Bronchoscopy in Children With Foreign Body Aspiration

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Introduction and objectives: Aspiration of foreign body presents a high incidence of mortality during the paediatric life period. Family suspect and detection of specific symptoms and signs determine the need of bronchoscopy. The objective of this study is to establish the clinical parameters that indicate foreign body in airway.
Methods: Retrospective study in 44 children with foreign body aspiration. We reviewed age, sex, family suspect, blood analysis, chest x-ray, time to consulting, location, type, complications, and time to discharge.
Results: Decisive clinical factors that indicate a foreign body in airway are family suspect and respiratory clinic. Findings after auscultation and chest x-ray support suspect, but final diagnostic only can be made after bronchoscopy. Bronchoscopy with foreign body removal was performed during first 24 hours in 86.36% of patients, and founded that those with delayed diagnosis had increased morbidity.
Conclusions: Family's suspect is the most important parameter that indicates foreign body located in airway. Bronchoscopy performed during the first hours avoids morbidity. This is a secure technique when performed in adequate place with trained personnel.

Key words: Foreign body. Airway. Rigid bronchoscopy.

Broncoscopia en población infantil tras aspiración de cuerpo extraño
Introducción y objetivos: La aspiración de cuerpos extraños supone en la edad pediátrica una importante causa de mortalidad. La sospecha familiar y la detección de síntomas y signos de riesgo determinan la necesidad de realizar una broncoscopia. El objetivo de este trabajo es determinar qué parámetros ofrecen más sensibilidad para detectar un cuerpo extraño obstructivo.
Métodos: Estudio retrospectivo en 44 pacientes con sospecha de cuerpo extraño en la vía aérea. Se estudia la edad y el sexo, la sospecha familiar, la clínica, la analítica, la radiografía de tórax, el tiempo medio hasta la consulta hospitalaria, la localización del cuerpo extraño, el tipo de cuerpo extraño, las complicaciones y la estancia hospitalaria.
Resultados: Los factores más determinantes que indican la presencia de un cuerpo extraño fueron la sospecha familiar y la clínica. Los hallazgos tras la auscultación y la radiografía de tórax dan apoyo a la sospecha, aunque el diagnóstico final sólo se establece tras la realización de la broncoscopia. Se realizó broncoscopia en las primeras 24 h, y se extrajo cuerpo extraño en el 86,36% de los pacientes; en los casos en que se retrasó el diagnóstico hubo aumento de la morbilidad.
Conclusiones: La sospecha clínica familiar inicial es el factor fundamental para llegar al diagnóstico. La realización de esta técnica en las primeras horas tras la sospecha evita morbilidad. La broncoscopia es una técnica segura siempre que sea realizada en un medio adecuado y por personal entrenado.

Palabras clave: Cuerpo extraño. Vía aérea. Broncoscopia rígida.

INTRODUCTION

The aspiration of a foreign body represents an important cause of morbidity and mortality during childhood.[1] Its consequences depend crucially on the degree of obstruction. Thus, some of them are resolved spontaneously after a coughing episode or through assisted manoeuvres that favour expulsion, and the rest arrive at the emergency services of hospitals with varying degrees of suspicion among relatives and clinical signs. In these cases, enquiries of the relatives, an exhaustive examination and a series of additional tests will determine the indication of a bronchoscopy.

On those occasions when the family does not suspect the aspiration of a foreign body, diagnosis is delayed which

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Received November 11, 2007.
Accepted for publication January 28, 2008.

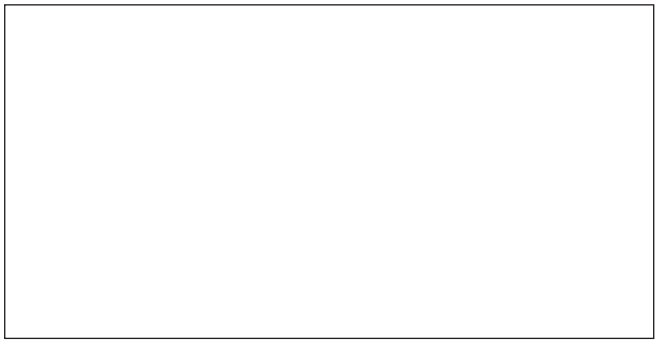

Figure 1. Set comprising bronchoscopes, optics, and tweezers.

leads to a chronic respiratory syndrome. In such cases the definitive diagnosis can be delayed until the onset of complications. It is therefore important to promote among the general population a series of preventive measures and actions for responding to suspected mechanical obstruction of the airway.

Despite the fact that rigid bronchoscopy is a safe and useful technique for extracting foreign bodies from the airway in paediatric patients, it is not without risks and complications have been described, such as pneumothorax, pneumomediastinum, haemoptysis, laryngeal oedema, bronchial stenosis, tracheobronchial fistulae, and even death of the patient.[2] Therefore, there must be a high degree of suspicion to indicate the examination.

The objective of this study is to establish what are the signs and symptoms that determine the need for a bronchoscopy when aspiration of a foreign body is suspected in childhood.

METHOD

A retrospective review of 44 patients is presented, all of them treated at the Paediatric Emergency Department (under 14 years) of the Hospital Universitario Juan Canalejo in A Coruña, with a suspected foreign body in the airway. The period of study covers 11 years, between 1995 and 2006.

The variables of the study are age and gender, relatives' suspicions, clinical signs, analyses, chest x-ray, average time to hospital consultation, location of foreign body, kind of foreign body, complications, evolution after bronchoscopy, and hospital stay.

Of the 44 cases admitted with a suspected foreign body, 3 expelled the foreign body spontaneously. In addition, another 2 improved after corticosteroid therapy and bronchodilators and therefore did not require further interventions.

In the 39 remaining cases, rigid bronchoscopy was performed with general anaesthesia. A Karl Storz bronchoscope with a Storz optic of 0° and various tweezers were used. Depending on the diameter of the airway, the 3.5 to 4 mm tweezers proved most useful. The tweezers should allow the introduction of the optics through the work channel (Figure 1). The optic is connected to a camera for the magnification of the image and its display on a monitor.

Microsoft Excel and Microsoft Word 2003 software have been used for processing the data.

RESULTS

The 44 patients came to the paediatric emergency department of our hospital and after initial suspicion were admitted to the intensive care unit.

Of the total number of children admitted, 27 (58.7%) were male and 17 (41.3%) female.

Regarding the incidence by age, we distinguish 3 age intervals; the most prominent, with 68.18% of the total (n=30), was that under 36 months. The second incidence peak corresponds to the age group between 36 and 84 months, with 13.6% (n=6), and the third between 84 and 144 months, with 18.18% (n=8). Thus, two thirds of the total correspond to children under 5 years, with a subsequent rise although less marked, between 7 and 14 years.

Of the total number of children admitted, bronchoscopy with extraction of the foreign body was performed on 86.36% (n=38), all during the first 24 hours following admission. Of the total, 3 patients spontaneously expelled the foreign body after a coughing episode; 2 improved with medication and did not require bronchoscopy; and finally, 1 received a bronchoscopy in which no foreign body was found.

A percentage of 81.82% (n=36) of patients arrived at the emergency service in the first 12 hours with family suspicions of foreign body. The remaining 18.18% (n=8) came late without suspicion of aspiration, thus delaying consultation in the emergency department between 1 and 4 months. Of these, 50% (n=4) were initially diagnosed with common cold. This group of patients diagnosed late was the one with the most important complications, including 2 cases of pneumonia and 1 case diagnosed with pneumopericardium, pneumomediastinum, and pneumothorax.

The most characteristic symptom was coughing, which was present in 52.27% (n=23); other related symptoms were choking in 36.3% (n=16), breathing difficulty in 22.68% (n=10), cyanosis in 13.6% (n=6), and wheezing in 9.1% (n=4). The remaining 4.5% (n=2) showed no symptoms and came only with suspicion of aspiration.

The analysis carried out did not reveal significant alterations in the acute stage. Despite this, of the 8 patients who came late, 62.5% (n=5) presented leukocytosis with fever.

Alteration in the arterial oxygen saturation levels was only found in 9.09% (n=4) of patients.

The lung auscultation revealed hypoventilation in 54.5% (n=24), wheezing in 38.6% (n=17), snoring and crepitation in 25% (n=11), and tugging in 13.6% (n=6). The remaining 22.7% (n=10) resulted in normal auscultation. This test in our series is presented with a sensitivity of 82.1% and specificity of 50%.

All patients underwent a chest x-ray in inspiration and expiration, which were normal in 22.72% (n=10). In addition,

indirect signs of emphysema appeared in 43.18% (n=19) (Figure 2), atelectasis in 11.36% (n=5), and signs of alveolar condensation in 15.9% (n=7). A radio-opaque foreign body was only found in 9.09% (n=4). In our series, chest x-ray showed a sensitivity of 84% and a specificity of 66% compared to the emergence of indirect signs.

The bronchoscopic examination was performed in all cases before the first 24 hours following admission. A percentage of 12.82% (n=5) required a second intervention, which took place in the following 24-48 hours. Of these patients, 2 correspond to the cases diagnosed after 1 month. The other 3 cases came between the third and seventh day after the aspiration. In all these cases the family did not suspect the existence of a foreign body. Only 1 patient required a third examination, and it was a case which arrived 1 month after the aspiration incident.

All cases were resolved with rigid bronchoscopy; none required open surgery.

Of the total aspirated material, 61.3% (n=27) corresponded to organic material in the form of nuts, of which the most common was the peanut. This type of material was found mainly in the first age peak, 1-36 months. Another 25% (n=11), corresponded to inorganic materials; the most frequent being pen caps, but pins, small fragments of stone, and even a tooth were also detected.

Regarding the location, it was more frequent in the right main bronchus, with 40.9% (n=18), followed by the left main bronchus in 36.36% (n=16), the carina in 6.8% (n=3), and only in 1 case was the foreign body located in the trachea.

After the bronchoscopy, 69.23% (n=27) of patients were asymptomatic. Up to 30.76% (n=12) showed some sign of hypoventilation, which disappeared in the following days with medication.

A post-bronchoscopy control radiography was carried out in all cases, which showed normalization in 76.9% (n=30). In up to 20.51% (n=8) some degree of segmental residual atelectasis remained, which was also resolved with medication.

The average length of stay was 4.07 days; patients who were admitted later had a longer stay, although in general an extended stay did not usually occur and only in 3 of these late diagnosis cases was it delayed up to 10-12 days.

Figure 2. Radiological sign of right lung entrapment.

DISCUSSION

The importance of a foreign body lodged in the airway depends on several factors, including its nature, size, location, and, most importantly, the degree of obstruction caused. In most cases this is an acute episode in which the family suspects that the child has aspirated a foreign body and then displays some type of respiratory clinic. Thus, we have seen that the 2 fundamental and most sensitive factors for which the patients attended were the relatives' suspicion of aspiration and some kind of respiratory clinical signs.[3-5] Likewise, we noticed that the diagnosis of patients in whom the relatives' suspicion is not firm may be delayed up to months, and such was the case for 8 patients; in half of them there was confusion with other respiratory obstructive episodes, pneumonia, or bronchial hyperreactivity episodes. This fact, in addition to delaying the diagnosis, hinders the endoscopic examination by the appearance of inflammatory formations in the form of oedema and granulations. In these cases, the removal of the foreign body may be hindered or prevented, not only because of the difficulty in locating the foreign body, but also by the onset of haemorrhages when handling them. The most sensible approach in such cases is to conclude the first examination and treat the patient with steroids and antibiotics, and then try again after 24-48 hours.[3,4] Therefore, the long-term consequences of a foreign body in the airway which is not diagnosed can be fatal, and can even lead to a need for open surgery to extract it.[2]

With regard to clinical presentation, we can talk about 3 phases: a first in which signs appear immediately after the aspiration time, in which the most characteristic feature is a sudden episode of coughing with choking and difficulty in breathing, a second phase, varying in length from minutes to hours, dependent on several factors among which the location, degree of obstruction and local reaction generated stand out as the most important (the patient may be asymptomatic in this phase), and finally a third phase in which symptoms appear as a result of a local reaction, again in the form of sudden coughing and breathing difficulty.[3,6]

With regard to physical examination, we found that the most characteristic fact is hypoventilation of one of the lungs, which is consistent with other studies consulted.[2,4] By contrast, bilateral hypoventilation often reflects a chronic obstructive inflammatory process, which is usually accompanied by snoring or wheezing, although it does not rule out the existence of an obstructing body in the trachea or carina. Despite the fact that most patients studied presented some type of alteration in auscultation, we found that normal examination does not discard it.

With respect to imaging tests, chest x-ray showed acceptable sensitivity, with low specificity. Therefore, on suspicion of this kind of episode, it must always be done in inspiration and expiration, as it is the most sensitive technique when we referring to the indirect signs of obstruction. Obstructive emphysema is the most frequent sign of air entrapment, found in our series as well as in other work reviewed.[3,6] On occasions, this technique is complicated to perform in children, and their sensitivity may be increased if practised in lateral decubitus and phases of inspiration and expiration.[3]

In accordance with other work reviewed, we have found as the most common location the primary right bronchus in connection with more vertical, wider and shorter anatomical disposition.[7] Similarly, their nature varies depending on the age of the patient; during the first years of life it is more in relation with the immaturity of the swallowing system and there is a predominance of nuts. Conversely, as the children grow, interest in their external surroundings increases, and in relation with schooling, the leading cause of the aspirative phenomena becomes pen caps.[5,8]

On the bronchoscopy technique, the possibility has been described in the literature of carrying out a prior flexible bronchoscopy, which in theory is less traumatic, especially when in diagnostic doubt.[5,9] As we noted in our casuistry, no complications rose from rigid bronchoscopy, so we prefer this technique at an early stage. The examination with flexible fibrobronchoscope would only add time to the operation, with the impossibility of carrying out the removal of the foreign body.

From all this, the protocol for action against a foreign body lodged in the airway should include admission to the ICU, enquiries of relatives, auscultation, and chest x-rays. If the relatives' initial suspicion is strong and the clinical presentation is consistent, bronchoscopy must be indicated even if the radiography is negative. In doubtful cases, the patient must be admitted and treated with steroids, bronchodilators, and antibiotics. If he or she improves, we can observe the patient to monitor the clinical symptoms with auscultation and a new radiography; and in the event of an aggravated respiratory condition, we can proceed with the bronchoscopy.

CONCLUSION

The relatives' suspicion of foreign body aspiration, respiratory clinical signs, auscultation, and chest x-ray are the key factors that lead us to indicate a bronchoscopy in childhood age. Of these, the most indicative is always the family's suspicion of an aspiration incident.

The completion of the bronchoscopy in the first 24 hours facilitates the examination and avoids complications.

Rigid bronchoscopy is preferable for these patients and requires trained personnel to be carried out. The co-ordination of the paediatric ICU, otolaryngology, and anaesthesia services is essential to achieve the maximum profit from this technique.

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