Transoral robotic surgery (TORS)

Transoral robotic neurosurgery (TORS) offers new possibilities that have not been experimented in the field of minimally invasive skull base neurosurgery.

A transoral robotic approach already has been utilized for laryngopharyngeal lesions by many head and neck surgeons.

Despite the vast number of successful applications already reported using this technique, there exists one case report and cadaveric study demonstrating the feasibility of using a robotic surgical system in the craniovertebral junction [1) 2)].

Chauvet et al. propose to evaluate the feasibility of transoral approach to the sella turcica with the da Vinci robot system on cadavers, and performed four robot-assisted dissections on human fresh cadavers in order to reach the pituitary fossa by the oral cavity. Cavum mucosa dissection was performed by the head and neck surgeon at the console and then the sphenoid was drilled by the neurosurgeon at the bedside, with intraoperative fluoroscopy and a “double surgeon” control. Mucosa closure was attempted with robotic arms.

They succeeded in performing a sellar opening in all cadavers with a minimally invasive approach, as the hard palate was never drilled. The video endoscope offered a large view inside the sphenoidal sinus, as observed in transnasal endoscopy, but with 3D visualization. The camera arm could be inserted into the sphenoidal sinus, and instrument arms in the pituitary fossa. Operative time to reach the pituitary fossa was approximately 60 min in all procedures: 20 min of initial setup, 10 min of mucosal dissection, and 30 min of sphenoid surgery. New anatomical landmarks were defined. Advantages and pitfalls of such an unpublished technique were discussed. This is the first cadaveric study reported da Vinci robotic transoral approach to the sella turcica with a minimally invasive procedure. This innovative technique may modify the usual pituitary neuroendocrine tumor removal as the sella is approached infero-superiorly [3)].

Dissection of pharyngeal wall to the exposure of C1 and odontoid process was performed with full robotic procedure. Although assistance of another surgeon was necessary for drilling and removal of odontoid process due to the lack of appropriate end-effectors, successful robotic procedures for dural sutures and exposing spinal cord proved its safety and dexterity.

Robot-assisted odontoidectomy was successfully performed in a human cadaver using the da Vinci® Surgical System with few robotic arm collisions and minimal soft tissue damages. Da Vinci® Surgical System manifested more dexterous movement than human hands in the deep and narrow oral cavity. Furthermore, sutures with robotic procedure in the oral cavity demonstrated the advantage over conventional procedure.

Presenting cadaveric study proved the probability of robot-assisted transoral approach. However, the development of robotic instruments specific to spinal surgery must first precede its clinical application.

On the basis of this preclinical development, we hypothesized that robotic transoral surgery for craniovertebral junction lesions might have advantages over the conventional transoral surgical method [4)].

These potential advantages include more unrestricted movement in the narrow and deep oral cavity, and, as such, tracheostomy may not be necessary [5)].

Although more comparative study with standard transoral procedure is required to prove the benefits of robotic transoral approach in complication rate or technical comfort, robotic transoral procedure might play a considerable role in anatomically difficult cases such as restricted mouth opening or highly placed odontoid process behind nasopharyx [6].

Pure Robotic Surgery for Odontoid Tumor: First Case [7].

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