Original Article

Access this article online
Website: www.afrjpaedsurg.org
DOI: 10.4103/0189-6725.143129
Quick Response Code:

An audit of morbidity and mortality associated with foreign body aspiration in children from a tertiary level hospital in Northern India

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ABSTRACT

Background: There is paucity of data regarding the morbidity and mortality of rigid bronchoscopy in children for foreign body (FB) retrieval from India. The aim was to audit data regarding anaesthetic management of rigid bronchoscopy in children and associated morbidity and mortality. **Materials and Methods:** Hospital records of all patients below 18 years of age undergoing rigid bronchoscopy for suspected FB aspiration (FBA) between January 1, 2002 and December 31, 2011 were audited to assess their demographic profile, anaesthetic management, complications, and postoperative outcomes. The children were divided into early and late diagnosis groups depending on whether they presented to the hospital within 24 hours of FBA, or later. **Results:** One hundred and forty children, predominantly male (75%), with an average age of 1-year and 8 months, presented to our hospital for rigid bronchoscopy during the study period. Majority of children presented in the late diagnosis group (59.29% vs. 40.71%). The penetration syndrome was observed in 22% of patients. Majority of patients aspirated an organic FB (organic: Inorganic FB = 3:1), with peanuts being the most common (49.28%). A significantly higher number of children presented with cough (P = 0.0001) and history of choking (P = 0.0022) in the early diagnosis group and crepitations (P = 0.0011) in the late diagnosis group. Major complications included cardiac arrest (2.1%), pneumothorax (0.7%), and laryngeal oedema (9.3%). The average duration of hospitalization in our series was 3.08 ± 0.7 days. **Conclusions:** Foreign body aspiration causes considerable morbidity, especially when diagnosis is delayed.

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Key words: Anaesthesia, foreign body aspiration, morbidity, mortality, paediatric, rigid bronchoscopy

INTRODUCTION

Foreign body aspiration (FBA) in the paediatric age group is not only associated with considerable morbidity and mortality but also psychological distress for both the children as well as the parents. Early diagnosis and prompt management of FBA are imperative to prevent long-term complications. Due to paucity of data on the anaesthetic management of children with tracheo-bronchial FBA from the Indian subcontinent; we decided to study children presenting with FBA to our institute from January, 2002 to December, 2011. Unlike previous studies from India, we compared the peri interventional morbidity and mortality in the early and late diagnosis groups in this patient population.

PATIENTS AND METHODS

This retrospective study was conducted at a tertiary referral centre in northern India, with paediatric surgeons experienced in performing bronchoscopic procedures. Informed patient consent was waived off by the Institutional Review Board and the Ethics Committee as this was a retrospective audit. The study included all patients below the age of 18 years undergoing bronchoscopy for suspected FBA between January 1, 2002 and December 31, 2011. Patients with incomplete records were excluded from the study. Anaesthesia for the bronchoscopic procedures was provided by consultant anaesthesiologists, along with anaesthesia trainees and technicians.

The medical records of the patients were analysed to record patient characteristics including: Name, hospital

identification number, age, gender, weight, date of hospital admission, and discharge. The children were divided into early and late diagnosis groups depending on whether they presented to the hospital within 24 h of FBA or later. The clinical findings on admission were noted including presence of fever, dyspnoea, cyanosis, stridor, and wheezing episodes. History of atopy, bronchial asthma, history of a witnessed episode of choking, vomiting, and suspected duration of FB retention was recorded. All bronchoscopies were performed under general anaesthesia using a rigid bronchoscope (Karl Storz) of calibre 2.5, 3.5, 5, depending on the age of the children. Data pertaining to the anaesthetic management including duration of preoperative fasting, administration of antisialagogue pre medication and steroids, technique and course of anaesthetic induction, maintenance of anaesthesia including use of neuromuscular blocking drugs, inhalational agents and duration of rigid bronchoscopy, type and location of FB were also noted.

Peri-operative adverse events such as arterial desaturation (SpO_2 <90%), bronchospasm, laryngospasm, and laryngeal oedema were noted. Other complications including episodes of bradycardia (heart rate <60/min), cardiac arrest, pneumothorax, postextubation stridor, need for re-intubation, and referral to paediatric intensive care unit for postoperative mechanical ventilation were also recorded.

Quantitative variables are presented as mean ± standard deviation qualitative data are expressed as a percentage of total patient number. Data were analysed using the Student's *t*-test, Chi-square, and Fisher's exact tests where appropriate. $P < 0.05$ was considered as statistically significant.

RESULTS

A total of 140 children with an average age of 1-year and 8 months underwent bronchoscopy at our hospital during the study period. The ratio of males to females was 3:1. Majority of children presented in the late diagnosis group (59.29% vs. 40.71%). Figures 1 and 2 display the distribution of patients according to age and the time of presentation to the hospital, respectively. History of a choking episode was reported in 22% of patients. The average duration of FB retention was 5 ± 7.77 days. The triad of choking episode, vigorous coughing with vomiting (the penetration syndrome) was observed in 22% of patients. Table 1 presents the clinical features observed in the early and late diagnosis groups. A significantly higher number of children in the early diagnosis group presented with cough ($P = 0.0001$) and history of choking ($P = 0.0022$) while crepitations ($P = 0.0011$) were more frequent in the late diagnosis group.

Table 2 presents the data pertaining to the anaesthetic management of the patients. Most

Table 1: Frequency of clinical features in children in the early and late diagnosis groups

Clinical feature	Early diagnosis (n = 57)	Late diagnosis (n = 83)	P value
Cough	52	29	0.0001
Dyspnoea	33	42	0.3953
H/o choking	20	11	0.0022
Fever	16	24	0.9203
Vomiting	20	32	0.6801
Wheezing	21	26	0.4970
Stridor	5	10	0.5380
Decreased breath sounds	35	58	0.2965
Crepitations	1	17	0.0011
H/o bronchial asthma	1	3	0.6457
H/o atopy	1	2	1

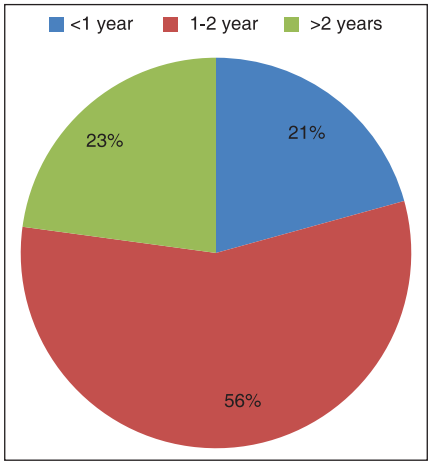


Figure 1: Distribution of patients according to the age at presentation to the hospital

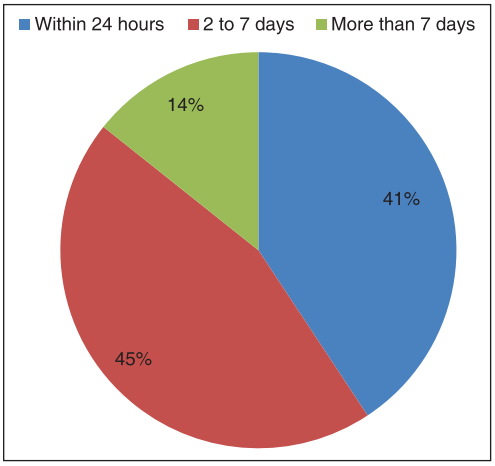


Figure 2: Distribution of patients according to the time at presentation to the hospital

patients (71.42%) had an adequate duration of fasting in the preoperative period. Figure 3 depicts the site of FBs observed. Majority of patients had aspirated an organic FB; with peanuts being the most common (49.28%); while whistle parts were the most common inorganic FB.

Table 3 lists the complications noted in the study population. Major complications included cardiac arrest (2.1%), pneumothorax (0.7%), and laryngeal oedema (9.3%). All three patients who had cardiac arrest were in the early diagnosis group. There were one mortality and two children who had cardiac arrest were discharged home after recovery. One patient developed a pneumothorax requiring drainage by an intercostal chest drain. One child each required a second bronchoscopy and thoracotomy. Re-intubation was required in 10.7% children, and 7.8% required postoperative mechanical ventilation. The average duration of bronchoscopy (33.56 ± 45.96 in the early diagnosis group and 42.79 ± 70.71 min in the late diagnosis group) were comparable statistically (P = 0.3504). Children in the late diagnosis group had a longer duration of hospital stay 3.30 ± 0.71 days compared with 2.75 ± 2.82 days in the early diagnosis group, the difference being comparable statistically. The average time to diagnosis in the late diagnosis group was 7.76 ± 7.78 days. The average duration of hospitalization in our series was 3.08 ± 0.7 days.

DISCUSSION

Foreign body aspiration has been reported to be a leading cause of morbidity and mortality in the paediatric age group.[1,2] Sheriff *et al*. reported 8.3% injuries in children due to foreign bodies from tertiary care centre in India.[3] Goren *et al*. studied the mortality in children in relation to FBA and reported that 36.4% of the victims were dead on arrival, 50% on intervention, and 13.6% after complications due to delayed hypoxia.[4] We studied and compared the morbidity and mortality in the early and late diagnosis groups of paediatric FBA presenting to our hospital.

Children below the age of 3 years are recognized as a high risk group for FBA;[5,6] as corroborated by our data and other studies.[7-9] The reasons cited for this include the tendency of toddlers to explore objects by putting them in their mouths, incomplete dentition, in co-ordinated swallowing, easy distractibility during eating and also lack of constant parental supervision due to increased mobility.[10] Male predominance in our patient population is expected from a centre in Northern India where gender bias is prevalent, and the sick male child is given prompt attention, while the female child may be neglected; as reported by other Indian studies.[7-9] Male preponderance is also reported in the literature with boys accounting for 61% (confidence interval [CI]; 59-63%) of children with FBA according to a systematic review on FBA[6] except in two studies from Turkey.[11,12]

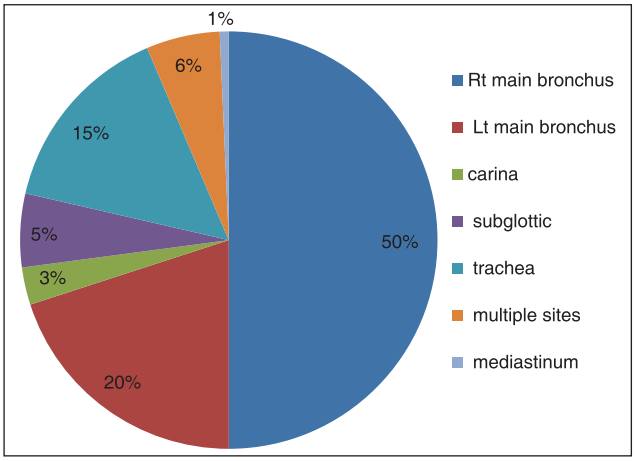


Figure 3: Sites of foreign body observed in the study

Table 2: Anaesthetic agents used during rigid bronchoscopy

Anaesthetic agent	Number of patients	Percentage
Antisialagogue agent		
Atropine	57	40.7
Glycopyrrolate	83	59.3
Steroid used		
Hydrocortisone	80	57.1
Dexamethasone	60	42.9
Inhalational anaesthetic agent		
Halothane	104	74.3
Sevoflurane	36	25.7
Neuromuscular blocking agent		
Atracurium	104	74.3
Succinylcholine	36	25.7

Table 3: Frequency of complications in children in the early and late diagnosis groups

Complication	Early diagnosis (n = 57)	Late diagnosis (n = 83)	P
Desaturation	10	11	0.4839
Bradycardia	7	9	0.7913
Cardiac arrest	3	0	0.0653
Bronchospasm	4	3	0.4425
Laryngospasm	2	1	0.5666
Pneumothorax	0	1	1
Laryngeal oedema	7	6	0.3125
Re-intubation	10	5	0.0303
Postoperative ventilation	7	4	0.1219
Second bronchoscopy	0	1	1
Death	0	1	1

Majority of children in our study aspirated organic foreign bodies; with peanuts being the most common; as reported by earlier Indian studies.[7,9] Peanuts are relatively cheap and freely available during the festive season in our part of the country, which is probably the reason for them being the most common aspirated FB in our series. Previous review article has reported that most (81%, CI: 77-86%) of the aspirated foreign bodies are organic materials, including nuts (especially peanuts) and seeds (mainly sunflower and watermelon).[6] In contrast to these findings, an Italian series found teeth[13] and two Turkish studies found headscarf pins as the most commonly aspirated objects.[11,12]

According to the available literature, the history of a witnessed choking episode is highly suggestive of acute aspiration.[14-16] In our study, the history of choking episode was forthcoming in 22% of all patients. The history of choking episode was elicited significantly more frequently in the early diagnosis group than in the late diagnosis group. Previous investigators have also noticed that witnessing of choking episode was the most important historical event to pinpoint an early diagnosis of FBA in children.[15,17] Unlike our results, Wiseman reported a higher percentage of history of witnessed choking in 80% of patients.[18] The reasons for this difference may be that the reliability of clinical history may be low in the developing countries and will vary with the educational status of the parents. This is corroborated by a study by Singh *et al*. who found abysmally low level of awareness in 63 primary caregivers about FBA in children.[19] Furthermore, not all parents or caregivers may witness or remember the choking episode. The history of choking episode may not be revealed by the children due to fear, embarrassment or limited speech in case of younger children.[20]

The clinical features of FBA are myriad and variable and depend on the stage at which the patient is seen, the nature of the FB, its size and site and its effects on the lung distal to it. The clinical features range from complete airway obstruction; to no symptoms or signs at the two ends of the clinical spectrum. In our study, the most common symptoms and signs were cough, breathlessness, history of noisy breathing, and decreased breath sounds (unilateral); similar to Indian[8,9] and western studies.[1,2,12,15] Signs and symptoms typical in delayed presentations include unilateral decreased breath sounds and ronchi, persistent cough or wheezing, recurrent or nonresolving pneumonia, or rarely, pneumothorax.[6] Our data showed significantly higher number of children in the late diagnosis group presenting with crepitations indicative of infective pathology.

In our series, most of the patients presented to the hospital after 24 h of FBA. Previous studies have reported 23%[2] to 69%[21] of patients presenting in the late diagnosis group. The interval of time between beginning of symptoms and correct diagnosis was studied by Wiseman who, reported that 46% of children studied were diagnosed within 24 h following the onset of symptoms, 54% were diagnosed at the end of the 1st week, 24% at the end of the 1st month, and the remaining 16% after 1 month (up to 6 years).[18] Karakoc *et al*. studied the phenomenon of delayed diagnosis in a 7-year period, and a median symptomatic period of 3 months was reported.[22] Various reasons for delayed diagnosis of FBA in children include misleading and variable clinical history and findings, misdiagnosis by clinicians, parental delay in seeking treatment. Children with FBA are frequently misdiagnosed as recurrent pneumonia, croup, bronchial asthma, intermittent tracheobronchitis, or reactive airway disease. Longstanding and undiagnosed FB can lead to complications including asphyxia, subglottic oedema, pneumonia, bronchiectasis, atelectasis, bronchoesophageal fistula, and pneumothorax.

Various anaesthesia techniques have been used successfully for the management of bronchoscopy during FB extraction, including inhalational induction[23,24] and TIVA techniques.[13,25,26] There is no consensus on the use of spontaneous or controlled ventilation during anaesthesia for bronchoscopies. In our study, the bronchoscopies were performed under general anaesthesia with inhalational induction and controlled ventilation in all children. Most of the children received halothane as sevoflurane was unavailable at our centre before 2005.

Consistent with most of the previous reports;[1,8,9,18] foreign bodies were located predominantly in the right bronchial tree in our series. An exception to this rule is a series by Vane *et al*.[27] who found 53.4% of foreign bodies in the left lung. The complications observed in our patients were similar to those in previous reports on paediatric bronchoscopy for FB retrieval. Minor complications included arterial desaturation, bradycardia, bronchospasm, and laryngospasm. Major complications included cardiac arrest, pneumothorax, and laryngeal oedema. All three patients who had cardiac arrest were in the early diagnosis group. The instance of re-intubation was significantly more in the acute diagnosis group when compared to the

late diagnosis group. The mortality rate in our study (0.7%) is comparable with previous reported mortality rates.[14] Fidowski *et al*. reviewed 10,236 children with FBA and reported a death rate of 0.42% with major iatrogenic complications in 0.96% of children; including severe laryngeal oedema or bronchospasm requiring tracheotomy or re-intubation, pneumothorax, pneumomediastinum, cardiac arrest, tracheal or bronchial laceration, and hypoxic brain damage.[6]

Studies from the Indian population on FBs in the tracheo-bronchial tree have reported complication and mortality rates of 10% and 2%, respectively; with bronchospasm (8%) and subglottic oedema (2%) as the most common complications.[9] In earlier studies, history of previous bronchoscopy, duration of the procedure, and the type of FB have been identified as variables that reliably predict the occurrence of complications.[28] It is generally accepted that the longer the FB stays in the tracheo-bronchial tree, the more frequently complications occur.[9,11]

The need for thoracotomy or tracheotomy is a complication of FBA itself or a complication of bronchoscopy. In our study, one child each required a second bronchoscopy and thoracotomy. Earlier reports have observed rates of thoracotomy and tracheotomy to be between 0% and 6% and 0% and 2.8%, respectively.[29] Repeated bronchoscopic examination may be essential for 1-3% of patients, particularly if the FB is a peanut or other friable material that can easily break down.[30] Previous studies have reported lengthy procedures (>80 min), related to delayed or missed foreign bodies complicated by the presence of granulations and purulence and repeat procedures due to lack of technical experience in removing airway FB.[2] In another Asian study, 5.3% of 469 patients, in whom bronchoscopy was unsuccessful, were transferred to an adjacent chest hospital for thoracotomy.[31] In contrast to these studies, Kiyan *et al*. reported no requirement of thoracotomy or tracheotomy and no mortality in their study.[16]

Although children in the late diagnosis group, in our study, had a longer duration of hospital stay, the difference was comparable statistically among the groups. The average duration of hospital stay in our series is comparable to data from Germany[32] and Hong Kong.[17] Data from Asian population report that 86.6% of the patients were hospitalized less than 2 days, and longer stays were secondary to complications either from FBA or procedures for FB removal.[2] In contrast to these, Tomaske *et al*., reported early hospital discharge between 2 and 4 h after rigid bronchoscopy in 65.2% children; but significantly longer median post interventional stay in the "subacute" group than in the "acute" group.[29] Predictive factors of prolonged pulmonary recovery including evidence of inflammation on preoperative radiographs, aggravation of pulmonary lesions on postoperative films, and prolonged duration of bronchoscopy may prevent early discharge.[6] Ciftci *et al*. found bronchoscopy time (57 ± 2.9 min vs. 23 ± 1.2 min) to be prolonged in children with postoperative complications in comparison with those without complications.[14]

The strength of our study is that we have studied the interventional morbidity and mortality resulting from rigid bronchoscopy. Multiple studies from India have reported data regarding FB types, but there is limited discussion on management strategies and complications. The limitations of our study are that it is a retrospective audit, and the complications may be under reported. We did not study the radiological findings, the misdiagnoses or the reasons for delayed admissions in this population. Although we did look into the duration of hospital admission, the complications were not categorized as pneumonia, bronchiectasis etc., and long-term follow-up after hospital discharge was not reviewed.

CONCLUSION

Foreign body aspiration in children causes considerable morbidity and mortality and is missed and misdiagnosed frequently. Large scale, ongoing, educational programs for primary caregivers and physicians are required to increase awareness of the types of foods and objects that pose a choking risk for children; to enable them to recognize FBA in children and to treat choking in children. Proper public education and ongoing training and legislations enforcing mandatory labelling of toys and food items that constitute a choking hazard, can have a significant impact on the incidence of FBA.[33,34]

ACKNOWLEDGMENTS

All paediatric surgeons from the department of Paediatric surgery, Christian Medical College and Hospital, Ludhiana.

REFERENCES

1. Bittencourt PF, Camargos PA, Scheinmann P, de Blic J. Foreign body aspiration: Clinical, radiological findings and factors associated with its late removal. Int J Pediatr Otorhinolaryngol 2006;70:879-84.
2. Tan HK, Brown K, McGill T, Kenna MA, Lund DP, Healy GB. Airway foreign bodies (FB): A 10-year review. Int J Pediatr Otorhinolaryngol 2000;56:91-9.

3. Sheriff A, Rahim A, Lailabi MP, Gopi J. Unintentional injuries among children admitted in a tertiary care hospital in North Kerala. Indian J Public Health 2011;55:125-7.
4. Goren S, Gurkan F, Tirasci Y, Kaya Z, Acar K. Foreign body asphyxiation in children. Indian Pediatr 2005;42:1131-3.
5. Foltran F, Ballali S, Passali FM, Kern E, Morra B, Passali GC, *et al*. Foreign bodies in the airways: A meta-analysis of published papers. Int J Pediatr Otorhinolaryngol 2012;76 Suppl 1:S12-9.
6. Fidkowski CW, Zheng H, Firth PG. The anesthetic considerations of tracheobronchial foreign bodies in children: A literature review of 12,979 cases. Anesth Analg 2010;111:1016-25.
7. Gulati SP, Kumar A, Sachdeva A, Arora S. Groundnut as the commonest foreign body of tracheobronchial tree in winter in Northern India. An analysis of fourteen cases. Indian J Med Sci 2003;57:244-8.
8. Shivakumar AM, Naik AS, Prashanth KB, Shetty KD, Praveen DS. Tracheobronchial foreign bodies. Indian J Pediatr 2003;70:793-7.
9. Kaur K, Sonkhya N, Bapna AS. Foreign bodies in the tracheobronchial tree: A prospective study of fifty cases. Indian J Otolaryngol Head Neck Surg 2002;54:30-4.
10. Altkorn R, Chen X, Milkovich S, Stool D, Rider G, Bailey CM, *et al*. Fatal and non-fatal food injuries among children (aged 0-14 years). Int J Pediatr Otorhinolaryngol 2008;72:1041-6.
11. Karakoç F, Karadag B, Akbenlioglu C, Ersu R, Yildizeli B, Yüksel M, *et al*. Foreign body aspiration: What is the outcome? Pediatr Pulmonol 2002;34:30-6.
12. Tokar B, Ozkan R, Ilhan H. Tracheobronchial foreign bodies in children: Importance of accurate history and plain chest radiography in delayed presentation. Clin Radiol 2004;59:609-15.
13. Divisi D, Di Tommaso S, Garramone M, Di Francescantonio W, Crisci RM, Costa AM, *et al*. Foreign bodies aspirated in children: Role of bronchoscopy. Thorac Cardiovasc Surg 2007;55:249-52.
14. Ciftci AO, Bingöl-Kologlu M, Senocak ME, Tanyel FC, Büyükpamukçu N. Bronchoscopy for evaluation of foreign body aspiration in children. J Pediatr Surg 2003;38:1170-6.
15. Heyer CM, Bollmeier ME, Rossler L, Nuesslein TG, Stephan V, Bauer TT, *et al*. Evaluation of clinical, radiologic, and laboratory prebronchoscopy findings in children with suspected foreign body aspiration. J Pediatr Surg 2006;41:1882-8.
16. Kiyan G, Gocmen B, Tugtepe H, Karakoc F, Dagli E, Dagli TE. Foreign body aspiration in children: The value of diagnostic criteria. Int J Pediatr Otorhinolaryngol 2009;73:963-7.
17. Chik KK, Miu TY, Chan CW. Foreign body aspiration in Hong Kong Chinese children. Hong Kong Med J 2009;15:6-11.
18. Wiseman NE. The diagnosis of foreign body aspiration in childhood. J Pediatr Surg 1984;19:531-5.
19. Singh A, Ghosh D, Samuel C, Bhatti W. Pediatric foreign body aspiration: How much does our community know? J Indian Assoc Pediatr Surg 2010;15:129-32.
20. Orji FT, Akpeh JO. Tracheobronchial foreign body aspiration in children: How reliable are clinical and radiological signs in the diagnosis? Clin Otolaryngol 2010;35:479-85.
21. Saquib Mallick M, Rauf Khan A, Al-Bassam A. Late presentation of tracheobronchial foreign body aspiration in children. J Trop Pediatr 2005;51:145-8.
22. Karakoc F, Cakir E, Ersu R, Uyan ZS, Colak B, Karadag B, *et al*. Late diagnosis of foreign body aspiration in children with chronic respiratory symptoms. Int J Pediatr Otorhinolaryngol 2007;71:241-6.
23. Aydogan LB, Tuncer U, Soylu L, Kiroglu M, Ozsahinoglu C. Rigid bronchoscopy for the suspicion of foreign body in the airway. Int J Pediatr Otorhinolaryngol 2006;70:823-8.
24. Yadav SP, Singh J, Aggarwal N, Goel A. Airway foreign bodies in children: Experience of 132 cases. Singapore Med J 2007;48:850-3.
25. Shen X, Hu CB, Ye M, Chen YZ. Propofol-remifentanil intravenous anesthesia and spontaneous ventilation for airway foreign body removal in children with preoperative respiratory impairment. Paediatr Anaesth 2012;22:1166-70.
26. Malherbe S, Whyte S, Singh P, Amari E, King A, Ansermino JM. Total intravenous anesthesia and spontaneous respiration for airway endoscopy in children – a prospective evaluation. Paediatr Anaesth 2010;20:434-8.
27. Vane DW, Pritchard J, Colville CW, West KW, Eigen H, Grosfeld JL. Bronchoscopy for aspirated foreign bodies in children. Experience in 131 cases. Arch Surg 1988;123:885-8.
28. Zaytoun GM, Rouadi PW, Baki DH. Endoscopic management of foreign bodies in the tracheobronchial tree: Predictive factors for complications. Otolaryngol Head Neck Surg 2000;123:311-6.
29. Tomaske M, Gerber AC, Weiss M. Anesthesia and periinterventional morbidity of rigid bronchoscopy for tracheobronchial foreign body diagnosis and removal. Paediatr Anaesth 2006;16:123-9.
30. Sahin A, Meteroglu F, Eren S, Celik Y. Inhalation of foreign bodies in children: Experience of 22 years. J Trauma Acute Care Surg 2013;74:658-63.
31. Zhang X, Li W, Chen Y. Postoperative adverse respiratory events in preschool patients with inhaled foreign bodies: An analysis of 505 cases. Paediatr Anaesth 2011;21:1003-8.
32. Göktas O, Snidero S, Jahnke V, Passali D, Gregori D. Foreign body aspiration in children: Field report of a German hospital. Pediatr Int 2010;52:100-3.
33. Sadan N, Raz A, Wolach B. Impact of community educational programmes on foreign body aspiration in Israel. Eur J Pediatr 1995;154:859-62.
34. Karatzanis AD, Vardouniotis A, Moschandreas J, Prokopakis EP, Michailidou E, Papadakis C, *et al*. The risk of foreign body aspiration in children can be reduced with proper education of the general population. Int J Pediatr Otorhinolaryngol 2007;71:311-5.

Cite this article as: 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;11:287-92.

Source of Support: Nil. **Conflict of Interest:** None declared.