

Transoral robotic surgery (TORS)

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Transoral robotic surgery (TORS) is a novel and minimally invasive approach to tongue neoplasms that has significant advantages over classic open surgery or endoscopic transoral laser surgery. Transoral robotic surgery (TORS) has been performed on three human patients with tongue base cancers in a prospective human trial by O'Malley BW Jr, et al(2006). TORS provided excellent three-dimensional visualization and instrument access that allowed successful surgical resections from cadaver models to human patients[1].

.Human clinical trial with a transoral robotic surgery (TORS) has been evaluated in a patient with a benign neoplasm of the parapharyngeal space and infratemporal fossa has been reported since 2007.

The ability to access and dissect tissues within the various areas of the parapharynx and infratemporal fossa has been evaluated, and techniques to enhance visualization and instrumentation have been developed. Using TORS approaches are permitted excellent access, visualization, and tissue dissection within the parapharyngeal space and infratemporal fossa in both the cadaver and canine experiments. The first known human surgical case of TORS performed by O'Malley BW Jr, Weinstein GS.(2007) and was used to remove a parapharyngeal space and infratemporal fossa cystic neoplasm. Wide visualization, followed by complete resection using the identical techniques developed in the preclinical models, was achieved. The robotic procedure allowed adequate and safe identification of the internal carotid artery and cranial nerves, and excellent hemostasis was achieved with no complications during or after surgery.

The TORS approaches provided excellent 3-dimensional visualization and instrument access that allowed successful parapharyngeal space and infratemporal fossa surgical resections from cadaver models to the first known human patient application. Robotic surgery for the skull base holds potential as a minimally invasive approach to skull base neoplasms; however, continued development and investigation is warranted in a prospective human clinical trial before final conclusions can be drawn as to the full advantages and limitations of this approach[2].

Weinstein GS, et al (2007) performed transoral robotic surgery (TORS) on 3 human patients with supraglottic carcinoma in a prospective human trial. The study was approved by our institutional review board and involved the da Vinci Surgical Robot (Intuitive Surgical, Inc, Sunnyvale, California). All procedures were completed robotically. The median overall operation time to perform the robotic procedure was 120 minutes (range, 1:32:48 to 2:58:18), including 18 minutes (range, 00:6:07 to 00:30:39) for exposure and robotic positioning.

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There were no intraoperative or postoperative complications or surgical mortality. The preliminary results of their series suggested that application of the da Vinci robotic surgical system for TORS to supraglottic partial laryngectomy is technically feasible and relatively safe. Furthermore, TORS provides excellent surgical exposure that allows complete tumor resection. Most importantly, TORS provides an alternative to open approaches and "conventional" transoral supraglottic partial laryngectomy [3].

Transoral robotic surgery (TORS) can overcome the limit of "line of sight" often met in classic transoral procedure[4].

Park YM, et al (2009) utilized a robotic surgical system to evaluate the feasibility and oncologic safety of transoral partial pharyngectomy and laryngectomy. They performed TORS by using a "da Vinci surgical robot" (Intuitive Surgical, Inc., Sunnyvale, CA). An FK retractor (Gyrus Medical Inc., Maple Grove, MN) was used to expose the cancerous lesion transorally, and an endoscopic arm was introduced through the oral cavity with two instrument arms placed 30 degrees apart from the endoscopic arm. They performed TORS on 1 patient with pyriform sinus carcinoma and 4 patients with glottic carcinoma as a prospective human trial.

The average surgical time measured was 39 minutes, including an average of 25 minutes used for locating the robotic surgical system in place and exposing the lesion. TORS provided a magnified three-dimensional view and overcame the limitation resulting from the "line of sight" that hinders the classic transoral procedure. All surgical resection margins were free of carcinoma. There were no perioperative complications, and also, no mortality due to the surgical procedure. This study demonstrated that the application of TORS for partial pharyngectomy and partial laryngectomy is technically feasible and safe[4].

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Park YM, et al (2010) performed TORS using da Vinci Surgical Robot (Intuitive Surgical Inc., Sunnyvale, CA) in 10 patients with T1 or T2 pyriform sinus cancer and posterior pharyngeal wall cancer. They used FK retractor (Gyrus Medical Inc., Maple Grove, MN) for transoral exposure of the lesion. A face-up 30-degree endoscope was inserted through the oral cavity and two instrument arms were located in both sides of the endoscope. Pyriform sinus was totally resected as a cone-shape from the vallecular to apex region, and ipsilateral arytenoid cartilage was saved for function preservation. The aryepiglottic fold was resected medially. Laterally, the inner perichondrium of the thyroid cartilage was peeled off after perichondrium was incised horizontally to make sure of the safe margin of antero-lateral portion.

The posterior margin is an inferior constrictor muscle of the posterior pharyngeal wall. They evaluated the robotic set up time, robotic operation time, blood loss, surgical margins, swallowing time, decannulation time, and surgery related complications. Transoral robotic hypopharyngectomy was performed successfully in all 10 patients. The mean robotic operation time was 62.4min, and an average of 17.5min was required for the setting of the robotic system. There was no significant perioperative complication in the cases. Swallowing function returned to all patients within 8.3days average. Decannulation was carried out within an average of 6.3days after surgery. Transoral robotic hypopharyngectomy has been proved a feasible and ontologically safe technique for the treatment of early hypopharyngeal cancer[5].

Moore EJ, et al (2009) performed in forty-five patients with previously untreated oropharyngeal squamous cell carcinoma transoral robotic surgical removal of the tumor with or without neck dissection and with or without adjuvant therapy. All 45 patients underwent complete transoral robotic surgical excision with simultaneous unilateral or bilateral neck dissection.

Margins were negative for tumor. Mean operating time for tumor removal was 71.3 minutes for the last 35 cases. There were 15 stage T1 tumors, 18 T2 tumors, 3 T3 tumors, and 9 T4a tumors. Twenty-six patients had base of tongue primary tumors and 19 had tonsillar fossa

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tumors. Fourteen patients had a tracheostomy tube placed at surgery, and all patients had their tracheostomy tube removed (mean duration of use, 7.0 days). Twenty-two patients (48.9%) had a nasogastric feeding tube placed, and all patients had their feeding tube removed (mean duration of use, 12.5 days). Eight patients had percutaneous gastrostomy (PEG) tubes placed, and all eight eventually had their PEG tubes removed (mean duration of use, 140.3 days). Average hospital stay was 3.8 days.

There were no major complications and no procedure was aborted because of an inability to remove the tumor. The authors concluded that transoral robotic surgery is a safe and efficacious method of surgical treatment of oropharyngeal neoplasms. Advantages of the technique include adequate ability to visualize and manipulate with two hands lesions in the base of tongue. Patients were able to retain or rapidly regain oropharyngeal function in the majority of cases[6].

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