Pen Cap Aspirations: Maneuvering for Successful Extraction

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Abstract

Aim of this study was to analyze the therapeutic approach with enhanced success of bronchoscopy. We retrospectively analyzed the results of bronchoscopic extraction of pen cap aspirations in our unit from 2000 to 2014. Out of 239 bronchoscopies performed for foreign bodies in airways, there were 8 cases of pen cap aspirations. All 8 were males and age ranged from 5 to 11 years. Seven cases had definitive history, while one patient had a history of chronic respiratory ailment. The foreign bodies were lodged in right and left bronchi in four cases each and seven had their open-end toward the proximal airways. Bronchoscopic extraction was successful in seven patients. The maneuver of rotating the optical forceps by 90 degrees so as to align the pen cap with the vocal cords resulted in success in all the cases. One patient underwent thoracotomy and bronchotomy for removal. Pen cap aspirations occur in school-going children. Aligning the optical forceps with vocal cords during extraction avoids the need for tracheostomy or thoracotomy.

Keywords

- foreign body
- pen cap aspirations
- bronchoscopy
- tracheostomy
- thoracotomy

Introduction

The majority of childhood choking-related injuries are associated with food items, such as nuts, beans, candy, grapes, vegetables, and popcorn.^{1–3} Aspirated pen caps account for 3 to 8% of all nonfood-related aspirations.^{3,4} Rigid bronchoscopy is now considered the gold standard for diagnosis and removal of aspirated foreign bodies.^{5,6} School-going children use pens with plastic caps in many countries. These children have a tendency to chew the pen caps while playing or studying, leading to a significant risk of aspiration. Like other foreign body aspirations (FBAs), the pen caps are also more likely to enter the right main stem bronchus as it is wider and more in alignment with the trachea. Due to their relatively large diameter, pen caps can obstruct the larynx, bronchus, or even tracheal lumen completely and could be a more dangerous aspiration as compared with other FBA.⁷ Because of the configuration of the foreign body, many authors have reported difficulty in removing pen caps via the vocal cords. While bronchoscopic extraction is successful in the majority of cases,

a few may require an open surgical procedure, such as tracheostomy, thoracotomy, and bronchotomy.^{5–7} We reviewed our experience with pen cap aspirations.

Methods

A total of 239 children with FBA were admitted between January 2000 and June 2014 to a Pediatric Surgical unit, out of which 8 children had pen cap aspirations. The study was approved by the departmental ethics committee.

Rigid bronchoscopy was performed both to confirm the diagnosis and remove the pen caps. All procedures were performed under general anesthesia with the use of short-acting muscle relaxants in the usual manner. An appropriately-sized rigid ventilating bronchoscope (Karl Storz) with a compatible optical forcep having a 0-degree viewing telescope was used for removing the pen caps. Each pen cap was grasped with the optical forceps and brought out up to the subglottic level along with the bronchoscope. The forcep was then rotated by 90 degrees to either the left or right side, while keeping it

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Fig. 1 Pen cap protruding outside (inset) when held with the usual downward orientation of forceps (arrow).

inside the bronchoscopic sheath so as to bring the eccentrically held pen cap in alignment with the vocal cords allowing its easy removal.

The grasping prongs of the optical forceps (Karl Storz) open at right angles to the handle of the forceps making the pen cap project outside of the luminal circumference of the bronchoscope (►Fig. 1). A simple rotational maneuver of the optical forceps by 90 degrees aligns the pen cap with the lumen of bronchoscope and the vocal cords (►Fig. 2) for smooth extraction.

Results

All patients with pen cap aspirations were males and ages ranged between 5 and 11 years. Duration of symptoms varied from 6 hours to 6 months. Seven out of eight patients had a definite history of pen cap aspiration with choking and cough. One patient had a persistent cough and recurrent respiratory tract infection for a period of 6 months and was being treated medically before he was subjected to bronchoscopy. Pen caps were lodged in the left and right main bronchus, respectively, in four patients each. X-ray of the chest was performed in all the children; however, it was suggestive of FBA in three patients only, showing hyperinflation (two) and pneumonia (one). Out of eight patients, seven had a successful broncho-

Fig. 2 Pen cap aligned with instrument (inset) when the handle is rotated through 90 degrees (arrow).

scopic retrieval of the inhaled pen cap with the modified maneuver as described above. Bronchoscopic removal of the pen cap failed in one patient in whom the pen cap was lodged with its closed-end toward the bronchoscope. This patient was subjected to thoracotomy and bronchotomy. No significant postoperative complications occurred in any of the patients. Seven patients were discharged within 24 hours of intervention and one patient, who had undergone thoracotomy, was discharged after 5 days of surgery. All the patients are doing well in follow-up (2–12 years).

Discussion

Some children have the habit of putting a pen in their mouth with cap at its rear end. Pen caps are easily inhaled while talking, laughing, coughing, or taking a deep breath.^{3,4,7} In our report, all patients with pen cap aspirations were school-going children and all of them were boys. Seven out of eight children had successful bronchoscopic extraction. Male predilection may be related to higher level of activity.^{5,6}

The most common signs and symptoms of FBA are choking, coughing, wheezing, and decreased breath sounds. Of all the findings, the most predictive is witnessed aspiration with a choking episode.⁸ All pen cap aspirations have a definitive history as older children are able to relate the episode as compared with smaller children in whom one has to rely on witnessed history which is present in only 40 to 50% of the cases.^{3,4,7} However, one patient in our series did not realize that the pen cap had been aspirated as the initial respiratory symptoms might have been less severe or the child was too scared to report it for the fear of admonition from the parents.

The pen caps usually lodge with the open end facing upward because of the position at the time of aspiration and the gush of inhaled air pushing the pen cap down the airway.³ Many authors believe that bronchoscopic retrieval of aspirated pen caps is impossible and have described open surgical approach as the primary modality.^{3,7} In a series of 19 patients with inhaled pen caps, Ulkü et al⁷ were able to bronchoscopically remove the caps in nine patients (48%) only. Five patients (26%) required an additional tracheostomy and thoracotomy for removal which was attributed to the slippery surface of the caps and a bigger diameter rendering an extraction through the vocal cords difficult. Jiaqiang et al reported the largest series of pen cap aspirations to date and advocated the use of a bronchoscope with a larger diameter than the cap itself so as to extend the glottis and facilitate extraction through the vocal cords;³ however, such larger diameters may not be suitable for all patients. They also described the application of reverse grasping forceps, which seems to allow a better grip as it opens inside of the cap on the inner serrated surface and, hence, keeps the forceps, bronchoscope, and cap in alignment with the vocal cords. However, with this specialized instrument there was report of slipping of the pen cap at the level of vocal cords, which could lead to asphyxia. There have been isolated case reports of perforated pen caps being removed with the help of a Fogarty catheter passed through the pen cap hole.⁹ There may be concerns about variable pen cap shapes and sizes and applicability of this technique in all cases. With our

technique, there is minimal difficult ergonomics that overcomes the malalignment with the vocal cords, which we believe is the most important bottleneck in the removal of aspirated pen caps.¹⁰

Conclusion

Pen cap aspirations can be a difficult problem to handle even for the most experienced bronchoscopist. Open-ended pen caps are generally removed successfully by bronchoscopy and rarely require thoracotomy. With a commonly available set of instruments, modification of technique near the glottis aligning the FB along the vocal cords results in successful extraction and avoids the need for tracheostomy, thoracotomy, or bronchotomy.

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