

# The bamboo skewer: airway management in a patient with penetrat- ing injury of the floor of mouth

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**Purpose:** To report a safe airway management option in patients with penetrating injury of the floor of the mouth, reinforcing the similar experience of others and illustrating the importance of proper assessment and planning before airway negotiation.

**Clinical features:** A 23-yr-old man was admitted with a penetrating injury of the floor of mouth caused by falling on bamboo and with the foreign body *in situ*. The extent of penetration could not be assessed clinically but computerized tomography (CT) was used to assist in preoperative evaluation of the airway. After atropine iv, fentanyl iv, topical cocaine and lidocaine spray, awake fiberoptic guided nasal intubation was performed successfully and the patients airway secured before induction of anaesthesia. Elective tracheostomy was performed postoperatively which was removed on day 5. Post-operative recovery was uneventful.

**Conclusion:** Awake fiberoptic guided nasal intubation was useful in managing the airway of a patient with a penetrating injury of the floor of mouth and foreign body *in situ*. Thorough previous evaluation of the patients airway by CT scan, careful topicalisation of the airway, and judicious use of iv sedation and anti-sialogue contributed to the safe and successful airway management.

## Key words

AIRWAY: obstruction, intubation;  
INTUBATION: difficult, technique, fiberoptic.

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**Objectif:** Présenter une modalité efficace de gestion des voies aériennes applicable aux accidentés porteurs d'une plaie pénétrante du plancher de la bouche. Cette observation corrobore d'autres expériences identiques et illustre l'importance d'une évaluation et d'une préparation appropriées avant toute manipulation des voies aériennes.

**Éléments cliniques:** Un homme de 23 ans était admis avec une plaie pénétrante du plancher de la bouche avec un corps étranger *in situ* conséquence d'une chute sur un bambou. En préopératoire, l'importance de la pénétration ne pouvait être déterminée par la clinique mais la tomographie axiale a procuré une bonne évaluation des voies aériennes. Après de l'atropine iv, de la cocaïne topique et une vaporisation de lidocaïne, une intubation nasale vigile guidée par fibroscopie était effectuée et les voies respiratoires contrôlées avant l'induction de l'anesthésie. Une trachéotomie préventive était exécutée et abandonnée le cinquième jour. La récupération s'est produite sans incidents.

**Conclusion:** Une intubation nasale vigile guidée par fibroscopie a procuré le contrôle des voies aériennes d'un patient souffrant d'une plaie pénétrante du plancher de la bouche avec un corps étranger *in situ*. Après l'évaluation par tomographie axiale, une anesthésie de contact soignée des voies aériennes, l'utilisation judicieuse de la sédation et d'un antisialogue ont permis de contrôler efficacement les voies aériennes.

Patients with traumatic penetration of the floor of mouth with the penetrating object *in situ* present a challenge to the anaesthetist in terms of airway management and awake tracheostomy under local anaesthesia may be considered necessary. We describe a patient whose floor of the mouth was penetrated by a piece of sharp bamboo, and who presented with the bamboo *in situ*. The airway was managed successfully by awake fiberoptic intubation, after careful evaluation of the airway with the aid of computerized tomography (CT).

## Case report

A 23-yr-old construction site worker, previously in good



FIGURE 1 The patient with the bamboo *in situ* (arrow). (Reproduced with patient's written permission).

health, slipped while working and fell onto a pile of bamboo used for building scaffolding. The bamboo penetrated the floor of his mouth and broke on entry so that only a small portion was left protruding from the wound. (Figure 1).

On arrival in hospital, he was conscious. He had no signs of upper airway obstruction and breathing was adequate. However, he could not open his mouth more than 1 cm of inter-incisor distance. Therefore, the extent of bamboo penetration could not be determined clinically. He did not protrude his tongue, when asked, suggesting that his tongue was probably also penetrated by the bamboo. There was some blood oozing from the mouth and swelling in the submandibular region and right cheek. There was no rhinorrhoea or otorrhoea. The bamboo was not radio-opaque and was not clearly seen on the plain radiography of the mandible.

The head and neck surgeon decided to explore and remove the bamboo piece. Since the patient's airway was not in immediate danger, CT of the face and upper neck



FIGURE 2 Coronal CT scan of pharynx showing the 'bamboo' as radiolucent streaks of air (arrow).

was performed to aid both in the evaluation of the airway for the anaesthetist and in the subsequent surgical management. He was transferred to the CT suite without sedation and with pulse oximeter monitoring.

The CT showed the bamboo as a straight, radiolucent foreign body (corresponding to air within the bamboo stick) entering the anterior aspect of the floor of mouth, and piercing the right side of tongue (Figure 2). The tip of the bamboo could not be clearly defined, but the small pockets of air in the right parapharyngeal space suggested it lay there. There was no evidence of skull base penetration or fracture. The right posterior nasal choana was obstructed by soft tissue swelling (Figure 3), and the pharyngeal airway was displaced to the left (Figure 4). Blood was noted in the right maxillary sinus.

After considering the clinical assessment, CT scan and similar reported experiences,<sup>1</sup> it was decided to perform awake fiberoptic intubation through the left nostril before induction of general anaesthesia. Awake tracheostomy under local anaesthesia was planned if awake fiberoptic intubation had failed.

The patient was brought to the operating room without premedication and with pulse oximeter monitoring. On arrival, intravenous access was secured and standard monitoring with non-invasive blood pressure, pulse oximeter and ECG was applied. Atropine 0.3 mg *iv* was given as an anti-sialogue. The upper airway was anaesthetised by instilling 2 ml cocaine 4% into the left nostril with the neck fully extended. Equipment for transtracheal jet ventilation (14G Angiocath® and VBM Manujet III jetting device) and tracheostomy was checked and ready.

After 10 min, the patient was placed in the sitting

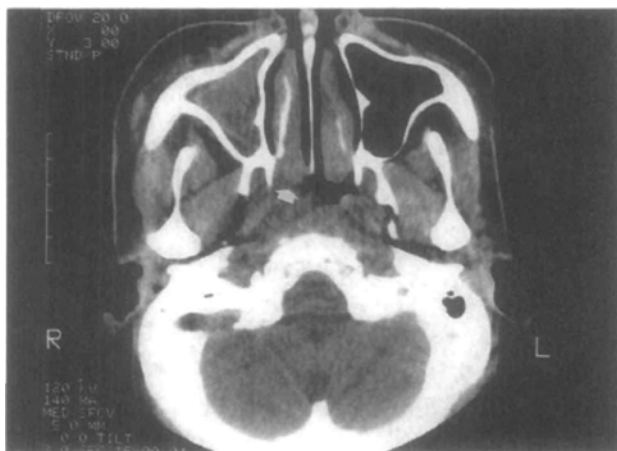


FIGURE 3 Axial CT scan at the level of nasopharynx showing anatomical distortion of upper airway with obstruction of right posterior choana (arrow).

position. Fentanyl 25 µg *iv* was given for light sedation. With the anaesthetist standing in front of the patient, the fiberoptic bronchoscope (Olympus BF P-30) was advanced gently through the left nostril. Initially, the view was obscured by blood and secretions in the oropharynx and continuous oral suction was applied. The view improved but, due to swelling of the surrounding soft tissue and inability of the patient to protrude his tongue, the vocal cords could not be visualized clearly. The patient was asked to phonate and the movement of the epiglottis associated with phonation brought the vocal cords into better view. The fiberoptic bronchoscope was advanced into the trachea while lidocaine 4% was injected through the suction port of the bronchoscope as the scope was advanced. A size #7 endotracheal tube already softened in warm water was railroaded into the trachea smoothly. Anaesthesia was then induced with fentanyl, thiopentone and atracurium *iv* and maintained, using IPPV, with O<sub>2</sub>/air/isoflurane, and intermittent boluses of atracurium. The operation proceeded uneventfully for 90 min. Intraoperative findings, similar to the CT scan, showed that the bamboo had penetrated the floor of mouth obliquely through the tongue and soft palate. (Figure 4) The tip of the bamboo was located in the parapharyngeal space at the level of the nasopharynx.

Although it was decided to allow the patient to wake up and resume spontaneously breathing no bed was available in the Intensive Care Unit. Thus, in view of the extent of injury and the degree of oedema seen intraoperatively, elective tracheostomy was created under general anaesthesia. The trachea was extubated and he recovered from anaesthesia breathing spontaneously via



FIGURE 4 Axial CT scan at level of oropharynx showing swelling in right lateral pharyngeal wall and deviation of pharyngeal airway to left (arrows).

the tracheostomy. The postoperative course was uneventful and the patient was discharged from hospital after two weeks.

#### Discussion

The difficulty in airway management in this patient resulted from: (1) limited mouth opening; (2) uncertainty concerning the extent of anatomical distortion and position and size of intraoral foreign body; (3) fixation of the tongue by the foreign body and (4) possibility of worsening of the extent of injury with coughing, bucking or other movement during airway negotiation. The options for securing the airway included tracheostomy under local anaesthesia, awake fiberoptic guided nasal intubation, retrograde intubation and blind nasal intubation. Tracheostomy, although it appeared to be the safest option, was not selected because it is more invasive and is associated with immediate and delayed morbidity,<sup>2</sup> especially when performed in a hurry under local anaesthesia in an awake patient. Blind nasal intubation and retrograde intubation, which both involved blindly railroaded the endotracheal tube, are also not desirable because the extent of anatomical distortion and the exact position of the bamboo inside the mouth was not known.

Fiberoptic guided intubation is useful in the management of the difficult airway. The success rate is >98% when performed electively.<sup>3</sup> Major causes of difficulty include uncooperative or combative patients and copious secretions and bleeding in the airway.<sup>3,4</sup> Our patient was calm and co-operative when assessed preoperatively, and there was only a little blood oozing from the mouth. Therefore, fiberoptic intubation had a good

chance of being successful, provided adequate care was given to evaluation of the airway and that it caused no further trauma or bleeding during intubation. Also, it had been reported previously in a similar case.<sup>1</sup> Compared with other airway management options, fiberoptic guided intubation is less invasive and the anatomy of the airway can be assessed at the same time that intubation is being performed. Therefore, this technique was chosen.

Computerised tomography of the skull base and upper neck was useful in the initial evaluation as it allowed exclusion of penetration of the skull base by the bamboo. Since the bamboo was constituted by thin streaks of radiolucent material which were masked by the surrounding fat and soft tissue, the bamboo was not well seen in plain x-ray examination. The CT scan delineated the course of the bamboo in upper neck. Nasotracheal intubation in the presence of skull base fracture or penetration carries the risk of introducing the endotracheal tube into the intracranial cavity<sup>5</sup> and, thus, tracheostomy would have been indicated. We also needed to identify the anatomical distortion of the upper airway to ensure safe passage of the fiberoptic bronchoscope as well as the endotracheal tube. Gross swelling or deviation of the airway, or associated fracture of the mid facial skeleton could have precluded passage of the fiberoptic bronchoscope or endotracheal tube. Intubation manoeuvres might also aggravate the injury and cause considerable bleeding in the presence of these abnormalities. Clinical evaluation of the airway, in this regard, was impossible and this was performed by CT. The airway was deviated to the left due to soft tissue swelling in the right pharyngeal wall. This deviation together with the swelling suggested that intubation via the right nostril might have been impossible. The right sided approach was also more likely cause a mucosal tear, due to this deviation and swelling.<sup>6</sup> The presence of blood in the right maxillary sinus suggested a fracture of the nasal bone or maxilla, although not seen on the CT, so that intubation via the right nostril risked further trauma and infection. Thus, the left nostril was chosen. Based on CT imaging, the space behind the tongue and the posterior pharyngeal wall was judged to be adequate for passage of the endotracheal tube. The tongue was confirmed to have been pinned down by the bamboo and very little tongue movement would be possible during intubation. It was impossible for the patient to protrude the tongue during fiberoptic bronchoscopy. Instead, asking him to phonate during the procedure was found to be very effective. This moved the epiglottis and made the vocal cords more visible in the blood-stained field.

At no time was the bamboo piece seen through the fiberoptic bronchoscope and there was considered to be

adequate space to railroad the endotracheal tube once the scope entered the trachea.

We did not perform either superior laryngeal nerve block or transtracheal injection of local anaesthetic to provide local anaesthesia of the airway for several reasons. Transtracheal injection of local anaesthetic, although generally accepted as safe and superior to local spray or nebulized lidocaine for tracheal mucosal and vocal cord anaesthesia, can also cause rare complications including mucosal bleeding from the trachea, local haematoma and swelling, paratracheal abscess and surgical emphysema.<sup>7</sup> Transtracheal injection is relatively contraindicated in patients with potential risks of aspiration.<sup>8</sup> In our patient, should there be local haematoma formation, subsequent emergency cricothyroidotomy, if required, may become more difficult. In addition, we considered it unwise to puncture the cricothyroid membrane unnecessarily because of the potential need for transtracheal jet ventilation later in the course of airway negotiation and, thus, the risk of subcutaneous emphysema. Superior laryngeal nerve blocks are not possible if there is swelling in the submandibular region. Therefore, the airway was anaesthetized with a 'spray-as-you-go' technique.<sup>7,8</sup> Adequate anaesthesia of the airway during airway management was considered to be important because excessive coughing or other movement could have contributed to further extension of the penetration injury.

In conclusion, the present case illustrates that, in managing the airway of patients with a penetrating injury of the floor of mouth and an intraoral foreign body, awake fiberoptic bronchoscope guided nasal intubation can be done safely and successfully. A previously reported similar case<sup>1</sup> also had a satisfactory outcome using the same technique. We conclude that the success of this technique in such situations is dependent upon careful and thorough evaluation of the airway preoperatively, preferably with aid of imaging techniques such as CT.

## References

- 1 Bullingham A, Hampson-Evans D, Palazzo M. An impaled neck. Management of difficult airway access. *Anaesthesia* 1994; 49: 866-9.
- 2 Weissler MC. Tracheotomy and Intubation. In: Bailey BJ, Johnson JT, Kohut RI, Pillsbury HC III, Tardy ME Jr (Eds.). *Head and Neck Surgery - Otolaryngology*. Philadelphia: JB Lippincott Company, 1993: 718-9.
- 3 Ovassapian A, Mesnick PS. The art of fiberoptic intubation. *Anesthesiology Clinics of North America* 1995; 13: 391-409.
- 4 Morris IR. Fiberoptic intubation. *Can J Anaesth* 1994; 41: 996-1008.

- 5 *Horellou MF, Mathe D, Feiss P.* A hazard of naso-tracheal intubation (Letter). *Anaesthesia* 1978; 33: 73–4.
- 6 *Irish JC, Gullane PJ.* Complications of intubation and other airway management procedures. *Anesthesiology Clinics of North America* 1995; 13: 709–24.
- 7 *Graham DR, Hay JG, Clague J, Nisar M, Earis JE.* Comparison of three different methods used to achieve local anesthesia for fiberoptic bronchoscopy. *Chest* 1992; 102: 704–7.
- 8 *O'Callaghan-Enright S, Finucane BT.* Anesthetizing the airway. *Anesthesiology Clinics of North America* 1995; 13: 325–36.