The authors describe the use of superior laryngeal block and transtracheal block for the patient with cervical cord injury. Included in the text are anatomical considerations and the method of administration. Two case studies are presented.

Each year, a total of 11,200 persons receive spinal cord injuries. Approximately 4,200 of those injured die before they can reach a hospital, and another 1,150 die during hospitalization. Respiratory disturbance during the acute phase of upper thoracic or cervical spinal injury accounts for the high morbidity and mortality rate.

The diaphragm is innervated by the phrenic nerve, which exits the spinal canal at C_4; smaller branches exit at C_8 and C_9. When lesions are present above C_5, diaphragmatic innervation is completely lost. Partial diaphragmatic innervation is preserved when lesions are present at C_5. When lesions are present at C_8, diaphragmatic innervation is intact but intercostal and abdominal support to ventilation is lost.

The intercostal muscles are innervated by the intercostal nerves, which exit the spinal canal at T_1 through T_9. Innervation of the abdominal muscles is through T_7 to T_12 and L_1; the scalene muscles are innervated through C_4 to C_6; and the sternomastoid muscles through C_2 and the spinal accessory nerve. Clearly, ventilatory function must be carefully evaluated in all cervical and thoracic spine injuries. An ascending level of spinal cord edema can also seriously compromise ventilation.

Immobilization and/or traction of the head and neck is essential in cervical spine injuries. This means that extension and flexion maneuvers used during intubation will not be possible. Generally, these patients are intubated awake after adequate sedatives and narcotics have been administered. However, to avoid further spinal cord damage, the patient must be restrained from the rapid, jerky head movements associated with straining on the endotracheal tube while it is being advanced and once it is in place. Superior laryngeal nerve block and transtracheal block have proven to be tremendously helpful in these situations.

Anatomy

The superior laryngeal nerve, a branch of the vagus, arises from the nodose ganglion and descends in the neck to the level of the hyoid bone, where it terminates by dividing into internal and external branches. The external division penetrates the cricothyroid muscle to which it supplies motor innervation.

The internal branch of the superior laryngeal nerve passes below the greater cornu of the hyoid bone and penetrates the thyrohyoid membrane.
Here it immediately ramifies, sending sensory branches to the base of the tongue, epiglottis, and the mucous membrane of the larynx as far inferiorly as the vocal cords. Thus two points, the hyoid bone and the thyroid cartilage, indicate the site of entry into the larynx and serve to identify the site to be blocked. Figure 1 shows the relation of the superior laryngeal nerve to the hyoid bone and thyroid cartilage. The point at which the nerve enters the larynx via the thyrohyoid membrane is also shown. There is no motor component to the nerve, and thus no risk of laryngeal dysfunction once the block has been performed. The recurrent laryngeal nerve is not in the immediate area, and there is little risk of it being blocked.

Sensory innervation of the trachea is achieved by the recurrent laryngeal nerve, which may be blocked by topical application of a surface-acting local anesthetic. A block of the recurrent laryngeal nerve itself is contraindicated because a motor blockade of the larynx would result.

Method

The hyoid bone may be identified by palpation high in the neck. The bone articulates with no other bone, so it is freely movable; this mobility serves as a useful marker. The neck is cleaned thoroughly with alcohol or an iodophor antiseptic. Six ml of 2% lidocaine is drawn into a syringe fitted with a 21-gauge needle.

The carotid sheath is gently retracted posteriorly, and the needle is directed at the hyoid bone and aimed at the greater cornu. After the bone is contracted, the needle is directed caudad until it slips off the bone and through the thyrohyoid membrane. The needle is now in a space bounded laterally by the thyrohyoid membrane, medially by the pharyngeal mucosa, and containing the ramifications of the internal branch of the superior laryngeal nerve. After aspiration to detect either air or blood, lidocaine 2 ml is injected into the space. Another 1 ml is injected as the needle is retracted just outside the thyrohyoid membrane. The block is then repeated on the other side.

The nose and mouth may be anesthetized by the meticulous application of 2% lidocaine to the mucosa, using 4-5 ml drawn up into a syringe and applied without a needle. The often-used bulb spray produces an undependable and inconstant spray which may leave unanesthetized gaps.

In the patient with cervical trauma, forcible transtracheal spray of local anesthetic is best avoided in order to minimize the risk associated with coughing or straining when the anesthetic enters the trachea. Cricothyroid puncture may be used if the anesthetic is slowly dribbled into the trachea, and not rapidly injected.

The hyoid bone may be difficult to locate if the patient has a short fat neck, or if there is edema in the area. In such an event, the block technique may be altered by identifying the superior border of the thyroid cartilage and "walking" the needle cephalad and through the thyrohyoid membrane. It may be possible, too, to inject the needle directly through the membrane, identifying its position by noting its resistance to the needle. However, identification of the hyoid bone or thyroid cartilage provides a more certain indication of the depth to which the needle must be inserted in order to perform the block.

Case reports

At the authors’ institution, eight patients who presented with cervical spine injuries were successfully intubated and anesthetized using bilateral superior laryngeal and transtracheal blocks. Two are presented here.

A 23-year-old Black male was admitted with a diagnosis of C4-5 subluxation, facial lacerations, and right frontal lobe contusion after an automobile accident. The patient was placed in Gardner-Wells tongs for more than six weeks. When he was changed to a halo, he displayed instability of the fracture. He was returned to the tongs for more than two months. When still no sign of
union appeared, the patient was scheduled for anterior cervical spine fusion of C4-5.

The patient was premedicated with diazepam 10 mg PO and brought to the operating room, where his vital signs were monitored. He was sedated with fentanyl citrate and droperidol (Innovar®) 2 cc IV and was given bilateral superior laryngeal block with 3 cc of 1% lidocaine and a transtracheal block with 2 cc of 1% lidocaine in the method previously described. An atraumatic blind nasal intubation was successfully completed while the patient was in traction. He was transferred to the operating room table and general anesthesia was instituted. The patient was extubated in the operating room. His postoperative course was uneventful and he was discharged two weeks later without neurologic deficit.

A 57-year-old Black male was admitted with a diagnosis of rheumatoid arthritis, odontoid erosion fracture, C1-2 subluxation, mild restrictive pulmonary disease, and hypertension. The patient was placed in Gardner-Wells tongs for 18 days while his blood pressure was being controlled in preparation for cervical laminectomy and fusion.

The patient was brought to the operating room without premedication. His vital signs were monitored and he was sedated with diazepam 5 mg and fentanyl .15 mg IV.

An atraumatic blind nasal intubation was successfully completed after bilateral superior laryngeal block with 4 cc of 2% lidocaine and transtracheal block with 2 cc of 2% lidocaine were performed in the manner previously described. The patient, remaining in traction, was then transferred to the operating room table and general anesthesia was instituted. The patient was extubated in the operating room. His postoperative course was uneventful and he was discharged three weeks later with no neurologic deficit.

**Discussion**

The eight cervical spine injured patients presenting to the authors' institution experienced no complications. In a recent series of 140 blocks performed at a New York hospital, only two complications occurred. One patient developed a small, well circumscribed hematoma which was contained with manual pressure. In another previously intubated patient, it was not recognized that the cuff of the endotracheal tube was malpositioned in the larynx. As the needle penetrated the thyrohyoid membrane a loud "pop" indicated that it had penetrated the cuff, thus necessitating reintubation.

A full stomach would be an absolute contraindication to the technique described because of the risk of aspiration of gastric contents through the anesthetized larynx. Infection or tumor in the area of the block is also considered a contraindication to its use.

Local anesthetic block of the upper airway by topical application of local anesthesia to nose, mouth and trachea, combined with block of the internal branch of the superior laryngeal nerve, has a broad spectrum of clinical usefulness, facilitating endotracheal intubation, laryngoscopy and bronchoscopy. The block may decrease the discomfort of intubation in the awake patient with cervical spine injury needing endotracheal intubation and ventilatory support. The technique is safe, effective, and has little risk of complication.

**REFERENCES**


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