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Airway management using submental intubation in head and neck surgery

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Abstract: In 1995 the first tracheosubmental intubation (TSI) in Poland was performed in the Clinic and Department of Cranio-Maxillofacial Surgery at Jagiellonian University Medical College in Kraków. Our 20 years of experience with using TSI in the field of cranio-maxillofacial surgery, with 316 successfully performed intubations, resulted in one of the largest bodies of material analysed in the literature so far. The aim of this study was to evaluate the efficacy and complications of TSI in the field of cranio-maxillofacial surgery in patients where orotracheal or nasotracheal intubation is contraindicated and tracheostomy can be avoided. To fulfil this objective we present our own experience with the use of TSI in the field of cranio-maxillofacial surgery. This retrospective study included 316 patients who were operated on with general anaesthesia via TSI in the Department of Cranio-Maxillofacial Surgery, Jagiellonian University Medical College, Kraków, from 1995 to 2014 (20 years). Indications for TSI were as follows: multifragmentaric fractures of the bones of mid- and lower face in 262 patients (82.9%), simultaneous osteotomies of the maxilla and mandible due to mandibular prognathism with maxillary compression in 62 patients (19.6%), extensive facial cancer infiltrating both the nose and lips in 4 patients (1.2%) and posttraumatic deformities of the nose and jaws in 4 patients (1.2%). In all 316 patients TSI was successfully performed and proved to be the optimal method of airway management, providing a comfortable surgical approach with the operating field free from an intubation tube. Complications were observed in 12 patients (3.8%) and included wound infection in 7 patients (2.21%), transitory salivary fistula in 3 patients (0.95%), and hypertrophic scarring in 2 patients (0.63%). TSI is considered to be a safe and simple technique of intubation, which makes it possible to avoid tracheotomy complications when it is difficult or impossible to perform orotracheal or nasotracheal intubation. TSI facilitates the simultaneous performance of complex procedures, including both mid-face and lower face correction, in a one-step procedure, providing complete intraoperative control of the occlusion as well as facial symmetry.

Key words: panfacial trauma, submental intubation, airway management, maxillofacial injuries, orthognathic surgery.

Introduction

There are certain clinical situations in the field of head and neck surgery which make general anaesthesia via oro- or nasotracheal intubation significantly inconvenient or even impossible to perform. In such cases, an elective short-term tracheotomy or tracheosubmental intubation (TSI) is indicated. The latter is considered to be less invasive and associated with a lower complication rate than a tracheotomy [1, 2].

The submental route for endotracheal intubation was first described by Francisco Hernandez Altemir in 1986 [3]. From the first introduction of TSI by Altemir, indications for this method of airway management on general anaesthesia have considerably increased.

Currently, the use of TSI include:

- in traumatology: patients with panfacial fractures who require reduction and osteosynthesis of the fractured bones of the midface, nose and/or mandible with simultaneous control of the occlusion
- in aesthetic and reconstructive surgery: simultaneous performance of nose and lips correction or reconstruction, facelift, rhynoplasty
- in orthognathic surgery: simultaneous osteotomies of the maxilla and mandible
- selected oncological patients: tumours infiltrating both nose and lips
- cranial base oncological surgery, including transfacial approaches to the cranial base [4, 5].

Possible complications of TSI include dislocation of endotracheal tube and unplanned extubation (especially in paediatric surgery), lingual nerve injury, Wharton's duct or submandibular salivary gland injury, excessive bleeding, wound infection, salivary fistula, keloid or hypertrophic scarring [5–7].

Inflammatory and neoplastic infiltrations of the floor of the mouth and submandibular region and temporomandibular ankylosis are local contraindications to TSI. This method of intubation is also contraindicated in patients with coagulopathies and tendency to keloid or hypertrophic scar formation. Additionally, TSI is not performed when prolonged ventilation is expected (>72 hours) or in case of lack of patient consent for this procedure [1, 3, 5, 7, 8].

Aim of the study

The aim of this study was to evaluate the efficacy and complications of TSI in the field of cranio-maxillofacial surgery in patients where orotracheal or nasotracheal intubation is contraindicated and tracheostomy can be avoided. To fulfil this objective we present our own experience with the use of TSI in the field of cranio-maxillofacial surgery.

Material and methods

Medical documentation of patients hospitalized in the Department of Cranio-Maxillofacial Surgery, Jagiellonian University Medical College, Kraków was analysed to select the study group. We included patients who were operated on with general anaesthesia via tracheosubmental intubation. From 1995 to 2014 (20 years) 316 patients (100%) were operated on with general anaesthesia via TSI in the Department of Cranio-Maxillofacial Surgery, Jagiellonian University Medical College, Kraków: 249 men (78.8%) and 67 women (21.2%), aged from 6 to 72 years (32 years on average). The analysed variables were as follows: age, sex, indication for TSI, intraoperative and postoperative complications, need of post-operative ventilation, duration of the post-operative ventilation.

Results

Indications for TSI were as follows: multifragmentaric fractures of the bones of mid- and lower face in 262 patients (82.9%), simultaneous osteotomies of the maxilla and mandible due to mandibular prognathism with maxillary compression in 62 patients (19.6%), extensive facial cancer infiltrating both the nose and lips in 4 patients (1.2%) and posttraumatic deformities of the nose and jaws in 4 patients (1.2%).

Table 1. Indications for tracheosubmental intubation in 316 patients.

Multifragmentaric fractures of the facial skeleton	Simultaneous osteotomies of the maxilla and mandible (orthognathic surgery)	Extensive facial cancer infiltrating both the nose and lips	Other (posttraumatic deformities of the nose and jaws)	Total number of patients
262 (82.9%)	62 (19.6%)	14 (4.4%)	4 (1.2%)	316 (100%)

Operative procedure

Tracheosubmental intubation follows orotracheal intubation with a reinforced airtight tube with the use of a laryngoscope or a fiberoscope. After skin decontamination with a coloured antiseptic (e.g. 10% povidone-iodine solution), a horizontal 1.5 cm line in the place of the planned skin incision is marked in the midline of the submandibular fold. Incision of the skin, performed with blade no. 15, is followed by blunt dissection of the tissues of the submandibular triangle including mylohyoid, geniohyoid, and genioglossal muscles into the oral cavity, behind the lower incisors, posteriorly to the sublingual caruncle. Incision of the oral mucosa is made laterally from the frenulum of the tongue. First the cuff and then the tube are inserted through the formed channel. The tube is then sutured to the skin with Nylon 3.0, which stabilizes the tube, with additional fixation by the muscles of the floor of the mouth. When the surgery is completed, the tube together with the cuff is passed back into the oral cavity (unless longer intubation is required, TSI may be prolonged safely for 72 hours). Extubation is conducted routinely. The skin wound is closed with Nylon 5.0 using layered closure technique. The oral mucosa is closed with Nylon 4.0. During the postoperative period perfect oral hygiene must be kept (including the use of 0.12% chlorhexidine oral rinse every 6 hours) as well as daily submandibular skin wound cleansing and disinfection. Skin sutures are removed after 7 days, and intraoral sutures — 10 days after the surgery.

In all 316 patients TSI was successfully performed. It proved to be a very useful technique, providing a comfortable surgical approach with the operating field free from an intubation tube, complete intraoperative control off the occlusion as well as facial symmetry. The scar in the submental area was hidden in the submental fold and aesthetically well accepted by all patients, apart from two patients with hypertrophic scarring. In five patients with extensive facial trauma prolonged TSI enabled artificial and controlled ventilation (in 4 patients up to 48 hours and in one patient to up 72 hours) in the Intensive Care Unit without performing a tracheotomy. Complications were observed in 12 patients (3.8%) and included wound infection in 7 patients (2.21%), transitory salivary fistula in 3 patients (0.95%), and hypertrophic scarring in 2 patients (0.63%) (Table 2).

Table 2. Complications of tracheosubmental intubation in 316 patients.

Complication	Number of patients (%)
Wound infection	7 (2.21%)
Salivary fistula	3 (0.95%)
Hypertrophic scar	2 (0.63%)
Total number of patients	12 (3.80%)

Discussion

The choice of the best method of intubation to provide general anaesthesia for patients operated on in the field of cranio-maxillofacial surgery is particularly challenging due to the fact that the operating field for both the surgeon and the anesthesiologist overlap. Another reason that makes airway management difficult, is that some clinical situations make orotracheal or nasotracheal intubation difficult or impossible to perform [3, 9]. Orotracheal intubation doesn't allow control of the occlusion (necessary in traumatology and orthognathic surgery), and impairs assessment of the symmetry of the face. Nasotracheal intubation tends to be difficult or even impossible to perform in cases of nasal septum deviation or hypertrophy of nasal turbinates. This method of intubation may lead to transferring infection from the nose to the bronchial tree, retropharyngeal perforation, and additionally, in patients with maxillary fractures may lead to epidural infection [5, 10]. Other disadvantages of nasotracheal intubation include: poor tolerance of the tube when prolonged intubation is indicated, the risk of sores and subsequent secondary deformities of the nostril, and the possibility of damaging the tube during Le Fort I osteotomy of maxilla [3, 5]. Tracheotomy is associated with numerous general and local, early and late clinically important complications, it may also be difficult to perform in children, obese patients, and patients with thyroid gland enlargement [11]. On the basis of the literature and our own experience, planned anaesthesia via tracheotomy should be considered as the last method to be chosen [3, 5, 6, 11]. Early local complications include bleeding, haemorrhage, subcutaneous or mediastinal emphysema, esophagotracheal fistula, and laryngeal recurrent nerve palsy. Early general complications include cardiac arrest due to the stimulation of the vagus nerve, posthypercapnic shock as the result of a sudden decrease in carbon dioxide level, acute pulmonary edema without connection with circulatory disturbances, and aeroembolism [3, 5, 11]. A number of late complications have been recognized: laryngeal or tracheal stricture, haemorrhage from large blood vessels as the result of the decubitus of the vessel walls, extensive granulation and inflammatory complications. Reported incidence of early complications of tracheotomy is 6–8%, and the incidence of late complications is 60% [12].

According to the literature, the reported complication rate of TSI varies from 0.24% to 7.13% [13]. Table 3 depicts the incidence of complications relating to TSI representing 842 patients from 41 articles published between 1984 and 2011 [13].

Since the first introduction of TSI by Altemir in 1986, several modifications of the previous technique have been proposed in order to improve outcomes and to minimise the risk of complications [5, 9, 10]. In Altemir's original technique the tube was inserted in the submandibular area which could harm important anatomical structures in the mentioned region (facial vein and artery, submandibular salivary gland, lingual nerve, sublingual nerve).

Table 3. Complications of tracheosubmental intubation in 842 patients — a literature review (1984–2011) [13].

Complication	Number of patients (%)
Wound infection	23 (2.7%)
Damage of the tracheal tube	10 (1.1%)
Salivary fistula	10 (1.1%)
Hypertrophic scar	3 (0.4%)
Unplanned extubation	2 (0.3%)
Lingual nerve paresis	1 (0.1%)
Extensive bleeding	2 (0.3%)
Mucocele	1 (0.1%)

J.F. Hönig from Göttingen in 1993 modified the TSI technique by relocating the insertion point of the endotracheal tube into the submental triangle [10]. On the basis of the review of the literature concerning TSI from the last 30 years, the majority of technique alterations involve passing the tube through the mylohyoid muscle. Gadre and Waknis proposed “transmylohyoid” as more adequate terminology, as in this technique the tube can be inserted through the mylohyoid muscle anywhere between the first mandibular molars of either side anterior to the masseter muscle, instead of being limited to the submental triangle [14].

Most authors agree that subperiosteal tube placement, originally proposed by Altemir, is not necessary. Midline insertion of the endotracheal tube decreases the risk of bleeding and enables easier tube location [14]. Some authors suggest the use of two endotracheal tubes — one conventional for orotracheal intubation, and the second one armoured. The latter is inserted through the submental skin incision. The conventional oro-tracheal tube is then replaced with the armoured one. The advantage of this technique is limiting the risk of the hypoxia during the intubation procedure, but concurrently this manoeuvre may result in introduction of the infection into the lower respiratory tract [7, 15].

A trend of increasing attention on the subject of TSI can be observed over the last 30 years. Nearly 90% of the publications regarding this way of intubation have appeared in PubMed in the last decade. Nevertheless, most retrospective studies investigating outcomes and complications of TSI include only relatively small study groups. According to the literature review [13], from 1984 to 2011 (25 years) 41 papers have been published on this topic, which altogether analysed 842 patients (on average 20.5 patient per one publication). Considering this, our 20 year experience with the use of TSI in the field of cranio- and maxillofacial surgery, with 316 successfully performed

intubations, comprises one of the largest bodies of material analysed in the literature so far.

Conclusions

TSI is considered to be a safe and simple technique of intubation, which makes it possible to avoid tracheotomy complications when it is difficult or impossible to perform orotracheal or nasotracheal intubation. In the field of aesthetic, plastic and reconstructive surgery this technique allows operation in the field free from an intubation tube, with the possibility of full control of facial symmetry. Therefore, TSI facilitates the simultaneous performance of complex procedures including both mid-face and lower face correction in a one-step procedure. In addition, if prolonged intubation is required, the tube may be left in place for 72 hours. TSI is the best solution for general anaesthesia in patients with multi- and comminuted fractures of the facial skeleton (simultaneous fractures of the mid- and lower face) and in patients requiring orthognathic surgery, providing complete intraoperative control of occlusion with proper protection of the airway. It is also useful in surgical oncology, allowing ablation and reconstruction in patients with tumours infiltrating the region of the nose and lips.

Conflict of interest

None declared.

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