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# Evaluation of level I neck nodes involvement in advanced malignancy of the larynx and the hypopharynx

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## Abstract

**Background:** Advanced cancer larynx and hypopharynx has high potentiality to nodal spread. Level of lymph node metastasis highly depends on site and stage of laryngopharyngeal carcinoma. Level I cervical lymph node dissection was performed to advanced laryngeal and/or hypopharyngeal tumors in this study.

**Results:** According to our statistical analysis and data, none of those thirty patients had pathologically positive level I neck lymph nodes after dissection with only one patient suffered from marginal mandibular nerve affection and three patients complained of dry mouth post-operatively, confirming the result that there is no need for prophylactic level I neck dissection in the absence of clinically palpable suspicious lymph nodes.

**Conclusion:** Although it carries relative low morbidity, there is no need for prophylactic level I neck dissection in advanced laryngeal and/or hypopharyngeal cancer patients without clinically detectable nodal metastases “NO neck.”

**Keywords:** Dissection, Level I, Laryngopharyngeal, Cancer

## Background

Head and neck squamous cell carcinomas accounts for about 6% of all new cancers diagnosed yearly. Of these malignancies, 25% arise on the laryngopharyngeal area, with incidence of nodal metastases varying from 25 to 65% [1]. Since previous studies in the literature have shown that 20–30% of laryngopharyngeal cancer patients with a clinical non-detectable neck nodes “NO neck” harbor occult cervical metastasis, many surgeons advocate a policy of prophylactic neck dissection in the treatment of laryngeal cancer patients without clinically apparent neck nodes (i.e., NO) [2]. It is widely accepted that the laryngeal lymphatic drainage occurs along expected pathways, and levels II, III, and IV lymph nodes are the most commonly involved. Metastases in level I or level V are rare and are usually associated with metastases in other lymph node levels [3].

Although the available imaging tools (e.g., ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI)) are useful in identifying lymph node metastasis, they have a low sensitivity and from here arises the importance of prophylactic neck dissection [4–6]. However, one should take in consideration that the prophylactic dissection of neck level I can be associated with particular complications due to injury of one or more of the structures related to it as the mandibular branch of the facial nerve, the lingual and facial arteries, the lingual and hypoglossal nerves, and the facial vein. These valuable structures are liable to injury during neck level I dissection, with very significant consequences [7]. Also, excision of the submandibular gland during neck dissection can result in xerostomia, leading to reduced quality of life [8]. Previous studies showed that dissection of neck level I is accepted only in laryngeal cancer patients with clinically detectable suspicious neck nodes. However, in patients without clinically palpable nodal metastases, sparing levels I is oncologically safe and reduces the risk of associated complications [5].

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We investigated the prevalence of level I neck lymph nodal metastases in those with advanced laryngeal and/or hypopharyngeal tumors and we assessed the post-operative morbidity.

## Methods

This is a prospective study that included thirty patients with advanced laryngeal and/or hypopharyngeal tumors for whom we did neck dissections including level I at the Department of Otorhinolaryngology, Head and Neck Surgery.

Ethical committee approval of Otorhinolaryngology, Head and Neck Surgery Department, at our institute was granted before embarking on the study. Informed consents were retrieved from all participants of this study.

We followed strict inclusion criteria where patients diagnosed as having advanced laryngeal and/or hypopharyngeal malignancy were included in the study. According to the *National Comprehensive Cancer Network* [9], we concluded that advanced malignancies of the larynx and/or hypopharynx which are surgically resectable include stages T3 (in which there is fixation of the hemilarynx) and T4a (The tumor invades the thyroid/cricoid cartilage, hyoid bone, thyroid gland, esophagus, or central compartment soft tissues, including prelaryngeal strap muscles and subcutaneous fat).

Exclusion criteria for this study included the following:

- Patients who had early laryngeal and/or hypopharyngeal tumors whether T1-T2.
- Those who had distant metastases "M1."
- Patients who are surgically in-operable as in T4b (tumor invades prevertebral space, encases carotid artery, or invades mediastinal structures).
- Patients who were medically unfit for surgery or refused surgery.
- Those who had undergone previous submandibular gland surgery.

The surgeries were done by a senior professor assisted by a staff member surgeon.

Every patient was subjected to the following:

### Pre-operative evaluation

- Full history: Age, sex, any special habits of medical importance, duration of symptoms, and previous treatment modalities received whether previous neck surgery or previous radiotherapy sessions.
- Full ENT examination with special concern to the site of primary lesion, tumor-node-metastasis (TNM) staging status (according to the *National Comprehensive Cancer Network* [9] and the *American Joint Committee on Cancer* [10]).

- Essential preoperative investigations as routine labs, ECG, and chest X-ray to detect fitness for general anesthesia and distant chest metastases.
- Computed tomography and/or MRI of the neck for radiological detection of the site, direct local spread of the primary tumor, presence of suspicious enlarged lymph nodes and their number.
- Direct laryngoscopy for biopsy taken from the primary tumor and for mapping of the local direct spread of the primary.

### Operative evaluation

We performed either of the following two types of neck dissection according to the site of the primary and clinical staging of the tumor:

- Modified radical neck dissection: In which removal of lymph nodes levels I through V was performed, with preservation of one or more non-lymphatic structures as sternomastoid muscle, spinal root of accessory nerve, or the internal jugular vein.
- Selective neck dissection: In which there was selective removal of one or more of the nodal groups/levels I-IV based on the location of the primary tumor. We performed this type of dissection in the patients with clinically undetectable "N0" neck tumor.
- We did routine neck dissection that was done first sparing level I, then we dissect level I separately. The fat was divided in the submental area from the anterior belly of the digastric muscle, and dissected with submandibular gland backwards superficial to mylohyoid muscle until the posterior belly of digastric muscle. Upper border of the submandibular gland was freed by dividing and tying the vessels including the facial artery. Mylohyoid muscle was retracted anteriorly to reveal the deep part the submandibular gland and submandibular duct which is transfixed and divided. The specimen "Level I nodes and the gland" was then removed and sent for pathological examination separately.
- The neck node specimens were sent to the department of pathology for processing and examination which included assessment of the positivity of nodes in each level, the presence of extracapsular spread and the presence of tumor in soft tissues and the submandibular gland. The T and N stages were determined from the pathologist's report.

### Early post-operative assessment

We assessed the patients immediately post-operative for complications of level I dissection as injury of the marginal mandibular nerve "which injury results in deviation of the angle of the mouth to the contralateral side," the lingual nerve "which transmits taste sensation from

anterior two-third of the tongue,” hypoglossal nerve “which injury cause deviation of the tongue to the contralateral side” and dryness of the mouth.

#### Follow-up evaluation

Also, we assessed them regularly following the operation by clinical follow-up examination to detect post-operative complications by history taking and examining the patients in the outpatient clinic 1, 3, and 6 months following surgery. Also, radiological follow-up by doing CT neck to detect suspected early local recurrence whether in the primary tumor or the lymph nodes. It is done 1, 3, and 6 months following surgery.

Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) for Windows program (version 11). Descriptive statistics were carried out for all variables including obtaining mean, standard deviation and range. The independent samples student (*t*) test was used for statistical analysis for all our parametric variables. *P* value of 0.05 or less was considered significant, and a *P* value of 0.01 or less was considered highly significant.

#### Results

Regarding the overall patient population, there were 27 males (90%) and 3 females (10%) ranged in age between 43 and 70 years with a mean age of 54.8 years. Only 3 patients (10%) had a past history of receiving radiotherapy as a curative treatment for the primary tumor with recurrence of the tumor later and they underwent surgery after failure of the radiotherapy.

#### Lymphatic extension of the primary tumor clinically and radiologically

On clinical examination of the neck, we found that about 21 patients (70%) had no clinically palpable suspicious lymph nodes, while 7 patients (23.3%) had level II

only, one patient (3.3%) had level III only, and one patient (3.3%) had both levels II and III palpable lymph nodes. None of the included patients had any palpable suspicious level I neck lymph nodes (Fig. 1).

#### T.N.M. staging of the tumor clinically and radiologically

About 20 patients (66.7%) were classified as T3 while the remaining 10 patients (33.3%) were considered as T4a due to radiological evidence of extralaryngeal spread. About 21 patients (70%) were considered as N0, four patients (13.3%) were N2, and 5 patients (16.6%) were N3 (Fig. 2).

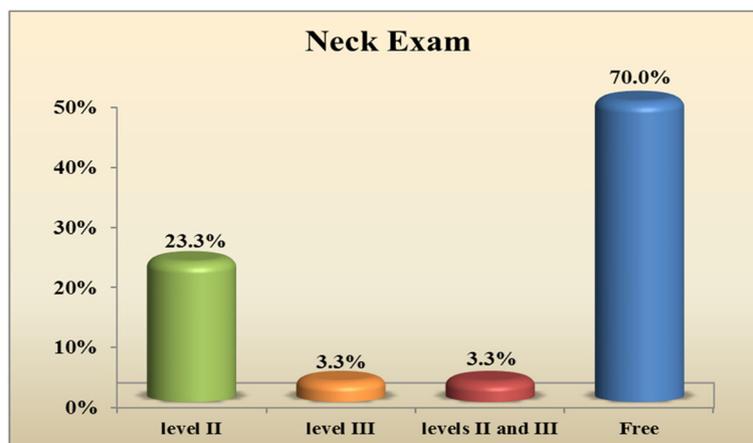
#### Type of neck dissection

Selective neck dissection was done in 21 patients (70%) in whom no clinically palpable lymph nodes were detected while modified radical neck dissection was done in the remaining 9 patients (30%) with pre-operative palpable suspicious neck nodes (Table 1).

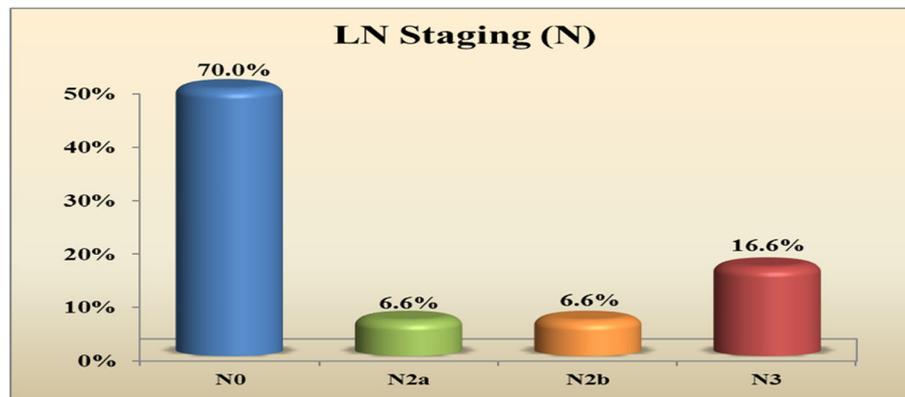
#### Post-operative pathology of the tumor and dissected nodes

The post-operative pathological exam of the excised laryngeal/hypopharyngeal specimen confirmed invasion of the skeleton cartilage by the tumor—which was predicted pre-operative by imaging studies—in 10 patients (33.3%) of the study sample. The type of the tumor in the whole population study was squamous cell carcinoma with the degree of tumor differentiation ranged from well differentiated in one patient (3.3%), moderately differentiated in 21 patients (70%) to poorly differentiated in 8 patients (26.7%) (Table 2).

Regarding the post-operative pathological exam of dissected lymph nodes, in our study, 10 patients (33.3%) were proved pathologically to have positive neck lymph nodes for malignancy, one of them showed no clinically palpable suspicious lymph nodes pre-operatively. None



**Fig. 1** Lymphatic spread of the primary tumor clinically and radiologically



**Fig. 2** Lymph nodal staging of the included patients

of those patients had affected level I neck lymph nodes or the submandibular gland (Table 2).

**Post-operative complications**

Only one patient (3.3%) suffered from post-operative permanent deviation of the angle of the mouth due to injury of the marginal mandibular nerve during level I dissection. Three patients (10%) complained of persistent not-improving significant xerostomia or dry mouth postoperatively; however, those patients had received radiotherapy as a curative treatment before surgery which may explain their exaggerated complaints of dry mouth rather than considering only level I dissection as a single cause of such complaint (Table 3).

None of the study population presented with hypoglossal nerve paralysis or other complications related to neck dissection.

Mean follow-up period was 3 years. During follow-up evaluation, three patients (33.3%) who had total laryngectomies and selective neck dissection were presented later with radiological evidence of nodal (level II) post-operative recurrence which required further investigations and interventions (Table 3).

**Discussion**

We noticed few patients “not included in this study,” who had previous total laryngectomies with selective neck dissections sparing level I, presented to us during follow-up in the outpatient clinic with malignant recurrence in the level I neck nodes which raises the question of our study: Is it oncologically safe to spare the

ipsilateral level I during neck dissection for advanced cases with malignancy of the larynx and the hypopharynx?

In our study, 90% of the affected patients were males with their mean age about 54.8 years matching with the results of previous studies of the literature which confirmed that patients diagnosed with laryngeal and/or hypopharyngeal cancers are typically men aged 55-70 years with a history of tobacco use, alcohol ingestion, or both [11].

On clinical examination of the neck and by imaging, we found that about 70% of patients had no clinically palpable suspicious lymph nodes, while 7 patients (23.3%) had level II only, one patient (3.3%) had level III only, and one patient (3.3%) had both levels II and III palpable lymph nodes. None of the included patients had any palpable suspicious level I neck lymph nodes.

**Table 2** Post-operative pathological exam of the specimen and pathology of dissected neck nodes

	Frequency (n=30)	Percentage
<b>Pathology of tumor specimen</b>		
Laryngeal cartilage invaded	10	33.3
No laryngeal cartilage invasion	20	66.7
<b>Differentiation</b>		
Well	1	3.3
Moderate	21	70.0
Poor	8	26.7
<b>Pathology of submandibular gland</b>		
Free	30	100.0
<b>LN level I pathology</b>		
Free	30	100.0
<b>Pathology of other neck levels</b>		
+VE	10	33.3
Free	20	66.7

**Table 1** Type of neck dissection performed

	Frequency (n=30)	Percentage
<b>Neck dissection</b>		
Modified radical neck dissection	9	30.0
Selective neck dissection	21	70.0

**Table 3** Post-operative complications and recurrence

	Frequency (n=30)	Percentage
<b>Post-operative complications</b>		
Dry mouth	3	10.0
Marginal facial	1	3.3
No	26	86.7
<b>Recurrence by follow up CT</b>		
Yes	3	10.0
No	27	90.0

This was proved by past studies which concluded that the lymphatic drainage of the larynx occurs along predictable pathways, and levels II, III, and IV lymph nodes are the most frequently involved. Metastases in level I or level V are rare and are usually associated with metastases in lymph nodes along the internal jugular vein [3].

Our work showed that 70% of the post-operative pathological exams of the tumor were moderately differentiated squamous cell carcinomas which are identical to literature results [12].

Regarding the post-operative pathological examination of dissected lymph nodes, 10 patients (33.3%) were proved pathologically to have positive neck lymph nodes for malignancy, one of them showed no clinically palpable suspicious lymph nodes pre-operatively which reflects the importance of prophylactic neck dissection even in the absence of radiologically suspicious neck lymph nodes as discussed before in past studies [5].

However, none of them had pathologically positive level I neck lymph nodes after dissection reaching the result that there is no need for prophylactic level I neck dissection in the absence of clinically palpable suspicious lymph nodes.

Many studies in the literature have handled the issue of prophylactic level I dissection in N0 neck and confirmed our results [5, 13].

Regarding the post-operative complications related to level I dissection and according to the previous literatures, the prophylactic dissection of level I is considered to be associated with particular complications related to the removal of the submandibular gland and injury of important structures as the marginal branch of the facial nerve, the lingual and facial arteries, the lingual nerve, and the hypoglossal nerve with very significant consequences [5]. However, from our study results, we can say that those complications may be negligible in well-trained skilled hands.

## Conclusion

In advanced laryngeal and/or hypopharyngeal cancer patients without clinically palpable neck nodes "N0 neck," there is no need for prophylactic level I neck dissection

and its preservation is economical and reduces the risk of comorbidity. It is oncologically safe for the 3 years; however, 5-year survival rate is not assessed in this study.

Special attention should be paid, from one side, to increase the sample size and, on the other side, to improved techniques for detection of malignancy in submandibular glands and level I lymph nodes as by using cytokeratin staining techniques.

## Abbreviations

AJCC: American Joint Committee on Cancer; CNS: Central nervous system; CRT: Chemoradiotherapy; CT: Computed tomography; DVT: Deep venous thrombosis; Fig: Figure; FNAC: Fine-needle aspiration cytology; HPV: Human papilloma virus; ICA: Internal carotid artery; ICU: Intensive care unit; LC: Laryngeal carcinoma; MRI: Magnetic resonance imaging; PET: Positron emission tomography; PGS: Paraglottic space; RT: Radiotherapy; SCC: Squamous cell carcinoma; SD: Standard deviation; SGE: Subglottic extension; TG: Thyroid gland; TGI: Thyroid gland invasion; TL: Total laryngectomy; TSH: Thyroid-stimulating hormone; WHO: World Health Organization

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## Authors' contributions

OH (corresponding author) shared in interpreting, and writing the paper. HM shared in substantial contributions to the conception and interpretation. OM shared in data collection, writing, statistics, and drafting. MS shared in revising the manuscript and general guidance throughout the work. All authors have approved the submission version.

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## Availability of data and materials

The datasets used and/or analyzed during the current study are available by the corresponding author and ready to be shared upon reasonable request.

## Declarations

### Ethics approval and consent to participate

All procedures performed in this study were in accordance with the ethical standards of the research committee of ENT Department, Cairo University, Egypt, on 2017. Ethical committee approval of Otorhinolaryngology, Head and Neck Surgery Department, at Cairo University, Egypt in 2017 was granted before embarking on the study. Reference number is not available. Informed written consent to participate in the study was provided by all participants or their legal guardian.

### Consent for publication

Not applicable.

### Competing interests

All authors declare that they have no competing interests.

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## References

1. Ferlito A, Rinaldo A, Silver CE, Robbins KT, Medina JE, Rodrigo JP, Shaha AR, Takes RP, Bradley PJ (2008) Neck dissection for laryngeal cancer. *J Am Coll Surg* 207(4):587–593. <https://doi.org/10.1016/j.jamcollsurg.2008.06.337>
2. Pinilla M, Gonzalez FM, Lopez-Cortijo C, Arellano B, Herrero J, Trinidad A, Vergara J (2003) Management of N0 neck in laryngeal carcinoma. Impact on patient's survival. *J Laryngol Otol* 117(1):63–66. <https://doi.org/10.1258/002221503321046676>

3. Dos Santos CR, Paulo S, Magrin J, Ferlito A, Filho JG, Johnson LF, Kowalski LP (2001) Involvement of level I neck lymph nodes in advanced squamous carcinoma of the larynx. *Ann Otol Rhinol Laryngol* 110(10):982–984. <https://doi.org/10.1177/000348940111001016>
4. Huang BY, Solle M, Weissler MC (2012) Larynx: anatomic imaging for diagnosis and management. *Otolaryngol Clin North Am* 45(6):1325–1361. <https://doi.org/10.1016/j.otc.2012.08.006>
5. Wiegand S, Esters J, Müller HH, Jäcker T, Roessler M, Fasnula JA, Werner JA, Sesterhenn AM (2012) Relevance of level I and IIB neck dissection in laryngeal cancer. *J Laryngol Otol* 126(8):795–799. <https://doi.org/10.1017/S0022215112001077>
6. Hermans R (2006) Staging of laryngeal and hypopharyngeal cancer: value of imaging studies. *Eur Radiol* 16(11):2386–2400. <https://doi.org/10.1007/s00330-006-0301-7>
7. Ozer E, Karapinar U, Ryoo C, Agrawal A, Schuller DE (2010) When to address level I lymph nodes in neck dissections? *Otolaryngol Head Neck Surg* 142(3):355–358. <https://doi.org/10.1016/j.otohns.2009.11.033>
8. Ebrahim AK, Loock JW, Afrogheh A, Hille J (2011) Is it oncologically safe to leave the ipsilateral submandibular gland during neck dissection for head and neck squamous cell carcinoma? *J Laryngol Otol* 125(8):837–840. <https://doi.org/10.1017/S0022215111001095>
9. National Comprehensive Cancer Network. NCCN. Clinical practice guidelines in oncology: head and neck cancers. V 1. 2015.
10. The American Joint Committee on Cancer: the 7th edition of the AJCC cancer staging manual and the future of TNM (2010) *Ann Surg Oncol*. 17(6): 1471–1474
11. Saleh EM, Abdullwahab AA, Kammal MM (1995) Age and sex incidence of hypopharyngeal tumours in Upper Egypt: Assuit University experience. *J Laryngol Otol* 109(8):737–740. <https://doi.org/10.1017/S0022215100131184>
12. Marchand JL, Luce D, Leclerc A, Goldberg P, Orlowski E, Bugel I, Brugere J (2000) Laryngeal and hypopharyngeal cancer and occupational exposure to asbestos and man-made vitreous fibers: results of a case-control study. *Am J Ind Med* 37(6):581–589. [https://doi.org/10.1002/\(SICI\)1097-0274\(200006\)37:6<581::AID-AJIM2>3.0.CO;2-D](https://doi.org/10.1002/(SICI)1097-0274(200006)37:6<581::AID-AJIM2>3.0.CO;2-D)
13. Kruse A, Grätz KW (2009) Evaluation of metastases in the submandibular gland in head and neck malignancy. *J Craniofac Surg* 20(6):2024–2027. <https://doi.org/10.1097/SCS.0b013e3181be87a3>

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