Otolaryngology: Open Access
ISSN: 2161-119X

Tamaki, Otolaryngol (Sunnyvale) 2022, 12:9

Mini Review Open Access

Otolaryngology & Head and Neck Surgery Robotic Surgery: A Review

Akina Tamaki*

Otolaryngology-Head and Neck Surgery, University Hospitals Cleveland Medical Center, USA

Abstract

Recent developments in robotics technology have made it possible to undertake more complicated surgical procedures with reduced invasiveness. The use of robotic aid in otolaryngology and head and neck surgery was discussed in this article. We emphasise the benefits of robotic surgery and its clinical use in this area. Traditional oropharyngeal tumour resection involves an open approach, which frequently calls for a midline mandibulectomy to safely remove the tumour with oncologic margins.

A thorough evaluation of the literature on robotic surgery in head and neck, craniofacial, and oral and maxillofacial (OMF) surgery was conducted. The goal was to provide a concise summary of the various anatomical areas of research in the fields of head and neck, craniofacial, and OMF surgery (pre-clinical and clinical). The current indications are described, and the critical reader is encouraged to evaluate the utility of this novel technique by emphasising many pertinent factors. There were 838 papers found in the Cochrane and PubMed libraries that were written between 1994 and 2011. 202 publications were included after the abstracts were reviewed for clinical or technical relevance. These complete papers underwent a thorough screening process before being divided into four categories: clinical papers, educational elements, technical/practical aspects, and pieces on summary. Regarding clinical viability, this comprehensive analysis identified the following key indications: TORS for skull base surgery, TORS for trans-axillary thyroid and endocrine surgery, and TORS for upper digestive and respiratory tract diseases. This comprehensive study found a positive decrease in morbidity in patients with upper digestive and respiratory tract cancer in terms of functional outcome.

Keywords: Head and neck surgeries; Robotic surgery; Technology; Otolaryngology; Transoral robotic surgery; Microvascular surgery

Introduction

Minimally invasive surgery (MIS), a procedure that is effective and well-tolerated in many surgical specialties, has recently benefited from technological and procedural advancements. It has a number of benefits over traditional surgical methods, including quicker recovery times, a lower risk of postoperative infections, less discomfort, improved postoperative immune function, and cosmetic outcomes [1]. This has led to the rise in popularity of robotic-assisted surgery (RAS) in a number of surgical specialties, and numerous institutions are now investing in medical robotic technology, when compared to traditional surgical procedures, this cutting-edge technology has been proved to be safe, to produce better or equivalent results, and to be potentially less expensive. Due to this, its application in surgical specialties including otolaryngology and head and neck surgery has gained interest.

There have been numerous airway operations, head and neck surgeries, and surgeries involving a significant amount of surgical dissection [2]. Major tissue damage, functional disability, and a lower quality of life may ensue from this. However, with minimally invasive techniques, the surgeon has several endoscopic entry sites because to enhanced video imaging, endoscopic technology, and instrumentation. Despite the fact that endoscopic technology has advanced, there are still a number of difficulties with the method. Examples include (1) the instrumentation's limited range and degree of motion, (2) the operative field's limitation to "line of sight," (3) the absence of three-dimensional imaging of the operative field, (4) the amplification of physiological tremors, (5) the dexterity's compromise, and (6) the incoherent hand-eye coordination. With these difficulties in mind, the development of surgical robotics was motivated by the need to enhance the advantages of MIS while overcoming the constraints of existing endoscopic technologies [3].

The Evolution of the Current Robotic System

The Puma 560 was the first robotic surgical device created, and it was utilised in 1985 to more precisely execute neurosurgical biopsies. Since then, numerous robots have been created. However, the da Vinci Surgical Robot is the only FDA-approved and actively marketed system (as of 2009 for Transoral Robotic Surgery-TORS) for head and neck surgery (Intuitive Surgical Inc., Sunnyvale, CA, USA) [4].

The National Aeronautics and Space Administration's (NASA) goal to create a technique to perform telepresence surgery on astronauts in orbit led to the creation of this device. Both the Stanford Research Institute and the US Army expressed interest in this technology because they saw potential in taking it to the battlefield to deliver surgical care to a wounded soldier as quickly as possible-even with the surgeon performing surgery from a distance [5]. The Intuitive Surgical Corporation was established in 1995 to create telerobotic systems for commercial public use, and it were initially utilised in general surgery. In 1999, it reported the first two cases of robot-assisted fundoplication, and in 2002, it reported the first robot-assisted colectomy. In 2005, MacLeod and Melder performed the first transorally performed robotic surgery in the head and neck, excising a vallecular cyst. Three tongue base tumour patients had TORS as part of a prospective clinical investigation in 2006 [6].

***Corresponding author:** Akina Tamaki, Otolaryngology-Head and Neck Surgery, University Hospitals Cleveland Medical Center, USA, Tel: 18091297357; E-mail: Tamaki.akina@gmail.com

Received: 01-Sep-2022, Manuscript No: ocr-22-76074, **Editor Assigned:** 05-Sep-2022, Pre QC No: ocr-22-76074(PQ), **Reviewed:** 19-Sep-2022, QC No: ocr-22-76074, **Revised:** 26-Sep-2022, Manuscript No: ocr-22-76074(R), **Published:** 30-Sep-2022, DOI: 10.4172/2161-119X.1000485

Citation: Tamaki A (2022) Otolaryngology & Head and Neck Surgery Robotic Surgery: A Review. Otolaryngol (Sunnyvale) 12: 485.

The Current Robotic System

The surgical cart (or slave unit) has four arms; one arm holds a 0° or 30° 12 mm stereoscopic camera (with two optical channels, each 5 mm in diameter), and the other three arms hold 5 mm (paediatric size) or 8 mm (conventional) EndoWrist instruments (Intuitive Surgical Inc.), which can be quickly and easily switched out by surgical staff depending on the surgeon's preferences and the needs of the procedure [7].

Two light sources, an insufflator, and circuitry that create the three-dimensional image are all included in the vision cart. Another monitor for the assistant surgeon is typically stored on the cart. Two images, one for each eye, are shown on the surgeon's console (or master unit). As a result, a 3-dimensional image is produced, considerably enhancing depth perception in the surgical setting. Additionally, the console serves as the interface through which the surgeon operates the hand manipulators to control the instrument [8]. The camera, instrument arm grasping (disengagement of the hand controllers from the surgical arms), focus adjustment, and electro cautery are all controlled by pedals on the surgeon's console. Additionally, there are controls for settings and surgeon customisation. Pitch, yaw, and roll, plus two more degrees of freedom in the wrist and two more for tool actuation, for a total of seven degrees of freedom, are all provided by the EndoWrist instruments, which are operated by the surgeon at the master console. In contrast, endoscopic devices only have four degrees of freedom [9].

Methods and Materials

Following assessment by the University of California, San Francisco Institutional Review Board, this study was determined to be exempt. To evaluate resident experience and views toward advanced training in TORS, TLM, sialendoscopy, and SP-US, we created a 20-item survey. We specifically aimed to evaluate resident exposure to and access to focused skills training in these operations, as well as the volume of these procedures performed by residents, as well as general trainee views concerning [10].

For a cohort of patients with clinically early stage (cT1/2N0) p16+ tonsillar squamous cell carcinoma from Kaiser Permanente Southern California Health Plan between 2012 and 2017, direct treatment costs for surgery and IMRT were computed from SEER-Medicare data. The group was then subjected to a Markov decision tree model with a 5-year time horizon that included the cost of treatment, surveillance, and recurrence [11].

Discussion

The use of new surgical tools in head and neck surgery has completely changed how many illnesses are treated. In oropharyngeal and laryngeal malignancies, the transoral surgical techniques of TORS and TLM have been demonstrated to provide clinical outcomes comparable to those of their open surgical equivalents, delivering decreased postoperative patient morbidity, quicker functional recovery, and improved aesthetics. In order to focus treatment, reduce side effects from prolonged radiation exposure, and provide the possibility for location-specific surgical care, it is essential to identify the primary site in head and neck cancer. Retrospective data suggests that locating the main tumour is linked to better overall survival [12].

Conclusion

The usage of minimally invasive surgery is on the rise, which has influenced how new technology is conceived of, created, and applied in clinical settings. The constraints of robotic surgery are being overcome as it develops. It is enhancing the results, enabling better cosmetic outcomes, and lowering hospital stays and infection rates. However, since surgical robots were created to carry out treatments in large cavities, such the abdomen, many otolaryngology and head and neck procedures require the use of bigger equipment. A variety of otolaryngology procedures are beginning to be performed using the da Vinci robot system, and the results have been great thus far.

There are also certain drawbacks to robotic surgery, such as the size of the robotic system, which requires more personnel to set up and presents new difficulties for the anaesthesia team and surgical assistants. Sadly, the exorbitant expense of robotic technology prevents its regular presence and utilisation in the majority of operating rooms around the world. This necessitates the creation of more portable, adaptable robotic platforms that are smaller, cheaper, and easier to use as well as specialised equipment for head and neck surgery duties.

In addition to the evidence supporting the viability and safety of robotic surgery in head and neck procedures, postoperative results in terms of airway control and oropharyngeal function are on par with or better than those obtained with conventional surgical techniques. Robot-assisted surgery demonstrated a tendency toward positive cure and recurrence rates, albeit we did not examine the specifics of the oncologic results. This is due to its capacity to remove tumours in their entirety, which is made possible by the robotic system's enhanced dexterity and 3D imaging. Future research comparing robotic approaches to Transoral Laser Microsurgery (TLM), open surgery, and chemo radiotherapy, in our opinion, is necessary to substantiate these claims. The reported findings advocate its further usage and investigation and support the viability and safety of robotic surgery in head and neck surgeries.

Acknowledgement

None

Conflict of Interest

None

References

1. Garg A, Dwivedi RC, Sayed S (2010) Robotic surgery in head and neck cancer. Oral Oncology. 46:571-576.
2. Mack MJ (2001) minimally invasive and robotic surgery. JAMA. 285:568-572.
3. Moore EJ, Olsen KD, Kasperbauer JL (2009) Transoral robotic surgery for oropharyngeal squamous cell carcinoma a prospective study of feasibility and functional outcomes. Laryngoscope. 119:2156-2164.
4. Cadiere GB, Himpens J, Vertruyen M, Bruyns J, Fourtanier G et al (1999) Nissen fundoplication done by remotely controlled robotic technique. Annales de Chirurgie. 53:137-141.
5. McLeod IK, Melder PC (2005) Da Vinci robot-assisted excision of a vallecular cyst. Ear, Nose and Throat Journal. 84:170-172.
6. Lawson G, Matar N, Remacle M, Jamart J, Bachy V et al (2011) Transoral robotic surgery for the management of head and neck tumors: learning curve. European Archives of Oto-Rhino-Laryngology. 268:1795-1801.
7. Prasad SM, Ducko CT, Stephenson ER, CE Chambers, Damiano RJ et al (2001) Prospective clinical trial of robotically assisted endoscopic coronary grafting with 1-year follow-up. Annals of Surgery. 233:725-732.
8. Feifer A, Al-Ammari A, Kovac E, Delisle J, Carrier S et al (2011) Randomized controlled trial of virtual reality and hybrid simulation for robotic surgical training. BJU International. 108:1652-1657.
9. Weinstein GS, O'Malley BW, Snyder W, Sherman E, Quon H et al (2007)

Transoral robotic surgery radical tonsillectomy. Archives of Otolaryngology-Head and Neck Surgery. 133:1220-1226.

10. Mukhija VK, Sung CK, Desai SC, Wanna G, Genden EM et al (2009) Transoral robotic assisted free flap reconstruction. Otolaryngology-Head and Neck Surgery. 140:124-125.

11. Park YM, Kim WS, Byeon HK, De Virgilio A, Jung JS et al (2010) Feasiblity of transoral robotic hypopharyngectomy for early-stage hypopharyngeal carcinoma. Oral Oncology. 46:597-602.

12. Weinstein GS, Malley JW, Desai SC, Quon H (2009) Transoral robotic surgery does the ends justify the means. Current Opinion in Otolaryngology and Head and Neck Surgery. 17:126-131.