ISSN: 2755-0176

Journal of Cancer Research Reviews & Reports

SCIENTIFIC Research and Community

Research Article

Open Access

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

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**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.

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**Received:** March 25, 2022; **Accepted:** April 04, 2022; **Published:** April 11, 2022

## 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 thesqueal 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 sinuses 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 pituatry 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 can be concealed. In the quest to superior cosmetic outcomes, laparoscopy has ended up with remote incisions but at the cost of more tissue dissection than an open thyroidectomy. So, it is also called endoscopic thyroidectomy or remote access thyroidectomy. It has to be differentiated from MIT (Minimally Invasive open Thyroidectomy) in MIT, the procedure is done as in conventional open method but with a smaller incision (<6 cm).

The first endoscopic thyroidectomy was performed in 1997, by Huscher. He used 3 ports at suprasternal notch, at the angle of the mandible and midway between the other two, around 4 cm above the clavicle. All the laparoscopic ports were placed along the anterior border of the sternocleidomastoid, 30° scope was used in a FNAC proven benign nodule. Since then, there have been various other techniques that have been described - neck, axilla, transoral (transvestibular and trans – floor of mouth approaches), posterior auricular, breast and chest approaches for both benign and malignant tumours, although trans-axillary and anterior chest wall routes remain favorite extra cervical route. Although the routes of access may vary, the access is invariably done in subcutaneous or sub-pectoral plane away from the clavicles and in a subplatysmal plane above the clavicles [9-15].

The endoscopic thyroidectomy techniques broadly divided into 2 categories - video-assisted gasless and purely endoscopic with gas-insufflation methods. Each of the method has its unique advantages and disadvantages. The video assisted gasless technique has the advantage of lesser dissection, prevention of complication associated with gas insufflation and faster learning curve but has the disadvantage of having a small scar in the neck. Again, the totally 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 1: Selection criterias for Remote-Access Thyroid Surgery**

| Sl No | Selection criterias | Indications |
|---|---|---|
| 1 | Factors relating to the patient include | (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). |
| 2 | Factors relating to the thyroid pathology include | (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. |
| 3 | Factors relating to specific approaches include the fact that the distance between the axilla and the sternal notch should ideally be <15–17 cm for an axillary approach. Absolute contraindications include | (i) evidence of thyroid cancer with extrathyroidal extension or lymph node involvement; (ii) Graves' disease; (iii) substernal extension; and (iv) previous neck surgery. Overall, the ideal patient is a patient with <3 cm unilateral nodule who wishes to avoid a neck scar. |

**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

central neck compartment the mean retrieved LNs was 6.1 ± 4.4 and in the lateral compartment it was 27.7 ± 11.0. The authors reported no major complications. Alternatively a retro-auricular incision can be placed to do the neck dissection as described by Lee et al. In an analysis of 128 patients from South Korea, which was compared robotic MRND with conventional open surgery. Although the operating time was higher in robotics (271.8 min vs. 208.9 min), other important parameters like postoperative complications and oncological outcomes including postoperative thyroglobulin levels did not differ much. Postoperative swallowing difficulties and sensory changes were often in open surgery arm ($p=0.041$ and $p<0.0001$ respectively). Subsequently other investigators had also confirmed encouraging results [17-21].

Recent Advances in Robotics in Head and Neck Cancer:

The current robot system approved is da vinci Xi by FDA on 2014 contain video assisted visualization and computer enhancement. In May 2018 the FDA approved da vinci single port system. It includes three units: 1.Vision cart 2.Surgeon console 3.Surgical cart. The surgical carts have four arms that are easily interchangeable by surgical staff. The vision cart containsan insufflator, light sources, and 3D image generator. The surgeon's console displays two images. The Endowrist instrument is controlled by the surgeon, provides seven degrees of freedom. The emerging surgical procedures by using da vinci Xi are Pediatric thyroidectomy, laryngeal cleft repairs, neoplasm of infra-temporal fossa, Robotic parathyroidectomy and Robotic parotidectomy gaining popularity and have more advantages then the conventional procedure [22].

## 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 wide spread 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

1. Castellano A, Sharma A (2019) Systematic Review of Validated Quality of Life and Swallow Outcomes after Transoral Robotic Surgery. Otolaryngol Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg 161: 561-567.
2. Strong MS, Jako GJ (1972) Laser surgery in the larynx. Early clinical experience with continuous CO2 laser. Ann Otol Rhinol Laryngol 81: 791-798.
3. Strong MS (1975) Laser excision of carcinoma of the larynx. The Laryngoscope 85: 1286-1289.
4. Vaculik MF, MacKay CA, Taylor SM, Trites JRB, Hart RD, et al. (2019) Systematic review and meta-analysis of T1 glottic cancer outcomes comparing CO2 transoral laser microsurgery and radiotherapy. J Otolaryngol Head Neck Surg 48: 44.
5. Gangwani K, Shetty L, Seshagiri R, Kulkarni D (2019) Comparison of TORS with conventional surgery for oropharyngeal carcinomas in T1–T4 lesions. Ann Maxillofac Surg 9: 387.
6. de Almeida J, Byrd J, Wu R, Stucken C, Duvvuri U, et al. (2014) A Systematic Review of Transoral Robotic Surgery and Radiotherapy for Early Oropharynx Cancer: A Systematic Review. The Laryngoscope 1: 124.
7. Kelly K, Johnson-Obaseki S, Lumingu J, Corsten M (2014) Oncologic, functional and surgical outcomes of primary Transoral Robotic Surgery for early squamous cell cancer of the oropharynx: a systematic review. Oral Oncol 50: 696-703.
8. Nichols AC, Theurer J, Prisman E, Read N, Berthelet E, et al. (2019) Radiotherapy versus transoral robotic surgery and neck dissection for oropharyngeal squamous cell carcinoma (ORATOR): an open-label, phase 2, randomised trial. Lancet Oncol 20:1349-1959.
9. Hüscher CS, Chiodini S, Napolitano C, Recher A (1997) Endoscopic right thyroid lobectomy. Surg Endosc 11: 877.
10. Gagner M, Inabnet WB (2001) Endoscopic thyroidectomy for solitary thyroid nodules. Thyroid Off J Am Thyroid Assoc. 11: 161-163.
11. Yeung HC, Ng WT, Kong CK (1997) Endoscopic thyroid and parathyroid surgery. Surg Endosc 11: 1135.
12. Miccoli P, Berti P, Conte M, Bendinelli C, Marcocci C (1999) Minimally invasive surgery for thyroid small nodules: preliminary report. J Endocrinol Invest 11: 849-851.
13. Shimizu K, Akira S, Jasmi AY, Kitamura Y, Kitagawa W, et al. (1999) Video-assisted neck surgery: endoscopic resection of thyroid tumors with a very minimal neck wound. J Am

Coll Surg 188: 697-703.

14. Ikeda Y, Takami H, Sasaki Y, Kan S, Niimi M (2000) Endoscopic neck surgery by the axillary approach. J Am Coll Surg 191: 336-340.
15. Nakano S, Kijima Y, Owaki T, Shirao K, Baba M, et al. (2002) Anterior chest wall approach for video-assisted thyroidectomy using a modified neck skin lifting method. Biomed Pharmacother Biomedecine Pharmacother 56: 96-99.
16. Berber E, Bernet V, Fahey TJ, Kebebew E, Shaha A, et al. (2016) American Thyroid Association Statement on Remote-Access Thyroid Surgery. Thyroid Off J Am Thyroid Assoc 26: 331-337.
17. Kang S-W, Lee SH, Ryu HR, Lee KY, Jeong JJ, et al. (2010) Initial experience with robot-assisted modified radical neck dissection for the management of thyroid carcinoma with lateral neck node metastasis. Surgery 148: 1214-1221.
18. Lee HS, Lee D, Koo YC, Shin HA, Koh YW, et al. (2013) Endoscopic Resection of Upper Neck Masses via Retroauricular Approach Is Feasible With Excellent Cosmetic Outcomes. J Oral Maxillofac Surg 71: 520-527.
19. Lee J, Chung WY (2013) Robotic thyroidectomy and neck dissection: past, present, and future. Cancer J Sudbury Mass 19: 151-161.
20. Lee J, Kwon IS, Bae EH, Chung WY (2013) Comparative analysis of oncological outcomes and quality of life after robotic versus conventional open thyroidectomy with modified radical neck dissection in patients with papillary thyroid carcinoma and lateral neck node metastases. J Clin Endocrinol Metab 98: 2701-2708.
21. Möckelmann N, Lörincz BB, Knecht R (2016) Robotic-assisted selective and modified radical neck dissection in head and neck cancer patients. Int J Surg 25: 24-30.
22. Caio M Oliveira, Hiep T Nguyen, Alberto R Ferraz, Karen Watters, Brian Rosman, et al. (2012) Robotic Surgery in Otolaryngology and Head and Neck Surgery: A Review. Minimally Invasive Surgery 286563.