



Three case reports of serious complications following tooth aspiration after coronary artery bypass grafting

Prikazi 3 primerov resnih zapletov ob aspiraciji zoba po operaciji premostitve koronarnih arterij

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Abstract

Coronary artery bypass grafting (CABG) is a major surgery primarily performed in adults, who are often prone to dental problems such as loose incisor teeth, decay, dental bridges, and porcelain veneers. Tooth aspiration is associated with severe complications, including hypotension, hypoxemia, cardiac arrest, pneumonia, abscess, bronchopleural fistula, and empyema. We are reporting three unusual cases of tooth aspiration following CABG and their complications. Among the three patients, one died due to severe complications including bronchopleural fistula, empyema, and sepsis, whereas the remaining two patients recovered successfully and were discharged home. The paper emphasizes that the treating team, including cardiologists, intensivists, surgeons and anaesthesiologists, should have a high index of suspicion for dental injury, especially in the context of difficult intubation and in the presence of pneumonia as a postoperative complication.

Izvilleček

Operacija premostitve koronarnih arterij (CABG) je obsežen kirurški poseg, ki se izvaja predvsem pri odraslih bolnikih, pri katerih so pogosto prisotne zobozdravstvene težave, kot so majavi sekalci, zobni karies, zobni mostički in porcelanske luske. Aspiracija zoba je povezana z resnimi zapleti, vključno s hipotenzijo, hipoksemijo, srčnim zastojem, pljučnico, abscesom, bronhoplevralno fistulo in empiemom. Predstavljamo 3 nenavadne primere aspiracije zoba po operaciji premostitve koronarnih arterij ter z njo povezane zaplete. Od 3 bolnikov je eden umrl zaradi hudih zapletov, vključno z bronhoplevralno fistulo, empiemom in sepo, preostala 2 pa sta uspešno okrevala in bila odpuščena v domačo oskrbo. Članek poudarja, da mora biti celotni zdravstveni tim, vključno s kardiologi, intenzivisti, kirurgi in anesteziologi, posebej pozoren na možnost poškodbe zob, zlasti pri oteženi intubaciji in ob pojavu pljučnice kot zapleta po operaciji.

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1 Introduction

Tooth aspiration is a very uncommon but potentially severe issue that can occur during induction of anaesthesia during difficult intubation in cardiac surgery. In a 15-year retrospective review, we have recorded only 3 cases of tooth aspiration occurring in over 7000 cardiac surgeries. Protective airway reflexes, including the cough reflex, are suppressed during induction of general anaesthesia, increasing the risk of aspiration of avulsed teeth or dental prostheses, particularly in patients with poor dentition and difficult airway management (1). Kritchevsky et al. (2) stated that potential complications of tooth aspiration include recurrent bronchiectasis, lung abscess, pneumonia, and haemoptysis. Warner et al. (3) found that lung abscess is frequently the first sign in patients and should prompt concern for a tooth being in the lungs after cardiac surgery. Tracheal intubation is a routine and essential procedure in cardiac surgery. Therefore, anaesthesiologists must possess the necessary skills in airway management for this high-risk surgery. Airway management in patients with coronary artery disease is unique when compared to other surgeries, as it depends on factors such as the patient's primary diagnoses, urgency, acute coronary syndrome, and presence of untreated co-morbid diseases. Intubating CABG patients, particularly those with congestive heart failure, often poses challenges due to their limited physiological reserves and narrow margin of safety when an unanticipated difficult airway is encountered. Schälte et al. (4) stated that the incidence of difficult intubation (DI) in the cardiac surgery theatre is 8-13.2%. Airway management-related morbidity (e.g., aspiration, hypotension, hypoxemia, and esophageal intubation) and mortality rate reportedly occur in 28.0% - 39.0% (2,3) and 3.0% of patients (1), respectively, but tooth trauma and aspiration are exceedingly rare entities in cardiac surgery patients. Heinrich et al. (5) found that when faced with challenging intubation, practitioners tend to raise the lifting forces of the laryngoscope blade, which can result in harm to intraoral tissues and osseous structures. Occurrence in CABG patients usually has a subtle presentation as most anaesthesiologists are unaware of aspiration of any foreign material, or do not report it to the surgeon or cardiologist. Duan et al. (6) described poor oral hygiene, avulsed teeth, and lack of expertise as major risk factors for foreign body aspiration in patients. Timely identification and removal of

foreign objects is crucial to avoid serious health issues and potential death. The retrieval process comes with risks, as the patient may experience sudden decompensation due to low cardiac output or other postoperative complications at any time. We are presenting three adult patients who had an iatrogenic aspirated tooth by the anaesthesiology team during intubation and underwent retrieval of the aspirated tooth using flexible bronchoscopy, which caused bronchopleural fistula, empyema and sepsis, resulting in death in one patient and successful management in the other two patients.

2 Case 1

A 78-year-old male underwent CABG. Preoperative airway assessment revealed poor dentition with a loose maxillary incisor. The patient also had limited neck extension and a Mallampati class III airway, suggesting a potential risk for difficult intubation. The preoperative team noted a loose tooth, but no formal dental evaluation was performed. He developed hypoxemia, hypotension, and arrhythmia following a failed intubation attempt. Due to the unanticipated loss of airway on induction, endotracheal intubation was performed under general anaesthesia induced with oxygen, Fentanyl, and Isoflurane and maintained routinely. Emergency tracheostomy was on standby in the case of endotracheal intubation failure. A second attempt was successful with the same laryngoscope using the right molar approach and a stylet. Postoperative recovery was

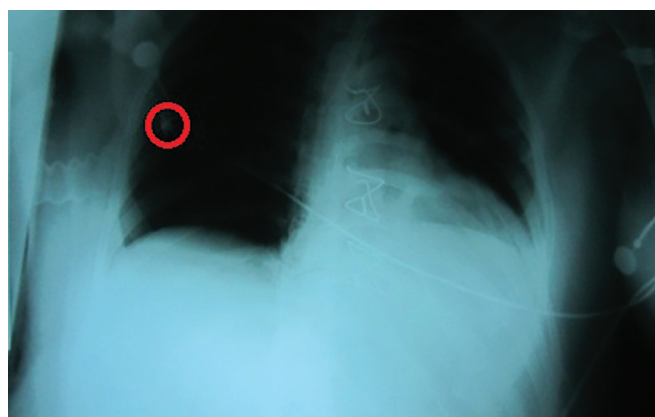


Figure 1: The X-ray shows a tooth in the right main bronchus. Source: archive of the Imam Ali Hospital, Kermanshah, Iran.

initially uneventful. However, on the 2nd postoperative day, he became agitated in the intensive care unit due to acute dyspnea. The chest X-ray showed a foreign body (a tooth) (Figure 1). Accidental aspiration of the tooth during difficult intubation was concluded. An attempt to remove the tooth from the right bronchial tree using a flexible bronchoscope was unsuccessful. Intubation was required, and successful extraction was done using a rigid bronchoscope on the third postoperative day. Unfortunately, the procedure was complicated by bronchopleural fistula, empyema, septicaemia, and eventually death.

3 Case 2

A 67-year-old male patient was admitted electively for CABG. On pre-anaesthetic evaluation, the patient was found to be overweight. Airway examination demonstrated a Mallampati class III airway and increased body mass index, both recognized predictors of difficult tracheal intubation. His mandibular contour, mouth opening, and neck movement were normal. No predictors of difficult intubation were identified during the pre-anaesthetic assessment; however, unexpected difficult airway management was encountered during induction. Due to unanticipated airway loss during induction, routine endotracheal intubation was attempted. Difficult intubation was announced after 3 failed attempts, and airway management was performed with an airway mask. Emergency tracheostomy was performed with a size 7.5 cuffed tracheostomy tube (TT) while the patient was on full-support mechanical ventilation. The patient maintained 100.0% SpO₂ during positive pressure ventilation without hypoxia or a fall

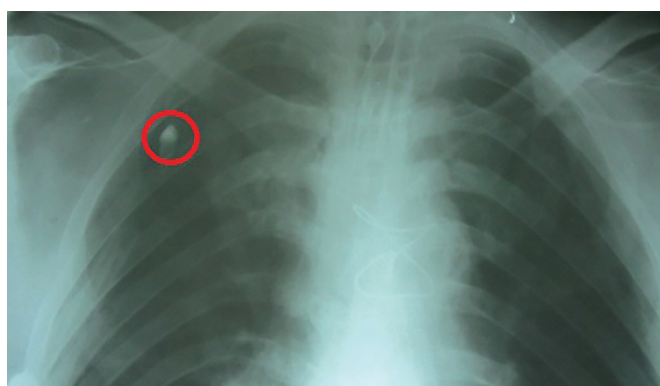


Figure 2: Shows the aspirated tooth in the right pleural space.

Source: archive of the Imam Ali Hospital, Kermanshah, Iran.

in oxygen saturation.

The chest X-ray later showed a tooth in the right lung. Fiberoptic bronchoscopy was performed by an otolaryngologist, and no endobronchial pathology was detected. A repeated chest X-ray revealed a massive right-sided pleural effusion, necessitating thoracotomy on the second postoperative day. Pus-filled fluid in the pleural cavity was removed with no growth of bacteria and significant air escaping. A right thoracotomy was performed by a thoracic surgeon after intubation on the 3rd postoperative day. An incisor tooth and a bronchopleural fistula were discovered during the procedure (Figure 2). Since the right upper lobe was destroyed, a lobectomy was performed. The patient's recovery after surgery went smoothly, and he was discharged home on the 16th day. Pathological examination revealed bronchopneumonia with multiple abscesses. The patient was followed up for 9 months and did not experience any bronchopulmonary symptoms or additional issues.

4 Case 3

A 48-year-old male presented to the emergency room two weeks post-CABG complaining of acute onset of dyspnoea. Preoperative airway assessment was notable for anticipated airway difficulty due to upper airway oedema and restricted visualization of the glottic structures. The patient underwent tracheostomy during surgery due to difficult intubation. In this patient, intubation with a laryngoscope was extremely difficult as a result of nasopharyngeal oedema and a combination of swelling of the tongue, oropharyngeal structures, epiglottis, and aryepiglottic folds secondary to repeated attempts at laryngoscopy. We were unable to perform fiberoptic intubation due to swelling in the oropharyngeal structures, which limited our ability to maneuver the fiberscope and see the glottic opening.

No abnormality was reported by the cardiologist or anaesthesiologist on routine postoperative chest X-ray. The postoperative period was complicated by chills, fever, and a productive cough that were attributed to tracheitis and the complication of tracheostomy. With improvement in his general condition by antibiotic therapy, the patient was discharged home. On the 14th post-operative day, the patient woke up with shortness of breath at home, together with some productive cough of white, offensive sputum, fever, and haemoptysis. Upon arrival at the emergency department, he was saturated 85.0% with a high respiratory rate but was haemodynamically stable. Physical exam was significant for decreased air entry on the right side. Chest



Figure 3: Shows the aspirated tooth impacted in the distal right bronchus.

Source: archive of the Imam Ali Hospital, Kermanshah, Iran.

X-ray revealed a tooth in the right bronchus (Figure 3). The patient denied any dental procedure after his surgery, as well as the use of any sedative drugs or alcohol intake. It was believed that it must have occurred during the time of the failed trials of intubation. He was taken to the intensive care unit and had a flexible bronchoscopy procedure carried out. A tooth was identified in the distal right main-stem bronchus, impacted in the lung tissue. Endobronchial forceps were used to grasp the tooth root. Light traction was applied, and the tooth was slowly dislodged from lung tissue. With the tooth grasped by the forceps, the bronchoscope, forceps, and tooth were extracted en bloc through the vocal cords. The patient was treated with antibiotics during which he reported dramatic improvement of his symptoms, and he was discharged in a stable condition after 14 days.

5 Discussion

Tooth aspiration is a rare but potentially serious complication of airway management during cardiac surgery. Although dental trauma associated with endotracheal intubation is well recognized, aspiration of an avulsed tooth is uncommon and may remain undetected, particularly in sedated or mechanically ventilated patients. In the present case series, all three patients experienced difficult airway management, and delayed diagnosis contributed to significant morbidity, including bronchopleural fistula, empyema, bronchopneumonia, and death in one patient. These cases highlight the importance of maintaining a high index of suspicion for dental aspiration when postoperative respiratory complications occur following difficult intubation (1-6).

Due to the size of the aspirated tooth, complete

airway obstruction is rare. In cardiac surgery patients, the signs and symptoms of tooth aspiration may be atypical and nonspecific. In this case series, the diagnosis of tooth aspiration was made the morning after surgery when the anaesthesiologist reviewed the new postoperative chest X-ray (4,5). In CABG, aspiration of a lost tooth or a part of a tooth occurred during induction of anaesthesia.

Risk factors for tooth aspiration in cardiac surgery include advanced age, neurological problems, maxillofacial abnormalities, poor oral hygiene, tooth decay, loose teeth, short neck, airway tumours, and inexperienced anaesthesiologists.

In difficult intubation and emergency cases, multiple laryngoscopy attempts can damage teeth and increase the risk of aspiration. In difficult cases of intubation, multiple attempts of laryngoscopy also cause severe oedema of the soft tissue of the larynx, which also increases damage to the tooth, to find an airway for intubation. Deep sedation during induction for cardiac surgery abolishes protective airway reflexes and increases the risk of aspiration (6). Sometimes, at the start of induction, poor sedation for any reason causes excessive movement in agitated cases, which increases the risk of tooth trauma, fractures, and aspiration.

Perrott et al. (7) reported that in dentistry, the risk of dental aspiration increased in general anaesthesia and in deeply sedated cases compared to local anaesthesia. This conclusion revealed that deep sedation is a risk factor for tooth aspiration in cardiac surgery when airway protective reflexes, such as coughing, are abolished. Tooth aspiration is a rare complication following CABG, but silent aspiration may not be uncommon. Tooth aspiration cannot be an emergent life-threatening condition because the aspirated object is small enough to cause complete airway obstruction. Between 500 and 2000 deaths due to foreign body aspiration happen annually in the United States (8). Horner et al. (9) stated that dental injury is a common complication of laryngoscopy and intubation, occurring in around 1 out of every 4,500 patients under general anaesthesia. The effects of dental trauma under general anaesthesia can vary, but the most feared result is when a dislodged tooth is inhaled into the lungs. Schwartz et al. (10) showed that in typical situations a knocked-out tooth can become misplaced either in the mouth or the drapes. If the tooth is not located, a thorough imaging of the head, neck, chest, and abdomen might be necessary. To avoid this, teeth protectors may be used; however, they are awkward and can block the vision. Aspiration of a tooth during challenging intubation situations is a

recognized complication that requires quick identification and immediate treatment to reduce possibly severe and, at times, deadly outcomes. Cardiac surgery patients under general anaesthesia are at risk of aspirating dental appliances or teeth, which may introduce oral microorganisms into the lower respiratory tract and predispose patients to infectious complications such as aspiration pneumonia and lung abscess. Oral microbial flora can contribute significantly to post-aspiration pulmonary infections. The oral cavity harbors a diverse microbiota including bacteria, fungi, protozoa, and viruses. Among these microorganisms, *Streptococcus* and *Staphylococcus* species are frequently associated with aspiration-related respiratory infections. Therefore, prolonged retention of an aspirated tooth may increase the risk of secondary infectious complications, particularly in patients with poor oral hygiene and pre-existing dental disease (1-3).

Here, we report a rare and unusual case series of tooth aspiration in its presentation. Lee et al. (11) found that diagnosing tooth aspiration early in post-operative patients is hard due to the fact that aspiration is seldom taken into account if there is no sudden clinical manifestation. Therefore, a tooth lodged in the bronchus can go unnoticed for an extended period and lead to severe complications. Anaesthesiologists must consider the possibility of an aspirated avulsed tooth in difficult intubation cases, particularly in hypoxic patients. After surgery, clinicians need to examine clinical symptoms and radiological findings thoroughly. CT is superior to chest radiography in identifying endobronchial foreign bodies (12). Henderson (13) stated that if a patient's chest X-ray is negative or the clinical symptoms are uncertain, bronchoscopy is necessary to confirm the diagnosis. In Xue et al.'s (14) study, both flexible and rigid bronchoscopy have been used for the diagnosis and removal of the teeth.

Performing a tracheotomy can help with the removal of an aspirated tooth. The complications of tooth aspiration were reported in the literature very commonly in orofacial or maxillofacial surgery. According to results from the largest study with just five cases, tooth aspiration complications were identified as chronic lung disease, lobectomy, pneumomediastinum, recurring haemoptysis, pneumothorax, bronchiectasis, bronchopleural and broncho-cutaneous fistula, pleural effusion, and empyema of the cavity (15).

An avulsed incisor tooth moves unidirectionally as the anaesthesiologist encounters complications of difficult intubation such as hypoxia and agitation in the sedated patient. Because of sedation, it is impossible to

expectorate once the tooth has been aspirated. Tooth migration to the pleural space may be the cause of a bronchopleural fistula. Hence, we were confident that the bronchopleural fistula was caused by medical intervention. Additionally, the haemoptysis that occurred the day after the tube drainage was caused by the abscess and bronchopneumonia (16). Although a few cases of tooth aspiration in maxillofacial surgery were reported, cases involving adult patients in CABG are very rare. Although uncommon, we advise surgeons to keep in mind the possibility of unexpected foreign body aspiration in cases of postoperative lung infection. Unlike patients undergoing cardiac valve surgery, for whom preoperative dental assessment is commonly recommended to reduce the risk of infective endocarditis, routine dental evaluation before isolated CABG is not universally required. Nevertheless, our cases suggest that identification of loose teeth, advanced dental decay, or unstable dental prostheses before surgery may help reduce the risk of dental trauma and aspiration during airway management. Therefore, selective dental assessment may be considered in CABG patients with poor oral health or obvious dental instability (17). The physicians should be aware of the life-threatening complications of tooth aspiration. It is necessary to get a dentist's consultation for patients with loose and shaky teeth before heart surgery. Additionally, it is advisable to undergo a dental check-up before surgery to detect any substantial decay that could potentially elevate the risk of respiratory infections (18).

Any significantly loose teeth may harbor bacteria, which could cause a lung abscess after aspiration. Nevertheless, it is advisable to postpone non-emergency dental cleanings for approximately 12 weeks after valve surgery to allow proper healing of the valve, but there is also some confusion about oral antibiotics after dental work after CABG surgery. Current guidelines do not recommend routine antibiotic prophylaxis for dental procedures solely on the basis of previous CABG surgery. Decisions regarding antibiotic prophylaxis should follow established cardiovascular and infectious disease guidelines and be individualized according to patient-specific risk factors. It is challenging to diagnose tooth aspiration early in intubated patients because clinicians rarely consider aspiration unless there is a sudden clinical issue (10). Therefore, in all three cases mentioned, the anaesthesiologist failed to detect tooth aspiration, leading to serious complications from an undetected endobronchial tooth.

Heinrich et al. (5) recommended that doctors should suspect that any tooth that has been avulsed and not

found as possibly aspirated in intubated patients, especially for those shaky and loose teeth. Duan et al. (6) found that it is important to closely examine the medical history, clinical symptoms, and radiological results. CT scans are better at detecting endobronchial foreign bodies compared to chest X-rays. Bronchoscopy should be conducted to confirm the diagnosis in cases where chest radiography is negative or clinical findings are uncertain. Flexible and rigid bronchoscopies are both applicable for diagnosing and extracting teeth. Tracheotomy that is performed for difficult intubation may facilitate the removal of an aspirated tooth. In dental injuries associated with difficult intubation, maxillary central incisors are at the greatest risk. During laryngoscopy, half of dental trauma from intubation occurs, while 23.0% happens after extubation (10).

Dental aspiration is a rare injury but is more common in elderly patients with periodontal disease or loss of a dental root. In patients in whom intubation is difficult, if an entire tooth is avulsed, it can be aspirated and logged in the right or left bronchial tree. Aspiration is more prone to occur in the right lower lobe because of the straighter path and wider bore of the right main bronchus (19). Tooth aspiration can lead to severe complications like obstructive pneumonia, atelectasis, lip lacerations, and hematomas due to inexperienced practitioners performing careless laryngoscopy, resulting in the need for bronchoscopy for removal (20).

Damage to the tooth, usually associated with an oropharyngeal trauma, odynophagia, painful swallowing, and uvula oedema, has been reported. Incidence of sore throat after difficult intubation is approximately 40.0% - 65.0% when blood is found on airway instruments (21). The prophylaxis methods for the prevention of these complications are consulting with a dentist for all patients with poor oral hygiene, tooth decay, and those who have tooth loosening. In patients with short necks and fat cases, the chance of difficult intubation and its complications, such as aspiration, should be considered and intubation must be done by an experienced anaesthesiologist. In patients with poor oral hygiene, loose teeth, advanced dental caries, or unstable dental prostheses, preoperative dental evaluation may help identify individuals at increased risk of dental trauma and aspiration during airway management. These antibiotics usually cover common oral species, including anaerobic and gram-positive streptococci and staphylococci bacteria (21).

During the study period, approximately 7,000

cardiac surgical procedures were performed at our institution. Difficult airway management was documented in a minority of cases, while only three cases of tooth aspiration were identified over 15 years, highlighting the rarity of this complication.

6 Conclusion

Tooth aspiration is a rare but potentially serious complication of airway management during CABG surgery. Delayed diagnosis may result in severe pulmonary and pleural complications, including bronchopleural fistula, empyema, pneumonia, and death. Careful preoperative dental assessment, heightened awareness during difficult intubation, and prompt investigation of unexplained postoperative respiratory complications may facilitate early diagnosis and improve patient outcomes. Clinicians should consider the possibility of aspirated dental structures when postoperative pulmonary symptoms occur following difficult airway management.

Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

All authors have contributed to the result interpretation and manuscript drafting and approved the submission of the final copy for publication.

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Ethics Statement

This study results from a research project approved by Ilam University of Medical Sciences, Ilam, Iran (ethical code: IR.MEDILAM.REC.1404.145).

Consent for publication

Written informed consent for publication of the clinical details and accompanying images was obtained from the patients or their legally authorized representatives.

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