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Case Report

Application of Intravascular Techniques to Remove a Broken Tooth from the Airways after Emergency Intubation: A Case Report

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Abstract

Background: Tooth aspiration is a relatively uncommon complication of endotracheal intubation. Classic methods to remove a tooth from airways may fail in some cases, even rigid bronchoscopy, which is the method of choice for the removal of tracheobronchial Foreign Bodies (FB). Endovascular treatment is a potentially efficient treatment option in such cases.

Case Presentation: We report a case of a 35-year-old man who was admitted to hospital after an emergent on-street intubation with a broken tooth lodged in the distal part of the bronchial tube. A few attempts to remove the tooth with standard laryngological endotracheal equipment were unsuccessful.

Conclusion: Eventually, the tooth was successfully removed by an interventional radiologist with the use of intravascular tools including a microguidewire, balloon and loop. Usage of precise endovascular devices may be applied in successful removal of teeth or other foreign bodies from the tracheobranchial tree.

Keywords: Interventional Radiology; Perianesthetic Dental Injury; Treatment; Tooth Aspiration

Introduction

Endotracheal intubation is a method to restore airway patency in critically ill patients. Accurate oxygenation and airway management are core in this procedure. The procedure may be associated with systemic complications and local injuries, particularly when performed emergently and outside the hospital [1]. Adverse events associated with the procedure include perianaesthetic dental injuries. Tooth aspiration is a relatively uncommon complication, reaching 0.2% [2, 3]. The radiological assessment of the FB is extremely important as it allows to locate and determine the nature of a foreign body and therefore to plan the treatment strategy. In case of a suspicion of the FB in airways, chest x-ray, bronchoscopy, and CT are conducted most often.

Removal of the tooth may be challenging for medical staff. When it comes to treatment options, bronchoscopy is still a method of choice in such cases as it has been proven to be a safe and effective method (95% of efficiency) [4]. If the foreign body is lodged in the larynx or trachea or in the event of a craniofacial injury, cricothyrotomy or tracheotomy is indicated. Some cases require cardiothoracic surgical intervention, namely in case of rupture of the bronchial tree [5]. The employment of some endovascular equipment e.g. angioplasty balloons is also possible [6]. Herein, we report an exceptional case of the removal of a broken tooth from the airways performed by an interventional radiologist using precise intravascular equipment.

1.Diagnosis	X-ray, bronchoscopy, CT
2.Treatment options	
Flexible or rigid bronchoscopy	Primary diagnostic and therapeutic management method
Cricothyrotomy or tracheotomy	If FB is lodged in the larynx or trachea or in case of craniofacial injury
Open surgery or lobectomy	Unsuccessful attempt with bronchoscopy
Intravascular intervention	Unsuccessful attempt with bronchoscopy

Table 1: Diagnosis and management of foreign objects impacted in airways.

Case Report

A 35-year-old male was admitted to the intensive care unit of the University Hospital after sudden cardiac arrest followed by difficult, emergency on-street intubation. The intubation was especially challenging due to the patient's severe obesity (body mass index of 35), a large tongue (4 on the Comarch scale), and a relatively short neck. The dental injury was diagnosed following the intubation. The chest X-ray performed on admission revealed a foreign body (10 mm) lodged in the hilus of the right lung. However, due to the preliminary myocardial infraction diagnosis, the patient was initially transferred to the catheterization laboratory where coronary angiography was carried out. No acute stenotic lesions were found in the coronary arteries. Despite markedly impaired Left Ventricular Systolic Function (LVEF = 0.30), the patient's hemodynamic status remained stable. The first attempts to remove the tooth were performed via fibroscopy.

Due to complications, the patient was reintubated with the assistance of a tracheal tube guide (7.5 ETT/8.5 ETT). Subsequent standard attempts at tooth removal undertaken by a laryngologist were also unsuccessful. In the process, the tooth was displaced into the narrowest bronchial tube. Due to this complication, an experienced interventional radiologist was consulted. Tooth removal using precise intravascular equipment was proposed. The patient was positioned supine for optimal visualization of the bronchus tree, which was going to be navigated through with the use of specialized interventional equipment, and to ensure low radiation doses throughout the performed procedure. 7F long vascular sheath (Juszkat, Balton, Warsaw, Poland) was carefully inserted under the control of scopy through the intubation tube and then carefully navigated through the upper airways to the right bronchus under fluoroscopic navigation.

After ascertaining the firm position of the sheath, a special loop catching device (AmplatzGooseNeck Snare; ev3, USA) was initially used, but despite the initial assumption, it was not possible to achieve firm catch of the tooth with the use of the loop. The tooth was located in the bifurcation of the bronchus intermedius. On this level of bronchial tree, the dimension of the bronchus was almost the same as the dimension of the tooth, which caused problems in the proper loop placement. For the second approach, angioplasty balloon (5.0 × 20 mm; Aviator Plus, Cordis, USA) was chosen. A soft, guidable, with reduced traumatic potential 0.014-inch microguidewire (Whisper, Boston Scientific, USA) was advanced into the bronchial tree behind the tooth to the distal part of the bronchus. The guidewire was followed by the angioplasty balloon, which was carefully placed distally to the tooth (Figure 1A).

After confirmation of the balloon position, it was carefully inflated to the nominal values with a saline-diluted contrast medium and the whole system was pulled upwards, which caused the movement of the whole system (the balloon and tooth) towards wider segments of the bronchial tree. After this procedure, the broken tooth was positioned better to catch it with a catching device. The gold tungsten loop (AmplatzGooseNeck) was placed around the tooth, firm positioning was confirmed and a loop with a tooth was pulled back to the distal tip of the vascular sheath gently under the scope control (Figure 1B). As the diameter of the tooth was larger than the lumen of the vascular sheath, the loop with the fixed tooth and the sheath were removed together under continuous fluoroscopic control (Figure 1C and 1D). During the procedure, the patient was monitored, all vital parameters including blood saturation were stable, within the normal range. No complications during the novel procedure nor after occurred.

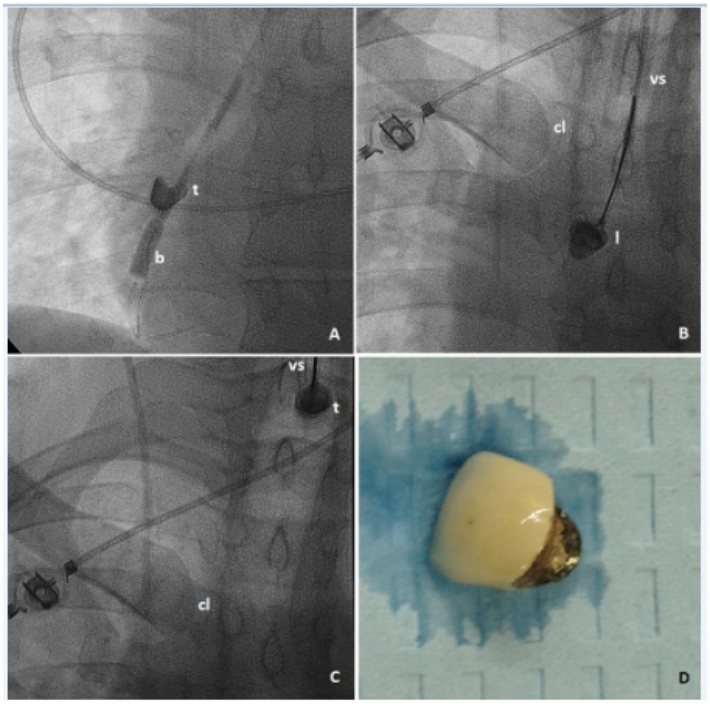

Figure 1: To reposition the tooth, an inflated intravascular balloon (b) was placed distal to the aspirated tooth (t), enabling mobilisation of the tooth proximally to the main bronchus **(A)**. A vascular loop (l) was then placed around the tooth **(B)** and pulled upwards together with the vascular sheath (vs) **(C)**. Note the difference in level between the loop and the clavicle attachment (cl) to the sternum in panels B and C. This led to successful retrieval of the tooth **(D)**.

Discussion

Endotracheal intubation-related tooth injury followed by tooth aspiration is relatively uncommon, with an incidence rate of 0.04% to 12.0% [7]. Many anesthesiologists- and patient-dependent risk factors for dental injury have been described to date [8]. In our case, the patient was intubated emergently on the street without any preparation. Moreover, the patient presented three high-risk factors, including morbid obesity, a relatively large tongue, and short neck. Thus, the risk of developing intubation-induced tooth injury was increased. The teeth most vulnerable to trauma are the upper incisors on the left side. They account for up to 90% of all intubation-related broken teeth [9]. In the described case, the tooth was aspirated following the trauma. The aspiration of teeth during intubation is a serious clinical condition, as the sharp edges of the tooth may cause damage to the mucosa lining the bronchia. Moreover, teeth are a source of many species of potentially virulent bacteria, which could eventually cause chronic pulmonary infection, lung collapse, or abscess formation [10]. Thus, emergent removal of the tooth was considered necessary.

In general, rigid bronchoscopy is the method of choice for the removal of tracheobronchial foreign bodies [11]. This option is safe and efficient for the majority of patients, as it provides adequate bronchial tree visualization and enables the application of a wide range of endoscopic tools [12]. After maxillofacial trauma, aspirated teeth may be removed with a flexible bronchoscope or by tracheotomy [13]. In the described case, all attempts, including several different forceps and the introduction of other endoscopic tools through the fiberscope, were unsuccessful. The tooth was smooth and oval-shaped and had become embedded in the excessive secreted mucous. Moreover, it was located relatively distally in the bronchial tree. If foreign bodies are completely buried in the bronchial mucosa and cannot be removed by bronchoscopy, then open surgery is often unavoidable [14]. In the case described here, the patient had significant impairment in left ventricular systolic function and respiratory failure secondary to cardiac performance, therefore, any surgical intervention would be considered high risk. Thus, a different approach was chosen. The use of more precise endovascular devices enabled the successful removal of the tooth. The use of a special gooseneck-shaped loop as the retrieval device was made possible by the relocation of the tooth using the angioplasty balloon.

Conclusion

FB aspiration is a life-threatening condition. Thus, prompt and differentiated diagnostic and therapeutic approach is a core

thing when it comes to the aspirated tooth. Despite few publications on the endovascular treatment of tooth aspiration, it seems to be deserving a note treatment option. Endovascular techniques and equipment should be considered if attempts to remove aspirated teeth using standard laryngological tools are unsuccessful. However, one should take into account the experience of the interventional radiologist performing the procedure.

Declarations

Availability of Data and Material

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Competing Interest

The authors declare that they have no competing interests.

Authors Contribution

RJ- Radiologist, proposed and performed procedure described in the case study, revision of drafts, given final approval of the version to be published.

AK- acquisition of data, analysed and interpreted the patient case regarding the intensive care conditions, contributor in writing the manuscript.

MB- Anaesthesiologist, assisted performed procedure, proposed modifications to procedure, consultations, revision of drafts, given final approval of the version to be published.

KS- analysed and interpreted the patient case regarding the new applications of intravascular equipment, data research, involved in drafting, contributor in writing the manuscript.

MHB- was responsible for data collection, literature research and analysis, involved in drafting, contributor in writing the manuscript.

AP-was responsible for accuracy or integrity of case report, involved in drafting, design of work, contributor in writing the manuscript.

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