Clinical Reports

Sevoflurane mask anesthesia for urgent tracheostomy in an uncooperative trauma patient with a difficult airway

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Purpose: Proper care of the trauma patient often includes tracheal intubation to insure adequate ventilation and oxygenation, protect the airway from aspiration, and facilitate surgery. Airway management can be particularly complex when there are facial bone fractures, head injury and cervical spine instability.

Clinical Features: A 29-yr-old intoxicated woman suffered a motor vehicle accident. Injuries consisted of multiple abrasions to her head, forehead, and face, right temporal lobe hemorrhage, and complex mandibular fractures with displacement. Mouth opening was < 10 mm. Blood pressure was 106/71 mmHg, pulse 109, respirations 18, temperature 37.3°C, SpO_2 100%. Chest and pelvic radiographs were normal and the there was increased anterior angulation of C4-C5 on the cervical spine film. Drug screen was positive for cocaine and alcohol. The initial plan was to perform awake tracheostomy with local anesthesia. However, the patient was uncooperative despite sedation and infiltration of local anesthesia. Sevoflurane, 1%, inspired in oxygen 100%, was administered via face mask. The concentration of sevoflurane was gradually increased to 4%, and loss of consciousness occurred within one minute. The patient breathed spontaneously and required gentle chin lift and jaw thrust. A cuffed tracheostomy tube was surgically inserted without complication. Blood gas showed pH 7.40, PCO_2 35 mmHg, PO_2 396 mmHg, hematocrit 33.6%. Diagnostic peritoneal lavage was negative. Pulmonary aspiration did not occur. Oxygenation and ventilation were maintained throughout the procedure.

Conclusion: Continuous mask ventilation with sevoflurane is an appropriate technique when confronted with an uncooperative trauma patient with a difficult airway.

Objectif : Le traitement d'un traumatisme comprend souvent l'intubation endotrachéale qui assure la ventilation et l'oxygénation adéquates, protège les voies aériennes contre l'aspiration et facilite l'opération. La prise en charge des voies aériennes peut être particulièrement complexe en cas de fractures des os du visage, de lésion à la tête et d'instabilité de la colonne cervicale.

Éléments cliniques : Une femme de 29 ans, intoxiquée, victime d'un accident d'automobile, présentait de multiples écorchures à la tête, au front et au visage, une hémorragie au lobe temporal droit et des fractures complexes avec déplacement de la mandibule. L'ouverture de la bouche était < 10 mm, la pression sanguine de 106/71 mmHg, le pouls de 109, la respiration de 18, la température de 37,3 °C, la SpO_2 de 100 %. Les radiographies pulmonaire et pelvienne étaient normales et le cliché de la colonne cervicale montrait une angulation antérieure accrue de C4-C5. Le dépistage des drogues a révélé la présence de cocaïne et d'alcool. On a d'abord planifié une trachéotomie vigile sous anesthésie locale, mais la patiente collaborant peu, on a administré, au masque, du sévoflurane à 1 % dans 100 % d'oxygène. La concentration de sévoflurane a graduellement monté à 4 % et la perte de conscience a eu lieu en moins d'une minute. La patiente a respiré spontanément et il a fallu légèrement soulever le menton et avancer la mandibule. Un tube de trachéotomie à ballonnet a été inséré chirurgicalement sans complication. L'analyse des gaz du sang a indiqué un pH de 7,40, une PCO_2 de 35 mmHg, une PO_2 de 396 mmHg et un hématocrite de 33,6 %. Le lavage diagnostique péritonéal a été négatif. Il n'y a pas eu d'aspiration pulmonaire. L'oxygénation et la ventilation ont été maintenues tout au long de l'intervention.

Conclusion : La ventilation continue au masque avec du sévoflurane est appropriée chez un patient non coopératif victime d'un traumatisme et dont les voies aériennes sont peu accessibles.

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PATIENTS with blunt trauma to the head and face often require tracheal intubation to insure adequate ventilation and oxygenation, protect the airway, and perform surgery. This communication describes the use of inhaled sevoflurane by mask for urgent tracheostomy in an uncooperative trauma patient with several anatomic predictors of difficult endotracheal intubation.

Case History

A 29-yr-old woman sustained multiple trauma following a car accident in which she was an unrestrained passenger. She was reported to have lost consciousness briefly. She was immobilized on a long spine board with cervical spine precautions (rigid collar, sandbags, and straps) and transferred to our hospital. In the emergency department, she was noted to be awake, crying, confused, occasionally agitated, but was answering most questions well. Blood pressure (BP) was 106/71 mmHg, pulse 109 bpm, respirations 18, temperature 37.3°C, SpO_2 increased from 86 to 100% with supplemental oxygen via face mask. There were multiple abrasions to her head, forehead, and face, and the mandible was grossly deviated. Mouth opening was < 10 mm. The Glasgow Coma Scale score ranged from 11 to 14. The patient was moving all extremities, deep tendon reflexes were within normal limits, there were no lateralizing signs and the pupils were equal bilaterally and reactive. Chest and pelvic radiographs were normal and the lateral cervical spine film showed increased anterior angulation of C4-C5. Drug screen was positive for cocaine and alcohol.

Because of increasing somnolence and brief periods of agitation, she was transferred to the operating room for urgent tracheostomy with local anesthesia. Prior to transfer to the operating room, the patient pulled out her Foley catheter and was struggling against the cervical restraints. The patient calmed down with firm reassurance and log-rolled onto the operating room table. The head and neck were immobilized manually and anesthesia monitors were applied. Glycopyrolate, 0.2 mg, *iv* and titrated midazolam, 4 mg, *iv* were given and the neck was prepared and draped for surgery. The BP was 140/80 mmHg, heart rate 110 bpm, respirations 30, SpO_2 100%. During infiltration of local anesthesia, the patient began to move and an infusion of propofol was started. The propofol infusion was titrated at 150 $\mu g \cdot kg^{-1} \cdot min^{-1}$. Despite the sedation and local anesthesia, the patient continued to move and could not be calmed down. Sevoflurane, 1%, inspired in oxygen 100%, was administered via face mask. The propofol infusion was discontinued. The concentration of sevoflurane was gradually increased to 4%, and loss of consciousness occurred within one minute. The patient breathed spontaneously and required gentle chin lift, jaw thrust, and assist. End tidal CO_2 was 32-38 mmHg. A cuffed tracheostomy tube, I.D. 6.0 mm was surgically inserted without complication. Blood gas analysis after tracheostomy and during controlled mechanical ventilation at eight breaths·min and tidal volume 650

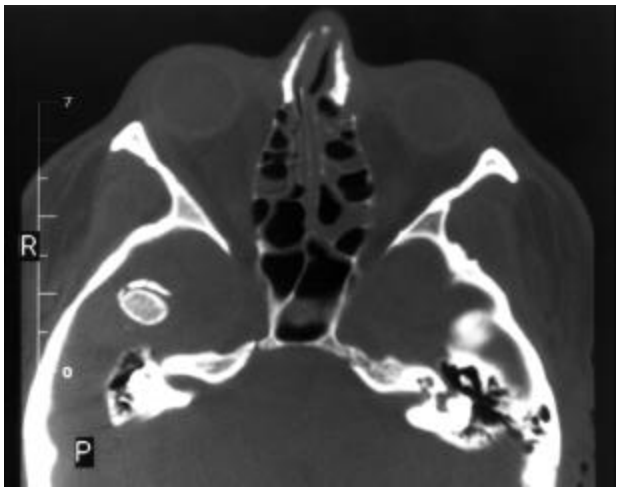

FIGURE 1 Computed tomography of the head showing the intracranial position of the right mandibular condyle.

FIGURE 2 Computed tomography of the head illustrating a large right temporal lobe hemorrhage.

mL showed pH 7.40, PCO_2 35 mmHg, PO_2 396 mmHg, hematocrit 33.6%. Diagnostic peritoneal lavage was negative.

Subsequent work-up revealed that the right mandibular condyle had been driven up and through the glenoid fossa and was in an intracranial position (Figure 1). There was a large right temporal lobe hemorrhage (Figure 2). Other injuries were a displaced left subcondylar mandibular ramus fracture and a right comminuted parasymphseal mandible fracture. Three days later, surgery was performed to remove the condyle from the intracranial fossa, reconstruct the right glenoid fossa with bone graft and temporal muscle flap, and repair the symphysis and left subcondylar fractures. She was discharged to a rehabilitation facility on the 18th postoperative day with independent mobility and activities of daily living, but mild cognitive dysfunction.

Discussion

Numerous techniques are available for tracheal intubation in the injured patient.[1,2] Because of the inability to open the mouth and the severity of the facial fractures, a decision was made to secure the airway using awake tracheostomy with local anesthesia. Although this technique has the advantage of preserving spontaneous ventilation while at the same time maintaining protective airway reflexes, tracheostomy may not be well tolerated in uncooperative patients such as the one presented in this report. Trauma patients are often uncooperative during airway maneuvres because of drug intoxication (e.g., alcohol, cocaine), head injury, hypoventilation, hypoxia, and other factors.[3] Refusal to cooperate during intubation may result in excessive patient movement, airway trauma, elevated intracranial pressure, and possible cervical spine injury. Because of the fluctuating level of consciousness, we were reluctant to administer opioid agents. It is possible that the agitation was due to painful injuries, and that the use of midazolam and propofol may have contributed to worsening of the confusion of an already obtunded patient with a closed head injury.

The use of deep sedation or general anesthesia has been shown to decrease upper airway tone and cause airway occlusion during spontaneous ventilation.[4] Thus, it is not surprising that the patient required a jaw thrust and chin lift maneuver to prevent airway obstruction as the concentration of sevoflurane was increased. Head extension was not done because of suspected cervical spine injury. Transtracheal jet ventilation was the backup plan to oxygenate the patient and ventilate the lungs in an emergency since there was insufficient mouth opening for placement of a Combitube or laryngeal mask airway.

It is recognized that this patient was at increased risk for gastric regurgitation and pulmonary aspiration with deep sedation and general anesthesia by face mask. Despite this increased risk, rapid sequence intubation together with cricoid pressure was not considered because of the inability to open the mouth. The priorities in this patient were to establish a definitive airway by providing optimal conditions for tracheostomy while at the same time preventing hypoxemia. Had regurgitation occurred prior to insertion of the cuffed tracheostomy tube, the plan was to place the patient in a head-down position to permit vomitus to run out of the mouth. Oropharyngeal and tracheobronchial suctioning, including bronchoscopy to remove food particles, would also be necessary. Thorough tracheobronchial suctioning would have awaited placement of the tracheostomy tube. Pharmacologic agents to stimulate gastric emptying (e.g., metoclopramide) were not used, although these agents may be helpful in some patients.

Nasotracheal intubation via a flexible fibreoptic bronchoscope was considered but not done because of the possibility of basilar skull fracture with disruption of the cribriform plate of the ethmoid bone. In these instances, the tracheal tube may traverse the fractured cribiform plate and disrupt the brain substance. Blind nasal intubation was not considered because of the above factors and because this technique may result in loss of the airway due to epistaxis or hematoma.[5]

Experience with inhalational induction in adults has previously been limited by the relatively slow uptake of halothane and the relatively high noxious nature of the other gases desflurane, isoflurane, and enflurane which produced complications such as excessive secretions, coughing, and laryngospasm during induction. In contrast, sevoflurane has a low blood:gas solubility and is associated with smooth induction of anesthesia with minimal or no airway irritation or cough, rapid control of anesthetic depth, and preservation of spontaneous ventilation.[7] Despite the possible adverse effects of volatile anesthetic agents on cerebral autoregulatory capacity, cerebral blood flow, and intracranial pressure,[8–10] sevoflurane has been shown to provide significant neuronal protection in the presence of hypoxia and ischemia.[11] Moreover, doses as high as 1.5 MAC sevoflurane do not impair static rate of cerebral autoregulation provided that normocapnia is maintained,[12] as occurred in this report. For these reasons, sevoflurane was chosen instead of the other volatile agents. Nitrous oxide was not used because it reduces the inspired oxygen concentration and may enlarge air- containing spaces (e.g., pneumothorax,

pneumocephalus). Higher doses of propofol were not used because of the risk of apnea and the desire to maintain spontaneous ventilation. It is acknowledged, however, that in the presence of hypercapnia ($PaCO_2$ 50- 66 mmHg), autoregulation is better preserved with propofol than with sevoflurane.[12]

In summary, inhalation induction of anesthesia using sevoflurane greatly facilitated airway management in an uncooperative, intoxicated multiple trauma patient with a difficult airway. Use of mask anesthesia permitted the performance of a surgical airway in a relatively controlled situation with maintenance of oxygenation and normocarbia.

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