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Case Report

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Airway Management in a Patient with Unique Craniofacial Penetrating Injury

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Craniofacial penetrating injuries are most commonly caused by gunshot and stab wounds. However, rare cases resulting from other uncommon sharp objects, such as chopsticks, metal bolts, and arrows, have been reported. High- or low-energy projectile injuries in the craniofacial region can lead to significant complications that require surgical intervention or airway protection. Early appropriate airway management in patients with craniofacial penetrating injuries is crucial as facial soft tissue can swell quickly after injury, compromising the airway and ventilation. We reported a 66-year-old female patient admitted to our hospital following acute craniofacial penetrating trauma, with a steel rod in the nasopharynx. This report presents the successful perioperative airway management of the case, in which nasotracheal intubation was impossible.

Key words: airway, craniofacial injury, mouthpieces

Introduction

Craniofacial penetrating injuries commonly result from gunshots, but rare cases caused by uncommon projectiles, such as chopsticks, metal bolts, and arrows have been reported.[1-3] This case report describes an unusual craniofacial penetrating injury in which the embedded object occluded the nasal cavities.

Case Report

A 66-year-old female fell into a 1-meter-deep pothole while walking through a road construction area at night. A steel rod penetrated her upper neck during the fall. The proximal end of the rod was cut by paramedics, and she was transferred to our emergency unit with the steel rod in situ. On arrival at our emergency department, her vital signs were as follows: blood pressure: 132/65 mmHg, respiratory rate: 20 breaths per minute, pulse rate: 66 beats per minute, body temperature: 35.6˚C, oxygen saturation: 98% with oxygen delivered at 3 liters per minute via nasal prongs, and Glasgow coma scale score: 15. The retained steel rod was 2 cm in diameter, and approximately 60 cm of the remaining section was exposed from the left chin. Neurological examinations revealed ipsilateral ptosis and

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vision loss and absent pupillary light reflex in the right eye, indicating injury to the right optic and oculomotor nerves. Urgent head and neck three-dimensional computed tomography was performed. The images showed a steel rod entering through the left chin, passing through the tongue base, oral cavity, and bilateral nasal meatus, and penetrating into the lacrimal and frontal bones of the right orbital wall (Fig. 1, Fig. 2A & Fig. 2B). There was also evidence of mild pneumocephalus in the right frontal region (Fig. 2C). Emergency surgical extraction of the steel rod was indicated, with planned exploration of the penetrating injury to the regional tissues by otolaryngologists, neurosurgeons, and plastic surgeons. The patient was evaluated for intraoperative airway management before endotracheal anesthesia. Her maximum mouth opening was approximately 2 cm between the incisors because the motion of the mandible was limited by the steel rod. Because assisted ventilation was considered difficult, and bilateral nasal cavities were occluded by the steel rod, which impeded nasotracheal intubation, awake fiberoptic-guided oral intubation with an endotracheal tube was chosen to establish a secure artificial airway for endotracheal anesthesia. The patient was positioned supine, and she was asked to bite down on an endoscopic mouthpiece (PAHSCO, Pacific Hospital Supply Co., Torng-lo, Taiwan, ROC) (Fig. 3A). The oral mucosa was anesthetized by circumferentially spraying 2% lidocaine, and the cough reflex was blocked by intratracheal instillation of 3 mL of 2% lidocaine. An endotracheal tube (7.0 mm inner diameter; Teleflex, Inc., Wayne, PA, USA) was guided by a flexible fiberoptic bronchoscope through the mouthpiece and successfully intubated into the trachea without causing trauma to the laryngeal tissues (Fig. 3B). After inducing anesthesia with intravenous anesthetics, cisatracurium (10 mg) was administered to facilitate mechanical ventilation via the oral endotracheal tube. General anesthesia was maintained with inhaled sevoflurane (2% – 3% in mixed gases). Following occipital craniotomy, the distal portion of the steel rod was accessed, and a skull base open fracture with an incomplete dural tear was noticed. The steel rod was carefully removed after right-sided multiple sinusectomies and inferior turbinectomy. Tracheostomy was also performed in the hyper-extended neck position by placing a shoulder pad under the patient's neck, as prolonged endotracheal intubation was anticipated. Postoperatively, the patient remained in the intensive care unit for 18 days to receive care for the regional wound and a deep neck infection. After resuming regular respiratory patterns without significant airway obstruction (i.e., both nostrils, nasal cavity, and oropharynx were patent), the patient was discharged from our hospital on postoperative Day 30.

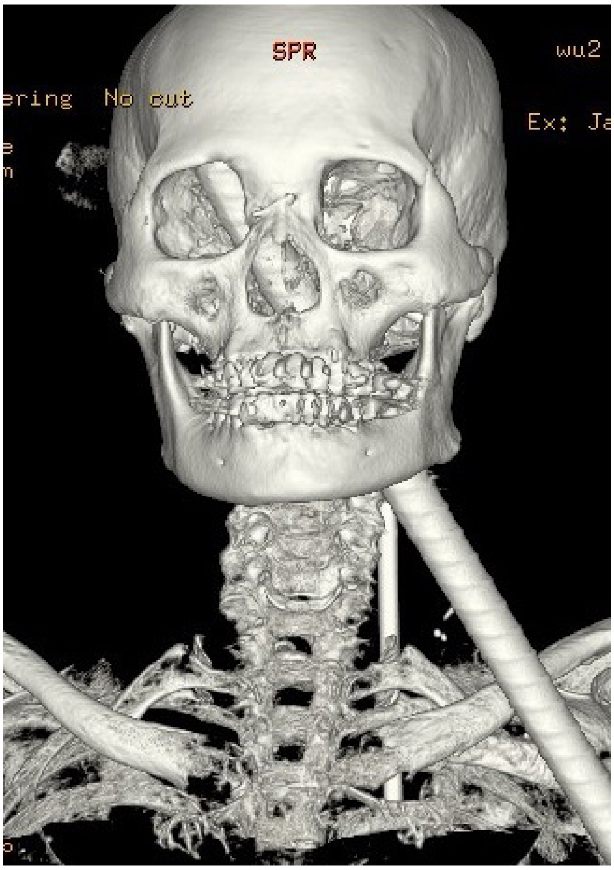

Fig. 1 The tri-dimensional computerized tomography showed the presence of a large steel rod entering through the left chin, extending through the tongue base, oral cavity, left nasal meatus, nasal septum, right nasal meatus, penetrating the lacrimal and frontal bone of the right orbital wall.

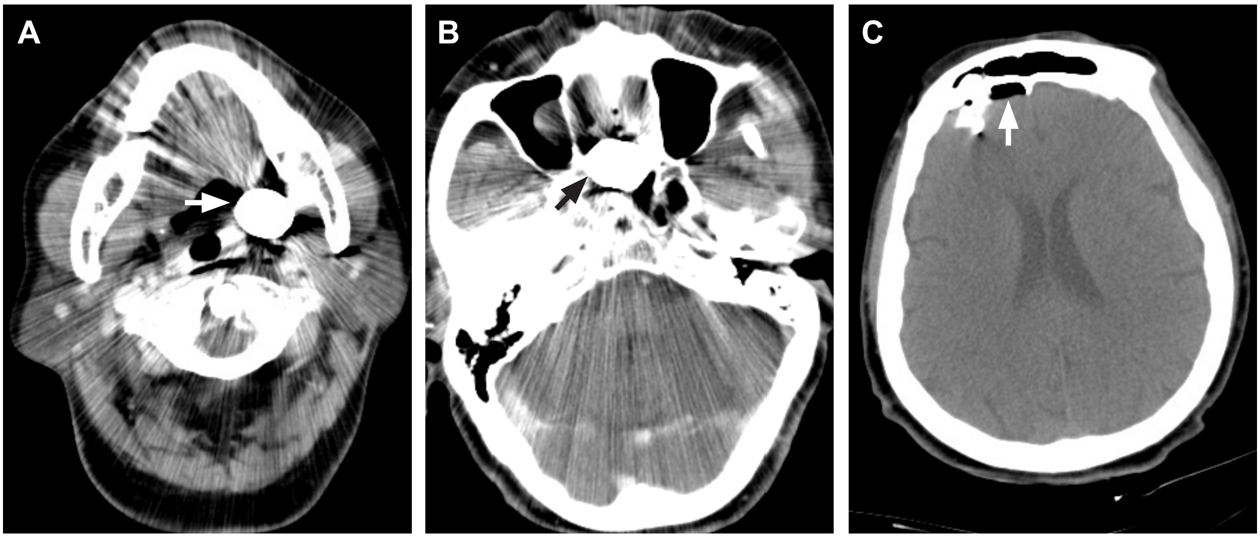

Fig. 2 (A) The computerized tomography scan showed that the steel rod was in the oral cavity (white arrow), and (B) both sides of the nasal cavity were occupied by the steel rod (black arrow). (C) The end of the steel rod penetrated the skull base near the right frontal bone into the cranial cavity, and pneumocranium was noted (white arrow).

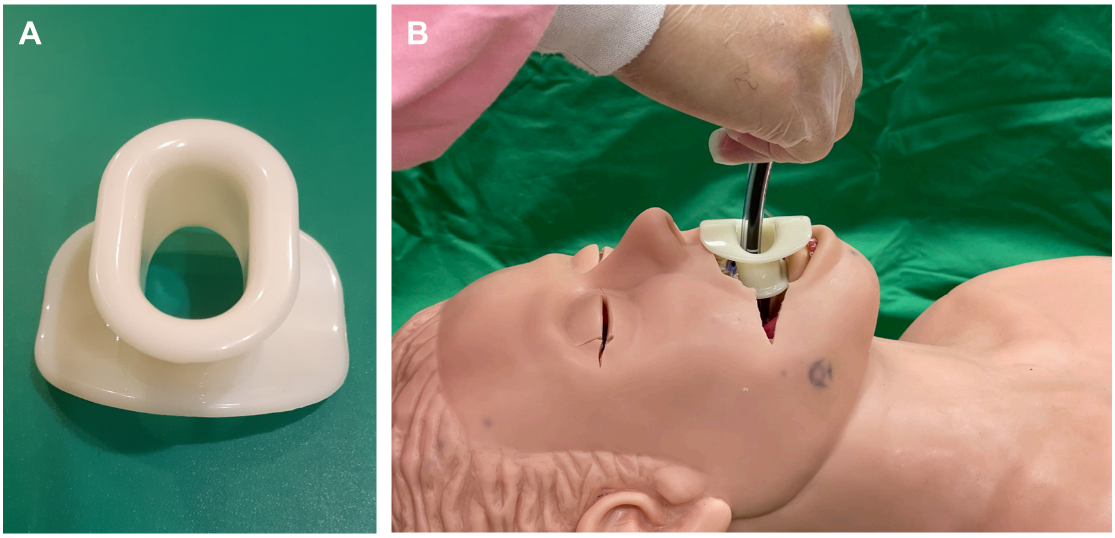

Fig. 3 (A) Endoscopic mouthpieces. (B) The picture demonstrates how to manage the airway and intubate in this case. After the oral mucosa was anesthetized by circumferential spraying of 2 v/v% lidocaine, and the coughing reflex was blocked by intratracheal instillation of 3 mL of 2 v/v% lidocaine, an endotracheal tube was guided by a flexible fiberoptic bronchoscope through the mouthpiece and intubated into the trachea. The key point is to confirm each anatomy and there is no cough reflex during the process.

Discussion

Airway management is a main concern in patients with craniofacial penetrating injury, as a compromised airway due to regional tissue swelling and retropharyngeal distortion can progress rapidly and result in significant consequences.[4] Early establishment of a secure artificial airway is also essential to prevent insufflation of blood or oral discharge into the trachea. In our case, the penetrating object in the mandible and nasal cavities precluded assisted mask ventilation when the patient was anesthetized or medically paralyzed before establishing a secure airway. Therefore, awake endotracheal intubation using fiberoptic bronchoscopy or surgical airway approaches was considered the main option for airway management in this patient. The use of a mouthpiece, commonly used during esophagogastroscopy, offers more comfortable support to the jaw and keeps the mouth open for the smooth passage of the bronchoscope.

Penetrating injuries to the head and neck can be divided into three anatomical zones.[5] The first zone (zone I) comprises the region from the clavicle to the cricoid cartilage. The second zone (zone II) extends from the cricoid cartilage to the angle of the mandible, and zone III extends from the angle of the mandible to the base of the skull. Our patient was considered to have injuries in zones II and III.

Nasal endotracheal intubation is more anatomically favorable for awake fiberoptic bronchoscopy as the laryngeal opening is more easily observed when the bronchoscope passes linearly through the nasopharynx with less obstruction by the tongue.[6] However, nasal endotracheal intubation was not possible in our case, as bilateral nasal cavities were obstructed by the steel rod.

In this case, we preferred awake fiberoptic bronchoscopic intubation versus awake tracheostomy to establish a secure airway before the operation. This was because the patient felt uncomfortable and became uncooperative with the hyper-extended position for tracheostomy, mainly because she was carrying a considerably heavy object in her lower neck. In addition to guiding endotracheal intubation, fiberoptic bronchoscopy could also allow direct visualization of the presence or extent of airway injury sustained during the initial trauma that was not clearly identified on the serial computed tomography images. Although using a video-assisted intubation stylet (VAIS) was an alternative to awake fiberoptic bronchoscopy for oral endotracheal intubation, VAIS usually requires higher levels of patient sedation and muscle relaxation to facilitate passing the rigid intubation stylet through the oropharynx. Therefore, VAIS-assisted intubation was not chosen as spontaneous ventilation was required during endotracheal intubation in this patient.

In addition to the early establishment of a secure airway, several perioperative issues must be addressed to safely remove a penetrating object from the craniofacial region, namely adequate surgical exposure of the skull base and paranasal sinuses.[7] Adequate perioperative hemodynamic monitoring and a multi-lumen central venous catheter are also essential for anesthetic management in critical craniofacial injury.[8]

In conclusion, we illustrated that awake fiberoptic bronchoscope-guided oral endotracheal intubation is a safe and effective approach to establish a secure airway to maintain ventilatory support and prevent respiratory collapse in patients with critical craniofacial penetrating injury.

Author Contributions

Conceptualization, Ping-Hsin Liu and Chien-Cheng Liu; Data Curation and Writing-Original Draft: Ping-Hsin Liu; Writing-Review, Editing and Supervision: Kuo-Chuan Huang.

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Conflicts of Interest

The authors declare no conflict of interest.

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