Evolution and Recent Advances in MIS in Head and Neck Cancers: A Comprehensive Review

Abhijit Basu¹, Jaya Kumar²*, Areendam Barua¹, Jyoutishman Saikia³ and MD Ray³

¹(Lt)col Abhijit Basu, Military Hospital Jalandhar Cantt, India
²Senior Resident, Department of Surgical Oncology, DR.BRA Institute Rotary Cancer Hospital, All India Institute of Medical Sciences, New Delhi, India
³Surgical Oncology, All India Institute of Medical Sciences, Department of Surgical Oncology, India.

ABSTRACT

Minimally invasive approaches like Endoscopic and Robotics in head and neck cancers has got a wide area of application in managing Oral cavity, pharyngeal, hypopharyngeal, Laryngeal tumours, Sinus & Base of skull tumours and Thyroid & Parathyroid tumours. Transoral approaches allow easy access to these secluded sites and removal of tumours with minimal complications. Till today surgery has remained the only curative modality in head and neck cancer. With the availability of Endoscopy, laparoscopy and Robotic systems patients requiring major surgeries for small tumours can now be offered surgery with limited human resources, good aesthetic & cosmetic outcome with better patient compliance. The MIS is still a grey area of head and neck surgeries so we like to have a comprehensive review on the evolution and recent advances in MIS.

Introduction

The MIS is a grey area of head and neck tumours even though the MIS for abdominal surgeries has been performed widely the usage of the MIS in head and neck tumours are very less. Tumours in the head and neck region pose a unique challenge to achieve this progress, as neurovascular structures are in close proximity in head and region. Surgery in the head and neck region, especially in oral cavity, raises technical challenges due to narrow space. So these issues can be addressed by minimally invasive surgery. For instance, robotic surgery provides better visualization, movements and fit in narrow spaces and fewer complications when compared to conventional surgery. The achievements accomplished in these disciplines had inspired oncologists to attempts and achieve similar results.

Evolution of MIS in Head and Neck Surgery

TORS (Trans Oral Robotic Surgery) and TLM (Trans Oral Laser Microsurgery)

First robot approved in surgery was PUMA 560, is a robot with six degrees of movements, robotic surgeries began as early as 1985. The PUMA 560 was first used by Kwoh and colleagues in the neurosurgery for the base of skull surgeries. With the rapid in roads that was made into surgical branches by the robot, it is clear that head and neck surgery would not be left far behind. Robotic surgery was first used in 2005 for benign pharyngeal cyst, it has now found its utility in the field of oncology where it is not possible to reach the tumour with conventional surgery. Transoral Robotic Surgery is basically used in tumours of the hypopharynx and the larynx. With the increase in HPV related hypopharyngeal cancers and development of new techniques of node dissection, this field has turned exciting. TLM - Transoral Laser Microsurgery is the use of LASER for resection of mainly laryngeal tumours but it can also be used for other head and neck tumours.

Hypopharyngeal cancers which are HPV related has a special place for TORS/TLM for the following reasons: a) surgery alone is curative in this subgroup (a) margin of 1.5 – 2 mm is deemed adequate; (b) mostly in young patients and have better prognosis. They live long enough for the long-term effects of RT to set in. TORS/TLM can avoid the squeal by avoiding RT altogether or by management with lower doses of radiation.

If surgery is planned for patients of oropharyngeal cancer, TORS/TLM has multiple advantages irrespective of the HPV status. One important advantage is that no mandibulotomy or lip splitting incision used – lesser swallowing or speech derangement [1]. Better cosmetic, preservation of voice and lesser pain scores brings satisfaction to the patient. The ability to visualize whole tumour due to visual aids and magnification also leads to better visualization of margins and so lesser margin positivity rates. There is no need of long term feeding tubes as feeds can be started by the second week. Last but the least, most of the patients can be spared of tracheostomy.

In 1972, Strong and Jako first used a CO2 laser with a surgical microscope for use through a laryngoscope for benign procedure. In 1975, CO2 laser used by Strong to treat T1 laryngeal cancer and managed 11 patients with curative intent. Subsequently,
researchers developed sturdy instruments to better visualize and manipulate the larynx for resection. The recent introduction of flexible hollow tubes to deliver laser beam has added to the maneuverability and ease of tumour resection. A recent meta-analysis of 16 studies, none randomized has found that for T1 glottic carcinoma, TLM is the ideal procedure in terms of survival and laryngeal function. NCCN has mentioned TLM is a method for endoscopic removal of glottis and supraglottis cancer in Tis, T1 – T2 and select cases of T3 [2-4].

TORS first approved by US FDA for the use in oropharyngeal tumours and obstructive sleep apnoea, and became popular very rapidly, particularly in the United States of America. The NCCN has endorsed its use in cancers of the oral cavity, pharynx and the larynx. A number of meta analyses have reported TORS to be less time-consuming, more acceptable to the patients, and having less complications as compared to the more invasive techniques while being oncologically safe involving conventional surgery although the quality of this evidence is limited [5-7].

‘Early-stage SCC of the oropharynx: radiotherapy versus trans-oral robotic surgery (ORATOR)’ is a phase II RCT comparing primary radiation therapy with primary TORS for small-volume primary (T1-2, N0-2) OPSCC. The study is in progress will complete by the end of 2021. The result of QOL (Quality of life) post 1 year after therapy is out and it showed better QOL scores for the RT arm although not statistically significant. Another trial “EORTC 1420-HNCG-ROG” is a phase III, RCT assessing the “best of” radiotherapy compared to TORS/TLM in patients with T1-T2, N0 SCC of the oropharynx and BOT is in progress [8].

Endoscopic Skull-Base Surgery

For paranasal sinususes endoscopic surgery has become gold standard approach for chronic sinusitis, polyps and sinus tract tumours. The endoscopic approach is used to operate nasal cavity and skull base tumours. The advantage of endoscopic technique is no visible scars, less damage to vital structures, and speed recovery. In 1990 first trans-sphenoidal route used for access the sella with endoscopic approach which has offered better visualization of the operative field. After the successful trans-sphenoidal pituitary resection, the transnasal procedure has been initiated for lesions surrounding the sella and pituitary region.

Carcinoma of Thyroid

Minimally invasive thyroid surgery (MATS) & Minimally invasive Video Assisted Thyroidectomy (MIVAT): although the terminology suggests ‘minimally invasive’, it is far from true, which is in fact a remote access procedure, except the trans-cervical approach. It was originally conceived to rid the neck of a scar and instead approach the thyroid via alternate incisions which has added to the total endoscopic approach has the advantage of avoiding a scar in the neck but at the cost of more dissection and risk of complications associated with gas insufflation.

Robotic Thyroidectomy

It was first used for transaxillary thyroidectomy by Chung in 2007. Since then a lot of investigators have appreciated the safety and efficacy of robots for thyroidectomy. The use of robot is far greater in South Korea, compared to slower acceptance in the West. The Bilateral Axillo Breast Approach (BABA), Transaxillary, retroauricular (facelift) and transoral approaches are most commonly used. The transoral technique requires CO2 gas insufflation but the transaxillary and retroauricular approaches do not require CO2 insufflation. It has the added advantage of being able to carry out neck dissection at the same setting. Although, the NCCN and ESMO were not commented on minimal access surgery in thyroid cancers, the ATA statement on remote-access thyroid surgery was published on 2016 [16]. They have laid out the following selection criteria Table 1:

<table>
<thead>
<tr>
<th>SL No</th>
<th>Selection criteria</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Factors relating to the patient include</td>
<td>(i) thin body habitus (except for the facelift approach), and (ii) the absence of excessive body fat along the flap trajectory (except for the facelift approach).</td>
</tr>
<tr>
<td>2</td>
<td>Factors relating to the thyroid pathology include</td>
<td>(i) well-circumscribed nodule ≤3 cm, and thyroid lobe ≤5–6 cm in the largest dimension; and (ii) underlying thyroid pathology with no evidence of thyroiditis on ultrasound.</td>
</tr>
<tr>
<td>3</td>
<td>Factors relating to specific approaches include</td>
<td>(i) evidence of thyroid cancer with extrathyroidal extension or lymph node involvement; (ii) Graves’ disease; (iii) subcapsular extension; and (iv) previous neck surgery. Overall, the ideal patient is a patient with &lt;3 cm unilateral nodule who wishes to avoid a neck scar.</td>
</tr>
</tbody>
</table>

Neck Dissection

In 2010 Kang et al first described the robotic –assisted neck dissection for thyroid cancer. In their first experience with 33 patients, da Vinci S system used to do a modified radical neck dissection (MRND) via gasless trans-axillary approach. In the
Evolution and Recent Advances in MIS in Head and Neck Cancers: A Comprehensive Review.

**Discussion**

The aim of cancer surgeons is to complete tumour resection with less damage to the vital structures. The development of new technologies, modalities and various routes of approaches were put steps forward to achieve the goal. The application of minimal invasive approach can aid surgery in traditionally hard to achieve. One major issue is its high cost of equipment and consumables which makes the launch of such a program difficult. Other concerns are no clear guidelines on its use, or in the training of its techniques. A steep learning curve and less availability of cost-benefit analysis hampers the widespread use of these modalities. For surgeons, a real-time imaging allows to confirm the complete resection of the tumour. Although minimally invasive surgery in head and neck cancers is gaining popularity in parts of Asia but this remains grey area compared with conventional open procedures. However, in view of awareness of such techniques, its popularity might become patient driven. With the endoscopic procedures to other parts of skull base becoming possible, this MIS techniques to be a good alternative to open surgery.

**Conclusion**

The MIS in head and neck cancers is still under explored compare to MIS in abdominal and thoracic malignancies. The MIS in head and neck cancer to be explored and focused more for better compliance of the selected patient in future.

**Declarations**

Consent for Publication: Authors give full consent to the publisher, including reading, editing for the publication of this study.

**Availability of Data and Materials**

Data has been collected from the computerized database of the institution after getting the ethical clearance with a proper channel.

**Competing Interests**

The authors declare that they have no competing interests.

**Funding**

This research did not receive any special grant from funding agencies in the public, commercial or not-for-profit sectors.

**Author’s Contribution**

MDR and JS made substantial contributions to the conception or design of the manuscript, data collection, writing of the manuscript and to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of the manuscript. JS and Lt (Col) AB contributed to the data collection and design of the manuscript. Lt (Col) AB and AB drafted the work and contributed in tabulating and formatting the manuscript. AB helped in statistical work along with critical inputs in drafting the manuscript. All authors have read and approved the manuscript for submission in your peer reviewed journal.

**Acknowledgements**

None

Hoping for your kind consideration

Thanking you

**References**


