SHORT REPORTS

Inhalational anaesthesia in emergency medicine using a new volatile—sevoflurane

R G Mitchell, N Nichol, A S Goldie, D J Steedman

Abstract

Two cases are described in which an inhalation anaesthetic was performed in order to secure an airway in patients with upper airway compromise. The agent used, sevoflurane, is relatively new and its properties are described. This is an important technique in which accident and emergency staff should obtain the appropriate supervised training.

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Keywords: sevoflurane; inhalational anaesthesia; accident and emergency department

The first priority in the resuscitation of any patient is airway management.¹ A patent airway can be obtained in the majority of cases by simple manoeuvres such as head tilt, chin lift, and jaw thrust, with or without adjuncts such as oro- or nasopharyngeal airways.² If an airway is to be secured for ventilation and protected against aspiration, intubation is essential.

With patients in whom intubation may be difficult or in whom the airway is difficult to maintain with manual manoeuvres, the preservation of spontaneous ventilation and muscular tone within the upper airway is obligatory, as this maintains the status quo until a definitive procedure is performed. A careful inhalational induction using a volatile anaesthetic agent allows a safe method of inducing anaesthesia while preserving spontaneous ventilation and the patency of the upper airway. In this paper we describe two cases where this technique was applied in an emergency situation using sevoflurane, a new volatile agent, and we outline the principles involved.

CASE REPORTS

Case 1

A 42 year old woman presented as an emergency having been rescued from a house fire. Her initial Glasgow coma scale (GCS) was 3, rising to 13 during transfer to hospital. On arrival she was haemodynamically stable, self ventilating on high flow oxygen, and had mixed full/partial thickness burns of the face, scalp, and both hands. She had soot in her nares and pharynx, with profuse secretions in her airway and stridulous breathing. On auscultation she

had good air entry bilaterally with no added sounds. Arterial blood gases showed a metabolic acidosis, H^+ 52.5 nmol/l, P_{CO_2} 4.5 kPa, PO_2 48 kPa, and standard bicarbonate 13 mmol/l. Her ECG and chest x ray were normal. The carboxyhaemoglobin level on arrival was 40%.

Treatment was initiated with high concentration oxygen delivered by an anaesthetic circuit, but she remained drowsy and confused. In view of her compromised airway, inhalational induction of anaesthesia was performed using sevoflurane in oxygen with the patient initially in a sitting position; as the depth of anaesthesia deepened the patient was lain down to allow laryngoscopy and assessment of the ease of tracheal intubation. At direct laryngoscopy the vocal cords were oedematous and soot was visible in the trachea. An attempt at oral endotracheal intubation was unsuccessful as the level of anaesthesia had lightened. Having establishing that oral endotracheal intubation was possible, the inhalation induction was supplemented with a rapid sequence technique using 100 mg thiopentone and 50 mg suxamethonium in order to facilitate intubation. An 8.0 mm endotracheal tube was passed, and the patient was sedated, paralysed, and ventilated. She was then transferred to the regional burns intensive therapy unit.

Following a period of 10 days of ventilation she made a good recovery. She has no neurological deficit, although formal psychometric testing has not been performed.

Case 2

A 35 year old woman was admitted as an emergency with a two day history of sore throat. This had been associated with a fever, diarrhoea, and vomiting. During an episode of vomiting she had developed difficulty breathing. Her general practitioner had attended and given nebulised salbutamol with no effect.

On arrival in the accident and emergency (A&E) department she had an obvious inspiratory stridor with poor air entry bilaterally. She was centrally cyanosed, tachycardic at 160 beats/min, but maintaining her blood pressure at 150/90 mm Hg. Arterial blood gases on 10 l/min oxygen showed H^+ 52.2 nmol/l, P_{CO_2} 5.0 kPa, PO_2 12.8 kPa, and standard bicarbonate 17.9 mmol/l. Chest x ray and a soft tissue x ray

The Royal Infirmary of Edinburgh, Lauriston Place, Edinburgh:
Department of Accident and Emergency Medicine
R G Mitchell
N Nichol
D J Steedman

Department of Anaesthetics
A S Goldie

Correspondence to:
Dr R G Mitchell, Specialist Registrar, Department of Accident and Emergency Medicine, The Royal Infirmary of Edinburgh, Lauriston Place, Edinburgh EH3 9YW.

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of her neck performed in the resuscitation room suggested supraglottic obstruction but there was no radiological evidence of aspiration.

In view of the partial upper airway obstruction a gaseous induction was performed using 100% oxygen and sevoflurane. At laryngoscopy the supraglottic area was markedly erythematous with an adherent purulent discharge. A 6.0 mm cuffed endotracheal tube was passed through her cords and pus was aspirated together with gastrointestinal contents. She was transferred to the intensive care unit for continuing management.

Her recovery was complicated by septic shock and the development of adult respiratory distress syndrome. An elective tracheostomy was performed four days after her admission and she spent a further six days in the intensive care unit. She eventually made a full recovery and was discharged home.

Discussion

The recognition of a compromised airway, its rapid protection, and assistance with ventilation are of paramount importance in resuscitation of the critically ill.³ In the majority of patients, administration of anaesthetic drugs is required to facilitate tracheal intubation. To minimise the risk of gastric aspiration the commonly used technique in the emergency setting is a rapid sequence induction. Preoxygenation maximises oxygen reserves. Cricoid pressure is then applied as a rapidly acting intravenous induction agent induces loss of consciousness, while a short acting depolarising muscle relaxant produces muscle paralysis. Direct laryngoscopy is performed, a cuffed endotracheal tube is passed through the vocal cords, the cuff inflated, the position checked, and the tube secured. If intubation proves to be difficult several adjuncts are available: a long bladed laryngoscope, a stillette-type introducer, or a gum-elastic bougie. The use of this technique in the emergency department has been reported before.⁴ However, if an endotracheal tube cannot be inserted and an airway cannot be maintained, life threatening desaturation may ensue necessitating cricothyroidotomy or tracheotomy.

As the use of a muscle relaxant causes apnoea, rapid sequence induction is not a technique to embark upon when intubation might prove difficult and the ability to ventilate the patient manually cannot be guaranteed. In this situation preservation of spontaneous ventilation and airway muscular tone are of particular importance. Within an emergency setting, the largest group of patients in whom airway problems are encountered comprises those with major burns or maxillofacial trauma. In a burns patient potential airway problems can be predicted by the presence of identifiable risk factors. These factors include the presence of facial burns, soot in the nares or oropharynx, oropharyngeal burns, hoarseness, and carbonaceous sputum. In this group of patients, obtaining a secure airway is important and anaesthesia may be required. One method of inducing anaesthesia in this situation uses

inhalational agents. The patient breaths 100% oxygen, to which increasing concentrations of a volatile anaesthetic agent are added. When sufficient depth of anaesthesia is achieved, laryngoscopy is performed, followed if possible by tracheal intubation. The patient breaths spontaneously throughout, and the depth of anaesthesia may be readily decreased if airway obstruction begins to occur. If oral intubation is not possible, an alternative method such as fiberoptic laryngoscopy or surgical cricothyroidotomy may be required. In patients with upper airway compromise their airway is easiest to maintain during induction in a sitting position, until a sufficient level of anaesthesia is obtained for intubation to be attempted. In patients where soiling of the airway might occur induction should be performed in the head down lateral position.

Volatile anaesthetic agents are liquids with relatively low boiling points. They are delivered by means of a calibrated vaporiser, specific for each agent. Those currently used in the United Kingdom include halothane, enflurane, isoflurane, and the newer agents desflurane and sevoflurane. Traditionally, halothane has been used for inhalational induction; it has a pleasant smell and is non-irritant but causes depression of myocardium with associated bradycardia, sensitises the myocardium to the effects of catecholamines, is hepatotoxic, and produces a rise in intracranial pressure. Enflurane is less potent and is more soluble in blood, and is therefore not suitable for inhalational induction. Isoflurane causes greater airway irritation, producing coughing, breath holding, and even laryngeal spasm. Desflurane is a relatively new agent which has a rapid onset but is not suitable for inducing anaesthesia due to the marked airway irritation. Compared with intravenous anaesthetic agents the induction of anaesthesia is much slower using volatile gases; this can result in a transient state of excitation, not seen with the former.

Sevoflurane is a new volatile anaesthetic agent recently introduced in the United Kingdom. It has low solubility in blood,⁵ causing rapid equilibration across the alveolar membrane between inspired air and blood. Clinically this produces rapid induction of anaesthesia, a shorter period of excitation, and a rapid recovery. Sevoflurane has a pleasant smell, causes little airway irritation, and is generally well tolerated during inhalational induction; a greater concentration can therefore be used earlier, further increasing the speed of induction. Cardiovascular stability is well maintained with sevoflurane⁶ and there is no sensitisation of the myocardium to catecholamines. However, it does cause more respiratory depression than halothane⁷ and may indeed cause apnoea. This is particularly important in cases in which intubation and ventilation may prove difficult; if manual ventilation is not possible a surgical airway would be required. Sevoflurane has not previously been widely used for induction of anaesthesia in association with airway difficulties.⁸

In our patients, sevoflurane was well tolerated as an induction agent, causing no coughing or airway

irritation. Hypotension was not encountered with either patient, both of whom were already at risk, with possible volume depletion secondary to burns or sepsis. It has been shown that the emergence from sevoflurane anaesthesia is more rapid than with most other volatile agents.⁹ This was seen in the first patient, in whom visualisation of the cords was possible following inhalational induction but on attempting intubation, the depth of anaesthesia had lightened and supplemental intravenous induction agents were required. This property is of particular importance in compromised airways, as rapid emergence from anaesthesia would help to guard against desaturation should airway obstruction develop.

Maintenance of spontaneous ventilation and muscular tone is mandatory in the management of a compromised airway, in which intubation and ventilation may prove difficult. Inhalational induction of anaesthesia is the technique of choice and should be available within the resuscitation room. Sevoflurane was shown to be an effective inhalational agent in

the two cases described. A&E staff should be familiar with the technique of inhalational induction and should gain the appropriate degree of supervised experience under the direction of a skilled anaesthetist.

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Psychogenic stridor: diagnosis and management

Michael J Wareing, David Mitchell

Abstract

Psychogenic stridor is a rare cause of apparent acute upper airway obstruction, usually occurring in young female adults. The alarming presence of inspiratory stridor leads to suspicion of organic disease, with urgent management directed towards treatment of suspected pathology. Careful history taking may suggest the correct diagnosis and early examination of the larynx, preferably by fiberoptic nasendoscopic examination, may identify the underlying abnormality of paradoxical adduction of the vocal cords on inspiration, accounting for the stridor. This characteristic feature allows a positive diagnosis to be made and may avoid potentially harmful and inappropriate interventions. Three cases are presented, illustrating an evolution of management. (*J Accid Emerg Med* 1997;14:330-332)

Keywords: psychogenic stridor; fiberoptic nasendoscopy

Although functional upper airway obstruction and stridor is rare, its presentation often suggests life threatening upper airway disease, and management is often directed along urgent lines to protect the airway or even establish

alternative means of breathing through a tracheostomy. This is partly because the diagnosis, even recently, has been considered one of exclusion.¹ It is important to appreciate, however, that there are characteristic signs of psychogenic stridor, and recognition of these by direct laryngeal examination may spare the patient inappropriate treatment.

Case reports

CASE 1

A 12 year old girl was admitted through the accident and emergency (A&E) department with a short history of stridor which had woken her from sleep. On examination she had predominant inspiratory stridor and appeared distressed. There was a mild tachycardia but she was normotensive and apyrexial. Interestingly her voice was virtually normal. A brief period of pulse oximeter monitoring showed no desaturation. In view of the stridor it was decided to perform an examination under anaesthetic to exclude or confirm suspected epiglottitis and proceed on the basis of the findings.

Induction and intubation proved uneventful and complete endoscopic examination of the upper airway showed no abnormality. Extubation was likewise uneventful. The patient was observed overnight. Interview the following

Department of
Otolaryngology: Head
and Neck Surgery,
Guy's and St Thomas'
Hospitals, London SE1
M J Wareing

Department of
Otolaryngology: Head
and Neck Surgery,
Kent and Canterbury
Hospital, Canterbury,
Kent
D Mitchell

Correspondence to:
Mr M J Wareing, 14
Woodlands Park Road,
Greenwich, London SE10
9XD.

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