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Telerobotic ENT-Head and Neck Surgery in Clinical Practice

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Abstract

To examine the clinical data that has been published in telerobotic ENT-head and neck surgery, assess the value of current clinical applications, and pinpoint new development areas. The following keyword searches for papers were used to find them in PubMed, Medline, and the Cochrane Database: Telerobotic/Robotic ENT, Otorhinolaryngology, Head and Neck Surgery, Thyroid and Parathyroid Surgery. We omitted non-clinical review articles and preclinical investigations. Seven review articles were among the 45 publications that were located. 20 clinical trials have reported transoral robotic surgery (TORS), 13 have reported robotic-assisted thyroidectomy, 4 have reported Para thyroidectomy, and 1 has documented skull base surgery.

The majority of TORS papers deal with Stage III and IV oropharyngeal cancer. Improvements in swallowing function and the avoidance or dosage reduction of adjuvant chemotherapy and radiotherapy are clinical benefits. The absence of a neck scar is the main clinical benefit of robotic-assisted neck surgery. The robotic thyroidectomy learning curve is 50 cases. Body habitus is a crucial consideration when determining if robotic transoral and neck surgery is feasible. The use of robotic-assisted thyroidectomy, TORS, and Para thyroidectomy implies positive advancements in patient care. To evaluate clinical success, cost effectiveness, and patient benefit in the current applications, randomised control trials are required. The number of therapeutic applications that are currently viable in this field will increase as robotic technology continues to advance.

Keywords: Telerobotic ENT - Head and Neck surgery; Robotic Para thyroidectomy; Transoral robotic surgery; Robotic thyroidectomy; Oropharyngeal cancer; Chemotherapy and radiotherapy

Introduction

The US Department of Defense originally intended to utilise telerobotic surgery on the battlefield after it was created by NASA in 2001. In various surgical specialties during the past ten years, it has evolved into the accepted clinical practise. Since 2004, Imperial College London has been on the cutting edge of creating and gaining access to clinical applications in the UK. The daVinci surgical system is a master-slave telerobotic platform made up of a manipulator unit, a workstation, and a surgical cart [1]. The console surgeon operates four endowed robotic arms that improve manual dexterity while viewing a three-dimensional enlarged image. The physiological hand tremor is eliminated, and the surgeon's hand movements are motion scaled. The main benefits are the capacity to mimic an open surgical experience, reduce surgical trauma, and enhance precision. Improved patient care has resulted from this in a number of fields, including urology, gynaecology, cardiothoracic, and paediatric surgery. The current endoscopic procedures used in ENT-Head & Neck surgery have a number of drawbacks [2].

The intrinsic anatomical restrictions, which do not exist in open chambers like the abdomen, pelvis, or thorax, however, provide special technical difficulties. The location of the robotic arms must be significantly modified, and the operating room must be rearranged. Weinstein et al. carried out the crucial preclinical transoral robotic surgery (TORS) trials in 2005. 8 Subsequently, a growing number of therapeutic applications have been reported in TORS [3].

Materials and Methods

Following keyword searches of PubMed, Medline, and the Cochrane Database, an analysis of English-language literature was done. Telerobotic, robotic, and robotic-assisted otorhinolaryngology, ENT, head and neck, thyroid, and parathyroid surgery were the search terms utilised. These comprised case series, case reports, and prospective clinical trials. Non-clinical review articles and preclinical studies (cadaver and animal experiments) were disregarded. Existing clinical applications, feasibility, exclusion criteria, morbidity, mortality, length of stay, cost, and learning curve were just a few of the specific factors that were assessed [4].

The references of pertinent works were assessed as a source for additional research. Three ENT-Head and Neck surgery experts (N Tolley, C Vicini, and G Weinstein) as well as the American Cancer Society Department of Surveillance and Health Policy Research were asked for personal communication of unpublished clinical data [5].

Discussion

The use of telerobotic in ENT-head and neck surgery is a young, fast developing discipline. TORS was given FDA approval in December 2009 for use in the larynx, hypopharynx, and oropharynx. Traditional transoral surgery may present technical difficulties due to poor target visualisation. On the other hand, an open approach can necessitate life-altering surgery. In TORS, a Boyle Davis mouth gag or FK retractor is used to transorally insert two 5 or 8 mm wristed instrument arms and a central 3D 8.5 or 12 mm endoscope. The console surgeon operates the devices to carry out multi-planar, en bloc resection. There have been reports of decreased postoperative stay and improved functional outcomes due to less blood loss [6].

This is not surprising considering the majority of TORS cases fell into the T1 and T2 group, which accounts for over 60% of patients

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with advanced stage oropharyngeal cancer listed in the 2007 American National Cancer Database. Additionally, all patients with Stage I and Stage II illness, which are T1 or T2 tumours by definition, are included in this. The majority of individuals with oropharyngeal cancer have T1 and T2 tumours, according to most studies, regardless of treatment. Therefore, the N stage rather than the T stage is the main problem with relation to disease-specific survival. This decides the requirement for adjuvant therapy following TORS or the use of chemotherapy and radiation if non-surgical therapy is utilised as the primary treatment option for oropharyngeal cancer. Given that the majority of patients have advanced Stage III and IV disease, the TORS therapy paradigm is comparable to other trials in this regard. Comparatively, problems related to swallowing at 2 years after initial chemo radiotherapy for oropharyngeal cancer have been reported to range from 13 to 43%. To further assess these potential benefits, randomised research contrasting TORS with well-established therapies such transoral laser surgery and primary chemo radiation are required [7].

In contrast to the usual anterior neck approach, robotic parathyroid and thyroid surgery uses a lateral approach. To reduce the tunnelling distance between the axilla and neck, the ipsilateral arm is abducted at the shoulder in RAT. Through an axillary incision, three robotic arms carrying the endoscope and two 8 mm instruments are inserted. Through the same incision, a different anterior chest or peri-areolar breast incision, or both, a fourth arm-used for thyroid retraction-is inserted. The absence of a neck scar is the main benefit. Scars that are noticeable, like those on the front neck, are bad for one's self-image. Results from a case control study on a robotic thyroidectomy at three months support this. In the longest series, brachial plexus neurapraxia was reported to occur 0.3% of the time due to over-traction caused by the arm posture [8].

12% of patients in another cohort reported experiencing brief shoulder discomfort, despite the fact that there was no pain difference between the robotic and control thyroidectomy groups. 37 With the robotic technique, swallow function appear to be improved. This might be as a result of the limited Para-oesophageal traction, the lateral approach's avoidance of midline strap muscle dissection, and the use of 3D magnification to precisely manipulate tissue. The temporary RLN rate with RAT is 4.3%, which is comparable to traditional surgery. The 0.5% frequency of thyroiditis and pathology larger than 6 cm is responsible for the permanent RLN palsy. Although the frequency of temporary hypocalcaemia ranged from 18 to 40%, permanent hypocalcaemia was not recorded. Blood loss was not documented, however only 5 individuals (0.5%) had muscle flap haemorrhages; of these, 1 needed surgery [9].

The early functional results from RAP and RAT are promising. Randomized clinical studies are required to assess possible benefits and long term prospective outcome data are soon to be available. There hasn't been much research done on how patients perceive the appearance of their scars after having thyroid and parathyroid surgery. Numerous surgical techniques that leave no scars in the neck have been described over the past ten years. If these procedures are adopted in parathyroid and thyroid surgery, it will depend on whether patients choose a scar-free neck approach. It must also be demonstrated that the morbidity associated with these methods is at least equal to the recognised low access methods [10].

Conclusion

The use of limited access endoscopic procedures in ENT-Head and Neck surgery is facilitated by robotic assistance. Numerous possible patient care enhancements are reported in the clinical studies that were analysed. These include shortening the length of hospital stays and lowering the morbidity related to oropharyngeal cancer surgery, such as the avoidance of a mandibular split, improved PEG dependence rates, and swallow function. A robotic-assisted procedure in thyroid and parathyroid surgery enables a scar-free neck approach. Additionally, it provides a fresh perspective on how to surgically treat patients with obstructive sleep apnea. To assess clinical outcome and patient benefit in existing applications, randomised control trials are required.

It is also essential to have a strong framework for instruction, evaluation, and safe application. Further tool and endoscope miniaturisation will determine whether minimum access procedures like anterior skull base surgery can be expanded. The rapidly developing field of robotic surgical technology has potential for expanding this specialty's clinical applications. Uncertainty surrounds the long-term benefits of robotic surgery in otolaryngology, head, and neck surgery.

Conflict of Interest

None

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