Bronchoschopy should always be performed in children on suspicion of foreign body aspiration

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ABSTRACT

INTRODUCTION: Foreign body aspiration (FBA) can have a fatal outcome, and the diagnosis is challenging since symptoms and signs may vary. We therefore investigated whether it was possible to identify predictors indicating the presence of a foreign body.

MATERIAL AND METHODS: The medical records of children undergoing bronchoscopy at Odense University Hospital for suspected FBA in the period from 1977 to 2010 were reviewed and analyzed.

RESULTS: A total of 143 children underwent bronchoscopy due to suspected FBA. The medical records of 137 of these children were accessible. Their median age was 1.84 years, 62.8% were male and foreign bodies were found in 76 cases (55.5%). The only variable that statistically significantly predicted the presence of a foreign body was a radiologic finding (any abnormal chest X-ray or fluoroscopy) (p = 0.023). A foreign body was found in 22 out of 47 (46.8%) patients with no radiologic findings and in three of 11 (27%) patients with neither symptoms at admission nor radiologic or physical findings.

CONCLUSION: Parental suspicion of an FBA indicates acute bronchoscopy in children regardless of signs, symptoms and findings.

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Foreign body aspiration (FBA) is potentially fatal. In previous studies, mortality rates have ranged from 0% to 3%. Generally, the cause of death was asphyxiation [1-3]. Severe complications after bronchoscopy are rare and most are caused by the foreign body itself [2, 4, 5]. History, symptoms, physical and radiologic findings cannot rule out an FBA [6-9]. Some studies have revealed a high specificity for radiologic signs [7, 9] and oxygen saturation [7], although the latter finding is based on a very sparse data material. Symptoms and signs vary and may be absent at admission [7, 9]. An FBA usually initially presents as severe cough, cyanosis and/or stridor, which later progress into an asymptomatic state. The aim of this study was to investigate whether symptoms, physical examination and/or radiological findings can be used as predictors of FBA, to assess the management of children with suspected FBA in hospital and to describe the type, localization, mortality and complications of an FBA.

MATERIAL AND METHODS

We performed a retrospective review of medical charts of children aged 0-18 years who underwent bronchoscopy for suspected FBA at the ENT Department, Odense University Hospital (OUH) from 01.01.1977 to 31.12.2010. The data were found by searching through the medical charts of all children who underwent bronchoscopy including those who underwent the procedure on suspicion of an FBA. Since this was the inclusion criterion, some children with a foreign body in the upper oesophagus were included if they had a bronchoscopy for suspected FBA. In statistical analyses, both foreign bodies in the airways and in the upper oesophagus were considered an event, since the latter situation sometimes mimics an FBA. We collected data on patient age, gender, time from hospitalization to bronchoscopy, type and localization of foreign body, cough and respiratory distress at aspiration, symptoms and physical findings at hospitalization, pre-bronchoscopy radiologic findings, bronchoscopic or oesophagoscopic findings and complications. These data were entered into a spreadsheet (Microsoft Excel 2007). Symptoms and physical findings at admission included cough, dyspnoea, cyanosis, fever, respiratory distress and murmurs at auscultation. Radiologic findings were defined as abnormal chest X-ray and/ or fluoroscopy.

According to Danish law, patient consent was not necessary since this was a retrospective study that did not involve variables with sensitive personal information.

Statistical analysis was performed using the Pearson uncorrected χ^2 -test to evaluate the correlation between a variable (gender, radiologic findings, etc.) and the evidence of a foreign body revealed by broncho-/oeso-phagoscopy. A null-hypothesis stating no association between a variable and evidence of foreign body was used. Two-sided tests were used and p values below 0.05 were considered statistically significant.

Trial registration: not relevant.

RESULTS

Medical charts were available for 137 of 143 patients. Some of the above mentioned data were not available for all 137 cases as may be expected in a retrospective study.

ORIGINAL ARTICLE

Department of ENT Head & Neck Surgery, Odense University Hospital

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predicting the finding of a foreign body.

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TABLE 1

FB found, Sensitivity, Specificity, Variables % (n/N) mean (CI) mean (CI) p-value^a 0.63 (0.56-0.71) 0.38 (0.28-0.47) 0.917 Gender (n = 137)Male 56 (48/86) Female 55 (28/51) Age (n = 137) 0.55 (0.48-0.63) 0.39 (0.30-0.50) 0.525 < 2 years 53 (42/79) \geq 2 years 59 (34/58) Ingestion^b of FB (n = 137) 0.59 (0.51-0.67) 0.51 (0.41-0.61) 0.241 Observed 60 (45/75) Not observed 50 (31/62) Cough at onset (n = 137) 0.70 (0.62-0.77) 0.36 (0.27-0.45) 0.472 Yes 58 (53/92) 51 (23/45) No 0.62 (0.54-0.70) 0.38 (0.28-0.48) 0.957 Respiratory distress at onset (n = 137) 55 (47/85) Yes 56 (29/52) No 0.204 Symptoms or findings^c at admission (n = 122)^d 0.56 (0.46-0.64) 0.56 (0.46-0.66) Present 59 (36/61) Absent 48 (29/61) Auscultation at admission (n = 122)^d 0.49 (0.40-0.58) 0.61 (0.51-0.71) 0.238 Abnormal 59 (32/54) Normal 49 (33/68) Radiologic examination (n = 88)^d 0.57 (0.47-0.66) 0.68 (0.54-0.80) 0.023 Abnormal 71 (29/41) Normal 47 (22/47)

CI = confidence interval; FB = foreign body.

a) p < 0.05 was considered statistically significant.

b) a witness observed that a FB was put into the mouth.

c) Symptoms include all symptoms and physical findings at admission except those found in auscultation.

d) Since this was a retrospective review of medical charts, all data were not obtainable for all patients, and only some had undergone radiologic examination.

TABLE 2

Type of foreign bodies found (N = 76).

	No. of patients	%
Nuts/seeds (peanuts)	27 (12)	36
Vegetables (carrots)	15 (13)	20
Fruits (apples)	3 (3)	4
Tablet (abboticin)	1 (1)	1
Toys (plastic peices)	7 (7)	9
Other (small metal pieces)	22 (7)	29
Unknown	1	1
Total	76	100

A foreign body was found in 76 (56%) of the patients. Four foreign bodies were located in the oesophagus. The median age was 1.84 years (range: 0.33-18.2), 86 (63%) were males and 51 (37%) were females. A total of 95 patients (69%) were less than three years old. There was no difference in the frequency of a foreign body finding in males (56%) compared with females (55%), nor for the group of patients < 2 years (53%) compared with those aged \ge 2 years (59%) (**Table 1**).

In most cases (70%), the foreign bodies were organic, predominantly nuts/seeds or carrots. Toys and small metal pieces were the more common inorganic foreign bodies (**Table 2**). The localizations of the foreign bodies are shown in **Figure 1**. The majority (67%) was found in the main stem bronchi, predominantly on the right side. A total of 16 foreign bodies (21%) were found in or at the ostia of the lobar bronchi. Only seven (9%) had a foreign body in the trachea and only four (3%) in the larynx. The distribution of foreign bodies between the right and the left side of the bronchial tree were 57% and 43%, respectively.

As listed in Table 1, the only variable that predicted the finding of a foreign body was abnormal radiologic findings (p = 0.023) which had a sensitivity of 57% and a specificity of 68%. However, in 47 patients the radiologic examination showed no abnormity, although a foreign body was found in 22 (47%) of these patients. The other variables were all non-significant for the finding of a foreign body (Table 1). Seven patients had a radiologic examination showing a radio-opaque foreign body. A foreign body was found in all these patients at bronchoscopy. Eleven patients had no symptoms at admission and normal physical and radiologic examinations, although an airway foreign body was found at bronchoscopy in three (27%) of these patients.

The duration of symptoms before seeking professional medical assistance was zero days for 103 (75%) patients, 1-7 days for 27 (20%) patients and more than seven days for seven (5%) patients. At the OUH, 110 (80%) patients had a bronchoscopy less than 28 hours after admission; only one (1%) patient underwent the procedure later than 28 hours after admission. For the remaining 26 patients (19%), no data were available regarding delay. It should be noted that nine patients (7%) expulsed an aspirated foreign body by coughing before undergoing bronchoscopy. No foreign bodies were found at the subsequent bronchoscopy in these patients. One patient expulsed a foreign body after bronchoscopic removal of three airway foreign bodies (carrot pieces), which showed that one piece had been overlooked. Seven patients (5%) were transferred from other hospitals. One of these patients underwent bronchoscopy at another hospital, which did not reveal an airway foreign body. This patient was transferred to the OUH 13 days later due to an abnormal radiologic finding (shift of the mediastinum). At the OUH, a foreign body was found and removed. This demonstrates that a foreign body was overlooked at bronchoscopy in at least two (3%) cases. A total of 21 patients (15%) had a complication of which only three (2%) were major (one was briefly intubated, one was briefly admitted at the Intensive Care Unit and one had a brief case of significant oedema in the larynx). None of the charts specified whether any of the complications originated from the foreign body itself or from the subsequent bronchoscopy. However, a foreign body was found in 20 out of the 21 patients with complications (95%, p < 0.001). A single death occurred in a 43-month-old boy who aspirated an Abboticin tablet at home and arrived at the OUH with cardiac arrest. The tablet was found in the trachea and had caused extensive inflammation thereby impairing breathing. Although an attempt was made to resuscitate the child, he died due to extensive cerebral damage.

DISCUSSION

There are no symptoms, physical or radiologic examinations that can identify or, more importantly, rule out FBA with certainty in a patient referred to hospital due to suspected FBA. In previous studies [2, 7, 8], a foreign body was found in 43% to 79% of patients with suspected FBA, whereas our study showed a foreign body in 56%. We found that the majority (69%) of patients with



suspected FBA were less than three years old, which is consistent with the findings of other studies (74-76%) [2, 7, 8]. In contrast to Shlizerman et al [6], we found no statistically significant difference in the frequency of finding a foreign body in males compared with females. We found that the majority (70%) of foreign bodies were organic. Latifi et al [10] also found a higher proportion (89%) of organic than non-organic foreign bodies. The results of our and other studies indicate that edible objects, especially carrots, apples, nuts and seeds, comprise the greater part of airway foreign bodies. The majority of aspirated foreign bodies may be avoidable if national guidelines recommended that young children should be restricted from eating nuts, seeds and raw carrots and apples. This was also the conclusion of a recent Danish study by Iversen & Klug [11].

The localization of foreign bodies in our study had a predisposition towards the right side of the bronchial tree (57%), which is consistent with other studies [3, 10, 12], and which can be explained by the anatomy of the lungs, as the right stem bronchus runs a more vertical course. A radiologic finding was the only statistically significant variable in predicting a foreign body at bronchoscopy. However, the sensitivity and specificity were very low (Table 1). This correlates with the findings of other studies [2, 6, 8, 11]. Bronchoscopy therefore cannot be avoided if an FBA is suspected, even in cases where no actual symptoms are found and the clinical and radiological examinations are normal. This has also been reported in a prospective study by Even et al [9]. Radiological examination should therefore not be used as a routine examination in these cases unless additional information is needed, especially in delayed cases when atelectasis or pneumonia might be suspected.

In our study, a foreign body was found in the upper oesophagus of four patients. These patients were included in our analyses since they underwent bronchoscopy for suspected FBA and thereby met the inclusion criteria. Furthermore, respiration can be impaired in patients with a foreign body in the upper oesophagus.



An optical forceps (F) is passed through the rigid bronchoscope (B) to firmly grab a piece of almond (A). The forceps and the rigid bronchoscope can then be removed simultaneously from the respiratory tract whereby the foreign body is removed.

Hence, it is important to diagnose and treat these patients similarly to patients with an FBA.

In our review, 75% of the 137 patients sought medical assistance in less than a day and 95% within a week of symptom onset. In comparison, Tomaske et al [8] found that 104/370 (28%) sought medical assistance after two weeks, and Tokar et al [3] found that 27/214 (13%) had a delay of 72 hours or more. Tokar et al [3] noticed an increase in the frequency of pneumonia from 6% to 37% when removal of an airway foreign body was postponed for more than 72 hours.

This suggests that immediate treatment is important to reduce the risk of complications due to an FBA. In our study, 2% had a major complication. Other studies demonstrated a major complication rate between 1% and 7% [4, 5]. Of the 21 patients with complications, 20 had a positive bronchoscopy, which suggests that complications may have been caused by the foreign body itself rather than by the bronchoscopic procedure. A foreign body was overlooked at bronchoscopy in two cases, which demonstrates that the procedure is not foolproof.

CONCLUSION

Our study indicates that bronchoscopy should always be performed when an FBA is suspected, even in the absence of signs, symptoms and positive findings. No major complications seem to be related to bronchoscopy, but are rather due to the aspirated foreign body.

We found that foods such as nuts, seeds and raw carrots and apples are the most prevalent organic foreign bodies aspirated. It is advisable to avoid these foods in children under three years of age. CORRESPONDANCE: Amirsalar Samkani, Gammel Kongevej 127, 4. tv., 1850 Frederiksberg, Denmark. E-mail: amsam03@gmail.com ACCEPTED: 29 August 2013

CONFLICTS OF INTEREST: Disclosure forms provided by the authors are available with the full text of this article at www.danmedi.dk.

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