**A Case Report**

The use of combination cervical plexus block and general anesthesia for radical neck dissection in a patient with severe chronic obstructive pulmonary disease

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**Patients with severe chronic obstructive pulmonary disease (COPD) who receive a general anesthetic are at increased risk for postoperative pulmonary complications; therefore, it is desirable to avoid or to limit the dose of general anesthesia in these patients. Regional anesthesia, or a combination of regional and light general anesthesia, is an ideal choice for achieving this goal. This case report demonstrates how we used cervical plexus blocks in combination with light levels of general anesthesia for radical neck dissection in a patient with severe COPD.**

**Case summary**

A 70-year-old, 70 kg, 161 cm man with severe COPD presenting with occult head or neck cancer and right cervical lymph node metastasis (biopsy proven squamous cell carcinoma) was scheduled for right radical neck dissection.

Past medical history was positive for myocardial infarction (two years prior to this admission) with subsequent stable angina, congestive heart failure, atrial dysrhythmias, peripheral vascular disease and severe COPD with orthopnea. His only medication was at home where he had oxygen at 2 L/min through a nasal cannula.

Substance use included a greater than 50-pack-year history of cigarette smoking with smoking cessation six years prior to this admission. He also consumed 4 to 6 ounces of liquor and 3 to 4 beers each day.

Preoperative physical examination revealed a cachectic gentleman in no apparent distress as long as he remained sitting with his head elevated at least 45 degrees. His exercise tolerance was extremely limited due to the development of severe dyspnea with very minimal exertion. At home he was essentially chair-bound due to his COPD. Vital signs were blood pressure 150/90 mmHg, pulse 110 beats per minute, respiratory rate 22 breaths per minute and temperature 38 degrees C. All of these values were within this patient's usual ranges. He was edentulous with a class 1 airway. Heart sounds were distant and irregular. Breath sounds were decreased in the bases bilaterally.

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**Introduction**

The patient with chronic obstructive pulmonary disease (COPD) who receives general anesthesia is at increased risk for postanesthetic pulmonary complications including respiratory failure. LoSasso and associates recommend regional anesthetic techniques as being ideal selections for patients with COPD. Neill states that, "carefully selected nerve blocks can avoid the need for, or considerably reduce the dosage of, general anesthesia if this carries a greater than normal risk." We report a case where superficial and deep cervical plexus blocks in combination with light levels of inhalational general anesthesia were used for radical neck dissection in a patient with severe COPD.
Blood chemistries and complete blood count were within normal ranges. Electrocardiogram revealed multifocal atrial tachycardia and an old anteroseptal myocardial infarction. Chest x-ray showed evidence of COPD, right pleural effusion and a right pleural nodule. Arterial blood gases were within normal ranges other than a PaO₂ of 55 mmHg on oxygen at 2 L/min through a nasal cannula.

Preoperative pulmonary function tests revealed: forced vital capacity = 1.2 liters (33% of predicted), forced expiratory volume 1 second = 0.6 liters (21% of predicted) and 3 seconds = 1.09 liters (33% of predicted), forced expiratory flow 25-75 = 0.36 liters per second (13% of predicted), and minute ventilatory volume = 199 liters per minute (17% of predicted). None of these parameters were improved by inhaled bronchodilators. These values reflected an average decrease in pulmonary function of 20% from studies obtained six months earlier. At home his arterial oxygen saturation through pulse oximetry was 94-96% on oxygen 2 L/min through nasal cannula, decreasing to 92% with minimal exertion.

After consideration of the clinical and laboratory data, particularly the recent 20% decrease in pulmonary function, it was felt that the patient would do best with a combination of regional and light general anesthetic technique. He agreed to a technique using deep and superficial cervical plexus blocks in combination with light inhalational general anesthesia.

The patient received no preoperative medication. After intravenous access was secured, an intrarterial catheter was placed in the right radial artery and a central venous pressure monitoring catheter was placed through the left basilic vein. Other intraoperative monitors consisted of oxygen analyzer, continuous electrocardiogram (lead II and modified V₁), esophageal stethoscope and temperature, pulse oximetry, end-tidal carbon dioxide concentration and blood pressure cuff.

In the operating room, after all monitors were connected and baseline vital signs were obtained, the right neck was prepped and draped. Maintaining strict asepsis and using the single injection technique described by Murphy,10 ml of 0.25% bupivacaine with 1:200,000 epinephrine was injected for the deep cervical plexus block. The superficial cervical plexus block was performed with 10 ml of the same solution using the method described by Katz. An immediate flushing of the skin occurred and the patient reported complete absence of sensation to pinprick in the right-sided C₂-C₄ dermatomal distribution within five minutes of administration of the blocks.

After five minutes of preoxygenation, general anesthesia was induced with d-Tubocurarine 3 mg, pentothal 3 mg/kg, lidocaine 100 mg and sufentanil 10 μg intravenously (IV). Tracheal intubation was facilitated by 100 mg of succinylcholine IV. Correct placement of the endotracheal tube was confirmed by auscultation of the chest and end-tidal carbon dioxide measurement. Postinduction and intraoperative vital signs were stable throughout the procedure. Mechanical ventilation was maintained without muscle relaxants to produce arterial oxygen saturation of 98-100% and end-tidal carbon dioxide concentration of 32-34 mmHg. Inspired gases were heated and humidified.

General anesthesia was maintained with oxygen 2 L/min, nitrous oxide 3 L/min, halothane 0.2-0.3% and sufentanil 20 μg IV. Nebulized terbutaline (1 mg diluted with 0.9% sodium chloride to a total volume of 3 ml) was added to the anesthetic circuit twice during the case to successfully treat wheezing. Intraoperative ECG, blood gases, blood chemistries and hematocrit remained stable during the six-hour radical neck dissection. Halothane and nitrous oxide were discontinued 10 minutes prior to the end of surgery. The patient was awake, following commands and breathing well five minutes after the end of surgery. He was extubated and taken to the recovery room awake, alert, talking and pain free. Vital signs and laboratory studies were stable.

Over the next two hours, the patient developed increasing tension and color change in the flap and was returned to the operating room for re-exploration. This was achieved without sedation or local anesthesia, and the patient was pain free during the re-exploration. He was returned to the recovery room and was discharged two hours later to the intensive care unit in stable condition. The block receded 12 hours after initiation.

The patient was discharged to the postsurgical ward on the first postoperative day. Pulmonary function tests and arterial blood gas studies were unchanged from preoperative values. He continued to do well and no new pulmonary problems were identified during his hospital stay.

Discussion

The cervical plexus is formed by the union of the ventral rami of the C₁, C₂, C₃, and C₄ spinal nerves. Each nerve communicates with the nerve above and below it by dividing into ascending and descending branches. The C₂ nerve does not contribute any cutaneous distribution to the superficial cervical plexus, but it is involved in the motor supply to the muscles of the occipital triangle through the deep cervical plexus. Nerves C₂, C₃ and
C₄ contribute to the cutaneous dermatomal distribution of the scalp, neck and shoulder through the superficial cervical plexus and to the motor supply of the neck musculature in a segmental fashion through the deep cervical plexus.⁴,⁵

Cervical plexus blocks produce anesthesia in the dermatomal distribution of C₂ through C₄. They are therefore suitable for surgery such as cervical lymph node biopsy, tracheostomy, thyroidectomy, carotid endarterectomy and resection of head and neck tumors.³,⁴,⁶,⁷

The deep cervical plexus may be blocked by using either a single needle or a multiple needle technique. Murphy and Katz, in describing the two techniques, position the patient supine with the patient's head turned away from the side to be blocked.⁴ The anesthetist should identify the tip of the mastoid process and the clavicular insertion of the sternocleidomastoid muscle. (See Figure 1.)

**Figure 1**

A—Mastoid process and insertion of sternocleidomastoid muscle

B—Insertion of the clavicular and sternal heads of the sternocleidomastoid muscle

C—Block needle inserted at lateral border of sternocleidomastoid muscle at the cornu of C₄

A straight line drawn between these two points along the lateral border of the sternocleidomastoid muscle usually lies just anterior to the transverse processes of the cervical vertebrae. The cornu of the transverse processes of C₂, C₃ and C₄ are palpated, identified and marked on the skin. The C₄ cornu will usually be located 1.5 cm below the mastoid process. The C₃ cornu will be located 1.25 to 2.5 cm caudad to C₂ and the C₂ cornu a like distance caudad to C₃. An alternative method of locating the C₄ cornu is to palpate the C₆ cornu just posterior to the lateral border of the sternocleidomastoid muscle at the level of the cricoid cartilage and to count cephalad two cornu along the lateral border of the sternocleidomastoid muscle.

After the cornu of C₄ is identified, the single injection technique as described by Murphy is used for the deep cervical plexus block.⁴ A skin wheal is raised over the cornu of C₄, and a single two-inch block needle is inserted through the skin wheal in a slightly caudad direction until the tip of the C₄ transverse process is contacted. This will occur after the needle is inserted to a depth of 1.25-3 cm. No attempt is made to elicit paresthesias during insertion of the block needle. Ten ml of local anesthetic solution is injected after careful aspiration for blood and cerebrospinal fluid (CSF). This should produce a satisfactory block.

The nerves forming the superficial cervical plexus are located at or about the midpoint of the posterior border of the sternocleidomastoid muscle. They radiate outward like spokes of a wheel. The anterior cervical nerves, the supraclavicular nerves, the great auricular nerve and the lesser occipital nerve will be anesthetized by the superficial cervical plexus block.⁸ Katz performs this block by positioning the patient supine with the patient's head turned away from the side to be blocked.⁸ A skin wheal is raised along the lateral border of the sternocleidomastoid at its midpoint. A two-inch block needle is inserted and 10 ml of local anesthetic solution is infiltrated as the needle is advanced 2-5 cm superiorly and inferiorly along the edge of the muscle. No attempt is made to elicit paresthesias while performing the block. It is not absolutely necessary to perform this block if a deep cervical plexus block is done because the deep block should anesthetize the nerves which form the superficial plexus.

Complications of cervical plexus blockade include inadvertent intravascular injection, toxic reactions, subarachnoid injection, injection into the epidural space, hematoma formation, infection, nerve damage and paralysis (blockade) of the phrenic nerve.³,⁴,⁶ Since the diaphragm is innervated by the phrenic nerve centrally and by the lower intercostals laterally, blockade of the phrenic nerve should not cause significant respiratory compromise in healthy individuals at rest. Phrenic
nerve blockade in patients with paralyzed chest walls can cause significant respiratory compromise or even respiratory arrest. The risk of complications may be minimized by aspiration tests (for blood and CSF), by careful needle angulation, by use of a small test dose, by adhering to strict aseptic technique and by using the single injection technique described by Murphy for the deep cervical plexus block. Cervical plexus blocks should be avoided in patients who are at risk for respiratory compromise due to phrenic nerve blockade.

Regional anesthesia alone was not felt to be an option for this patient because of the anticipated length of surgery and the patient’s inability to tolerate the supine position for any length of time. General anesthesia may be safely used in patients with incapacitating COPD. Those patients in this group who have a straight general anesthetic are inclined to experience postoperative pulmonary complications. A combination regional-light general anesthetic may aid in the avoidance of some of the postoperative pulmonary complications associated with straight general anesthesia while allowing the anesthetist to control ventilation in these high risk patients.

This case report presents an alternative technique for the anesthetic management of the patient with incapacitating COPD who is undergoing radical neck dissection. The cervical plexus blocks allowed the use of less than one-third minimum alveolar concentration halothane and very low dose sufentanil for maintenance of general anesthesia in this high risk patient. The technique achieved the goal of having an awake, alert and extubated patient, who after a six-hour radical neck dissection, tolerated hospital admission and re-exploration surgery without pulmonary complications.

REFERENCES


AUTHORS

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