Hypoglossal Nerve Palsy as Complication of Oral Intubation, Bronchoscopy and Use of the Laryngeal Mask Airway

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Key Words
Hypoglossal nerve · Intubation · Postoperative complication

Abstract
Hypoglossal nerve injury is a recognized but rare complication of oropharyngeal manipulation during intubation, bronchoscopy and use of a laryngeal mask airway. We present 2 new cases of temporary hypoglossal nerve palsy after orotracheal intubation for general anesthesia. The relevant literature is reviewed and different hypotheses concerning the pathophysiological mechanisms of nerve damage are discussed.

Introduction
Paralysis of the hypoglossal nerve is a multietiological condition. In the largest series to date (n = 100) [1], nearly half of the 12th nerve palsies were caused by tumors. Only 5% followed surgery, usually after head or neck operations. Among the operations the most common cause consists of carotid endarterectomy [2], but other operations in the upper part of the neck regularly involve the hypoglossal nerve as well [3]. In addition, the 12th cranial nerve is most commonly affected by radiation [4]. As opposed to other cranial nerves it is only rarely affected during the course of meningitis [5]. Infectious mononucleosis may also cause 12th nerve palsy [6]. Infrequently, hypoglossal nerve compression occurs with carotid artery dissections [7].

There are only a few case reports published in anesthesiologic or otolaryngological but not neurological journals, referring to hypoglossal nerve palsies following intubation, use of the laryngeal mask airway (LMA) or bronchoscopy [8–25]. These palsies are usually diagnosed by a consulted neurologist, asked for the underlying etiology, prognosis and treatment options. We therefore present 2 additional cases and give a review of the literature.

Case Reports
Case 1
Caused by a high-voltage accident, a 32-year-old man suffered shoulder dislocation on both sides and a tear of the left tuberculum majus humeri. No further injuries were observed and history-taking did not reveal indications of other illnesses. Physical examination disclosed no neurological abnormalities. On the day of the accident the dislocated shoulders were set and immobilized by Gilchrist bandage. Five days later the operation was performed. The administration of general anesthesia and orotracheal intubation with an 8.0-mm endotracheal tube with prior muscle relaxation proceeded with-
out difficulties. The split tuberculum majus humeri was repositioned manually and fixed with a spongiosa screw. Finally, a Gilchrist bandage was applied. The patient was awakened and extubated without difficulty. The duration of anesthesia was 75 min. A few hours afterwards the patient complained of swelling and pain of the right side of the tongue. He had difficulty in moving his tongue resulting in slightly disturbed speaking and swallowing. On neurological examination the tongue deviated to the right, minor swelling was observed at the right side of the tongue. No atrophy or fibrillation was seen. A diagnosis of an acute isolated right hypoglossal nerve palsy was made. The patient’s symptoms disappeared completely within 1 week.

Case 2

A 74-year-old man, who suffered from esophageal stenosis of unknown etiology for 30 years, presented with recurrent regurgitation of food. Esophagoscopy gave evidence of an obstructing meat bolus, which was extracted at the same session. A subsequent esophagoscopy 2 days later revealed perforation of the esophagus, which made an immediate surgical intervention necessary. Preoperative physical examination disclosed no neurological abnormalities. Administration of general anesthesia and orotracheal intubation with an 8.0-mm endotracheal tube with prior muscle relaxation took its regular course. Abdominal-thoracic esophagus resection and esophagogastrostomy were carried out. No intraoperative complications were noted. Awakening and extubation took place without difficulties. The duration of anesthesia was 4 h and 45 min. On the first postoperative day, the patient complained of difficulties moving his tongue, his speech was slightly slurred. No injury of the tongue was observed but swelling on its right side was seen. Neurological examination revealed an isolated right 12th nerve palsy with deviation of the tongue to the right, without atrophy or fibrillation. The patient’s symptoms resolved completely within 2 weeks.

Discussion

In both cases presented, the rapid improvement of the hypoglossal nerve palsy indicates that only minor nerve damage, i.e. neurapraxia had occurred. A surgical injury is unlikely because the procedures were confined to the shoulder in the first and to the chest and abdomen in the second patient. Therefore, we assume that nerve damage happened as a complication of orotracheal intubation. Because swelling of the tongue on the side of the hypoglossal palsy, in the first patient in combination with pain in the same location, was observed in both patients, we believe – as discussed later – that a temporary compression of the nerve along its superficial course at the lateral root of the tongue was the underlying pathomechanism.

There have been quite few cases of hypoglossal nerve palsy after different oropharyngeal manipulations published to date (table 1). As can be seen, damage to the 12th cranial nerve may occur as well after orotracheal intubation (cases 1–8, 10–14, 17–19, 21–25), as after bronchoscopy (cases 9, 15), and after the use of a LMA (cases 16, 20). No trend towards a certain age or gender preponderance can be identified from this data. The majority of cases occurred subsequent to rhinopharyngological surgery, especially tonsillectomy, but hypoglossal nerve palsies were noted after operations in other body regions, too (cases 12, 16, 17, 19, 20, 23–25). In 15 cases the nerve damage was localized on the right side, in 5 on the left, in 5 cases the lesion’s side is not known.

In about a quarter of the cases (7/25) hypoglossal nerve palsy was associated with ipsilateral damage of the lingual nerve. A few cases of isolated lingual nerve palsy following orotracheal intubation [26–28] or the use of the LMA [29, 30] have also been seen.

There have been 16 cases with mentioning of recovery. While in 13 cases complete recovery was achieved within 1 week to 4 months, only partial recovery was noted in 3 cases during the follow-up, and in 4 cases no improvement of the nerve palsy occurred at all.

Concerning the precise pathogenesis of hypoglossal nerve lesions during oropharyngeal manipulation, different lesion sites have been suggested. The nerve arises from the medulla oblongata and leaves the skull through the hypoglossal canal in the occipital bone. It descends between the internal carotid artery (ICA) and the internal jugular vein, passes just above the hyoid bone and reaches the lower border of the posterior belly of the digastic muscle, where it turns forward and medially. Here it lies below the submandibular gland and the lingual nerve. At the anterior margin of the hypoglossal muscle, it curves upwards towards the tip of the tongue, supplying branches of the tongue. In an intraoperative experiment, Michel and Brusis [20] could demonstrate that the anterior displacement of the tongue during intubation caused a substantial strain on the hypoglossal nerve. Additionally, repositioning the head, as performed in the ‘sniffing position’ during intubation, effected distension of the nerve as well. The authors assume that, depending on the extent of so exerted strain, the nerve’s function may be temporarily impaired due to stretching (i.e. neurapraxia) or the nerve may be permanently damaged due to extraction of its fibers (i.e. axonotmesis or neurotmesis). Additionally, Evers et al. [14] pointed out that the risk of distension of the nerve during intubation is increased, if pressure is applied to the cricoid resulting in immobilization of the nerve.

Direct compression of the hypoglossal nerve along its superficial course at the lateral root of the tongue represents a further reasonable pathophysiological concept [8]. Especially the large number of cases featuring simultaneous lingual and hypoglossal nerve damage support this
Table 1. Published cases of hypoglossal nerve palsies

<table>
<thead>
<tr>
<th>Author</th>
<th>Case</th>
<th>Patient age (years) and gender</th>
<th>Nerve palsy</th>
<th>Circumstance</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agnoli and Straus, 1970 [8]</td>
<td>1</td>
<td>53, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for direct laryngoscopy and excision of vocal cord polyposis</td>
<td>Partial within 6 weeks</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>71, f</td>
<td>Right n. hypoglossus</td>
<td>ITA for direct laryngoscopy and excision of vocal cord hyperplasia</td>
<td>Partial within 3 months</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>48, f</td>
<td>Right n. lingualis and n. hypoglossus</td>
<td>ITA for direct laryngoscopy and excision of vocal cord hyperplasia</td>
<td>Complete within 2 months</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>24, f</td>
<td>Right n. lingualis and n. hypoglossus</td>
<td>ITA for tonsillectomy</td>
<td>No recovery</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>57, f</td>
<td>Right n. lingualis and n. hypoglossus</td>
<td>ITA for direct laryngoscopy and tumor excision</td>
<td>No information</td>
</tr>
<tr>
<td>Baumgarten et al., 1997 [9]</td>
<td>6</td>
<td>45, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for nasal septoplasty</td>
<td>No recovery</td>
</tr>
<tr>
<td>Boenninghaus and Dennecke, 1982 [10]</td>
<td>7</td>
<td>36, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for tonsillectomy</td>
<td>No recovery</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>?</td>
<td>N. hypoglossus</td>
<td>ITA for bronchoscopy</td>
<td>?</td>
</tr>
<tr>
<td>Condado et al., 1994 [12]</td>
<td>10</td>
<td>44, m</td>
<td>Right n. lingualis and n. hypoglossus</td>
<td>ITA for laryngoscopy and excision of vocal cord hyperplasia</td>
<td>Complete within 3 months</td>
</tr>
<tr>
<td>Drouet et al., 1999 [13]</td>
<td>11</td>
<td>20, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for operation of the left shoulder</td>
<td>Complete within 2 months</td>
</tr>
<tr>
<td>Evers et al., 1999 [14]</td>
<td>12</td>
<td>56, m</td>
<td>Left n. lingualis and hypoglossus</td>
<td>ITA for hypophysectomy in a patient with acromegaly</td>
<td>Complete within 4 months</td>
</tr>
<tr>
<td>Hinze and Lincke, 1976 [16]</td>
<td>14</td>
<td>27, m</td>
<td>Right n. lingualis and n. hypoglossus</td>
<td>ITA for direct laryngoscopy and excision of a vocal cord polyp</td>
<td>Complete within 3 months</td>
</tr>
<tr>
<td>Kaess, 1955 [17]</td>
<td>15</td>
<td>58, m</td>
<td>Right n. lingualis and n. hypoglossus</td>
<td>Diagnostic bronchoscopy</td>
<td>Complete within 6 weeks</td>
</tr>
<tr>
<td>King and Steet, 1994 [18]</td>
<td>16</td>
<td>55, m</td>
<td>Left n. hypoglossus</td>
<td>LMA for general anesthesia; removal of Rush pins stabilizing humerus fracture</td>
<td>Nearly complete after 8 days</td>
</tr>
<tr>
<td>Konrad and Lakomy, 1960 [19]</td>
<td>17</td>
<td>32, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for aortic arch surgery</td>
<td>Complete within 12 months</td>
</tr>
<tr>
<td>Michel and Brussi, 1990 [20]</td>
<td>18</td>
<td>42, f</td>
<td>Left n. hypoglossus</td>
<td>ITA for tonsillectomy</td>
<td>No recovery</td>
</tr>
<tr>
<td>Mullins et al., 1992 [21]</td>
<td>19</td>
<td>40, m</td>
<td>Left n. hypoglossus</td>
<td>ITA for arthroscopy of the left shoulder and open repair of a tear of the left rotator cuff</td>
<td>Complete within 8 weeks</td>
</tr>
<tr>
<td>Nagai et al., 1994 [22]</td>
<td>20</td>
<td>62, f</td>
<td>Right n. hypoglossus</td>
<td>LMA for general anaesthesia; left total shoulder joint replacement</td>
<td>Complete within 1 week</td>
</tr>
<tr>
<td>Smoker, 1993 [23]</td>
<td>21</td>
<td>17, f</td>
<td>N. hypoglossus</td>
<td>ITA for tonsillectomy</td>
<td>No information</td>
</tr>
<tr>
<td>Streppel and Bachmann, 1997 [24]</td>
<td>22</td>
<td>35, m</td>
<td>Left n. hypoglossus</td>
<td>ITA for paranasal sinus surgery</td>
<td>Complete within 4 weeks</td>
</tr>
<tr>
<td>Venkatesh, 1997 [25]</td>
<td>23</td>
<td>65, m</td>
<td>Left n. hypoglossus</td>
<td>ITA for drainage of bilateral chronic subdural hematomas</td>
<td>Complete within 6 days</td>
</tr>
<tr>
<td>Dziewas and Lüdemann, 2001 [present study]</td>
<td>24</td>
<td>32, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for open repair of a tear of the left tuberculum maurus humeri</td>
<td>Complete within 1 week</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>74, m</td>
<td>Right n. hypoglossus</td>
<td>ITA for esophagus resection</td>
<td>Complete within 2 weeks</td>
</tr>
</tbody>
</table>

ITA = Intubation anesthesia; LMA = laryngeal mask airway.
hypothesis, as both nerves are quite closely together exclusively at the lateral margin of the tongue.

In 3 cases (3, 15, 22) a calcified ligamentum stylohyoideum was found and a compression of the 12th nerve between the intubation blade and the ligamentum was assumed. Finally, 1 case (23) was put down to nerve compression by inadvertent extubation with the cuff inflated.

Whereas hypoglossal nerve damage after intubation and bronchoscopy is caused by similar mechanisms, the use of LMA, which usually does not require laryngoscopy, should effect hypoglossal nerve damage in a different way. Nagai et al. [22] believed that in their patient, a 62-year-old woman who received general and epidural anesthesia for a total shoulder joint replacement, the hypoglossal nerve was compressed between the LMA cuff and the hyoid bone or cervical vertebra. King and Steet [18] reporting on a 55-year-old man who received general anesthesia and bronchoscopy is caused by similar mechanisms, the pressure by inadvertent extubation with the cuff inflated.

Another possible etiology of postoperative hypoglossal nerve palsy consists of an ICA dissection. As has been reported a few times, a hypoglossal nerve palsy may be the only presenting sign of an ICA dissection [31–34], which in turn is known to be a rare complication of either bronchoscopy [35] and orotracheal intubation [36]. To exclude this condition, extracranial Doppler and duplex sonography [37] or magnetic resonance imaging as even more sensitive method for detecting ICA dissections should be used if no signs of local compression of the nerve at the lateral tongue are present or if the patient complains of cervical pain. Additionally, a postoperatively noticed palsy of the hypoglossal nerve may be caused by central venous catheterization via the internal jugular vein [38, 39].

Although hypoglossal nerve palsy after intubation, bronchoscopy or use of LMA seems to happen exceptionally rarely, this complication should be known to neurologists, who will be consulted for the correct diagnosis (e.g. peripheral versus central tongue palsy), for the etiology and for the individual prognosis with respect to forensic and therapeutic consequences. The good chance of spontaneous recovery should keep from surgical revision of the hypoglossal nerve, at least in patients without prior neck operation. Rehabilitative measures, if at all necessary, may include dietary modifications and logopedic training.

References

18 King C, Steet MK: Twelfth cranial nerve paralysis following the use of a laryngeal mask airway. Anaesthesia 1994;49:786–787.
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Erratum

In issue 47/3/02, the authors’ list of the paper ‘Is the Right Amygdala Involved in Visuospatial Memory? Evidence from MRI Volumetric Measures’ (Eur Neurol 2002;47:148-155) was incomplete. The authors are as follows: