Anesthetic Consideration for Robotic Transoral Surgery

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Anesthesia for otolaryngologic and head and neck surgery has been described extensively in the anesthetic literature [1, 3, 4, 10, 15, 16, 19, 21]. This chapter is designated to the unique anesthetic consideration for transoral robotic techniques. Many cases require a neck dissection to be performed before or after the TORS (see elsewhere in the atlas). Hence, we will include anesthetic considerations for neck dissection as these procedures are sequential.

When planning the anesthesia approach for transoral robotic surgery (TORS), one should be ready to address the pitfalls and possible complications. Complications can be a result of robotic use [24, 28] and can be divided into intraoperative (bleeding and injury to the facial, lingual, and hypoglossal nerves; cranial nerves IX, X, and XI; and sympathetic chain) and postoperative (seroma formation, fascial edema, CSF leak, Horner's syndrome, meningitis, infections, vocal cord paralysis) [19, 25].

Anesthesia considerations for TORS are similar as in all other transoral interventions, such as tonsillectomies [5, 14, 18, 23]. Nevertheless, additional anesthetic considerations should be taken into account, the bulky structure of the robotic equipment and possible surgical complications. The patient is turned 180° away from the anesthesiologists' workstation, and a fairly large device is placed in the vicinity of the patient's head [28]. Once the robot has been positioned and engaged, the anesthesiologist is unable to readily access the patient. Thus, any lines, monitors, and patient protective devices must be placed before and should be secured to ensure no kinking or displacement. It is impossible to allow changes in patients' position or any kind of access to the patient if the robot is not detached first. Therefore, any patient management necessitates movement of the robot, which potentially could result in delay in critical treatment and might cause complications, especially in patients with comorbidity or pediatric cases (see Table 3.1) [34, 36, 39, 43, 44].

The surgery is done under general endotracheal anesthesia with standard ASA monitoring. An arterial line is advised for close tracking of blood pressure due to close proximity to brain structures [35].

Neck dissection precedes the TORS. This allows for a shorter operation time, decreased tissue manipulation, and minimized laryngopharyngeal swelling [26, 27]. General anesthesia induction is possible with propofol (2 mg/kg), fentanyl (2–3 mcg/kg), and a short-acting paralysis with succinylcholine 1 mg/kg to allow quick monitoring of the accessory nerve within 5–7 min. After nasal airway preparation with topical lidocaine lubricant and a vasoconstrictor like phenylephrine, the patient's trachea is intubated nasally. The tube is sutured to the patient's

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nasal septum and reinforced with tape. Extra care should be taken to avoid any bleeding while intubating. The eyes should be secured with safety goggles and the teeth protected with a molded dental guard. Due to limited access to the patient once surgery begins, the patients' arms should be properly tucked along the sides. Appropriate padding should be applied to protect pressure points and from the relatively heavy equipment within and outside the drapes. It is also necessary to attach extensions to the arterial and intravenous (IV) lines for easier access to the patient. The intravenous fluids and infusion pumps should be placed at the feet, near the anesthesia monitors (Table 3.1) [6, 7, 26, 33, 36].

Patients who undergo major maxillofacial surgery are at risk for considerable intraoperative bleeding. Controlled hypotensive anesthesia might reduce the extent of intraoperative bleeding and can potentially improve the visual quality of the surgical field. Nevertheless, hypotension carries the risk of hypoperfusion to vital organs and is unsafe in certain patients. Thus, the reduction of blood pressure should be adjusted according to the patient's general condition, age, and coexisting diseases. Normotensive or modified hypotensive anesthesia should be used for patients with ischemic heart disease, carotid artery stenosis, disseminated vascular disease, kidney dysfunction, or severe hypertension who are scheduled to undergo a major maxillofacial operation [2].

Table 3.1 Anesthesia checklist

Monitors and lines
1. Standard ASA monitoring (pulse, ECG, ETCO2, NIBP)
2. Arterial line
Safety
1. IV patency
2. Eyes secured
3. Teeth protected
4. Arms tucked
5. Pressure points padded
6. No heavy equipment in contact with patient
7. IV fluids, infusion pumps, and anesthetic machine are placed near patient's feet
8. Appropriate extension to all lines

The second stage of the surgery, the TORS, commences when the neck dissection is completed. At this point, patients' immobility must be absolutely guaranteed by pharmacological paralysis. Rocuronium is usually used (continuous drip 0.3 mg/kg/h) if there are no contraindications. Sudden jaw closure against the robotic arms can occur and lead to devastating consequences [36, 37]. Anesthesia is usually maintained with sevoflurane 1 MAC, continuous remifentanil infusion (0.06–0.1 mcg/kg/min), and continuous rocuronium infusion (0.3 mg/kg/h). We find remifentanil very useful in blunting sympathetic response during insertion of the mouth robotic arms and for surgical resection [14]. In addition, intravenous paracetamol and/or non steroidal anti inflamatory drugs (NSAID's) should be administered if there are no contraindications [32]. A long-acting opioid can be used as well, guided by the patient's risk of postoperative sedation and airway obstruction. All patients are given dexamethasone 10 mg after induction to minimize airway swelling in response to manipulation during surgery [31]. In addition, meticulous fluid management plays an important role in reducing edema [13]. Ondansetron is administrated for postoperative nausea and vomiting treatment [11].

At the end of the surgery, a decision should be made whether the patient is a proper candidate for immediate endotracheal tube extubation [40]. Risk factors for post-extubation upper airway edema may include head and neck surgery, high BMI, excess intraoperative fluid administration, blood products transfused, and female gender [13]. Moreover, patients suffering from sleep apnea are at greater risk for postoperative airway complications; therefore, they should have close cardiopulmonary observation for 24 h period after the operation [20]. The anesthesiologist should ask himself a few crucial questions: What was the duration of the surgery? Does the patient suffer from facial edema? Was there a difficult intubation? Should we expect for late edema that might obstruct the airway? Was surgery at any proximity to the recurrent laryngeal nerve? Is there any expected damage to the vocal cords? If all these questions are negatively answered, then

extubation is safe. In addition as in any surgery, some of the other extubation criteria include; the ability to follow commands, an intact gag reflex, train of four >0.9, adequate pain control, and less than 0.1 end-expiratory concentrations of inhaled anesthetics. Objective criteria include the following parameters; tidal volume, peak voluntary negative inspiratory pressure, alveolar-arterial PaO2 gradient, and dead space to tidal volume ratio [9, 17, 22, 41, 42, 45]. For successful extubation, patients should be fully awake. Commonly, we place an appropriately sized nasal airway prior to extubation. The nasal airway is generally well tolerated and left in place as long as needed. We find that this helps to maintain a fairly patent airway, especially when the patient drifts off to sleep. An appropriate dose of sugamadex is used at the end of surgery in order to reverse the rocuronium to a target train of four (TOF) >0.9 [12]. Conversely, there are centers in which patients are kept intubated for 24 h postoperative and then extubated in ICU with the presence of the surgeon after observing the resection site and the entire laryngopharyngeal mucosa [29, 30].

In the postanesthesia care unit (PACU), patients are positioned with the head up in 30–45°. Supplementary O2 is administered via nasal cannula or face mask. Pain control can be optimized with a multimodal approach: paracetamol, NSAID's, and tramadol. If needed, longer-acting opioids, such as morphine, can be used judiciously. Intravenous steroids are continued for 1–3 days to reduce airway edema [8, 38].

In summary, the main challenges for the anesthesiologist are potentially the difficult airway, prolonged surgery in the head and neck vicinity, and limited access to the patient in emergent situations. Accordingly, appropriate preparation, good knowledge of potential problems, and good communication with the surgical team are essentials for success.

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