Head and neck continued: a retrospective analysis of neck dissections from a New Zealand oral and maxillofacial surgery unit

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ABSTRACT

AIMS: The aim of this study is to analyse the demographics, diagnosis, nodal yield, metastatic rates and outcomes of patients undergoing neck dissections within the Waikato Hospital Oral and Maxillofacial Surgery (OMS) Department.

METHODS: All patients that underwent neck dissections under the care of OMS at Waikato Hospital between January 2016 and December 2021 were included. Data on patient demographics, diagnosis, surgery details, nodal yields, histological results and clinical outcome were collected retrospectively for analysis.

RESULTS: One hundred and five patients and 123 neck dissections were included in the final analysis. The median age was 65 years of age. The average nodal yield from a selective neck dissection of levels I–III was 20.1 and I–IV was 25.4. There was no metastatic nodal disease in level IIb, and only 2 neck dissections with nodal disease in level IV. Complications were mostly associated with free flap reconstruction rather than the neck dissection alone.

CONCLUSIONS: The demographics and outcomes of the study cohort are consistent with both the current population and previously published head and neck data. The OMS unit at Waikato Hospital recommends omission of levels IIb and IV in neck dissections for cN0 cases if deemed oncologically safe to do so.

Cancers of the head and neck are among the most common cancers worldwide, totalling in excess of 900,000 cases annually.[1] Squamous cell carcinoma (SCC) is responsible for 90% of all head and neck cancers, while oral squamous cell carcinoma (OSCC) accounts for 40% of all head and neck cancers.[2]

OSCC most commonly metastasises to cervical lymph nodes.[3] A neck dissection is used in the management of OSCC to gain regional control of the disease, allow for pathological staging and direct adjuvant treatment.[4] An access neck dissection (AND) enables access to vessels for free flap microvascular anastomosis and reconstruction without necessarily removing any lymph nodes for disease control or pathological examination.

Cervical lymph node metastases is one of the most significant independent prognostic factors for head and neck cancer, reducing overall survival by up to 50% when present.[5] Clinically node-negative necks (cN0) on histopathologic examination of the cervical lymph nodes ultimately have occult metastatic disease in approximately 20% of cases.[6] In 1990, Shah et al. found that neck levels I, II and III are at highest risk of metastasis from oral cavity cancers.[3] These findings have been reinforced in subsequent literature.[7–9]

The Oral and Maxillofacial Surgery (OMS) department at Waikato Hospital is the only OMS unit within Aotearoa New Zealand to independently ablate oral cavity malignancies, conduct neck dissections and to reconstruct the oral cavity defects using microvascular free flaps. Published research relating to neck dissections from OMS units in Australia and New Zealand is scarce.[10] The purpose of this study was to analyse the demographics, outcomes and nodal yield of patients who underwent neck dissections in the OMS department at Waikato Hospital. This would also facilitate the development of a prospective head and neck database, to ensure clinical governance of the OMS unit and to assess patient complications. With a foundation formed for future research in this area, appropriate patient management recommendations can be made.

Methods

Research consent was obtained from the Waikato District Health Board (now Te Whatu Ora

Waikato). Individual patient consent was obtained at the time of initial surgery to be included in future teachings and research. All patients that underwent a neck dissection under the OMS unit at Waikato Hospital between January 2016 to December 2021 were included for analysis. Patients were primarily identified through a search of Waikato Hospital's Inpatient Management data system and Head and Neck oncology meeting agendas. An example of words entered in the search were "neck* dissection", "wide* local* excision" and "free* flap* reconstruction". There were a total of 105 patients identified through this combined method of database searching and cross-checking. A unilateral neck dissection was counted as one neck dissection and a bilateral neck dissection counted as two for ease of averaging nodal yield. A total of 123 neck dissections were performed. Patients who underwent AND for free flap reconstruction were included to assess complications and for the purpose of creating an ongoing departmental oncology database. However, they were omitted from the statistics of nodal yield.

A database was created using Microsoft Excel 2021 (Microsoft, Redmond, WA, USA) that incorporated data points similar to those used in other head and neck research databases.[10] Patient data were collected retrospectively through electric and hard-copy notes.

Examples of the data points collected included patient demographics detailing gender, ethnicity, age and smoking and alcohol history. Diagnosis data collated histological diagnosis, tumour location and clinical TNM staging. Surgery details included the type of neck dissection (Selective Neck Dissection, Modified Radical Neck Dissection [MRND] and AND), the use of intraoperative frozen specimens, intraoperative findings (e.g., nerve sacrifice), use of tracheostomy and reconstruction modality. The total number of nodes collected per neck per level Ia, Ib, IIa, IIb, III, IV and V were recorded, in addition to the region and number of positive metastatic nodes. Information regarding lymphovascular invasion, perineural invasion, extracapsular spread and primary tumour depth of invasion were also collected. Post-operative complications and any incidence of post-operative shoulder dysfunction were both assessed with all three types of neck dissections. The Clavien–Dindo classification was used to classify complications during the post-operative inpatient stay.[11]

Data collection was completed by two independent researchers, with cross-checking of every fifth patient to ensure consistent and accurate data collection. Univariate statistical analysis was performed with Microsoft Excel. Multivariate statistical analysis was completed with SPSS statistical package (Version 26.0, IBM, Somers, NY, USA). Pearson's Chi-squared tests were used for disease characteristics. A p-value of <0.05 was taken to be statistically significant.

The demographics, diagnosis and primary site statistics were calculated by number of patients (n=105). The relationship between nodal disease and the important variables of differentiation of tumour, location of tumour and TNM staging was measured using only patients that underwent a SND/MRND for OSCC (n=84). The nodal yield for each level of the neck dissection, and percentage of these with positive nodes was calculated. The average total nodal yield was calculated based on a level I–III and I–IV neck dissection for OSCC.

Results

There were 123 neck dissections performed on 105 individual patients from 2016–2021. There were a total of 111 SNDs, 1 MRNDs (with internal jugular vein sacrifice) and 11 ANDs. Eighty-four patients had a unilateral or bilateral neck dissection for OSCC.

Demographic data are reported for the total number of individual patients (n=105). Data on demographics is shown in Table 1.

Squamous cell carcinoma was the most common diagnosis and indication for having a neck dissection at 85%, followed by ameloblastoma at 2% and osteoradionecrosis at 2%. Data on diagnosis is found in Table 2. The most common primary site was the tongue, at 36% of patients, followed by alveolar mucosa of the mandible at 20%. There was one unknown primary. Information on primary site is found in Table 3.

When analysing the relationship between TNM staging and nodal disease, 84 patients who had a SND or MRND for OSCC were included. Seventeen percent of patients had occult nodal disease. Table 4 demonstrates the number of both clinical and pathological T1–T4 and N0–N3 tumours.

Forty percent (40%) of cT4 tumours had at least one positive metastatic node, followed by 29% with cT3, 38% with cT2 and 6.7% with cT1 tumours (p=0.1). The percentage of nodal metastatic disease was 40%, 30% and 6% in poorly, moderately and well differentiated tumours, respectively (p=0.04). This was the only statistically significant finding. Tumours of the

Table 1: Demographics of the 105 patients included in the study.

Demographic	Number (n)	Percentage (%)
Sex		
Male	54	49
Female	51	51
Age		
Min	25	
Max	91	
Average	65	
Median	65	
Ethnicity		
NZ European	77	73
Māori	19	18
Asian	4	4
Other European	2	2
Cook Island	1	1
Indian	1	1
Latin American	1	1
Smoking		
Never	45	43
Ex	43	41
Current	17	16
Alcohol		
Never	35	33
Ex	9	9
Current	61	58

Table 2: Diagnosis of the 105 patients included in the study.

Diagnosis	Number (n)	Percentage (%)
Squamous cell carcinoma	89	85
Ameloblastoma	3	3
Osteoradionecrosis	2	2
Osteomyelitis	2	2
Sarcoma	1	1
Small cell neuroendocrine tumour	1	1
Oncocytoma	1	1
Mucoepidermoid carcinoma	1	1
Metastatic adenocarcinoma	1	1
Melanoma	1	1
Brachial cleft cyst	1	1
Adenoid cystic carcinoma	1	1
Adenocarcinoma	1	1

Table 3: Primary site of the 105 patients included in the study.

Primary site	Number (n)	Percentage (%)
Tongue	38	36
Alveolar mucosa of mandible	21	20
Alveolar mucosa of maxilla	14	13
Buccal mucosa	11	11
Floor of mouth	9	9
Unknown primary	4	4
Soft palate	2	2
Parotid	2	2
Lip	2	2
Tonsil	1	1
Cheek	1	1

Table 4: The total number/percentage of clinical N0, N1 and N2 patients that had either pathological negative or positive nodal disease on histological examination.

Clinical	Number	Pathological	Number
cN0	58	pN0	48 (83%)
		pN+	10 (17%)
cN1	11	pN0	7 (64%)
		pN+	4 (36%)
cN2	15	pN0	4 (27%)
		pN+	11 (73%)

Table 5: The number dissected, average nodal yield, number and percentage of positive nodes of each neck dissection level.

Neck dissection level	Number dissected	Number of levels with pN+	% of positive levels	Average nodal yield	Literature review of average nodal yield per level
Ia	99	3	3	2.7	4–5.7
Ib	106	17	16	3.6	
IIa	114	15	13	5.6	11.2–12.6
IIb	101	0	0	5.7	
III	110	9	8	5.7	7.2–7.6
IV	72	2	3	4.7	6.9–8.7
V	3	1	33	3	9.7

tongue had the highest proportion of positive cervical nodal involvement at 33%. This was followed by the alveolar mucosa of the maxilla and buccal mucosa, both at 33%, and tongue at 24%. There were only two oral cavity primary tumours that involved the lip, one of which had positive nodal disease. These differences were not statistically significant (p=0.82).

Total nodal yield and nodal disease were calculated as a proportion of total neck dissections performed (n=112), excluding AND. There were 99 level Ia neck dissections with an average nodal yield of 2.7 nodes. There were 3 neck dissections with positive nodes in level Ia, which made up 3% of the total number of level Ia dissections. There were 106 level Ib dissections with an average nodal yield of 3.6, with 17 necks (16%) having positive nodal disease. There were 114 level IIa dissections with an average nodal yield of 5.6, with 15 necks (13%) having positive nodal disease. There were 101 level Iib neck dissections with an average nodal yield of 5.7, with no positive lymph nodes found. Level III was dissected 110 times with an average nodal yield of 5.7, with 9 (8%) cases showing positive nodal disease. Level IV was dissected 72 times with an average nodal yield of 4.7, and only 2 necks (3%) with positive nodal disease. These two neck dissections with positive nodal disease also had positive nodes in levels level Iia and Ib. Therefore, there was no evidence of skip metastasis to level IV. There were only three neck dissections that included level V. One out of three had positive nodes in this level that was identified in the preoperative staging and work up of this patient. This was a pT4N2cM0 SCC of the floor of mouth, and also had positive nodal disease in levels Ia and III. The results show that with a selective neck dissection of levels I–III (n=35) and I–IV (n=68), there was a total average nodal yield of 20.1 and 25.4, respectively. This information can be visually found in Table 5.

Complications were calculated as a proportion of total patients included (n=105). These were classified using the Clavien–Dindo system and assigned scores from 0–IIIb.[11] There were no deaths intra-operatively or in the post-operative inpatient stay. There were 38 (36%) patients that had a Clavien–Dindo score of 0, 4 (4%) with a score of I, 33 (31%) with a score of II, 20 (19%) with a score of IIIa and 10 (10%) with a score of IIIb. There was a chyle leak in two (2%) patients. Post-operative shoulder dysfunction was reported at 17%. This number included those that reported shoulder dysfunction of any kind (including mild symptoms) up to 5 years of post-operative outpatients follow up.

The most common Clavien–Dindo II complications were blood transfusions, post-operative delirium, hospital-acquired pneumonia and the need for vasopressor support to aid with post-operative free flap blood pressure targets. The most common Clavien–Dindo IIIa complication was drainage of neck seroma by aspiration in clinic or with ultrasound guided technique. Seventy percent (70%) of these patients with a IIIa complication also had a free flap reconstruction. The most common Clavien–Dindo IIIb complication was due to venous congestion (n=5) of the free flap. Of all the patients that returned to theatre, 90% also had a free flap reconstruction.

Discussion

Waikato Hospital services a population of over 930,000, with Māori representing 23.7%, higher than the national average of 17.4%.[12] In our study population, 18.1% of the study population were Māori, which is therefore consistent with the national ethnicity distribution but is approximately 5% lower than the regional distribution. Patient demographics of age (65 years) and rates of smoking and alcohol use is consistent with previous head and neck cancer literature in New Zealand. However, a male predominance was not found in our study, which may be due to our sample size.[13]

Nodal status is one of the most significant independent prognostic factors for head and neck cancer.[3] Therefore, gaining an adequate nodal yield to obtain a representative nodal sample is paramount. In review of the literature, the mean lymph node yield was between 8 and 39.8 in SNDs.[14–16] There is no definite minimum lymph node count defining an adequate neck dissection, but this topic is of interest.[17] One study showed that a total lymph node yield less than 18 for a neck dissection of levels I–III was associated with decreased disease free specific and overall survival.[18] Another study also showed that the minimum total lymph node requirement for a selective neck dissection was six.[14] The average nodal yield in this study was 20.1 (range of 8–44) for a SND of levels I–III and 25.4 (range of 14–54) for a SND of levels I–IV, which both lie in the upper end of similar reported literature.[15–18] There is an observed correlation between a higher nodal yield and the extent of the cancer.[18] The higher number of T4 tumours compared to other

stages reported in our data might then explain the higher lymph node yield in this study.

Whether or not to dissect level IIb during routine elective/therapeutic neck dissection procedures is an ongoing debate within the literature.[19,20] This discussion centres on the fact that one of the most common long-term complications from neck dissections of level IIb is shoulder dysfunction due to damage to the spinal accessory nerve (SAN). Such shoulder dysfunction can manifest as chronic pain, weakness and reduced range of motion, which all reduce quality of life.[21,22] A SND in a clinically node positive (cN+) neck will most likely include level IIb dissection, but can be modified to preserve level IIb when it is oncologically safe to do so.[19] The benefits of including level IIb in a SND is to ensure occult metastatic disease is not missed in these nodes. A prospective analysis of level IIb lymph node metastasis in END for OSCC showed that metastatic disease in level IIb occurred in 5% of neck dissections and was only found in association with tongue OSCC. In addition all patients with positive nodes in level IIb had positive nodes in level IIa.[21] The counter argument is formed when the risk of occult metastatic disease within level IIb is too low to provide any oncological benefit and comes with increased morbidity.[20] Several studies have reported that with oral squamous cell carcinoma the risk of level IIb metastasis is as low as 2%.[23] Our study adds to this argument, as there were no nodal metastasis found at level IIb in 101 dissections. Therefore, level IIb nodes could be left *in situ* without significantly compromising regional clearance, specifically in patients with a cN0 neck, primary site excluding the tongue and no suspicious intraoperative lymph nodes found at other neck levels.[19,21,24–26] Our study reported shoulder dysfunction in 17% of patients over the course of outpatient follow up. This was difficult to measure retrospectively, but given it is a major complication of head and neck surgery, it warrants further research.

A significant complication uniquely associated with dissecting level IV is the potential for a chyle leak, due to the injury of the thoracic duct. A chyle leak is rare but potentially serious complication that occurs in 2–8% of neck dissections.[27] It can be defined as an iatrogenic thoracic duct injury causing leakage of lymphatic fluid into the surrounding vessels.[28] Our study reported a chyle leak in two (2%) patients. Level IV carries a low risk of occult metastatic disease with OSCC.[3] Therefore, routine dissection of level IV remains controversial in the literature.[29] A meta-analysis conducted in 2019 demonstrated very low rates of skip metastasis to neck level IV in patients diagnosed with cN0 OSCC. Their study reported the risk of level IV involvement at 2.53% and the risk of level IV skip metastasis at 0.5%. Subgroup analysis confirmed that pathological nodes at level I–III were not associated with an increased risk of level IV involvement and that the risk of level IV involvement with oral tongue SCCs was 3.6%. The authors concluded that elective treatment of level IV is not required in patients with cN0 OSCC.[29] Our data had no skip metastasis to level IV, but there were two out of 72 cases (3%) of level IV involvement with OSCC. These two cases both had positive nodes at level I and IIa. One patient was a poorly differentiated cT4cN1 tongue OSCC and the other was a cT2cN1 poorly differentiated buccal mucosa mucoepidermoid carcinoma. Thus, clinicians should consider extending their neck dissection to level IV in patients with gross macroscopic disease in upper levels and with advanced oral tongue cancer.

Conclusion

This study reported demographics and risk factor prevalence consistent with similar published data worldwide. Our practice has changed to consider omitting level IIb and IV when oncologically safe to do so. Furthermore, the OMS unit at Waikato Hospital provides comprehensive treatment and obtains safe patient outcomes for patients undergoing neck dissections for the treatment of oral squamous cell carcinoma.

COMPETING INTERESTS
Nil.

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