

The Difficult Airway: Propofol Infusion as an Alternative to Gaseous Induction

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The induction of anaesthesia in the patient with the potential for upper airway obstruction remains a significant clinical challenge, especially when techniques such as fiberoptic laryngoscopy and awake tracheostomy, which allow the airway to be secured prior to induction of anaesthesia, are not considered practical. Traditionally, rapid induction using intravenous agents administered via intravenous bolus is avoided because of the potential for sudden loss of airway patency. Slow inhalational induction may be the preferred alternative¹. Propofol, however, possesses pharmacokinetic and pharmacodynamic properties which make slow induction of anaesthesia practical, and perhaps a viable alternative to induction with volatile agents, but with some potential advantages. This led us to use this technique in the induction of anaesthesia in a patient with a potentially difficult airway.

CASE REPORT

A 24-year-old male weighing 72 kg was admitted for implantation of subcutaneous tissue expanders into his right neck and pre-auricular space to allow later skin coverage of facial scarring which had occurred some years previously as a result of septicaemia-induced skin necrosis. His past medical and anaesthetic histories were otherwise unremarkable. He was assessed at a preoperative visit the evening before surgery and no difficulty with anaes-

thesia was anticipated. No premedication was ordered and anaesthesia was conducted without incident. At induction (0915 hours) he received sodium thiopentone 350 mg, fentanyl 100 µg, morphine 10 mg, atracurium 50 mg, and was intubated easily, with anaesthesia then maintained with isoflurane in 70% nitrous oxide and 30% oxygen. Surgery was uneventful, with adequate haemostasis being achieved prior to skin closure, and after emergence (1200 hours) he was transferred to the general recovery ward.

At 1415 hours swelling was noted around the pre-auricular wound site. This swelling rapidly increased in size over the following 30 minutes, extending inferiorly into the neck. The patient was not overtly sedated and complained of pain and pressure in the right side of the face and neck and difficulty swallowing saliva, but no trouble in breathing.

On examination there was a large and expanding mass over the pre-auricular space tracking into the right side of his neck, with some leftward displacement of the trachea. There was no audible stridor but mouth-opening was limited to approximately 2 cm due to pain and facial swelling. Oxygenation remained satisfactory with pulse oximetry readings ranging between 95 and 97% on 6 l/min of oxygen via a Hudson mask.

An urgent surgical consultation was obtained and a diagnosis of acute arterial haemorrhage made. Although local pressure, removal of skin sutures over the cheek and evacuation of some haematoma reduced the facial swelling slightly, a large and still expanding haematoma remained and a decision was made to explore the wound under general anaesthesia. Because of the degree of neck and facial swelling it was considered that patency of the airway could not be guaranteed after rapid intravenous induction and, furthermore, it was anticipated that laryngoscopy could be difficult. Fiberoptic laryngoscopy was considered but not attempted

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because of copious secretions and lack of time for effective antisialogogue therapy. Slow induction of anaesthesia using IV propofol was therefore chosen.

The patient was transferred to the operating theatre and placed supine with 15° head elevation. Monitoring was commenced (non-invasive blood pressure, pulse oximetry, ECG) and the patient breathed 100% oxygen via a facemask and circle system. Equipment for difficult intubation and emergency cricothyrotomy was available and the surgeon was present in theatre prior to induction. A propofol infusion was commenced at a rate of 99 ml/h using a syringe driver connected to a free-running intravenous line. Ventilation and oxygenation remained satisfactory and the patient slowly became sedated until loss of response to voice was achieved two minutes after commencement of the infusion. At that point jaw support was gently introduced and then respiration gradually assisted without difficulty until manual ventilation was achieved at four minutes.

Oxygen saturation always remained above 98% and mean arterial pressure decreased gradually from 100 mmHg to 85 mmHg at 6 minutes. At approximately 6 minutes laryngoscopy was attempted using a Macintosh type blade. Mouth-opening was adequate and erythema and oedema were noted at the laryngeal inlet, particularly on the right side. The posterior half of the vocal cords were visible and appeared mildly oedematous. The depth of anaesthesia allowed reasonable relaxation and minimal cardiovascular response to laryngoscopy. The cords were sprayed with 10% lignocaine and a size 7.0 plastic endotracheal tube was passed without difficulty. Passage of the endotracheal tube into the trachea produced some coughing which ceased after a bolus dose of propofol. Positive pressure ventilation was then continued, further muscle relaxation achieved with vecuronium, and isoflurane used to maintain anaesthesia while the wound was explored. Brisk bleeding from the frontal branch of the superficial temporal artery and a branch of the facial artery in the cheek was noted and these vessels were cauterized, a large haematoma evacuated from the cheek, and the wound closed leaving a drain in situ. The patient was extubated without incident and demonstrated no evidence of airway problems postoperatively.

DISCUSSION

Despite the advent of a number of techniques for awake intubation, many anaesthetists believe gaseous induction still has a place in circumstances when there is doubt about maintenance of airway patency

during induction of anaesthesia, as it allows slow induction of anaesthesia with early detection of impending airway obstruction with deepening of anaesthesia. Lightening of anaesthesia due to any subsequent reduction in minute ventilation or by switching off the vaporizer may then allow improvement in the airway before complete obstruction occurs, following which alternative methods to secure the airway can be sought.

An inhalational technique is not, however, without its drawbacks. The modern volatile agents, although possessing relatively low blood gas solubility coefficients and thus rapid onset and offset of action, are often pungent, unpleasant to breathe at high concentrations and can cause increased airway sensitivity leading to coughing and laryngospasm². Guedel's Stage II of anaesthesia can also produce marked excitement making monitoring and airway assessment difficult. Induction can also be excessively prolonged in the presence of partial upper airway obstruction or poor respiratory function as the rate of volatile uptake and therefore the rate of induction is partially dependent on the minute ventilation and efficiency of gas exchange in the lungs. The use of nitrous oxide may improve the speed and quality of induction but does not allow 100% oxygen to be administered, thereby reducing the oxygen reserve should airway obstruction develop. The deep planes of anaesthesia necessary to allow laryngoscopy may produce severe cardiovascular depression and dysrhythmias, particularly in the presence of hypercarbia or hypoxia. Finally, the use of high volatile concentrations in patients with airway compromise will inevitably lead to gas escape and operating theatre pollution.

Induction using an infusion of propofol offers many of the advantages of inhalational induction but with potentially fewer problems. The use of the intravenous route permits the use of 100% oxygen and control of both the speed of induction and the depth of anaesthesia. Induction is generally smooth, with no increased airway sensitivity or Stage II excitement. Although involuntary movements are reported during induction of anaesthesia with propofol, such movements were not apparent in this case, are perhaps less frequent than commonly appreciated³ and, in the experience of the authors, are seldom a problem with this type of dose regimen. Of greater importance is the suppression of laryngeal reflexes produced by propofol, thereby making coughing, breath-holding and laryngospasm less likely and the detection of increasing airway obstruction easier, as well as allowing airway manipulation and laryngoscopy at relatively light planes of anaesthesia^{4,5}.

While bolus doses of propofol are associated with dose-dependent apnoea and cardiovascular depression, slow infusion administration minimizes respiratory depression, may produce less cardiovascular depression, and may allow smaller total induction doses to be used⁶. Further, the rapid redistribution seen with propofol means that cessation of infusion will result in rapid recovery of consciousness should onset of airway obstruction be detected⁷. Unlike inhalational induction, however, there is no automatic reduction in drug delivery as obstruction develops and respiration must be carefully monitored.

The infusion rate chosen in this case was a result of published pharmacokinetic literature⁸ and the experience of the authors in slow induction with propofol. Loss of consciousness was achieved more rapidly than anticipated, possibly as a result of the recent previous anaesthetic. It does highlight, however, the small doses of propofol required to induce loss of consciousness and the cardiovascular stability which can be achieved when propofol is administered at an appropriate rate. Furthermore, the gradual onset of anaesthesia, usually well tolerated by patients, and the ease with which ventilation was gradually supported in this case is typical of this form of induction.

The induction of anaesthesia in patients with actual or potential airway compromise, or in whom tracheal intubation is predicted to be difficult presents the anaesthetist with a number of problems. This case

report illustrates that slow controlled induction of anaesthesia using an infusion of propofol can avoid many of the potential problems presented by such patients, and we propose this as an induction technique to be considered when such patients present for surgery.

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