CASE REPORT

Acute presentation of a partially obstructing laryngeal tumour: adjuvant agents to gaseous induction of anaesthesia

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SUMMARY

We present the case of a 53-year-old man who attended our emergency department with stridor. He had recently undergone investigation for possible glottic cancer. We discuss the airway management of such a case. We believe this to be the first description of propofol target controlled infusion and clonidine to supplement a sevoflurane gas induction, in order to obtund response to intubation while maintaining spontaneous ventilation. We also consider how airway interventions may impact prognosis and need to be considered.

BACKGROUND

The anaesthetic management of patients with laryngeal tumours and acute airway compromise can pose a challenge with the recent Fourth National Audit Project (NAP4) study highlighting the risks of poor planning.¹ There is a lack of consensus regarding the safest approach to airway management in patients with obstructing lesions with the options including awake or asleep fiberoptic intubation, inhalation induction, awake tracheostomy and cardiopulmonary bypass in extremis.²

CASE PRESENTATION

A 53-year-old, 85 kg, white British male, presented with acute upper airway compromise. Of note,

he had no recorded medical history and was not taking any regular medication; however, he was an ex-heavy smoker, having stopped 5 years previously. This man was originally referred to our specialist Head and Neck service from a neighbouring smaller district general hospital, where he was found to have a sinister-looking, fixed right vocal cord on flexible nasendoscopy, highly suggestive of an advanced glottic cancer. Outpatient CT imaging of his neck and chest was unfortunately delayed for 3 weeks as he failed to attend his appointments. He subsequently presented to our hospital as an emergency with acute breathing difficulty. Our ear, nose and throat (ENT) colleagues reviewed him in the resuscitation department. He was stridulous and demonstrating postural signs of respiratory distress. His oxygen saturations were maintained on room air with a respiratory rate of 20/min. Repeat flexible nasendoscopy revealed a right hemilaryngeal cancer, centred on the anterior portion of the right fixed vocal cord, with an approximately 3 mm, highly precarious airway. The tumour had probably grown significantly since being seen in our neighbouring hospital.

INVESTIGATIONS

The CT neck and chest, confirmed an advanced hemilaryngeal tumour, extending to the inferior cricoid border, the aryepiglottic fold superiorly and eroding through the thyroid cartilage to involve the strap muscles and thyroid gland, all on the right-hand side. Radiologically, his CT scan suggested laryngeal staging of T4N1M0 (figures 1 and 2—CT scans). His venous blood results and arterial blood gas analysis were unremarkable.

TREATMENT

A joint decision was made between the anaesthetists and the ENT surgeons to secure this man's airway in theatre; he was anaesthetised on the operating table. A consultant anaesthetist (senior author) and a consultant Head and Neck surgeon were in attendance.

Prior to induction of anaesthesia, the surgeons prepared the neck with surface land-markings, skin preparation, subcutaneous local anaesthetic and vasoconstrictors. A tracheostomy set was prepared and the surgeons were scrubbed, ready for front-of-neck access if required.

Figure 1 Preoperative CT scan showing hemilaryngeal tumour.

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Figure 2 Preoperative CT scan showing hemilaryngeal tumour.

Intravenous access was secured. The patient was sat up at 60° and nebulised epinephrine was given, driven by 100% oxygen. Clonidine 100 mcg was administered as a titrated dose. The propofol target controlled infusion (TCI) was set to 0.5 mcg/mL and titrated to 1.0 mcg/mL, remembering to allow time for equilibration. Sevoflurane was the inhalational agent and was titrated quickly to a fractional inspired concentration of 8% in 100% oxygen. Direct laryngoscopy was performed, attaining a Cormack-Lehane grade 1 view. Using a paediatric gum elastic bougie, we passed a microlaryngoscopy tube (MLT) size 4.0. Minimal coughing was encountered, spontaneous ventilation was maintained throughout. End tidal CO₂ concentration helped to confirm tube position, in addition to auscultation.

Once the airway was secured, the surgeons carried out a microlaryngoscopy and laser debulking of the laryngeal tumour in order to anatomically establish a safer, patent airway (figures 3 and 4—prelaser and postlaser debulk). Following the procedure, the MLT was changed to a standard size 8.0 endotracheal tube to aid ventilation on the intensive care unit, using a ‘over bougie’ technique. The patient was transferred to the intensive care unit and remained intubated for a further 48 hours. During this period, the patient received a course of intravenous dexamethasone 6.6 mg three times daily and omeprazole 20 mg twice daily prior to extubation; these continued for 24 hours after extubation.

Figure 3 View of larynx showing microlaryngoscopy tube (MLT) in situ. Before debulking.

Figure 4 View of larynx after laser debulking of laryngeal tumour. MLT, microlaryngoscopy tube.

OUTCOME AND FOLLOW-UP

The intraoperative specimens confirmed poorly differentiated adenosquamous carcinoma, P16 negative. The multidisciplinary team recommended total laryngectomy, thyroidectomy and bilateral neck dissections (levels II–IV). The patient went on to have the surgery. Postoperatively, staging was confirmed as pT4pN1M0, with clear margins. He has made an excellent recovery.

DISCUSSION

An awake tracheostomy by the ENT team was considered. However, the procedure alone could lead to tumour seeding, thus, worsening the prognosis of the patient.³ Although the priority is to secure the airway as safely as possible, consideration needs to be given to the overall treatment aim. With this in mind, it was decided to try and secure the airway by less invasive means but always have the option of an emergency surgical tracheostomy.

The American Society of Anesthesiologists produced a report on the management of the difficult airway.⁴ This report can be referred to when considering our decision-making process. Naturally, this had been identified as a ‘difficult airway’, owing to the likelihood of a challenging or impossible tracheal intubation.

We considered an awake fiberoptic intubation (AFOI), but given the degree of narrowing we had some concerns of creating a ‘cork in bottle phenomenon’. This can occur when advancing the fibre-optic scope through the highly narrowed airway, thus, causing complete obstruction.⁵ We also discussed the issue of patient compliance and although fully aware and capacitous, the patient was extremely anxious and distressed. We therefore decided that attempting AFOI with topical anaesthesia was highly likely to be more distressing and unsuccessful. We concluded that a gas induction would be the most appropriate technique.

Inhalational anaesthesia using sevoflurane maintains spontaneous breathing of the patient. However, it can take a long time to achieve a depth of anaesthesia that enables tracheal intubation, with studies reporting 6.4 min and a Minimum Alveolar Concentration (MAC) of 4.52 required to achieve adequate intubating conditions in adult non-premedicated individuals.⁶

As was the case here, in a distressed patient who is an ex-heavy smoker with partial airway obstruction, it can be assumed that this

process will take even longer. Issues regarding obtunding airway reflexes by using sevoflurane alone have also been reported, thus, risking coughing and laryngospasm on instrumentation.⁷

The addition of a propofol TCI aims to reduce the MAC necessary for tracheal intubation and thus shorten the time required for this, with a careful balance struck between preventing apnoea and speed of induction of anaesthesia.⁸

In order to facilitate tolerance of the gas induction by the patient, the anaesthetic team considered a wide range of coinduction agents, including midazolam, remifentanyl and alpha-2 agonists such as clonidine and dexmedetomidine. The choice of coinduction agent was determined by the experience of the anaesthetic consultant and also the availability of the drug. Although a very effective and quick acting sedative and anxiolytic, the use of midazolam has been noted as contraindicated in patients with a compromised airway.⁹ Remifentanyl TCI was also considered; however, we excluded its use due to the side effect of respiratory depression.¹⁰ Alpha-2 agonists, administered as boluses or infusions, have been successfully used in settings such as the intensive care unit, as sedatives and aides for extubation due to their preservation of the respiratory drive, while acting as effective analgesics and anaesthetics.¹¹ It was agreed that clonidine would be used as the sedating agent of choice, in view of the consultant anaesthetist's experience of its use in paediatrics and the local unavailability of dexmedetomidine.

The decision was then made to use clonidine at a titrated dose of 100 mcg for anxiolysis, sevoflurane as the volatile agent of choice and propofol TCI to ensure adequate depth of anaesthesia, all while maintaining spontaneous ventilation.

An agreed structured plan of securing the airway, as suggested by the Difficult Airway Society, was formulated between the consultant anaesthetist and consultant ENT surgeon.¹² Following adequate sedation, Plan A would remain as direct laryngoscopy leading to tracheal intubation with a MLT size 4.0 tube, while using a paediatric bougie, with the patient breathing spontaneously. Plan B was to allow the patient to breathe spontaneously, ensure continuous oxygenation via the upper airway, while the surgical team perform a surgical tracheostomy under local anaesthetic. Plan C involved the use of rapid muscle relaxation with suxamethonium and emergency cricothyroidotomy.

Plan A was followed successfully and uneventfully, allowing direct laryngoscopy and tracheal intubation with a size 4.0 MLT and a paediatric gum elastic bougie. The surgeons then proceeded to debulk the laryngeal tumour.

Postoperatively, the patient remained intubated and was transferred to the intensive care unit. On admission to critical care and 48 hours prior to extubation, the patient was commenced on a regular intravenous regime of dexamethasone 6.6 mg three times daily to reduce current and postextubation laryngeal oedema and 20 mg omeprazole twice daily to prevent stress ulceration.¹³ The role of parenteral dexamethasone in reducing airway oedema in the intensive care setting has been reviewed and an intravenous dose of 4–5 mg every 6 hours, at least 24 hours prior to extubation has been suggested.^{14–16} Based on this, our experience and our institution's available preparation being 3.3 mg/mL, 6.6 mg of intravenous dexamethasone were regularly administered every 8 hours.

To conclude, we present a case with features that many anaesthetists will encounter during their training and will eventually manage as consultants. However, cases like this do not have a standardised management strategy, with a relative absence of literature discussion to date. We believe this to be the first description of this particular anaesthetic plan, which considers a highly distressed patient with an extremely precarious airway.

It provides important and transferable learning points to the management of similar cases. Based on our experience of this case and subsequent review of the literature, we strongly recommend consideration of coinduction and appropriate anxiolytic agents as adjuvants to conventional gaseous induction.

Patient's perspective

The patient was asked specifically about his experience and perception of the anaesthetic induction technique used. He stated 'I have very little recollection of the induction (which we the authors believe is mostly like secondary to the effects of clonidine). However, from my vague recollections I have only positive feedback for the care I received and the administered anaesthetic'.

Learning points

- Airway management options may have an impact on prognosis, especially in the context of ear, nose and throat surgery. Careful multidisciplinary team discussion is always needed.
- Establishing a structured and clear ABC airway management plan, as recommended by Difficult Airway Society, is extremely important in anticipation of both difficult airways and more routine cases.
- Sevoflurane alone is not normally sufficient to obtund airway reflexes—consider a coinduction agent, especially in high-risk patients.
- The use of clonidine as a sedative can prove very beneficial in patients where maintained respiratory effort is important.

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