

# Emergency awake surgical cricothyroidotomy for severe maxillofacial gunshot wounds

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IN PATIENTS WITH SEVERE FACIAL TRAUMA, a surgical airway is required if other types of intubation are not possible or not deemed safe.<sup>1</sup> The efficacy of a surgical cricothyroidotomy is well established as an emergency airway in the adult trauma patient and has certain advantages over a tracheostomy.<sup>2</sup> This procedure was performed at the Australian Defence Force surgical facility on the remote South Pacific island of Bougainville and was used to control the airway of a local man with gunshot wounds to the face. There has been minimal coverage of this topic in the Australian literature and, to my knowledge, this is the first published report of an emergency cricothyroidotomy performed on an awake, alert patient.

## Case report

A 24-year-old man was brought to our facility 4 hours after a self-inflicted gunshot wound directed through the floor of his mouth. It was estimated that he had lost at least one litre of blood before arrival. His tongue and floor of mouth were grossly swollen, there was continued bleeding and he was unable to swallow. His mandible appeared to be fractured, he could not open his mouth and preferred to sit up. He did not complain of neck pain or neurological symptoms, there was no deformity or tenderness of his neck and he could move all his limbs.

The patient had respiratory distress (respiratory rate, 32/min), but pulse oximetry showed an oxygen saturation of 100% while he was receiving 2L/min nasal oxygen. He was cool peripherally. His pulse rate was 95 beats per minute. Blood pressure was 145/75 mmHg. He was alert and orientated.

It was immediately obvious that securing a definitive airway was the first priority and a cricothyroidotomy was performed under local anaesthesia with the patient in the supine position, slightly head up. He remained cooperative throughout the procedure. Continual suctioning of his mouth was required until haemostasis was achieved. A size 7 Portex cuffed tracheostomy tube was placed. Following confirmation of position by

## Abstract

- ◆ I report the case of a patient with severe upper airway compromise following a self-inflicted gunshot wound to the face. An awake surgical cricothyroidotomy was performed to obtain a definitive airway and enable haemostasis. This case report highlights the uncommon but important role of awake cricothyroidotomy in managing severe airway trauma.

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Captain Anthony Chambers and Captain Doug Randell exploring the patient's mouth after they performed the cricothyroidotomy. Photograph courtesy of Lieutenant Colonel David Scott.

capnography and auscultation, the patient was anaesthetised with 50mg of ketamine and paralysed with 8mg of vecuronium. He was then ventilated with intermittent positive pressure ventilation and 100% oxygen. Anaesthesia was maintained with intermittent intravenous ketamine.

The wound was explored and haemostasis was achieved with nasal and oropharyngeal packing and an orogastric tube was inserted. Operative findings revealed an entry wound just under the chin, comminuted fracture of the mandible, grossly swollen tongue and a perforated hard palate, but no exit wound, although subcutaneous fragments could be palpated over the nasal bridge.

Intraoperative blood loss was 1.5L and fluid requirements throughout the procedure were 5 litres of crystalloid and 1 unit of packed cells. Because the blood supply was limited, a conservative transfusion strategy was employed. His haemoglobin level shortly after the transfusion was 80 g/L.

The patient was transferred to the intensive care unit for ventilation, further fluid management and haemodynamic



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monitoring. A central venous catheter, arterial line and urinary catheter were inserted, and a second unit of packed cells was transfused. From then on he was sedated uneventfully with propofol and morphine, paralysed with vecuronium and ventilated.

Postoperative x-ray images of the cervical spine appeared normal, and a chest x-ray appeared normal and showed an adequately positioned airway and gastric tube. Skull and facial x-rays revealed a comminuted fracture of the body of the mandible, bullet fragments in the nasal cavity and ethmoid sinus, but no penetration of the cranial vault or the frontal sinuses.

Thirty hours after surgery the nasal pack was replaced and the oral pack was removed. By that time bleeding was minimal. The patient's haemoglobin level was 59 g/L, and he was given 3 units of fresh whole blood. At this stage the facial and airway swelling had decreased markedly, so the paralysis and sedation were withdrawn and the patient was weaned to a T piece with spontaneous ventilation.

The postoperative course was complicated by ventilator-associated pneumonia, which delayed extubation. On Day 6 he returned to the operating theatre for plating of the mandible. After extubation he was able to speak and eat, although he had a hoarse voice. Before the nature of this hoarseness was identified, the patient was discharged and lost to follow-up.

## Discussion

Airway management of severe facial trauma is challenging.<sup>3</sup> Despite this, most patients can be safely intubated using a rapid-sequence technique.<sup>4,5</sup> A surgical airway should be reserved for those with severe injuries that make conventional intubation impossible, or after failed intubation.<sup>5</sup> It was anticipated that this patient would have a difficult airway, difficult bag-and-mask ventilation and, as there was no safe alternative of awake intubation, the insertion of a surgical airway while the patient was awake was considered the safest option. Once the airway was secured, anaesthesia, wound exploration, and haemorrhage control could follow. No other awake methods were used because of the condition of the patient's airway, bleeding and the lack of other equipment. In particular, an awake blind nasal technique of intubation was not attempted due to the possibility of a basilar skull fracture, the anticipated lack of success because of excessive bleeding and upper-airway swelling, and the opinion that the patient would better tolerate an awake cricothyroidotomy under local anaesthesia.

Cricothyroidotomy is the procedure of choice for the establishment of an emergency surgical airway.<sup>2</sup> It is easier and quicker to perform than a tracheostomy<sup>2</sup> and has less potential for early complications. The anatomy is more superficial, not overlaid by large blood vessels and is away from the pleura.<sup>6</sup> Less neck movement is required, which is advantageous in those with uncleared cervical spines.<sup>2</sup> Trained individuals with minimal surgical experience can perform cricothyroidotomy safely and expeditiously in most emergency situations.<sup>7</sup>

Surgical cricothyroidotomy has a complication rate of about 6%.<sup>6</sup> Early complications include misplacement of the tube, failure to cannulate the trachea, asphyxia, fracture of the cartilages and bleeding, while later complications include infection, voice change, subglottic stenosis, and granuloma formation.<sup>1,2</sup> Voice change is the most common complication, usually due to cord oedema and granulation tissue, and subglottic stenosis is the most serious (affecting 2% of patients).<sup>8</sup> Subglottic stenosis is less relevant in the emergency setting, as it has mostly been described in patients receiving long-term ventilation who have had elective cricothyroidotomies and with the tubes being left in for longer than 7 days.<sup>8</sup> Contraindications include laryngeal pathology, prolonged endotracheal intubation, laryngeal trauma and age less than 10 years.

There are two approaches to cricothyroidotomy: Seldinger and surgical. The surgical approach was used because it is faster,<sup>7</sup> was preferred by the operator and allowed insertion of a large tube for ease of ventilation during and after the procedure (the only Seldinger kit available at our facility had a size 4 tube). The method described by the *Early Management of Severe Trauma Manual*<sup>2</sup> was used, as it is the conventional teaching. However, some advocate a vertical skin incision followed by a horizontal incision through the cricothyroid membrane, as this minimises bleeding, leaving a clearer surgical field.<sup>1,3</sup> Detailed descriptions of the procedure are given elsewhere.<sup>1,2</sup>

A size 6, or 7 mm internal diameter, tube should be used:<sup>3,10</sup> larger tubes are harder to insert, leading to laryngeal trauma,<sup>9</sup> increased failure of cannulation<sup>10</sup> and increased pressure and scarring.<sup>11</sup> Furthermore, the use of a tracheostomy tube instead of a conventional tracheal tube appears to decrease the risk of right main bronchus intubation.<sup>12</sup>

If long-term ventilation is anticipated, early conversion to tracheostomy is warranted.<sup>10</sup> In this case, the cricothyroidotomy tube remained *in situ* longer than intended because the patient developed nosocomial pneumonia, and was not converted to an early tracheostomy because of our inability to perform that procedure.

Several case series<sup>7,9,12-20</sup> reveal that the most common indication for cricothyroidotomy is an inability to intubate. The incidence of cricothyroidotomy is variable, with about one per month performed in US trauma centres.<sup>13</sup> Survival rates are variable, reflecting the severity of the patient's trauma, and the outcome is dismal if cricothyroidotomy is performed after traumatic cardiac arrest.<sup>12</sup> In the prehospital setting, better results are achieved by personnel with more training and experience.<sup>15-19</sup> Results are also better in the emergency department than the prehospital setting, especially with experienced doctors, presumably due to better conditions and equipment, and more-skilled personnel.<sup>9,20</sup>

In conclusion, awake emergency cricothyroidotomy is a rapid, relatively easy and relatively safe procedure in a cooperative patient who requires an urgent definitive surgical airway. Although it can be performed competently after minimal training, ongoing training in airway management and in the procedure itself may improve performance.

## Competing interests

None declared.

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