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CLINICAL REPORT

Airway management in a patient with severe tracheal stenosis: bilateral superficial cervical plexus block with dexmedetomidine sedation

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Abstract A 54-year-old woman with a history of severe tracheal stenosis caused by papillary thyroid cancer with tracheal invasion was admitted for an elective surgery. A bilateral superficial cervical plexus block with 0.5 % ropivacaine 14 ml (7 ml per side) under dexmedetomidine sedation was performed, followed by tracheal dissection and endotracheal tube (ETT) insertion. The patient continued spontaneous respiration without any hypoxic event, and the bispectral index was maintained at a range of 50–80. After ETT insertion, a total thyroidectomy and tracheal resection with end-to-end anastomosis were performed under general anesthesia. The patient was transferred to the surgical intensive care unit after extubation, and she recovered without any complications.

Keywords Cervical plexus · Dexmedetomidine · Nerve block · Tracheal stenosis

Introduction

Anesthetic management of a patient with severe tracheal stenosis is challenging for anesthesiologists because of the critical airway and the difficulty in maintaining ventilation. When general anesthesia using endotracheal intubation is not possible, other anesthetic strategies are suggested, such as cervical epidural anesthesia (CEA) [1], local anesthesia [2], laryngeal mask airway (LMA) [3], cardiopulmonary bypass (CPB) [4], and extracorporeal membrane oxygenation (ECMO) [5]. However, these strategies have potential problems. We report a case of severe tracheal stenosis that received a bilateral superficial cervical plexus block under dexmedetomidine sedation through tracheal dissection until endotracheal tube (ETT) insertion, which allowed the airway to be secured before surgery under general anesthesia.

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Case report

A 54-year-old woman (weight 71 kg, height 163 cm) with a history of papillary thyroid cancer (PTC) with tracheal invasion was admitted to our hospital for tracheal surgery. She had a prior history of hypertension and stable angina pectoris that was managed with aspirin therapy. On physical examination, stridor was heard. Computed tomography (CT) of the neck and chest revealed a protruding mass occupying more than 80 % of the tracheal lumen (Fig. 1). In preparation for anesthesia, a continuous pulsed oxygen saturation (SpO_2) and arterial blood gas analysis (ABGA) were measured while she was awake and asleep; both were within normal ranges. We chose to perform a superficial cervical plexus block with dexmedetomidine sedation until the airway was secured. The patient was informed of the necessity and anesthetic procedures.

The patient was transferred into the surgical suite, and a routine monitor and bispectral index (BIS) were applied. A loading dose of dexmedetomidine (1.0 μg/kg) was administered over 10 min and continued at 0.4–1.0 μg/kg/h. During dexmedetomidine loading, a bilateral superficial cervical plexus block (SCPB) was performed, and 0.5 %

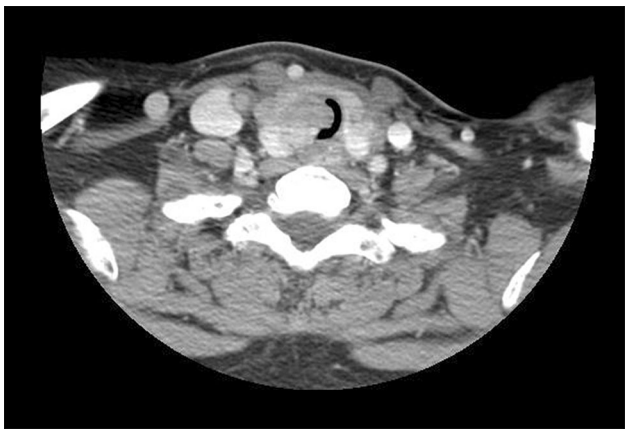

Fig. 1 Axial computed tomography scan shows tracheal intraluminal invasion of the thyroid carcinoma resulting in severe tracheal stenosis

ropivacaine 14 ml was administered (7 ml per side), guided by ultrasound. After confirming sensory block, the left radial artery was cannulated, and the right subclavian vein was catheterized. Dexmedetomidine at 0.4 μg/kg/h and remifentanil at 0.025 μg/kg/min were administered during the procedures, and BIS was maintained at 70–80. The SpO_2 was maintained at 95–99 % with 40 % oxygen administered through a facemask.

The cervical skin incision was infiltrated with 2 % lidocaine and epinephrine 1:100,000. Dexmedetomidine and remifentanil were continued at 1.0 μg/kg/h and 0.025–0.05 μg/kg/min, respectively. She remained sedated without any coughing or agitation, and continued breathing sufficiently until the trachea and thyroid were exposed, even as the fiberscope was inserted orally to locate the lower margin of the tracheal resection. One hour after skin incision, the ETT (ID 6.5) was directly inserted into the trachea by the surgeon, and general anesthesia commenced using desflurane and rocuronium at 0.6 mg/kg. During general anesthesia, less than 1 MAC of desflurane was required to maintain an adequate anesthetic depth. The heart rate and arterial blood pressure remained stable without need for opioid administration.

A total thyroidectomy with cervical dissection was performed, followed by a tracheal resection. When the posterior half of trachea was anastomosed, orotracheal intubation was performed using a 12 Fr levin tube which tip was stitched with 2-0 nylon for guide inserted retrograde from the dissected tracheal site to the oral cavity. Six hours after performing the nerve block, she was smoothly extubated and transferred to the surgical intensive care unit. She had no memory of the surgery. The visual analogue scale (VAS) was zero until 6 h postoperatively. During POD 3, VAS was less than 3 under patient controlled intravenous fentanyl analgesia. She was fully satisfied with her anesthetic management and transferred to a general ward 24 h postoperatively.

Discussion

The most frequently used ventilation technique for tracheal resection and reconstruction is positive pressure ventilation (PPV) under general anesthesia [6]. PPV is initiated following tracheal intubation with the ETT above or sometimes through the stenotic lesion. Once the trachea is transected, a sterile ETT is inserted into the distal trachea by the surgeon. However, this technique is impossible when tracheal stenosis is severe. The outer ETT diameter in adults is approximately greater than 8 mm, which cannot be passed through the lesion. Even if a pediatric ETT successfully passes through the stenotic lesion, the small inner diameter cannot ensure adequate ventilation. Furthermore, ETT intubation above the lesion is not a safe technique; even if spontaneous ventilation appears stable, the patient may not be adequately ventilated when PPV is applied.

Alternative strategies have been attempted in cases where PPV is impossible, such as CEA [1], local anesthesia [2], LMA [3], CPB [4], and ECMO [5]. Although these techniques are reportedly successful, each has potential problems. Despite the advantage of an intense sensory block in CEA, it is a high-risk procedure with fatal complications [7] including severe hypotension, accidental intrathecal or intravascular administration of the local anesthetic, spinal cord injury, epidural hematoma or abscess, and bilateral phrenic nerve block. Local anesthesia is also problematic; inadequate sensory block and patient discomfort are noted limitations. To overcome these problems, a large local anesthetic dose can be infiltrated, however, this can induce local anesthetic systemic toxicity or blockade of deeper neural structures including the phrenic nerve, cervical plexus, brachial plexus, and the recurrent laryngeal nerve. Without complete sensory block, adequate sedation can be difficult to achieve, leading to patient discomfort and even agitation. LMA also has been reported as a safe airway management in tracheal stenosis patients. However, insertion of LMA can be difficult in inadequately paralyzed patients, causing coughing, gagging, laryngospasm, and bronchospasm. During maintenance, movements of the head or neck may cause LMA displacement [8]. Although modern LMA devices less frequently induce these complications, we decided not to apply LMA. Under intense nerve block, only a minimal dose of opioid would be needed, which rarely disturbs spontaneous ventilation. CPB and ECMO enable excellent and safe ventilation and oxygenation. However, the high risk of hemorrhage caused by heparinization and invasive vascular access limit their use.

Ultrasound guided bilateral SCPB is a safe and easy technique that provides intense analgesia. It is frequently used for carotid endarterectomy [9], thyroidectomy [10], and cervical surgery [11]. The major complication is accidental deep administration of local anesthetic, inducing blockade of deeper neural structures. However, this complication is easily avoided by only administering the local anesthetic when the needle tip is directly visualized. Typically, 3–8 ml of 0.25–0.5 % ropivacaine or 0.25 % bupivacaine in each side is sufficient to induce blockade because the superficial cervical plexus is comprised purely of sensory nerves [12]. Bilateral SCPB is also beneficial during postoperative recovery. Previous studies have demonstrated that bilateral SCPB reduces acute postoperative pain scores and the incidence of postoperative nausea and vomiting after thyroidectomy [13, 14]. These effects seemed to result in a smooth extubation and excellent patient satisfaction in our case.

Dexmedetomidine is a highly selective α_2-adrenoreceptor agonist with sedative, sympatholytic, and analgesic properties. It is a unique sedative with few apparent respiratory side effects [15]. In regional anesthesia, intravenous dexmedetomidine prolongs the duration of local anesthetics and the time before postoperative analgesia is requested [16, 17]. However, dexmedetomidine has several side effects. First, it still carries an apneic risk induced by upper airway obstruction. We measured the ABGA and checked for respiratory obstruction as the patient slept to prevent an unexpected apneic event. This examination is appropriate because dexmedetomidine, unlike gamma-aminobutyric acid agents, generates a respiratory pattern and EEG changes similar to natural sleep [18]. Second, dexmedetomidine has a far lessened amnesia effect, which was overcome in this case by using midazolam premedication and desflurane anesthesia.

In conclusion, bilateral SCPB with dexmedetomidine sedation is a safe and effective anesthetic strategy when airway management for tracheal surgery is difficult due to severe tracheal stenosis. This outcome can be achieved with close examination and a case-by-case approach, providing excellent satisfaction for both patients and surgeons.

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Conflict of interest The authors have no conflicts of interest.

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