ANAESTHESIA OF THE UPPER AIRWAY USING TOPICAL ANAESTHETIC AND SUPERIOR LARYNGEAL NERVE BLOCK

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SUMMARY

Bilateral superior laryngeal nerve block was combined with topical application of local anaesthetic 140 times in 135 patients to anaesthetize the upper airway and facilitate tracheal intubation, laryngeal instrumentation, or to diminish the response to the endotracheal tube, in a patient already intubated. The technique was successful in 92% of attempts.

Sensory innervation of the larynx is provided by the internal branch of the superior laryngeal nerve, which can usually be blocked bilaterally. When combined with topical application of a local anaesthetic to the nose and mouth, and transtracheal instillation of local anaesthetic through puncture of the cricothyroid membrane, complete anaesthesia of the upper airway may be effected. This technique has previously been described as useful in facilitating awake tracheal intubation, laryngoscopy, bronchoscopy and radiographic procedures in the upper airway (Zuck, 1951; Wycoff, 1959; Gaskill and Gillies, 1966; Shultz, Chin and Williams, 1970).

ANATOMY

The superior laryngeal nerve is a branch of the vagus nerve arising from the nodose ganglion and descending behind the internal carotid artery, close by the pharynx. It ends here by dividing into external and internal branches. The external branch continues inferiorly and anteriorly and ends by penetrating the cricothyroid muscle, to which it supplies motor innervation.

From its point of origin the internal branch of the superior laryngeal nerve passes medially below the greater cornu of the hyoid bone to pierce the thyro-hyoid membrane, just superior to the superior laryngeal artery. After penetrating the membrane it 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 (Durham and Harrison, 1964). The site of entrance of the nerve into the larynx is thus marked by two landmarks which are usually easily identified—the hyoid bone and the thyroid cartilage (fig. 1).

The possibility of a motor component in the internal branch of the superior laryngeal nerve has been debated. Microscopic dissection has demonstrated that the nerve penetrates the interarytenoid muscle without supplying any motor innervation (Rueger, 1972). Block of the nerve then provides sensory blockade alone, without any risk of laryngeal dysfunction secondary to the paralysis of any intrinsic laryngeal muscle. The only major blood vessel in proximity to the nerve at its point of entry to the larynx is the superior laryngeal artery.

The recurrent laryngeal nerve is not in the immediate vicinity of the block and there is no risk of its being anaesthetized.

Sensory innervation of the trachea and the infraglottic portion of the larynx is supplied by the recurrent laryngeal branch of the vagus. In the cat sensation in the anterior infraglottic muscosa at the level of cricothyroid membrane is supplied by fibres of the external branch of the superior laryngeal nerve (Suzuki and Kirchner, 1965). The tracheal mucosa may be anaesthetized by topical application of local anaesthetic via cricothyroid puncture in the midline. There is no hazard since there are no major blood vessels in this area.

Sensory innervation of the mouth and pharynx is provided by branches of the trigeminal and glossopharyngeal nerves.
FIG. 1. Lateral view of the larynx, showing the relation of the internal branch of the superior laryngeal nerve to the hyoid bone, thyroid cartilage, and its point of entering the larynx via the thyro-hyoid membrane.

METHOD

We have combined superior laryngeal block with topical anaesthesia 140 times in 135 patients requiring awake endotracheal intubation, bronchoscopy or laryngoscopy, or who were coughing in response to a tracheal tube in position (table I). We evaluated the ease of obtaining airway anaesthesia and the predictability of the technique.

Eighty-seven of the blocks were performed in males, and 53 in females. The patients' ages ranged from 14 to 82 yr, with a mean of 45 yr. The block was considered successful if there was no cough or straining at endotracheal intubation or instrumentation, or if the previously intubated and responsive patient was now quieted.

Fifty patients required nasotracheal intubation for surgical correction of facial trauma, and were unable to open the mouth. Three patients had a fracture of the cervical spine. All were either premedicated lightly (for example pentobarbitone 100 mg i.m.) or, in most instances, received no premedication at all. In those not adequately sedated, diazepam 5.0–7.5 mg i.v. usually produced a calm and co-operative patient.

With the patient lying supine the head is maximally extended, and the hyoid bone identifiable by palpation. Since the hyoid does not articulate with another bone, it is readily movable, and this mobility serves as a useful identifying sign. After cleansing the neck with alcohol or iodophore, a 21-gauge needle was introduced laterally and directed at the greater cornu of the hyoid. The carotid sheath was gently retracted posteriorly. After contacting the bone, the needle was then walked caudad until it slipped off the hyoid, just through the thyro-hyoid membrane, and into a closed space bounded by the thyro-hyoid membrane laterally and the laryngeal mucosa medially. This space contains the ramifications of the internal branch of the superior laryngeal nerve. After careful aspiration to detect either air or blood, 2% lignocaine 2 ml was injected. The block was then repeated on the other side. Two millilitre of 2% lignocaine was then instilled by dropper into the nose (for nasotracheal intubation) and the mouth. Lignocaine 4 ml was injected via cricothyroid puncture, at the end of maximal expiration. The coughing produced by a spray of lignocaine introduced directly into the trachea spread anaesthetic droplets from the carina.

<table>
<thead>
<tr>
<th>Indications for block</th>
<th>No.</th>
<th>Success rate (%)</th>
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<tbody>
<tr>
<td>Awake oral intubation before operation</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Awake nasotracheal intubation before operation</td>
<td>56</td>
<td>95</td>
</tr>
<tr>
<td>Awake nasotracheal intubation not for surgery</td>
<td>40</td>
<td>95</td>
</tr>
<tr>
<td>Reduce post-intubation response to tube</td>
<td>14</td>
<td>92</td>
</tr>
<tr>
<td>Bronchoscopy with i.v. anaesthesia</td>
<td>21</td>
<td>86</td>
</tr>
<tr>
<td>Bronchoscopy with no other anaesthesia</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Laryngoscopy</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>92</td>
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to the inferior surface of the vocal cords, thus providing topical anaesthesia of the trachea. Superior laryngeal nerve block anaesthetized the interior of the larynx, and topical application of local anaesthetics to the nose and mouth completed anaesthesia of the upper airway.

If a tracheal tube was already in place, lignocaine 4 ml could be instilled directly into the tube in place of the cricothyroid puncture.

The hyoid may be difficult to locate accurately if the patient has a short, fat neck, or if there is oedema in the upper neck as might occur with a fractured mandible. In that event the block technique could be altered by identifying the superior cornu of the thyroid cartilage and walking the needle cephalad off this structure. It was also possible to identify the thyro-hyoid membrane itself and insert the needle directly through it, relying on the feeling of resistance offered by the membrane to indicate when it had been punctured. However, definite identification of either the hyoid bone, or superior cornu of the thyroid cartilage during the block provided a more reliable indication of the necessary depth of insertion of the needle.

RESULTS
One hundred and twenty-nine blocks were successful (92%). Although the duration of action of lignocaine is only 90 min, the blocks had to be repeated only five times and then, only after 4–6 h had elapsed. Therefore, in the 40 awake patients in whom the block was performed before endotracheal intubation for resuscitation or ventilatory support, and in the 14 patients who were awake and already intubated, there appeared to be an obtunded laryngeal reflex which outlasted the duration of nerve block.

The combination of nerve block and topical anaesthesia provided excellent conditions for bronchoscopy when the patient's co-operation and ability to cough were desired. In 21 of our patients undergoing bronchoscopy the block technique was supplemented with small (2–4 ml) i.v. infusions of a mixture of droperidol and fentanyl, which usually maintained the patient's co-operation and obviated the hazard of an inhalation anaesthetic in a patient with respiratory disease. In five patients nerve block and topical anaesthesia alone produced adequate operative conditions. Trans-tracheal block alone does not provide adequate anaesthesia for upper airway instrumentation. In six of our failed efforts trans-tracheal blocks had been performed adequately.

In our 140 blocks there were two complications (1.4%). One patient developed a small, well-circumscribed haematoma which was contained with manual pressure. In another patient, (trachea previously intubated), the cuff of the endotracheal tube was in the larynx, and not recognized as mal-positioned. As the needle penetrated the thyro-hyoid membrane a loud "pop" also indicated that it had penetrated the cuff, thus necessitating reintubation.

DISCUSSION
Local anaesthetic blockade of the upper airway, by topical application of local anaesthesia 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 awake patient needing endotracheal intubation and ventilatory support may have the discomfort of the tube decreased by the block. The technique is safe, effective, and has little risk of complication.

A full stomach would be an absolute contraindication to the technique because of the risk of aspiration of gastric contents through the anaesthesitized larynx. We consider infection or tumour in the area of the block to be contraindications to its use.

REFERENCES
Resumen

El bloqueo bilateral del nervio laringe superior se combinió 140 veces con una aplicación típica de agente anestésico local, en 135 pacientes, para anestesiar las vías respiratorias superiores y facilitar la intubación tráqueal, la instrumentación en la laringe, o para disminuir la respuesta al tubo endotraqueal en un paciente ya intubado. La técnica tuvo éxito en el 92% de los intentos.