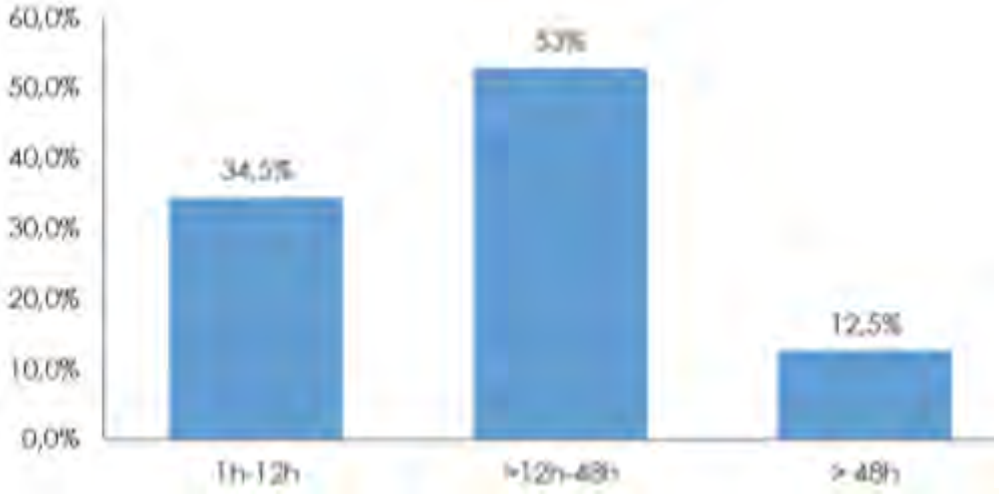


Circonstances d'inhalation des corps étrangers.



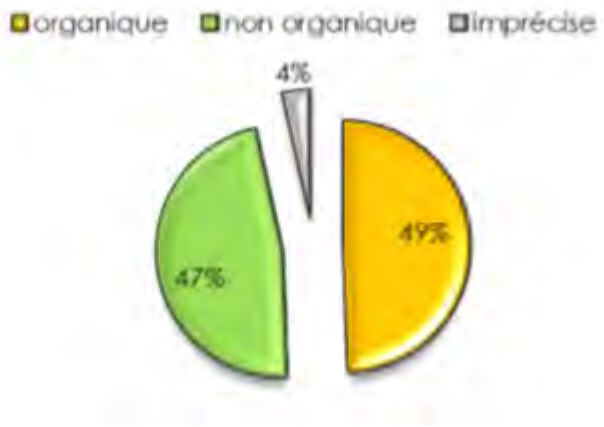
Délai entre l'inhalation et la consultation

Répartition des malades selon le syndrome de pénétration

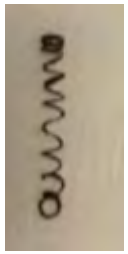


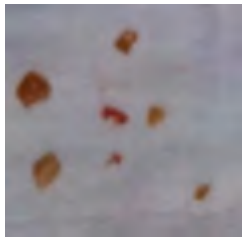
Délai entre l'admission et l'extraction

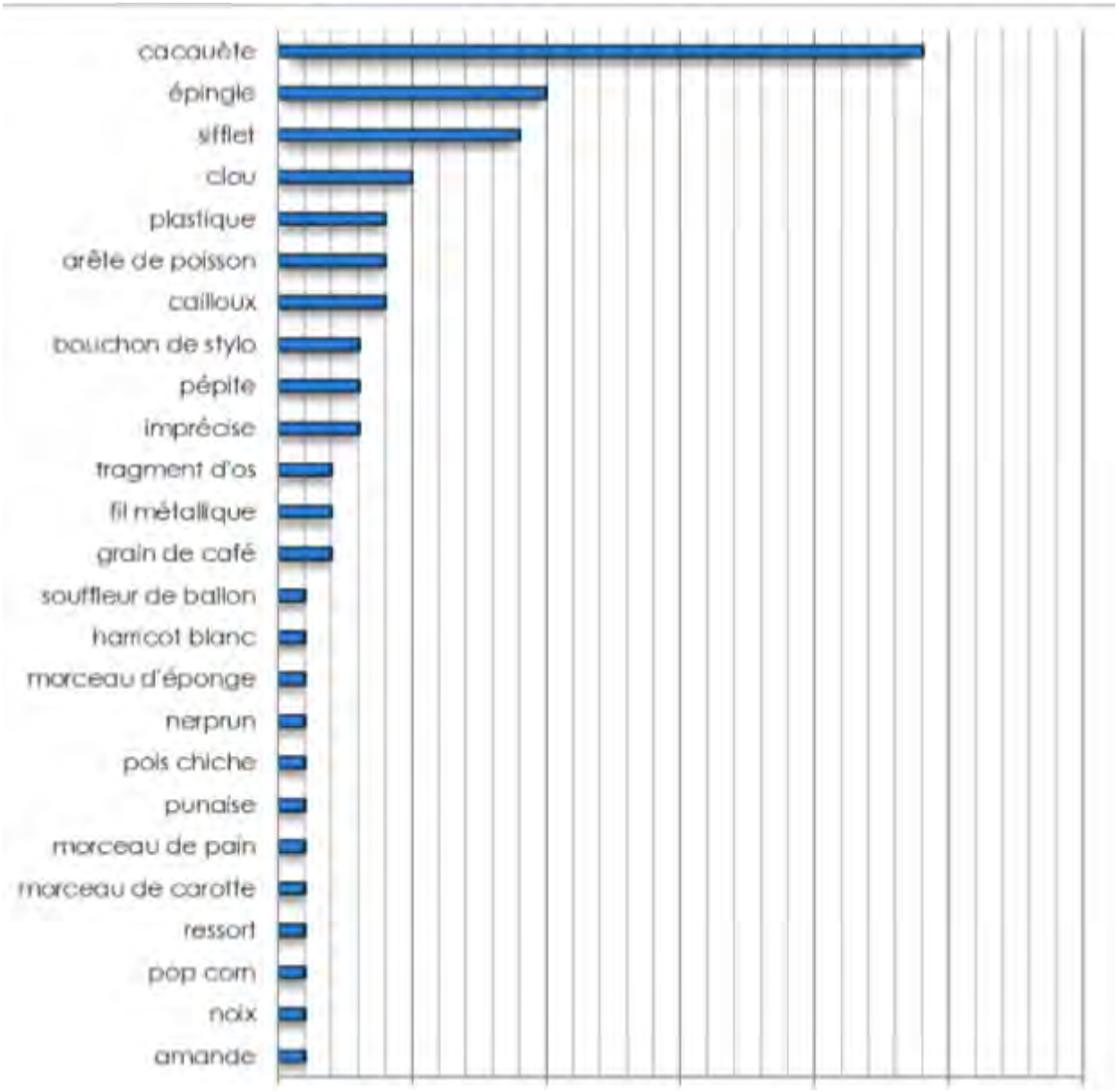
Mode d'extraction des corps étrangers



Répartition des corps étrangers selon leur nature






cacahuète
épingle
sifflet
clou
plastique
arête de poisson
cailloux
bouchon de stylo
pépite
imprécise
fragment d'os
fil métallique
grain de café
souffleur de ballon
haricot blanc
morceau d'éponge
nerprun
pois chiche
punaise
morceau de pain
morceau de carotte
ressort
pop corn
noix
amande

Trois situations:

– CE obstructif: Sept patients (8%)

*Six patients (7%): IVA

*Un patient: extraction par pince Magill.

-CE semi-urgent: 14%

– CE programmé: 78%

Anesthésie

-Induction inhalatoire au sevoflurane: 94%

-Entretien: Sevo + bolus propfol (75%) +/- Xylocaine2%
Morphinique: 55%
Curare: 45%

-Ventilation manuelle intermittente entre les tentatives

-Fin bronchoscopie: 80% intubé / 20% pris au masque

-Extubation

*Sur table: 90%

*Transfert en réanimation: 9 enfants

Complications

-Désaturation (Spo2<92%): 68%

-Bronchospasme: 23%

-Bradycardie (<60 bat/min): 7%

-ACR: 01 enfant

-Pneumothorax: 01

- Plusieurs circonstances de découverte de gravité différente

- Savoir **garder son calme**

- Protocole codifié

American Heart Association.

EUROPEAN RESUSCITATION COUNCIL

Advanced Life Support for Infants and Children

Aspiration de corps étranger

Obstruction **légère**
(toux présente et efficace)

Obstruction **sévère**
(pas de bruit respiratoire, voix aiguë en inspirium ou incapacité de parler ou de tousser, peu ou pas d'entrée d'air ± signes de détresse respiratoires sévères)

>1 an

Manœuvre de Heimlich

Ablation du CE

Intubation* -ventilation

Crico-thyroïdo -tomie

Algorithme basé sur les recommandations 2015 de l'American Heart Association

Dre L. Lacroix
K. Haddad
Oct. 2018

*En l'absence de mobilisation du CE, intuber avec mandrin en place en repoussant le CE plus loin dans l'une des 2 bronches souches

Simulation-based Assessment of Pediatric Anesthesia Skills

James J. Fehr, M.D., F.A.A.P.,* John R. Boulet, Ph.D.,† William B. Waldrop, M.D.,‡
Rebecca Snider, M.H.S., R.N.,§ Megan Brockel, M.D.,‖ David J. Murray, M.D.#

Anesthesiology 2011; 115:1308–15

Table 1. Pediatric Anesthesia Simulation Scenarios

Scenario	Scenario Descriptor	Scoring Items
Bronchospasm	5-yr-old, 20-kg child with asthma is wheezing after extremity fracture repair	Administer oxygen, auscultate lungs, review past medical history, inquire about intraoperative events, recognize wheezing, administer albuterol, confirm chest x-ray has been done, communicate with surgeons
Malignant hyperthermia	During inguinal hernia repair in a 6-yr-old, 20-kg child, MH occurs with elevated carbon dioxide, tachycardia	Give 100% oxygen, state diagnosis, discontinue volatile anesthetic, hyperventilate, call for malignant hyperthermia cart, administer dantrolene, administer bicarbonate, cool patient, order laboratory studies, call for ICU bed
Venous air embolus	Intraoperative resection of a Wilms tumor in a 6-yr-old, 20-kg child, complicated by sudden desaturation and decrease in end-tidal carbon dioxide	Recognize decreased end-tidal carbon dioxide, administer 100% oxygen, state diagnosis, notify surgeon, ask surgeon to flood surgical field, position patient in left lateral decubitus position, bolus fluid, administer epinephrine, arrange for ICU bed
Laryngospasm	At the beginning of strabismus surgery with a laryngeal mask airway in place, a 5-yr-old,20-kg child loses end-tidal carbon dioxide	Auscultate in <60 s, administer 100% oxygen, remove laryngeal mask airway, attempt bag-mask ventilation, call for help, deepen anesthetic, administer muscle relaxant, intubate patient, confirm end-tidal carbon dioxide, auscultate bilateral breath sounds
Appendicitis with sepsis	A 7-yr-old, 30-kg child with appendicitis is ill, appearing with heart rate 136, respiratory rate 38, and blood pressure 72/48	Check laboratory results, inquire about pain, check blood pressure before induction, bolus fluid, state diagnosis of possible sepsis, prepare suction, preoxygenate, rapid sequence induction with cricoid, decrease dose of induction agent, confirm end-tidal carbon dioxide
Airway foreign body	A 4-yr-old, 15-kg child preoperative for myringotomy tubes has a cough. Nurse is concerned. Mannequin with unilateral breath sounds and not on monitor	Ask for vital signs, administer oxygen, obtain past medical history, obtain history of cough, auscultate chest, obtain chest x-ray, state diagnosis, consult otolaryngology, plan for induction with maintenance of spontaneous respiration
Newborn resuscitation	Resuscitation of 2-kg newborn who was born less than 1 min ago: no respiratory effort, decreased tone, heart rate <60, and poor perfusion. The special care nurse and pediatrician have not yet arrived	Dry patient, stimulate and warm baby, suction mouth, begin bag-mask ventilation, call for help, start chest compressions for heart rate <60 after 30 s, intubate, request umbilical venous line, request bed in the NICU
Infant seizure	Called to evaluate 7-wk-old, 4.8-kg infant found seizing on the general pediatrics ward	Recognize seizure, give oxygen, place intraosseous needle when can't get an intravenous line, give anticonvulsant, recognize apnea, bag-mask ventilation, call for help, intubate patient, check glucose and electrolytes, request ICU bed

REVIEW ARTICLE

CME

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases

Christina W. Fidkowski, MD,* Hui Zheng, PhD,† and Paul G. Firth, MBChB*‡

Anesth Analg 2010;111:1016–25

-**Medline 2000-2009**:

–Corps étrangers trachéo-bronchiques uniquement (suspectés ou avérés).

–Nombre de patient > 100.

–Population exclusivement pédiatrique.

–Publications en langue anglaise.

-30 études dont seulement 3 prospectives

-12 979 cas dont 11 145 cas avérés

-Age moyen 2,1 -3,8 ans

-Garçons dans 61% des cas

-81 % de corps étrangers organiques

REVIEW ARTICLE

CME

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases

Christina W. Fidkowski, MD,* Hui Zheng, PhD,† and Paul G. Firth, MBChB*‡

Une histoire de syndrome de pénétration est très suggestive d'une inhalation de corps étranger, surtout s'il est constaté par un témoin.

Table 1. Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) of a Witnessed Aspiration Effect for Foreign Body Aspiration

	Sensitivity	Specificity	PPV	NPV
Aydogan et al. (1887, 1493)[7]	93.2	45.1	86.5	63.6
Ciftci et al. (663, 563)[11]	91.1	46.0	90.5	47.9
Tomaske et al. (370, 221)[35]	74.7	53.7	70.5	58.8
Ayed et al. (235, 206)[8]	81.6	37.9	90.3	22.4
Tokar et al. (214, 152)[34]	84.9	87.1	94.2	70.1
Skoulakis et al. (210, 130)[31]	91.5	56.3	77.3	80.4
Kiyan et al. (207, 153)[25]	37.3	96.3	96.6	35.1
Erikci et al. (189, 127)[16]	58.3	87.1	90.2	50.5
Heyer et al. (160, 122)[20]	75.4	92.1	96.8	53.8
Cohen et al. (142, 61)[12]	83.6	32.1	48.1	72.2

Values are percentages.

Data were available from 10 of the 30 studies that were reviewed. Study size is denoted (*n*, *n*) to represent the total number of patients and the number of patients with an aspirated foreign body, respectively.

REVIEW ARTICLE

CME

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases

Christina W. Fidkowski, MD,* Hui Zheng, PhD,† and Paul G. Firth, MBChB*‡

La toux est un signe assez sensible d'une inhalation de corps étranger.

Un stridor et une cyanose sont des signes plutôt spécifiques et peu sensibles.

Table 2. Sensitivity (Sens) and Specificity (Spec) of Symptoms for Foreign Body Aspiration

	Cough		Dyspnea		Wheeze		Cyanosis		Stridor	
	Sens	Spec	Sens	Spec	Sens	Spec	Sens	Spec	Sens	Spec
Tomaske et al. (370, 221)[35]	87.8	45.0			57.9	73.2			39.4	74.5
Ayed et al. (235, 206)[8]	80.1	34.5			30.1	65.5			16.5	65.5
Tokar et al. (214, 152)[34]	94.1	32.3			27.6	66.1				
Skoulakis et al. (210, 130)[31]	82.3	53.8	24.6	85.0			5.4	100	11.5	98.8
Kiyan et al. (207, 153)[25]	67.3	20.4	16.3	74.1	79.1	27.8	7.2	98.1		
Erikci et al. (189, 127)[16]	51.2	83.9	4.7	93.5	18.9	93.5				
Shivakumar et al. (165, 105)[29]	92.4	8.3	61.9	66.7	64.8	0	12.4	100	4.8	100
Heyer et al. (160, 122)[20]	41.0	55.3	33.6	68.4						
Kadmon et al. (150, 80)[23]			51.3	12.9					18.8	72.9
Cohen et al. (142, 61)[67]	93.4	28.4	14.8	92.6						

Values are percentages.

Data were available from 10 of the 30 studies that were reviewed to determine the sensitivity (Sens) and specificity (Spec) of the symptoms of cough, dyspnea, wheeze, cyanosis, and stridor for foreign body aspiration. Study size is denoted (*n*, *n*) to represent the total number of patients and the number of patients with an aspirated foreign body, respectively.

REVIEW ARTICLE

CME

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases

Christina W. Fidkowski, MD,* Hui Zheng, PhD,† and Paul G. Firth, MBChB*‡

-88% des corps étrangers ont une localisation bronchique

-52% ont une localisation bronchique droite, et 33% dans la bronche souche gauche.

-12% ont une localisation glottique et trachéale.

REVIEW ARTICLE

CME

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases

Christina W. Fidkowski, MD,* Hui Zheng, PhD,† and Paul G. Firth, MBChB*‡

-Corps étranger radio-opaque dans 11% des cas

-Radio normale dans 17 % des cas

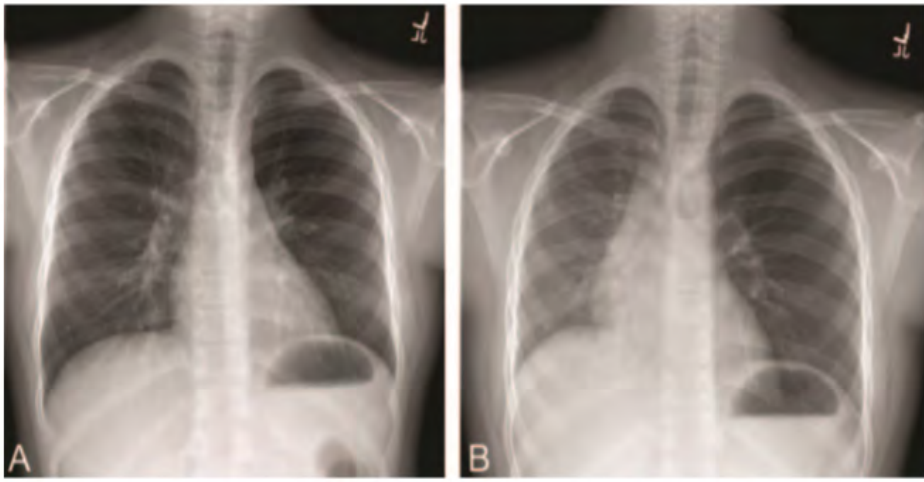


Table 3. Sensitivity (Sens) and Specificity (Spec) of Radiographic Findings for Foreign Body Aspiration

	Air trapping		Atelectasis		Mediastinal shift		Infiltrate	
	Sens	Spec	Sens	Spec	Sens	Spec	Sens	Spec
Tokar et al. (214, 152)[34]	41.7	91.9	12.6	71.0			11.9	74.2
Skoulakis et al. (210, 130)[31]	39.2	91.6	9.2	88.8			0	76.3
Kiyan et al. (207, 153)[25]	63.8	79.6	8.0	94.4			4.4	94.4
Shivakumar et al. (165, 105)[29]	49.5	80.0	22.9	83.3			3.8	41.7
Heyer et al. (160, 122)[20]	62.3	97.4	8.2	97.4	20.5	97.4	18.9	84.2
Kadmon et al. (150, 80)[23]	50.0	90.0			38.8	97.1		
Cohen et al. (142, 61)[67]	49.2	86.4	6.6	96.3	13.1	100	14.8	79.0

Values are percentages.

Data were available from 8 of the 30 studies that were reviewed to determine the sensitivity (Sens) and specificity (Spec) of the radiographic findings of localized air trapping, atelectasis, mediastinal shift, and infiltrate for foreign body aspiration. Study size is denoted (*n*, *n*) to represent the total the number of patients and the number of patients with an aspirated foreign body, respectively.

Evaluation pré- anesthésique

-**What? When? Where?**

Nature du corps ; Date de l'inhalation; Localisation du corps étranger

-**Le retentissement respiratoire du CE**

Les signe d'obstruction;

les signes d'infections;

L'oxygénodépendance

La stratégie anesthésique et opératoire doit faire l'objet d'un **débat précis** au sein de l'équipe:

Avec un opérateur peut être de garde…

- –Que vous ne connaissez pas très bien…
- –Qui ne connais pas très bien le matériel…

Protocole anesthésique

-Pas de prémédication sédative

-Monitorage: PNI, Spo2, ECG, Capno

-Pré-oxygénation-induction

-Mise en place d'une voie veineuse qui marche!

-Pour certains atropine (diminuer les sécrétions)

-Anesthésie locale de glotte par lidocaïne 3mg/kg

-L'anesthésiste laisse la tête au chirurgien ORL et se place à gauche ou à droite de l'enfant.

Le matériel

Age	Poids (en kg)	Bronchoscope	
		Numéro	Diamètre externe
N.Né	< 1,5	2,5	4
N.Né	< 3,5	2,5	4
1 mois	3,5 - 4,5	3	5,1
3 mois	4,5 - 6	3	5,1
6 mois	6 - 10	3,5	5,8
12 mois	10 - 12	3,5	5,8
2 ans	12 - 15	3,5	5,8
3 ans	15 - 17	4	7
4-5 ans	17 - 20	4	7
6 ans	20 - 22	5	7,9
7 ans	22 - 25	6	8,2
8 ans	25 - 28	6	8,2
9 ans	28 - 30	6	8,2
10 ans	30 - 35	6	8,2
12 ans	35 - 40	6,5	/
13-16 ans	40 - 60	7,5	/

Taille du bronchoscope appropriée: moins de complications

Review Article

The anaesthetic consideration of tracheobronchial foreign body aspiration in children

Pinar Kendigelen

Department of Anesthesiology and Intensive Care, Cerrahpaşa Medical Faculty, Istanbul University, Kocamustafapaşa, Istanbul, Turkey
Correspondence to: Dr. Pinar Kendigelen, MD. Department of Anesthesiology and Intensive Care, Cerrahpaşa Medical Faculty, Istanbul University, Kocamustafapaşa, Fatih, 34098, Istanbul, Turkey. Email: pinarken@gmail.com.

- **Détresse respiratoire**: Bronchoscopie urgente : IVA séquence rapide

- **Patient stable**: condition optimales, le matin

-Vérifier à la fin l'arbre laryngo-trachéo-bronchique

-**CE proximal**: VS (inhalatoire ou IV)

-**CE profond, procédure s'avère longue**: VC (curare): diminue le traumatisme par la toux, confort chirurgical

- On peut alors brancher le circuit accessoire sur le canal latéral du bronchoscope
- Entretien: Gaz /IV

Réveil :

*Extraction rapide, sans complication: masque/réveil

*Longue ou complication ou curarisé: IVA/réveil

Post extraction:

* Patient stable, procédure non compliquée: HDJ

*Complication avant/après extraction: Hosp+TTT

A Time Series Observation of Chinese Children Undergoing Rigid Bronchoscopy for an Inhaled Foreign Body: 3149 Cases in 1991–2010

Xu Zhang, Wen-Xian Li, Yi-Rong Cai

Department of Anesthesiology, Eye and ENT Hospital, Fudan University, Shanghai 200031, China

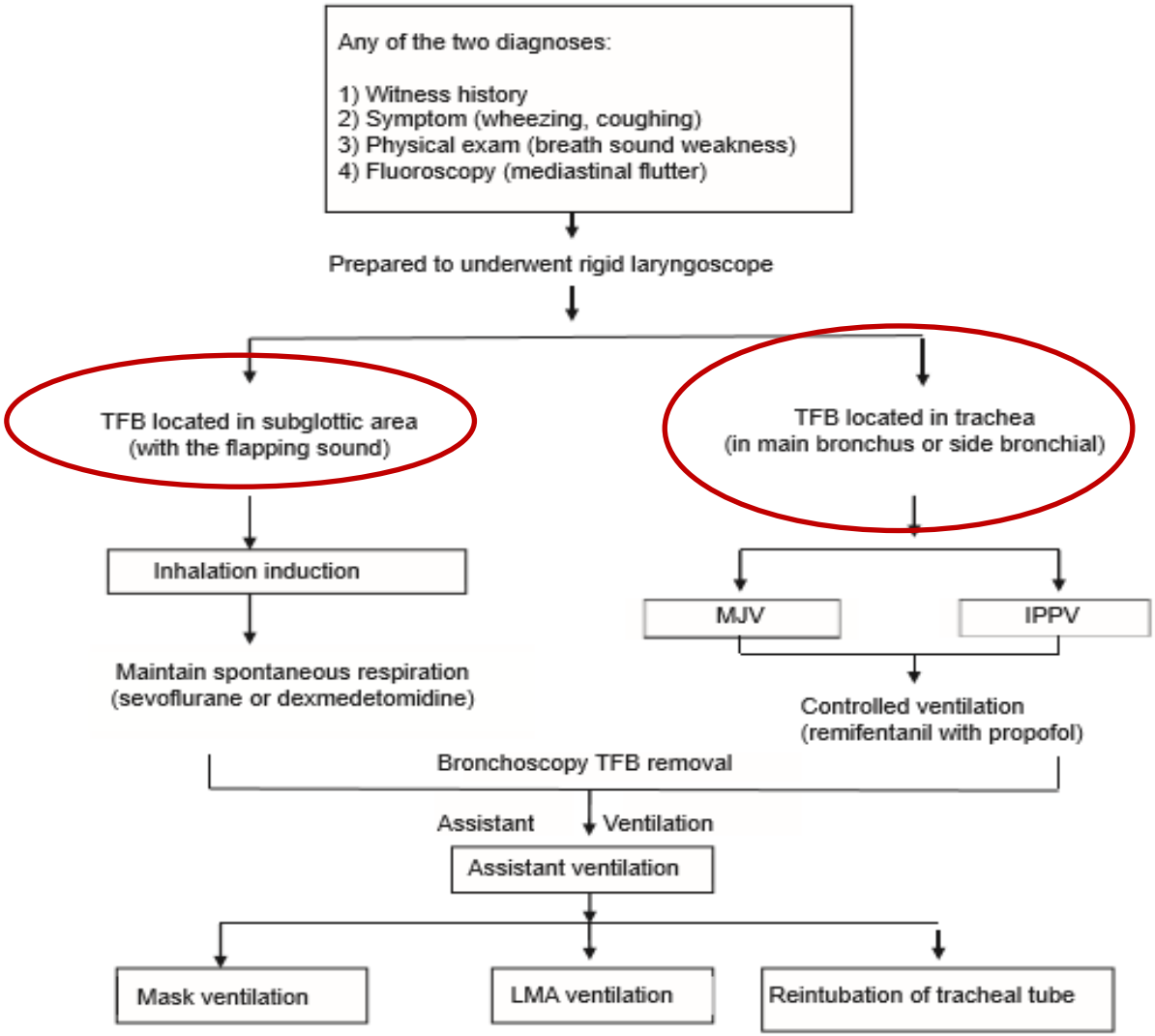


Figure 1: Diagnostic flow chart of TFB aspiration in children treated at the Eye and ENT Hospital. MJV: Manual jet ventilation; IPPV: Intermittent positive-pressure ventilation; TFB: Tracheobronchial foreign body; LMA: Laryngeal mask airway.

-**Même si la SpO2 parait bons** il faut demander régulièrement à l'endoscopiste de revenir dans la trachée et de retirer l'optique pour corriger l'hypercapnie et diminuer les pressions intrathoraciques.

-En cas de **toux ou de blocage respiratoire**, il faut revenir dans la trachée et approfondir l'anesthésie.

-Si la **ventilation semble mauvaise** demander à l'endoscopiste de remettre le bronchoscope au dessus de la carène et de retirer l'optique.

-Si **asphyxie durant l'extraction**: pousser le CE dans une bronche souche et ventiler l'autre poumon.

-En cas de **dégradation brutale** avec difficultés de ventilation, penser au pneumothorax.

-**Le passage de la glotte** lors du retrait du corps étranger peut imposer un approfondissement de l'anesthésie ou une curarisation courte.

Anesthésie locale de glotte et de trachée

Anesth Analg. 1996 May;82(5):1003-6.

Lidocaine plasma concentrations in pediatric patients after providing airway topical anesthesia from a calibrated device.

Sitbon P[1], Laffon M, Lesage V, Furet P, Autret E, Mercier C.

⊕ **Author information**

Abstract

The aim of this prospective study was to evaluate plasma lidocaine concentrations in infants and children after laryngeal spray using a calibrated device. Twenty-one patients aged 3 to 24 mo requiring laryngoscopy or bronchoscopy were included in the study. Anesthesia was induced via a mask with halothane up to 2% in 100% O2. Lidocaine was administered using a 5% lidocaine spray. For patients weighing less than 10 kg, one spray (8 mg of lidocaine) was administered. For those weighing from 10 to 20 kg, two sprays (16 mg) were given. The dose of lidocaine administered ranged between 0.9 and 2.6 mg/kg. Maximum plasma lidocaine concentration (Cmax) was 1.05 +/- 0.55 micrograms/mL (mean +/- SD; range 0.24-2.29 micrograms/mL). With this procedure, we demonstrated the safety of administering lidocaine to children by laryngeal spraying using a 5% sprayer.

Les posologies max autorisées vont de 3 à 4 mg/kg

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

A retrospective study of anesthesia during rigid bronchoscopy for airway foreign body removal in children: propofol and sevoflurane with spontaneous ventilation

Jun Chai[1], Xiu-Ying Wu[1], Ning Han[1], Li-Yin Wang[2] & Wei-Min Chen[1]

1 Department of Anesthesiology, Shengjing Hospital of China Medical University, Shenyang, China
2 Department of Otorhinolaryngology, Shengjing Hospital of China Medical University, Shenyang, China

Table 1 Clinical characteristics of the patients

	Group PropRemi[a] $n = 197$	Group PropSevo[b] $n = 238$
Age (months)	24.2 (17.0–25.0)	23.4 (16.0–27.0)
Male gender	110 (55.8)	134 (56.3)
Body weight (kg)	13.2 (10.5–14.5)	11.9 (10.5–13.5)
Time from event to hospital admission for foreign body (days)	10.2 (2.0–15)	8.9 (1.0–7.0)
Pneumonia before hospitalization, *n* (%)	62 (31.5)	80 (33.6)
Type of foreign bodies, *n* (%)		
Organics	184 (93.4)	228 (95.8)
Inorganic	13 (6.6)	10 (4.2)

The data are presented as mean ± SD, percentage or median and interquartile range.
[a]Maintenance anesthesia with propofol and remifentanyl.
[b]Maintenance anesthesia with propofol and sevoflurane.

Table 3 Adverse events during rigid bronchoscopy in the two groups

Adverse events (case)	Group PropRemi[a] $n = 197$	Group PropSevo[b] $n = 238$
Cough	55 (27.9)	26 (10.9)*
Breath holding (<10 s)	32 (16.2)	13 (5.5)*
Hypoxemia (SpO_2 < 90%)	56 (28.4)	37 (15.5)*
Body movement	43 (21.8)	18 (7.6)*
Laryngospasm	34 (17.3)	16 (6.7)*
Bronchospasm	18 (9.1)	8 (3.4)*
Tracheotomy	1 (0.5)	1 (0.4)
Cardiac arrest	0	1 (0.4)

The data are presented as number of cases and percentage.
[a]Maintenance anesthesia with propofol and remifentanyl.
[b]Maintenance anesthesia with propofol and sevoflurane.
*$P < 0.05$ compared with the other group.

Conclusion: Sevoflurane induction followed by a combination of sevoflurane and continuous infusion of propofol resulted in fewer adverse events than sevoflurane induction followed by TIVA with propofol and remifentanyl during rigid bronchoscopy for airway foreign body removal in children with spontaneous ventilation.

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

Pediatric Anesthesia 24 (2014) 1023–1030

ORIGINAL ARTICLE

Controlled ventilation or spontaneous respiration in anesthesia for tracheobronchial foreign body removal: a meta-analysis

Yuqi Liu[1], Lianhua Chen[2] & Shitong Li[2]

1 Anesthesiology Department of Obstetrics and Gynecology, Hospital of FuDan University, Shanghai, China
2 Department of Anesthesiology, The Affiliated First People's Hospital, Shanghai Jiaotong University, Shanghai, China

Results: From the included studies, 423 subjects received controlled ventilation, whereas 441 subjects received spontaneous respiration. There was no significant difference in the incidence of desaturation between controlled ventilation and spontaneous respiration (odds ratio, 0.70; 95% CI, 0.30–1.63). However, the incidence of laryngospasm was lower when controlled ventilation was performed (OR, 0.27; 95% CI, 0.10–0.76). The operation time (mean difference, −9.07 min; 95% CI, −14.03 to −4.12) was shorter in the controlled ventilation group.

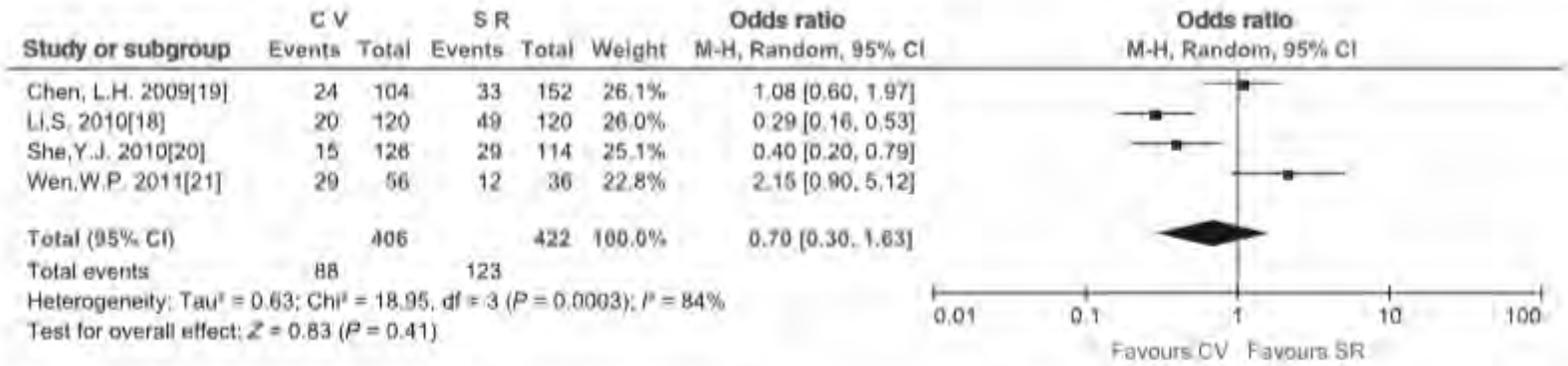


Figure 2 Forest plot for desaturation during foreign body removal. CV, control ventilation; SR, spontaneous respiration.

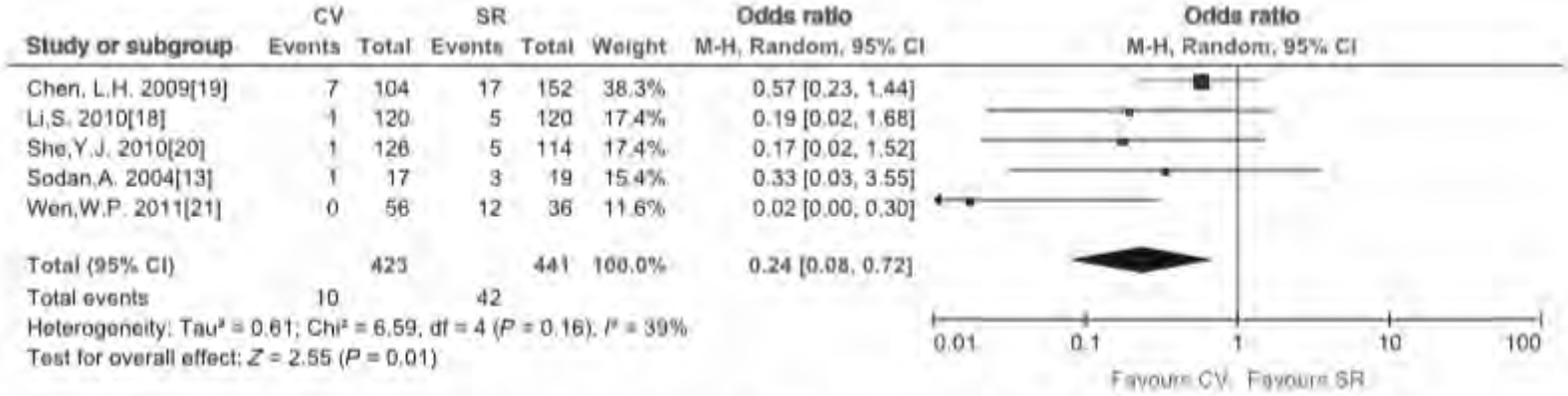


Figure 3 Forest plot for laryngospasm during foreign body removal. CV, control ventilation; SR, spontaneous respiration.

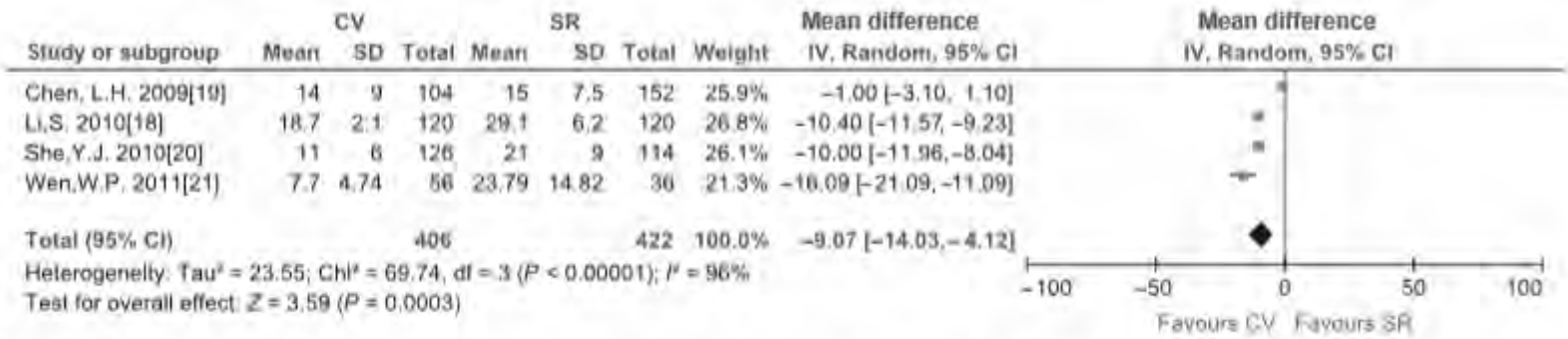


Figure 4 Forest plot for operation time for foreign body removal. CV, control ventilation; SR, spontaneous respiration.

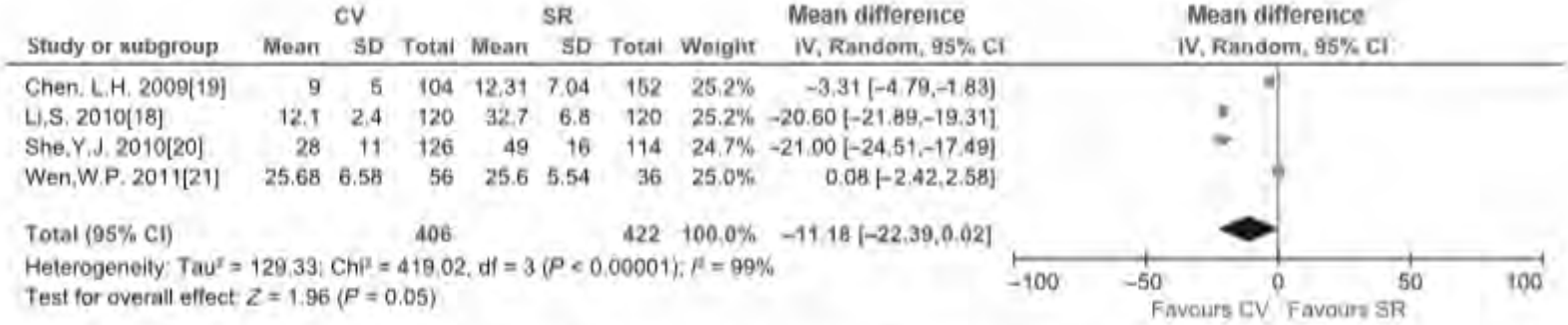


Figure 5 Forest plot for anesthesia recovery time during foreign body removal. CV, control ventilation; SR, spontaneous respiration.

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Anesthesia with sevoflurane and remifentanil under spontaneous respiration assisted with high-frequency jet ventilation for tracheobronchial foreign body removal in 586 children

Sheng Hu, Hai-long Dong, Yan-yan Sun, Dong-fang Xiong, Hao-peng Zhang, Shao-yang Chen & Li-ze Xiong

Department of Anesthesiology, Xijing Hospital, Fourth Military Medical University, Xi'an, Shaanxi, China

Pediatric Anesthesia 22 (2012) 1100–1104

Results: Among 586 patients, the foreign body was successfully removed by rigid tracheobronchoscopy in 558 patients, and no foreign body was found in 28 patients. Laryngospasm was observed during the procedure in five patients. Hypoxemia was observed in 15 patients (2.6%). No severe complications or deaths occurred. The mean operation time was 22 min and the average hospital stay was 2 days.

Conclusion: Inhaled sevoflurane anesthesia combined with remifentanil infusion, with spontaneous respiration assisted by HFJV and topical airway anesthesia, is safe and effective for tracheobronchial foreign body removal.

Ventilation spontanée ou assistée?

The Risk Factors for Hypoxemia in Children Younger than 5 Years Old Undergoing Rigid Bronchoscopy for Foreign Body Removal

Lian-hua Chen, MD, PhD*
Xu Zhang, MD*
Shao-qin Li, MD*
Yu-qi Liu, MD*
Tian-yu Zhang, MD, PhD†
Jun-zheng Wu, MD, PhD‡

Anesth Analg 2009;109:1079–84

Table 2. The Characteristics of Surgery

	Controlled ventilation (CV)		Spontaneous ventilation (SV)	
	MPPV (n = 104)	MJV (n = 128)	TIVA (n = 82)	SIHA (n = 70)
Duration of operation (min)	14 ± 9	15 ± 8	16 ± 8	14 ± 7
Duration of emergence from anesthesia (min)	9 ± 5	9 ± 6	16 ± 7*	8 ± 4
Percentage of cases with FBs removed (%)	90.4	86.7	72*	90
Location of FB (case)				
Main	15	12	7	8
Left	35	43	20	26
Right	43	55	32	29
Both	1	1	0	0
None	10	17	23	7

The data are represented as mean ± so, percentage, or number of cases.

MPPV = manual intermittent positive pressure ventilation; MJV = manual jet ventilation; TIVA = total intravenous anesthesia; SIHA = sevoflurane inhaled anesthesia; FB = foreign body.

* P <0.05 compared with the other three groups.

Table 3. Adverse Events in Different Ventilation and Anesthetic Technique Groups

	Controlled ventilation (CV)		Spontaneous ventilation (SV)	
	MPPV	MJV	TIVA	SIHA
Body movement (%)	2.2	1.2	11.8*	3.2
Hypoxemia (%)	23.4	9.2*	25.5	16.7
Breath-holding (%)	0	0	13*	3.7
Laryngospasm (%)	7.1	3.1	14.5*	6.7
Postoperative airway obstruction (%)	6	4.1	8.2	7.1
Pneumothorax (case)	3	4	2	0
Reintubation (%)	5	0	8	4
Change of ventilation (%)	0	0	10	3

The data are represented as percentage or number of cases.

MPPV = manual intermittent positive pressure ventilation; MJV = manual jet ventilation; TIVA = total intravenous anesthesia; SIHA = sevoflurane inhaled anesthesia.

* P <0.05 compared with the other three groups.

International Journal of Pediatric Otorhinolaryngology 77 (2013) 480–482

Contents lists available at SciVerse ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

An alternative method of management of pediatric airway foreign bodies in the absence of rigid bronchoscopy

Tewodros Tamiru [a,b], Paul E. Gray [a,b], Jonathan D. Pollock [a,b,c,*]

[a] Soddo Christian Hospital, Wolaitta, Soddo, Ethiopia
[b] Pan-African Academy of Christian Surgeons, Ethiopia
[c] Emory University, Department of Surgery, USA

Results: All seven patients presented in respiratory distress and were emergently managed in the operating room. The average age was 2.8 years (6 months–8 years of age). The foreign bodies were successfully removed in all patients. There were no mortalities and all patients were successfully discharged from the hospital.

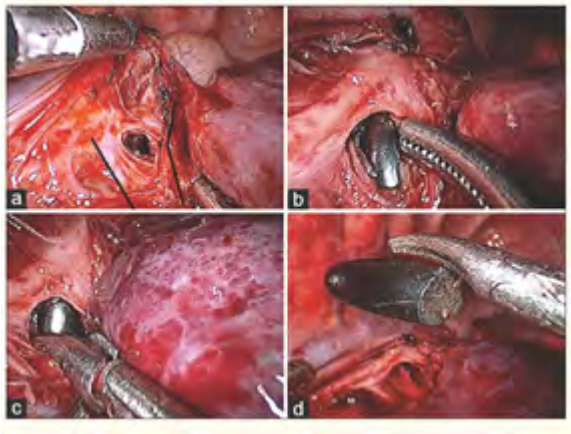
Conclusions: Pediatric airway foreign body aspiration is a life-threatening clinical entity in any setting, but it presents unique challenges in resource-limited settings where rigid bronchoscopy is not available. This report presents one such treatment modality and utilizes a combination of flexible fiberoptic bronchoscopy and tracheotomy to treat such patients.

Thoracoscopic foreign body removal and repair of bronchus intermedius following injury during failed bronchoscopic retrieval

Belal Bin Asaf, CL Vijay, Sukhram Bishnoi, Naresh Dua,[1] and Arvind Kumar

CONCLUSION

Thoracoscopy is a safe and efficient approach for management of patients with aspirated FB in whom initial attempts at removal by rigid bronchoscopy has failed or has caused inadvertent injury to the airway. However, hemodynamic stability of the patient and availability of necessary expertise are mandatory requirements for such endeavors.



Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

CASE REPORT

Anesthetic management of bronchial rupture following extraction of a fishbone from the bronchus after 5 months

Guoping Ma, Jingli Yang & Song Liu

Department of Anesthesiology, Pudong New Area Zhoupu Hospital, Shanghai, China

Pediatric Anesthesia 24 (2014) 544–546

If the injury and leakage are gentle, positive pressure ventilation with muscle relaxants could be considered.

However, **if the injury and leakage are severe**, intubation with a doublelumen tube or unilateral endobronchial tube should be performed with slow induction of anesthesia and spontaneous ventilation

Three teaching points are as follows:

1. Closed chest tube drainage is necessary and may increase the safety of anesthesia management in patients with tracheobronchial rupture, but the safety is not absolute.
2. Further examination is necessary to estimate the extent of injury in patients suspected with tracheobronchial rupture.
3. An appropriate mode of ventilation should be considered according to the extent of leakage in the trachea or bronchus.

International Journal of Pediatric Otorhinolaryngology 78 (2014) 2319–2321

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Case Report

Management of complicated airway foreign body aspiration using extracorporeal membrane oxygenation (ECMO)

Albert H. Park [a,*], David E. Tunkel [b], Erica Park [a], Douglas Barnhart [c], Edward Liu [d], Justin Lee [c], Richard Black [c]

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[b] Department of Otolaryngology-Head and Neck Surgery, Johns Hopkins University School of Medicine, United States
[c] Division of Pediatric Surgery, Department of Surgery, University of Utah, United States
[d] Pediatric Anesthesia, Primary Children's Hospital, United States

Table 1
Summary of case histories.

Patient number	Age of presentation [mo]	Symptoms	Foreign body	Location of foreign body	Timing of ECMO	Outcome
1	8	Increased WOB[a]	Kidney bean	Right bronchus	During endoscopic FB[b] removal	Resolved
2	22	Increased WOB[a]	Almond(s)	Trachea	Before endoscopic FB[b] removal	Resolved
3	24	Increased WOB[a]	Peanut(s)	Left bronchus	Before endoscopic FB[b] removal	Resolved

[a] WOB: work of breathing.
[b] FB: foreign body.

Complications

- Œdème laryngé
- Bronchospasme
- Pneumothorax ou pneumomédiastin
- Troubles de rythme cardiaque
- Hypoxie
- Infection
- Échec bronchoscopie
- Thoracotomie ou trachéotomie
- Arrêt cardiaque/ Décès

Table 4. Morbidity Associated with Bronchoscopy for the Removal of Tracheobronchial Foreign Bodies

Complication	Total *n*
Major nonfatal complications (*n* = 91)	
Severe laryngeal edema or bronchospasm requiring tracheotomy or reintubation[15,19,22,25,27,30,32]	43
Pneumothorax or pneumomediastinum[7,11,15,18,19,22,30,32,33]	27
Cardiac arrest[11,15,25,27]	11
Hypoxic brain damage[20,21]	5
Tracheal or bronchial laceration requiring repair[11,15,27]	5
Other serious complications (*n* = 136)	
Infection[13,19,21,26,32]	58
Failed bronchoscopy requiring thoracotomy (27)[7,8,11,13,15,19,36] or tracheotomy (10)[7,15]	37
Bleeding[15,19,27]	29
Thoracotomy (5)[8,15,19] or tracheotomy (7)[7,32]—not specified	12

of the 9437 children

of these 9437 children

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases. Christina W. Fidkowski et al . Anesth-Analg 2010

Bronchospasme ou laryngospasme

Original Article

Complications of Bronchoscopy for Foreign Body Removal: Experience in 1035 Cases

Leyla Hasdiraz,* Fahri Oguzkaya,* Mehmet Bilgin,* Cihangir Bicer †

From the *Department of Thoracic Surgery and †Department of Anaesthesiology and Reanimation, Medical Faculty, Erciyes University Kayseri, Turkey

Risk Factors	Number of patients
Infection needed aggressive medication	42 (4%)
Hypoxia and bradycardia due to obstruction during bronchoscopy	50 (5%)
Laryngeal edema, laryngeal spasm, bronchospasm needed ventilation support	37 (3.8%)
Trachea bronchial system bleeding	6 (0.6%)
Thoracotomy	6 (0.6%)
Pneumothorax	2 (0.2%)
Pneumomediastinum	1 (0.1%)

- **Fréquente +++ même après le geste**
- Nécessitant le recours à un support ventilatoire+/- bronchodilatateurs

Auteur	Année	Pays	%Bronchospasme
J.Zerella,	1998	Arizona (USA)	2%
L.Hasdiraz	2006	Arabie Saoudite	3.8%
Xu Zhang	1991-2010	Chine	2.05%
C.Fidkowski,	2010	Revue de la littérature 12 979 cas	0.45%

The Risk Factors for Hypoxemia in Children Younger than 5 Years Old Undergoing Rigid Bronchoscopy for Foreign Body Removal

Lian-hua Chen, MD, PhD*
Xu Zhang, MD*
Shao-qin Li, MD*
Yu-qi Liu, MD*
Tian-yu Zhang, MD, PhD†
Jun-zheng Wu, MD, PhD‡

BACKGROUND: Removal of an airway foreign body (FB) is usually performed by rigid bronchoscopy under general anesthesia, but the choice of anesthesia and ventilation techniques varies greatly among anesthesiologists and institutions. Hypoxemia is the most commonly observed adverse event during rigid bronchoscopy. It is influenced by a variety of factors including the patient's medical condition, the type of surgical procedure, and the anesthetic technique. In the current study, we investigated risk factors that statistically correlate with intraoperative or postoperative hypoxemia in young patients undergoing rigid bronchoscopy.

METHODS: From January 2007 to December 2008, 384 children younger than 5-yr-of-age subjected to rigid bronchoscopy for FB removal were included in the study. The detailed clinical information and perioperative adverse events were recorded. Surgical outcomes and incidence of perioperative adverse events were compared among different ventilation modes (spontaneous ventilation, manual intermittent positive pressure ventilation, and manual jet ventilation) and different anesthetic techniques (total IV anesthesia and inhaled anesthesia). An amalgamated dataset was used for the analysis of factors that correlated with perioperative hypoxemia.

RESULTS: In children who received total IV anesthesia with spontaneous ventilation during rigid bronchoscopy, we observed more intraoperative body movement and breath holding, significantly longer duration of emergence from anesthesia, lower percentage of successful FB removal, and more postoperative laryngospasm. Children in the manual jet ventilation group had the least occurrence of intraoperative hypoxemia. Five factors strongly correlated with intraoperative hypoxemia. Younger age, plant seed as the type of FB, longer surgical duration, pneumonia before the procedure, and spontaneous ventilation mode significantly increased the risk of intraoperative hypoxemia, whereas manual jet ventilation mode decreased it. Two factors were associated with postoperative hypoxemia: plant seed as a FB and prolonged duration of emergence from anesthesia.

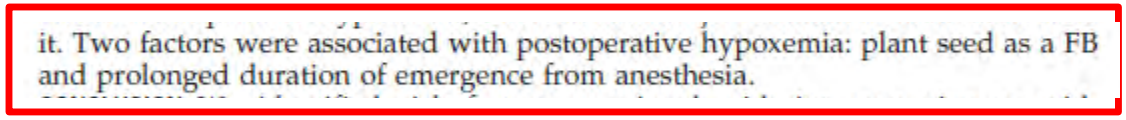
CONCLUSION: We identified risk factors associated with intraoperative or with postoperative hypoxemia in rigid bronchoscopy which included patient age, type of FB, duration of surgical procedure, pneumonia before the procedure, ventilation mode, and duration of emergence from anesthesia. These results provide evidence that will help clinicians to reduce the incidence of hypoxemia in high-risk children.

(Anesth Analg 2009;109:1079–84)

- Âge <24 mois
- Nature du CE: graines de plantes
- Durée procédure longue> 15 min
- Pneumonie avant le geste
- Mode VS

Hypoxie/ désaturation

- Même en post-opératoire: surtout si
  - corps étranger:graines de plantes
  - Réveil retardé
- Désaturation plus rapide chez l'enfant++
- Complications neurologiques au long terme si hypoxie prolongée


it. Two factors were associated with postoperative hypoxemia: plant seed as a FB and prolonged duration of emergence from anesthesia.

Chen LH, Zhang X, Li SQ, et al. The risk factors for hypoxemia in children younger than 5 years old undergoing rigid bronchoscopy for foreign body removal. Anesth Analg 2009;109:1079-84.

Pneumothorax / pneumomédiastin/ emphysème

- Peut être grave++: collapsus cardiovasculaire
- Peut se voir au cours ou après le geste
- Se manifeste par une dyspnée, confirmé à la Rx thorax
- Indépendant du mode de ventila utilisé

Auteur	Année	Pays	Incidence
Xiao-Jian Yang	2010-2015	Chine	1.5%
Xu Zhang	1991-2010	Chine	0.3%
A.Williams	2002-2011	Inde	0.7%
L.Hasdiraz	2006	Arabie Saoudite	0.2%

A Time Series Observation of Chinese Children Undergoing Rigid Bronchoscopy for an Inhaled Foreign Body: 3149 Cases in 1991–2010

Xu Zhang, Wen-Xian Li, Yi-Rong Cai
Department of Anesthesiology, Eye and ENT Hospital, Fudan University, Shanghai 200031, China

Table 1: Incidence of severe postoperative complications among patients with inhaled tracheobronchial foreign body inhalation by ventilation mode in 2005-2010 (n=1728)

Complications	Ventilation mode (%)		RR (95% CI)	P
	CV group (n=1501)	SV group (n=227)		
Severe hypoxemia	77 (5.1)	11 (4.8)	0.68 (0.42–1.85)	0.214
Laryngeal edema	21 (1.4)	3 (1.2)	0.43 (0.23–1.25)	0.521
Complete laryngospasm	27 (1.8)	8 (3.5)	0.65 (0.53–1.76)	0.256
Pneumothorax	7 (0.47)	1 (0.4)	0.23 (0.14–1.47)	0.843
Atelectasis	7 (0.47)	1 (0.4)	0.24 (0.11–1.34)	0.561
Death	4 (0.27)	0	0.54 (0.26–1.73)	0.053

CV: Controlled ventilation; SV: Spontaneous ventilation; RR: Relative risk; CI: Confidence interval.

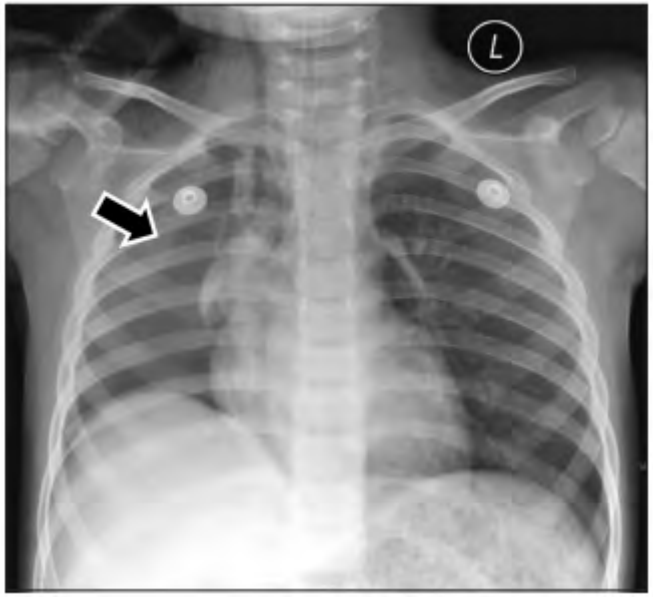
Original Article

Pneumomediastinum Secondary to Foreign Body Aspiration: Clinical Features and Treatment Explorement in 39 Pediatric Patients

Xiao-Jian Yang[1], Jie Zhang[1], Ping Chu[2], Yong-Li Guo[2], Jun Tai[1], Ya-Mei Zhang[1], Li-Xing Tang[1], Xin Ni[1,2]

[1]Department of Otolaryngology-Head and Neck Surgery, Beijing Children's Hospital, Capital Medical University, Beijing 100045, China
[2]Beijing Key Laboratory for Pediatric Diseases of Otolaryngology-Head and Neck Surgery, Beijing Pediatric Research Institute, Capital Medical University, Beijing 100020, China

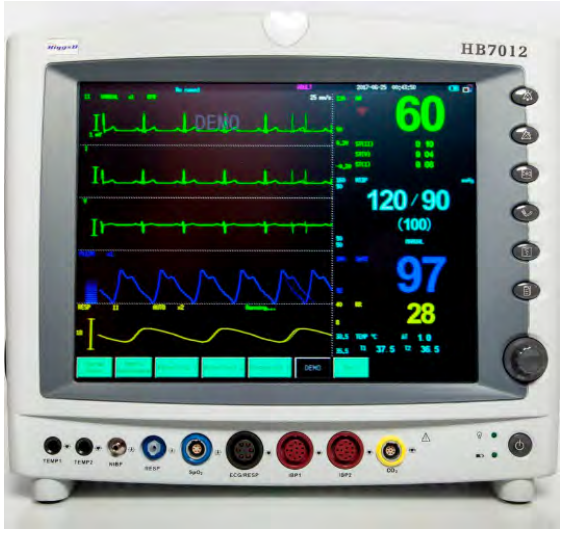
Pneumomédiastin , emphysème sous cutané massif et pneumothorax bilatéral compressif

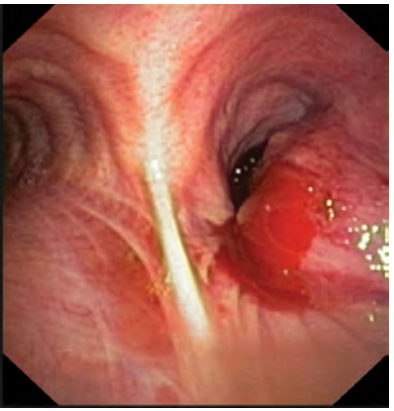


Pneumomédiastin avec pneumothorax droit

Troubles de rythme cardiaque

- Bradycardie+++
- Secondaires à l'hypoxémie; à la douleur; aux manipulations
- +/- Atropine en prémédication





Saignement / érosion muqueuse

- Gêne la visualisation
- Souvent gérée par lavage et aspiration
- Ne nécessite pas de bilan d'hémostase préalable
- Rarement :hémorragie foudroyante (perforation bronchique avec lésion artérielle de voisinage)

Clinical Case Report

Medicine

OPEN

Foreign body aspiration as a cause of cryptogenic hemoptysis in a child

A case report

Li Qiu, MD[a,b], Yiheng Zan, MD[a,b], Lin Zhong, MD[a,b], Hanmin Liu, MD[a,b], Qingfen Tao, RN[a], Lina Chen, MD, PhD[a,b,*]

Œdème laryngé

- Un stridor /Œdème laryngé (9.3%)
- Risque significatif de ré-intubation

- Nébulisations à l'adrénaline+ corticothérapie
- observation en SSPI pendant 4 heures de l'état respiratoire et cardiaque

Complications tardives: Granulome

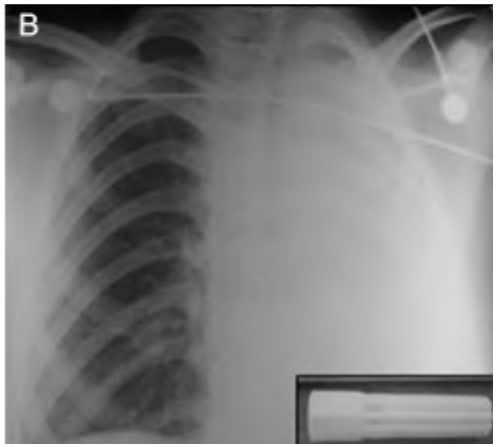
Tabla 3 Complicaciones por cuerpo extraño en la vía aérea

Complicaciones	Pacientes (N = 56)	%
Neumonía	18	32,1
Granuloma	15	26,8
Erosión mucosa	9	16,1
Atelectasia	7	12,5
Edema laríngeo	6	10,7
Intubación	5	8,9
Paro respiratorio	3	5,4
Bronquiectasias	2	3,6
Convulsiones	2	3,6
Hemoptisis	2	3,6
Estenosis subglótica	2	3,6
Derrame pleural	2	3,6
Neumotórax	1	1,8
Neumomediastino	1	1,8
Enfisema subcutáneo	1	1,8
Estenosis bronquial	1	1,8
Edema agudo de pulmón	1	1,8

- Complication fréquente
- Peut entraîner une obstruction aérienne et une dyspnée haute
- Parfois trachéotomie nécessaire

Rodríguez H, et al. Complicaciones debido a la aspiración de cuerpos extraños en niños. Acta Otorrinolaringol Esp. 2015.

Atélectasie



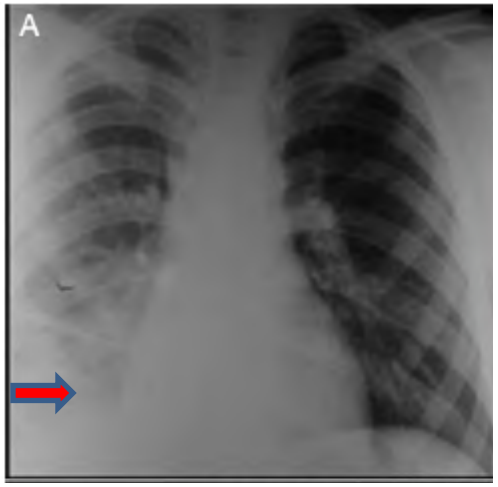
- Peut se voir jusqu'à 10.7% des cas (1)
- Cause ajoutée d'hypoxémie
- Se lève souvent après retrait du CE et ventilation à pression positive en per-opératoire

(1)

Original Article
Iranian Journal of Otorhinolaryngology, Vol.29(3), Serial No.92, May 2017

Laryngo-Tracheo-Bronchial Foreign Bodies in Children: Clinical Presentations and Complications

Hazem-Saeed Amer[1], *Mohammad-Waheed El-Anwar[1], Ashraf Raafat[2], Mohamed AlShawadfy[1], Ehab Sobhy[3], Samir-Attia Ahmed[4], Ahmed-MA Maaty[5]



Infection

- **Pneumonie** en premier lieu (> 32% des cas)
- Empyème ou abcès pulmonaire
- Si ATB: 3germes

Positive culture results (regardless of oropharyngeal flora status).

Bacteria/fungi	#	% of total	% of positive cultures
Haemophilus influenzae	4	12%	27%
Moraxella (Branhamella) catarrhalis	4	12%	27%
Streptococcus pneumoniae	4	12%	27%
Mixed anaerobes	3	9%	20%
Staphylococcus aureus	2	6%	13%
Pseudomonas aeruginosa	1	3%	7%
Fusarium species	1	3%	7%
Prevotella (Bacteroides) oralis	1	3%	7%
Candida albicans	3	9%	20%
Aspergillus glaucus group	1	3%	7%

The bacterial species associated with aspirated foreign bodies in children Maayan Gruber et al. Auris Nasus Larynx (2017),

Autres …

- Fistule trachéo-oesophagienne
- Dilatation des bronches avec surinfections à répétition

Journal of Surgical Case Reports, 2018;2, 1–3

doi: 10.1093/jscr/rjy022
Case Report

CASE REPORT

Tracheo-oesophageal fistula: a delayed complication of missed inhaled magnetic toys

Wanding Yang*, Michael Jones, and Sameer Mallick

Department of Otorhinolaryngology, Head and Neck Surgery, Leicester Royal Infirmary, Infirmary Square LE1 5WW, UK

Mortalité

- Le taux de morbi-mortalité varie largement selon les séries: sous-estimation.
- Secondaire le plus souvent à l'hypoxie++

Table 5. Mortality Associated with Bronchoscopy for the Removal of Tracheobronchial Foreign Bodies

Cause of death (n = 43)	of the 10,236	n
Cardiac/respiratory arrest		37
Hypoxic arrest at presentation[7,9,11,22,27,32,36]		15
Arrest due to tracheal foreign body[19,26]		5
Cardiac arrest during bronchoscopy, not specified[10,11]		3
Postoperative arrest[19,29]		3
Hypoxic arrest due to shifting foreign body[22]		2
Rupture of puss under pressure behind foreign body[19]		1
Respiratory arrest due to inhaled cement powder[13]		1
Not specified[15]		7
Bronchial rupture[15]		2
Severe bronchospasm[15]		1
Postoperative infection[11]		1
Multiorgan failure[21]		1
Not specified[18]		1

Auteur	Année	Pays	Mortalité
H.S.Amer	2013-2015	Egypte	0%
A.Williams	2002-2011	Inde	0.7%
Xu Zhang	1991-2010	Chine	0.1%
C.Fidkowski	2010	Revue de la littérature 12 979 cas	0.4%
Christopher A	2014-2015	USA	0.3%

The Anesthetic Considerations of Tracheobronchial Foreign Bodies in Children: A Literature Review of 12,979 Cases. Christina W. Fidkowski et al . Anesth-Analg 2010

La sortie

- À 4h en absence de complications
- La durée de séjour peut se prolonger par l'apparition de complications et notamment si:
  - durée de bronchoscopie >57 min
  - hypoxémie post-opératoire notamment en cas d'inhalation de graines de plantes
  - Aggravation d'images radiologiques

Ciftci AO, Bingol-Kologlu M, Senocak ME, Tanyel FC, Buyukpamukcu N. Bronchoscopy for evaluation of foreign body aspiration in children. J Pediatr Surg 2003;38:1170–6

Conclusion

-Le partage des voies aériennes impose une parfaite entente et **collaboration** entre médecin Anesthésiste et Chirurgien ORL.

-Se lancer dans une bronchoscopie c'est **anticiper** toutes les techniques avec sécurité maximale pour sortir ce corps étranger…

-Prévention+++