# Anesthetic concerns in transoral robotic surgery: initial experience of thirty-three cases.

Ezgi ERKILIÇ, Elvin KESİMCİ, Halide CEYHAN, Mustafa AKSOY*

Atatürk Training and Research Hospital, Anesthesiology and Reanimation Clinic, Ankara, TURKEY
*Yıldırım Beyazıt University Faculty of Medicine, Department of Anesthesiology and Reanimation, Ankara, TURKEY
Ezgi ERKILIC, Consultant of Anesthesia, MD.
Elvin KESIMCI, Assoc Prof of Anesthesia, MD, PhD.
Halide CEYHAN, Consultant of Anesthesia, MD.
Mustafa Aksoy, Assoc Prof of Anesthesia, MD.
eerkilic72@yahoo.com; 905053663491

**Abstract: Background/aim:** To describe the anesthetic management applied in transoral robotic surgery (TORS) in a single center in Turkey. **Materials and Methods:** We evaluated retrospectively 33 (13 females, 20 males; mean age: 55.6±13.5 years) consecutive symptomatic patients who underwent TORS under general anesthesia between January 2014- March 2016. **Results**: 33 patients undergoing TORS had 130 and 160 min for duration of surgery and anesthesia, respectively. 24 patients were orally intubated. 2 of the remaining were already with tracheostomies, and the rest were nasal intubated. At the end of the surgery; all of the patients were extubated in the operating rooms. In the early postoperative period; 12.1% of the patients required additional surgical procedures. **Conclusion:** We believe that TORS is emerging as a safe and successful therapy for the treatment of all benign and selected malignant otolaryngological tumors. An anesthesiologist plays an essential role this team. For successful anesthetic management in these patients, it is important to select the best approach with the understanding of the patient's health status, team and their choices.
[Ezgi ERKILIÇ, Elvin KESİMCİ, Halide CEYHAN, Mustafa AKSOY. **Anesthetic concerns in transoral robotic surgery: initial experience of thirty-three cases.** *Biomedicine and Nursing* 2017;3(1): 68-72]. ISSN 2379-8211 (print); ISSN 2379-8203 (online). http://www.nbmedicine.org. 9. doi:10.7537/marsbnj030117.09.

**Key words:** TORS, Transoral robotic surgery, anesthesia

## Introduction

Recent advances in equipment and surgical techniques have made minimally invasive surgery a well-tolerated and efficient technique in several fields of surgery. Robotic-assisted surgery (RAS) has gained popularity in several surgical specialties and many institutions are now investing in medical robotic technology for applications in general, urological, cardiac, gynecological, and neurological surgery.

Transoral robotic surgery (TORS) is a minimally invasive surgical technique developed by Weinstein and O'Malley for the first time (1). By the daVinci TM robotic system, lots of innovations have been supported in otolaryngological surgery for access to difficult areas in the oral cavity (2). TORS enables otolaryngologists to see the depth of surgical area with 3D endoscopic imaging system, camera, endoscope and the other equipments with high resolution. Compared to open-surgical techniques, TORS provides lots of advantages such that; patients need less disfiguring mandibulotomy, tracheostomy and chemotherapy. Also; the incidence of blood loss, infection and postoperative pain is reduced together with decreased recovery time. Speech and previous life standards are regained immediately (3). Thus; TORS benefits the patient, operating surgeon, and anesthesiologist and improves the overall outcome (4,5). However, clinical experiences of both otolaryngologists and anesthetists would be highly desirable in this setting, to answer important questions.

This study aims to analyze the anesthetic considerations in a series of TORS patients over a period of time.

## Materials and Methods

After Ethical Committee approval, data was collected retrospectively from the files of patients who underwent transoral robotic surgery for oropharyngeal, hypopharyngeal and laryngeal tumors between January 2014-March 2016, in our hospital. The anesthetic management plan was to intravenously (IV) induce anesthesia and paralyze if mask ventilation was possible. Maintenance of anesthesia was planned to be with inhalational agent. Difficult airway equipment was kept ready. Patient characteristics, American Society of Anesthesiologists (ASA) classification, reasons for hospital admittance, medical history, airway assessment, preoperative laboratory examinations, electrocardiogram, indications for TORS, intubation information, operation and anesthesia time, anesthetic agents used, postoperative hospital stay, and postoperative complications were recorded. The results are represented as numbers (percentage) or mean (range).

**Statistical analysis**

Data analysis was performed by using IBM SPSS Statistics, verson 19.0 (IBM Corp, Armonk, NY, USA). Data were shown as number of cases and percentages. Categorical variables were analyzed by Chi-square or Fisher's exact test, where appropriate. A p value less than 0.05 was considered statistically significant.

**Results**

We evaluated a total of 33 cases performed with TORS in a period of 26 months. The mean age of the patients was 55.6±13.5 years. 60.6 % (n=20) of the patients was male, and the rest 39.4 % (n=13) was female. According to ASA classification; 15.2% of the patients were in Class IV, while only 3 % were in Class I. A history of tobacco use was reported in 48.5 %. The demographic data are presented in Table 1. The patients underwent surgical interventions 1 (range: 1-28) day after the admission to the Ear Nose Throat Surgery Clinic. The surgical procedures performed are listed in Table 2. As for the operational data; the mean robotic set-up time was 45 min (range: 35-120 min) and mean TORS operating time was 130 min (range: 60-260 min). Mean anesthesia time was 160 min (90-290 min) (Table 2). 72.7% (n=24) of endotracheal intubations were oral; while 21.2% (n=7) was nasal intubations. 2 patients (6.1%) had already tracheostomies before the procedure. The intubations were performed by small (6.0-6.5 ID) endotracheal tubes.

Difficult airway management was observed in 6 (18.1%) patients. We had endotracheal intubation in these patients at second or third trials, by the help of an assistant giving cricoid pressure and pushing the larynx downward and toward the midline which brought arytenoids and posterior part of glottis into view.

**Table 1:** Demographic data of the patients. Values are expressed as mean (SD) or number (%).

| Patient characteristics | Number of patients (n=33) |
|---|---|
| Sex (male/female) | 13/20 |
| Age | 55.6±13.5 |
| Height | 166.7±10.3 |
| Weight | 74.8±17.4 |
| ASA class. I/II/III/IV | 1/9/18/5 |
| Comorbidity (yes/no) | 13/20 |
| Mallampati Score (MMS) I/II/III/IV | 20/7/4/2 |
| Ways of securing airway | |
| Oral intubation | 7 |
| Nasal intubation | 24 |
| Already tracheostomy | 2 |
| Cigarette smoking (yes/no) | 16/17 |
| Indications of surgery | |
| Tumour of larynx | 1 |
| Mass on base of tongue | 2 |
| Mass on tonsils | 3 |
| OSAS | 4 |
| Tumour of tonsil | 5 |
| Chronic tonsillitis | 6 |
| Lingual thyroid | 7 |
| Thyroidectomy | 5 |

SD: standard deviation; ASA: American Society of Anaesthesia, OSAS: Obstructive sleep apnea syndrome

After preoxygenation; anesthesia induction was established by intravenous agents in all patients with either thiopenthal sodium (87.9%, n=29) or propofol (12.1%, n=4). After intubation; the surgeon performed a direct laryngoscopy to examine the oropharynx, hypopharynx, and larynx. Then the patients were rotated 180 degrees away from the anesthetist and anesthesia machine, so we were placed to the patient's feet. This necessitated having a circle system with inspiratory and expiratory tubings twice the standard length. Since we were away from the airway and the study area was shared between the anesthetist and the surgeon; we wanted to secure the airway by suturing it to the patient's face by the surgeon. Thus; the Da Vinci robot docked. During maintenance remifentanil bolus (0.25 $\mu g.kg^{-1}$) was followed by remifentanil infusion (0.02-2 $\mu g.kg^{-1}min^{-1}$) that was combined by either sevoflurane (0.8-1.1% MAC) (72.7%, n=24) or desflurane (0.8-1% MAC) (27.3%, n=9) in an oxygen-air mixture of $FIO_2$ of 50%. All of the patients were extubated immediately after the surgical procedure in the operating room without any complication. Length of stay in hospital was 6 (range: 1-50) days. In the postoperative period; 12.1% (n=4) of the patients had additional surgical procedures afterwards (Table 2). In their follow up, 21.2 % of the patients had reoperations in the next three months' period.

**Table 2:** Operative and postoperative outcomes of patients. Values are expressed as median (range), or number (%).

| Parameters | Values |
|---|---|
| Robotic set-up time (min) | 45 ( 35-120 ) |
| Duration of operation (min) | 130 ( 60-260) |
| duration of anesthesia (min) | 160 (90-290) |
| Postoperative hospital stay (days) | 6 (1-50) |
| Reoperation in the first 24 hours | 4 (12.1%) |
| Reoperation within three months | 7 (21.2 %) |

**Discussion**

Recently, robotic technology has been carried out to benefit the patient with less pain and blood loss, shortened hospital stay and rare complications (6). The current applications of robot-assisted surgery are frequent in urology, general surgery, and gynecology. In this article, we reviewed our initial anesthetic experiences in oral surgery which is a relatively recent application.

Transoral robotic surgery (TORS) enhances visualization, increases manual dexterity, and the ability to perform surgery in a virtual environment (7). Anesthetic management of TORS has in common issues with other conventional surgical procedures of oral cavity; however; there are some important differences also.

In this study; the anesthetic management plan was to intravenously (IV) induce anesthesia and paralyze if mask ventilation was possible. Difficult airway equipment (videolaryngoscope, and tracheostomy sets) was kept ready; as had been suggested by other authors (8). Among all of the patients, 12.2% (4 patients) and 5.9% (2 patients) had difficulties in mask ventilation and in intubation respectively; but none of them needed tracheostomy. Afterwards, for introduction of the robotic arms through patient's mouth and upper airway; anesthetist moved to the patient's feet with the anesthesia machine and all monitors on. Thus; the operation table was organized such as the position of vision tower stayed on one side of the patient, while the robotic arms were over the head-end of the table (9). This position necessitated to have a circle system with inspiratory and expiratory tubings twice the standard length increasing apparatus dead space. Minute ventilation was increased to offset hypercarbia; considering smaller tidal volumes for lung-protective ventilation (10). Since we were away from the airway and the study area was shared between the anesthetist and the surgeon; we wanted to prevent unintentional extubation, so the endotracheal tube was sutured to the patient's face. Next; standard safety measures were implemented, so that soft tissue and eye protection were provided. The patients' hands were put away from the anesthesiologist for application of extension lines into intravenous catheters. In order to avoid displacemet and kinking, all intravenous lines, monitors and patient-protective appliances were secured before use, as in other authors' studies (11). At this point; the surgeon places a mouth gag or retractor in the patient's mouth to gain surgical exposure. Systemic vascular resistance, tachycardia, hypertension which are the most common cardiovascular changes related to this procedure can be alleviated by deepening the plane of anesthesia.

Kapoor et al; preferred desflurane, for maintenance of anesthesia, to benefit from its early recovery characteristic (12). We used either sevoflurane or desflurane.

As a result of preparations, set up time for these procedures is substantial. In a recent study; Genden et al reported a robotic setup time of 140 min (13). In another study; Moore et al reported a drop from 69 min to 22 min in the preoperative setup time after only

10 cases of TORS (14). We had a mean of 45 min for this stage. During this time, both the surgeon and anesthetists made the necessary arrangements. As time passed, the preparation time both for surgery and anesthesia could be lessened even to 35 min.

In this type of surgeries, endotracheal tube selection is another anesthetic issue. It is advised to choose the tube according to the TORS being performed (9). A wire-reinforced endotracheal tube is selected unless the surgery is planned to resect a tumor encroaching upon the larynx, which necessitates using a laser endotracheal tube. If this is the case, then standard patient safety measures should be implemented (covering the head and neck with moistened towels, taping and covering the patient's eyes, eye protection for operating room personnel, etc) (15). The recommendations on the approach for extubation, include the exchange of the wire-reinforced or Laser- Flex tube for a polyvinyl chloride (PVC) tube, if there is significant laryngopharyngeal edema or concern that airway compromise might develop; until resolution of the edema (9). In one report; all of the twenty-seven TORS patients were left intubated for the postoperative 24-72 hours (5). Iseli et al, kept twelve patients of fifty four patients, intubated for 48 hours after TORS and had tracheotomy in two patients at the time of TORS (16). Moore et al, pointed out that all patients with lesions on the base of tongue had required tracheotomies during TORS procedure (17). The decision about following the patient intubated or on tracheotomy usually depends on the type of the tumor and surgical approach applied. In some centers, when the dissection is adjacent to the vallecular or epiglottis, in a prolonged case in which the tongue base is suspected, and in a supraglottic partial laryngectomy, the patient is kept intubated during the postoperative period for 1.5 days for airway evaluation and management (17). However, in our study, our patients were extubated immediately at the end of the surgery without any complication.

For the first 12 to 24 hours, postoperative analgesia is recommended to be provided by multi-modal analgesia (4). For comfort of patients; intravenous patient controlled analgesia (IV PCA) with opioids can be used as an alternative method. We applied 1 g paracetamol IV with 4 mg ondansetron IV to all patients before the surgery was finished.

Robotic arm insertion into the intraoral space can cause some problems like lacerations of facial skin, injuries of teeth, lacerations of mucosa, fractures of mandible, fractures of cervical spine and ocular injuries. (18). Thus, care must be given at every stage of these procedures.

Today, as a result of developments in technology, TORS can be considered as a beneficial alternative treatment option for open surgical procedures. Thus, anesthesiologists will be confronted with a number of oral cavity, head and neck cases, and so they should be prepared to face issues related to the patient's safety both during the administration of anesthesia and in the postoperative period in the near future.

**Acknowlegdement**

We (all authors) declare that we have no conflict of interest in relation to our paper and this research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

All the authors contributed their best for the research.

The manuscript has been seen and approved by all authors.

**Corresponding author:**
Ezgi ERKILIC, MD.
eerkilic72@yahoo.com
905053663491

**References**

1. Weinstein GS, O'Malley BW Jr, Hockstein NG. Transoral robotic surgery: supraglottic laryngectomy in a canine model. Laryngoscope 2005;115:1315.
2. O'Malley BW, Weinstein GS, Hockstein NG. Transoral robotic surgery (TORS): glottic microsurgery in a canine model. J Voice 2006;20:263–8.
3. O'Malley BW Jr, Weinstein GS, Snyder W, et al. Transoral robotic surgery (TORS) for base of tongue neoplasms. Laryngoscope 2006;116:1465.
4. Uma Hariharan, Shagun Bhatia Shah, Ajay Kumar Bhargava Anesthesia for Trans-Oral Robotic Surgery: Practical Considerations. EC Anaesthesia 2.5 (2016): 212-216.
5. Weinstein GS, O'Malley BW Jr, Snyder W, et al. Transoral robotic surgery: radical tonsillectomy. Arch Otolaryngol Head Neck Surg 2007;133:1220.
6. Lee JR. Anesthetic considerations for robotic surgery. Korean J Anesthesiol. 2014;66:3–11.
7. Chen MM, Roman SA, Kraus DH, Sosa JA, Judson BL. Transoral robotic surgery: a population-level analysis. Otolaryngol Head Neck Surg. 2014; 150:968–975.
8. Racine SX, Solis A, Hamou NA, et al. Face mask ventilation in edentulous patients: a comparison of mandibular groove and lower lip placement. Anesthesiology 2010;112:1190.
9. Chi JJ, Mandel JE, Weinstein GS, O'Malley BW Jr. Anesthetic considerations for transoral robotic

surgery. Anesthesiology Clin 28 (2010) 411–422.

10. Hinkson CR, Benson MS, Stephens LM, Deem S. The effects of apparatus dead space on PaCO2 in patients receiving lung- protective ventilation. Respir Care 2006;51:1140–4.
11. Hockstein NG, O'Malley BW Jr, Weinstein GS. Assessment of intraoperative safety in transoral robotic surgery. Laryngoscope 2006;116:165.
12. Kapoor MC and Vakamudi S. "Desflurane – Revisited". Journal of Anaesthesiology Clinical Pharmacology 28.1 (2012):92-100.
13. Genden EM, Desai S, Sung CK. Transoral robotic surgery for the management of head and neck cancer: a preliminary experience. Head Neck 2009;31:283.
14. Moore EJ, Olsen KD, Kasperbauer JL. Transoral robotic surgery for oropharyngeal squamous cell carcinoma: a prospective study of feasibility and functional outcomes. Laryngoscope 2009;119(11):2156–64.
15. Desai SC, Sung CK, Jang DW, et al. Transoral robotic surgery using a carbon dioxide flexible laser for tumors of the upper aerodigestive tract. Laryngoscope 2008;118:2187.
16. Iseli TA, Kulbersh BD, Iseli CE, et al. Functional outcomes after transoral robotic surgery for head and neck cancer. Otolaryngol Head Neck Surg 2009;141:166.
17. Moore EJ, Olsen KD, Kasperbauer JL. Transoral robotic surgery for oropharyngeal squamous cell carcinoma: a prospective study of feasibility and functional outcomes. Laryngoscope 2009;119(11):2156–64.
18. Jeong Rim Lee. Anesthetic considerations for robotic surgery Korean J Anesthesiol 2014 January 66(1): 3-11).

3/21/2017