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Cervical lymph node metastatic patterns of squamous carcinomas in the upper aerodigestive tract

XIAO MING LI†, M.D., WILLIAM IGNACE WEI*, M.S., F.R.C.S.(ED), D.L.O., F.A.C.S.,
XIAO FENG GUO†, M.D., PO WING YUEN*, F.R.C.S.(ED), D.L.O.,
LAI KUN LAM*, F.R.C.S.(ED), F.R.A.C.S.

Abstract

The radical neck dissection specimens of 384 ethnically Chinese patients with different primary squamous carcinomas in the head and neck region were studied. Over 50 per cent of the specimens showed metastatic disease at one level in the neck. For oral cavity carcinoma, the levels of metastasis frequently involved were I, II and III while for carcinoma of the oropharynx, hypopharynx and larynx, the levels were II, III and IV. Extracapsular spread was present in 112/384 of patients (29 per cent) and this increased with advancing N-stages. Based on these findings, different selective neck dissections could be used for patients harbouring different primary head and neck carcinomas with limited neck disease.

Key words: Head and neck neoplasms; Carcinoma, squamous cell; Lymph nodes; Neoplasm metastasis

Introduction

Squamous cell carcinoma accounts for over 90 per cent of cancers arising from the upper aerodigestive tract. In view of the rich lymphatic drainage in this region, these tumours show a high incidence of metastasis to regional cervical lymph nodes. This influences the planning of therapy and also significantly affects the prognosis.

The surgical procedures employed in the management of cervical lymph node metastasis have evolved over the years from radical neck dissection (RND) to different types of selective neck dissection (SND) in recent years. The classical RND was described by Crile in 1906 and has remained the mainstay of surgical procedure. This operation offers comprehensive anatomical clearance of all cervical lymph node groups in the neck, although the rationale of removing all the lymph nodes in the neck despite different primary tumours has not been established. The operation also causes significant compromise of shoulder function and results in some cosmetic deformity. Removal of the internal jugular vein, particularly on both sides, produces oedema of face and occasional neurological deficit (Shah, 1990). For these reasons, modifications of the extent of lymphadenectomy, such as functional RND and regional SNDs have been proposed by many authors (Bocca *et al.*, 1984; Byers, 1985; Byers *et al.*, 1988). This was particularly advocated in patients who have no clinically palpable neck node or have only limited metastatic disease, i.e. the N0, N1 necks. In various reports, local tumour control rates have been used as evidence of efficacy of these surgical procedures, the rationale of performing different types of modification of neck dissection for various primary tumours in Asian patients, however, has not been properly documented.

The purpose of this study is to review retrospectively the prevalence and patterns of cervical lymph node metastasis from various primary squamous cell carcinomas of the upper aerodigestive tract in patients who have undergone classical RND. The aims are to determine the basis for advocating SND and RND in patient management and to plan rationally prospective clinical trials.

Patients and methods

Between 1980 and 1992, at the Head and Neck Division of Department of Surgery, The University of Hong Kong, Queen Mary Hospital, Hong Kong, 566 patients underwent RND for squamous carcinoma of the upper aerodigestive tract. Among them, 182 patients were excluded from the present review, because they had either a modified neck dissection or multiple primary tumours or had received previous treatment in the form of pre-operative radiation or chemotherapy. Thus a total of 384 ethnically Chinese patients were included in the present study. Among this population, 308 were

From the Division of Head & Neck Surgery*, Department of Surgery, The University of Hong Kong, Queen Mary Hospital, Hong Kong and the Department of Otorhinolaryngology†, Norman Bethune University of Medical Sciences, Changchun Jilin, China.
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male and 76 were female. Their ages ranged from 20 to 88 years, with a median of 60 years. The primary tumours were located in the oral cavity in 153 patients, in the oropharynx in 58 patients, in the hypopharynx in 100 patients, and in the larynx in 73 patients. All these 384 patients underwent classical radical neck dissection. The first group of 161 elective RNDs were performed for the clinically N0 neck, and the remaining 223 therapeutic RNDs were performed for the clinically N+ necks. The clinical N−stage was determined according to the clinical staging system for cervical lymph node metastases of the American Joint Committee on Cancer (AJC, 1992).

All the surgical specimens were subjected to histopathological examination and the records of these patients were reviewed to determine the characteristics of neck node metastasis and the levels of their distribution in the neck. The anatomical regions included in the different levels follow those reported by the Memorial Sloan-Kettering Cancer Centre (Shah *et al.*, 1981). Compilation of data was carried out using the dBase IV (Ashley Tate) program and statistical analysis was performed using the SPSS version 6.0 (SPSS Inc., Chicago, IL).

Results

The mean number of lymph nodes identified in an individual patient was 38. When one or more lymph node in the whole neck dissection specimen was detected to contain tumour, the specimen was reported to have metastatic disease. By this method of evaluation, metastatic disease was confirmed in 232/384 (60.4 per cent) RND specimens. The number of lymph nodes involved by metastatic disease varied from one to 17, mean five (Table I). Among the 161 patients whose necks were clinically staged to be N0, 51 patients' necks contained metastatic squamous carcinoma on histological examination. For the 223 patients who had palpable cervical lymph nodes clinically, 181 were confirmed to have metastatic cancer pathologically. Among the 384 patients, the feature of extracapsular spread was identified in the pathological specimens of 112 patients and this incidence increased with more advanced clinical N-stages. Extracapsular spread was noticed in 18 of the 161 patients with clinical N0 necks. In the 122 patients with N1 disease and the 76 patients with N2 necks the incidence of extracapsular spread was 29 and 40 respectively. In the 25 patients with N3 disease, extracapsular spread was present in all the RND specimens (Table II). The pattern of distribution of metastatic lymph nodes in the RND specimens in relation to the location of the primary tumour is shown (Table III). The distribution of cervical lymph nodes as reported in the pathological specimens were grouped from levels I through V and their relation to the primary tumour is also listed (Table IV).

TABLE I
DISTRIBUTION OF NUMBERS OF POSITIVE LYMPH NODES IN 384 RNDS

No. of positive nodes	No. of RNDs	Percentage
0	152	39.6
1	79	20.5
2	47	12.2
3	46	12.0
4	26	6.8
5	15	3.9
6	11	2.9
8	3	0.8
>10	5	1.3
Total	384	100.0

In patients with primary squamous cell carcinomas of the oral cavity, a total of 153 RNDs were performed. Among these, 60 were therapeutic and 93 were elective neck dissections. Metastatic disease was histopathologically confirmed in 65 RNDs specimens. The distribution of metastatic lymph nodes in RND specimens according to the clinical levels is shown in Table IV. The majority of metastatic lymph nodes were located at levels I, II and III. Levels IV and V were involved in nine patients (14 per cent).

For patients with primary squamous cell carcinomas of the oropharynx, 58 RNDs were performed. Among them, 39 were therapeutic and 19 were elective neck dissections. Metastatic tumours were histopathologically confirmed in 42 RND specimens and the majority of metastatic nodes were noted to be at levels II, III and IV. Level I involvement was present in only three RNDs (seven per cent) but there was no level V involvement (Table IV).

Patients with primary squamous cell carcinomas of the hypopharynx have the highest incidence of cervical lymph node metastasis among the different primary tumours. A total of 100 RNDs were performed for them either therapeutically or electively, the respective numbers were 76 and 24. Metastatic disease was histopathologically confirmed in 82 RNDs. The majority of metastatic nodes were located at levels II, III and IV, with seven (nine per cent) and six (seven per cent) at level I and level V respectively. All patients with level V involvement had positive lymph nodes at other levels (Table IV).

For patients with primary squamous cell carcinomas of larynx, a total of 73 RNDs were performed. Among them, 48 were therapeutic and 25 were

TABLE II
DISTRIBUTION OF HISTOLOGICALLY CONFIRMED METASTATIC TUMOUR AND EXTRACAPSULAR SPREAD

N-staging	Total no. of RNDs	No. of histologically positive nodes	No. of extracapsular spread
N0	161	51	18
N1	122	89	29
N2	76	67	40
N3	25	25	25
Total	384	232	112

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TABLE III
DISTRIBUTION AND HISTOLOGICALLY CONFIMED METASTATIC TUMOUR IN RELATION TO THE PRIMARY TUMOUR

Primary site	No. of RNDs	Positive nodes in elective RNDs (%)	Positive nodes in therapeutic RNDs (%)
Oral cavity	153	25.8 (23/93)	70.0 (42/60)
Oropharynx	58	31.6 (6/19)	92.4 (36/39)
Hypopharynx	100	50.0 (12/24)	92.1 (70/76)
Larynx	73	40.0 (10/25)	68.8 (33/48)
Total	384	31.7 (51/161)	81.2 (181/223)

elective neck dissections and metastatic nodes were histopathologically confirmed in 43 RNDs. The majority of metastatic nodes were present at levels II, III and IV with a slight preponderance at level III. Level I involvement was present in one specimen (two per cent) while level V involvement was present in four RNDs (nine per cent) (Table IV).

The overview of distribution of metastatic nodes showed that over 50 per cent of specimens revealed metastatic disease at one level although multiple level involvement was not uncommon. No specimen was noted to have metastatic lymph nodes at levels I through V (Table V). Among the 161 elective RNDs for clinical N0 necks, 12 were confirmed to have metastatic disease at level I, five were identified to have metastatic tumour at level V. All patients who had positive nodes at level V had metastatic tumours at other levels.

Discussion

The management of metastatic cervical lymph nodes remains a surgical challenge. For decades, radical neck dissection has been considered to be the standard treatment for neck metatasis. However, due to the significant morbidity associated with the operation, questions have been raised in the past three decades regarding its applicability in all patients who suffered from cancer in the head and neck region. The arguments against radical neck dissection were the associated functional disability and cosmetic deformity after operation. For these reasons, the routine use of radical neck dissection in the management of cervical lymph nodes may not be appropriate. Modifications of the classic RND have been proposed and there was confusion regarding the various types of modifications of neck dissection (Medina, 1989). Standardization of neck dissection terminology had been proposed and introduced into clinical practice by various authors (Byers *et al.*, 1988; Medina, 1989; Robbins *et al.*, 1991).

Functional neck dissection was initially introduced into clinical practice by Bocca, and in recent years, this has been advocated for different types of primary carcinomas (Khafif *et al.*, 1990). Indeed, functional neck dissection resulted in regional control rates similar to those acheived by RND, not only in carcinoma of the larynx but also for cancers at other sites especially when patients were carefully selected (Bocca *et al.*, 1984). Moreover, many modifications of neck dissection have emerged in the past 20 years and it appears that in the coming decade, the role of selective neck dissection will become established as the standard treatment for squamous carcinoma of the head and neck at certain stages of the disease. Several retrospective studies from the M.D. Anderson Hospital have demonstrated that modified neck dissection is an adequate therapeutic procedure for N0 or N1 neck disease for some primary head and neck tumours. It is now believed that selective neck dissection is an oncologically sound concept.

Modification of the classic RND is based on the finding that metastatic cervical lymphadenopathy from squamous carcinoma of the upper aerodigestive tract has a predictable pattern (Sharpe, 1981; Candela *et al.*, 1990; Shah, 1990). As long as the lymph nodes at highest risk of having metastasis are removed, the regional control rate is similar to removing all cervical lymph nodes.

Our present study of 384 RNDs for primary squamous cell carcinoma of the upper aerodigestive tract further consolidates this concept. Our study is unique, as it represents a large number of Chinese patients all of whom had underwent RND, and detailed pathological analysis of the cervical lymph nodal levels was available in every patient included in the review. The mean number of tumour-bearing cervical lymph nodes detected in our review was five and this was more than those reported with functional neck dissection (Byers, 1985).

We have identified that neck levels I, II and III were at greatest risk for nodal metastases from primary squamous carcinomas of the oral cavity and levels II, III and IV for nodal metastases from carcinomas of the oropharynx, hypopharynx and

TABLE IV
DISTRIBUTION OF HISTOPATHOLOGICALLY CONFIRMED METASTATIC NODES AT LEVELS I THROUGH V IN RELATION TO THE PRIMARY TUMOUR

	Level distribution				
Primary tumour site	Level 1	Level 2	Level 3	Level 4	Level 5
Oral cavity	30	62	29	5	4
Oropharynx	3	19	23	7	0
Hypopharynx	7	49	47	36	6
Larynx	1	20	29	11	4
Total	41	150	128	59	14

TABLE V
DISTRIBUTION OF TUMOUR-BEARING NODES IN LEVELS IN 384 RNDS

No. of level(s) with tumour-bearing nodes	No. of RNDs	Percentage
0	152	39.0
1	118	30.9
2	82	21.7
3	30	7.9
4	2	0.5
Total	384	100.0

larynx. In patients with primary squamous cell carcinomas of the oral cavity, the majority of cervical lymph node metastases were clustered at levels I, II and III. There was a small number of patients with macroscopic lymph node metastases at levels IV and V. Patterns of cervical lymph node metastases observed in this study supported the recommendation of a supraomohyoid neck dissection (levels I, II and III) for carcinomas of the oral cavity, and a lateral neck dissection (levels II, III and IV) for carcinomas of the oropharynx, hypopharynx and larynx. But still, there were some patients in whom levels I and V were involved by metastatic disease. It has been reported in a retrospective study of 1,227 neck dissections that only 40 patients (three per cent) had positive nodes at level V (Davidson *et al.*, 1993). Nearly all patients with posterior triangle metastases had clinically palpable nodes. Moreover, level V involvement was always associated with nodal metastases at other levels. Our present study showed similar findings. This implies that if a supraomohyoid neck dissection or lateral neck dissection is performed for patients with N+ necks, there may be some metastatic nodes left behind which may account for regional recurrence later. For these patients, post-operative radiotherapy should be recommended as it has been reported that the failure rate in the neck in patients who underwent the surgery alone was 18 per cent compared to 4.7 per cent when post-operative radiotherapy was given (Byers, 1985).

The present study also showed that the clinical N-stage was closely related to the pathologically-confirmed nodal metastasis and extracapsular spread, both were important prognostic factors. The higher the clinical N-stage, the greater was the chance of microscopic metastasis and extracapsular spread. Furthermore, the incidence of nodal metastasis and extracapsular spread was significantly higher in the clinical N2 and N3 necks than clinical N0 and N1 necks. Usually, lymph nodes did not have to be totally replaced by tumour before extracapsular spread occurs and this process could be seen in very small nodes. The incidence however was proportional to the size of the involved nodes. It has been demonstrated that, for nodes that were less than 1 cm in diameter, the incidence of extracapsular spread was 15 per cent to 25 per cent and for those of size 1 to 2 cm the corresponding figure was 25 per cent to 45 per cent (Snow *et al.*, 1982; Johnson *et al.*, 1985). Lymph nodes larger than 3 cm in diameter exhibited extracapsular spread in 75 per cent of cases. The impact of extracapsular spread on patient survival has been reported by many authors. Extracapsular spread was associated with a 50 per cent reduction in survival rate compared to those without extracapsular spread (Johnson *et al.*, 1985; Shah, 1990). Our results suggested that selective neck dissections could be employed for clinical N0 and N1 necks, while RND should be performed for clincal N2 and N3 necks.

The number of metastatic nodes in each RND specimen varied and it ranged from one to 17, (mean five) as shown in the present study. Most patients had limited disease with metastastic nodes at a single level, although some patients had very extensive disease and metastatic lymph nodes were identified at multiple levels. There was however no patient who had positive nodes at all five clinical levels. This indicated that for appropriate chosen patients with primary squamous cell carcinoma at certain sites of the upper aerodigestive tract, selective neck dissection might be adequate in extirpating metastatic nodes.

In summary, the cervical lymph node metastasis from squamous cell carcinoma of the upper aerodigestive tract has some predictable patterns, i.e. neck levels I, II and III are high risk regions for nodal metastases from primary squamous carcinomas of the oral cavity and levels II, III and IV are increased risk areas for nodal metastases from carcinomas of the oropharynx, hypopharynx and larynx. The pattern of cervical lymph node metastasis observed in this study supports the recommendation of a supraomohyoid neck dissection as a staging procedure for N0 and N1 patients with primary squamous cell carcinomas of the oral cavity and anterolateral neck dissection, clearing levels II, III and V in N0 and N1 patients with primary squamous cell carcinomas of the oropharynx, hypopharynx and larynx. For patients with N+ neck, post-operative radiotherapy should be given to eradicate the occult nodal metastases, especially when the primary tumour is at the hypopharynx.

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Address for correspondence:
Professor William I. Wei,
Professor of Otorhinolaryngology,
Division of Head and Neck Surgery,
Department of Surgery,
The University of Hong Kong,
Queen Mary Hospital,
Hong Kong.

Fax: (852) 28551897