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Retrospective Study of Nodal Yield from the Neck

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Abstract

Objective: To develop a protocol that can be utilised to audit and monitor performance of Head and Neck services. To determine whether the quantitative recovery of lymph nodes from the neck is dependent on operating surgeon, the type of neck dissection and effect of previous radiotherapy or chemo radiotherapy. The question is asked whether this data can be utilised to audit performance of head and neck services and to propose the number of nodes per level that would be considered adequate.

Methods: Retrospective analysis of data of 256 Neck Dissections (ND) from 210 patients with mucosal squamous cell carcinoma of the head and neck treated at St Georges Hospital between 2003 and 2007. Data were obtained for age, pre-operative TNM staging, surgeon, type of neck dissection, previous radiotherapy, previous chemo-radiotherapy, Total Nodal Yield per Neck Dissected (tNY), Positive Nodal Yield (pNY), Nodal yield per level of neck dissected. One-way analysis of variance was used to determine statistical significance amongst operating surgeons. The tNY and pNY were analysed with factorial analysis of variance to determine differences among types of ND and the effects of radiotherapy or chemotherapy.

Setting: The Thomas Tatum Head and Neck Unit at St Georges Hospital, Tooting, London.

Results: A significant difference in total nodal yield was found among dissections ($p < 0.001$). Selective neck dissection levels I-III mNY (Mean Lymph Node Yield) was 22.6, I -VI 30 and II-V 19.1. As one would expect the mNY (Mean Lymph Node Yield) from comprehensive ND I-V was 34.1. Previous radiotherapy significantly decreased mean tNY (Total Lymph Node Yield) whereas the presence or absence of preoperative radiotherapy had no significant effect on the positive nodal yield ($p = 0.6255$). The total nodal yield for levels I, III and V showed a higher variability between surgeons. The total nodal yield for selective neck dissection amongst all surgeons was more consistent (Range 19 to 26 nodes).

Discussion: The mean recovery rate of 34 nodes for comprehensive neck dissection (I-V) is near the upper limit of what has been reported in the literature. There are significant differences in the recovery of lymph nodes defined by level, and to our knowledge, no specific current guidelines exist in the literature or in the British Association of Head and Neck Oncologists to indicate the number of nodes per level that would be deemed acceptable to adequately stage the neck.

Conclusion: We propose that an average of 5 nodes per level should be deemed necessary to adequately stage the neck. The variability between surgeons is significant in harvesting lymph nodes in levels I, III and V. This may represent differences in surgical techniques or experience. Previous radiotherapy did not result in a significant reduction in the nodal harvest of the neck contrary to belief.

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Introduction

Head and Neck Mucosal Squamous Cell Carcinomas (HNMSCC's) make up the majority of head and neck cancers, and arise from mucosal surfaces throughout this anatomical region. These include tumors of the nasal cavities, paranasal sinuses, oral cavity, nasopharynx, oropharynx, hypopharynx, and larynx. Certain features of invasive mucosal carcinomas (type, size and grade of the primary carcinoma, the pattern of invasion and proximity of carcinoma to resection margins, lymph node status and the presence of extra nodal spread) have been shown to be related to clinical outcome [1-8]. Improvements in diagnosis and loco-regional surgical management, as well as adjuvant therapy, have led to improvements in quality of life and survival for head and neck cancer patients [9].

Surgical resection and or radiation therapy with or without chemotherapy are the mainstays of treatment for most head and neck cancers. For small primary cancers without regional metastases

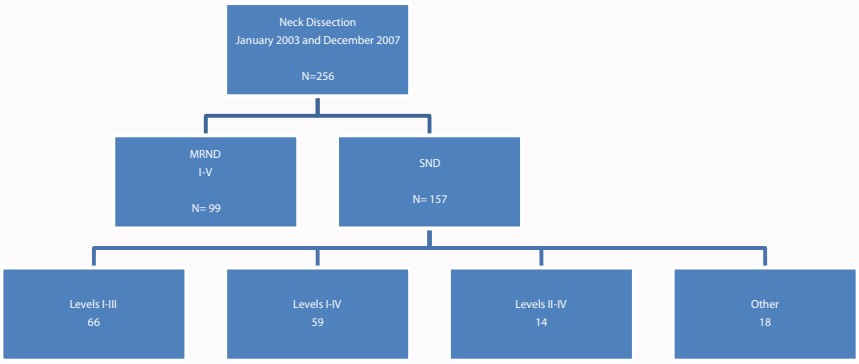

Figure 1: Within the study period there were total of 256 Neck Dissections.

(stage I or II), wide surgical excision alone or radical radiation therapy alone is used. For extensive primary tumors, or those with regional metastases (stage III or IV), primary chemo-irradiation with or without surgical salvage, or ablative surgery combined with post-operative adjuvant radiotherapy/chemo-irradiation may be appropriate depending on site and stage of disease.

Therefore correct and accurate analysis of the lymph nodes surgically excised in a head and neck cancer case is extremely important for the prognostic, diagnostic and treatment information it provides. In addition, optimal reporting of pathology specimens requires accurate specimen orientation and information from the surgeon.

Pathologists at the Thomas Tatum Head and Neck Unit, St Georges Hospital, follow the Royal College of Pathologists' Working Group on Cancer Services recommendations. Lymph nodes are identified by inspection and palpation of the specimen and assigned to the appropriate anatomical level indicated by surgical markers. Each discrete node is dissected out with attached per capsular adipose tissue. Larger nodes are bisected or sliced. If there is obvious metastatic tumour, the half/slice with the more extensive tumour is processed, together with the perinodal tissues to show the extent of extra capsular spread. If the node appears negative, all slices are processed. Small or flat nodes are processed whole, and where there are several nodes present from the same anatomical level, these are processed within the same cassette. An alternative method that was used in the dissection specimens prior to the Cancer Data set 2005 guidelines for selective dissections is to serially slice the fixed specimen and to embed all of the tissue [10]. Care was taken not to double-count larger nodes that are present in more than one block. Large nodes containing obvious metastatic carcinoma are sampled to identify any extra capsular spread. In recording the number of lymph nodes, the pathologists include all palpable nodes greater than 3 mm in diameter.

Gibbs P et al. [11] carried out an extensive study of more than 9000 patients Lymph Node Yield with colorectal cancer. They showed that there are multiple clinico pathologic factors that affect the LNY (Lymph Node Yield). The overall median LNY was 12 (Range 0 to 174). There was variation between centers as well as type of operation. Interestingly for colorectal cancer, tumors stage and differentiation did not influence node yield.

In a study by Batsakis, involving 20 cadaveric neck dissections [12], a quantification of lymph nodes in neck dissection took place. The average number of lymph nodes removed for levels I-V was 24,

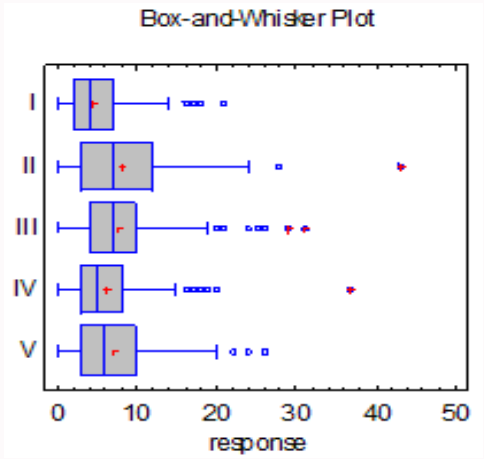

Figure 2: Results of the Nodal Yield per level.

with 13 for levels I-III and 19 for levels I-IV. Friedman et al. [13] concluded that the number of lymph nodes removed in selective neck dissection should be comparable to that of the corresponding levels in radical neck dissection, provided that strict adherence to surgical boundaries is maintained.

In patients with mucosal squamous cell carcinoma of the head and neck, cervical lymph node metastasis remains the single most important prognostic factor yet. There is wide variability in neck dissection nodal yields. The literature provides little information with respect to operator variation, nodal yield per level dissected from non-irradiated necks when compared to previously irradiated necks.

Tahwinder Upile et al. [14] analyzed over 200 neck dissection specimens. The neck dissection specimen was divided in theatre by surgeons into the appropriate levels and the separate pieces are placed in labeled pots containing 10% buffered formalin. This method was proposed to offer greater accuracy in reporting levels and yield from neck dissection.

Historically after Crile published his work in 1906 on neck dissection there was little in the literature about the systematic use of Radical Neck Dissection (RND) until Hayes Martin published his work in Cancer, 1951 and later wrote his textbook on Head and Neck Tumors in 1957. In 1967, Bocca and Pignataro published their work on a more conservative approach to neck dissection. The number of lymph node harvested as a "count" was not recorded in these publications.

SnapStat: Multiple Sample Comparison

Selection variable: Total

Sample	Count	Mean	Sigma
I	266	4.55095	3.44967
II	302	8.11961	6.22654
III	299	7.6443	5.67944
IV	229	6.05704	4.85593
V	142	7.1419	5.65382
	1238	6.74437	5.4352

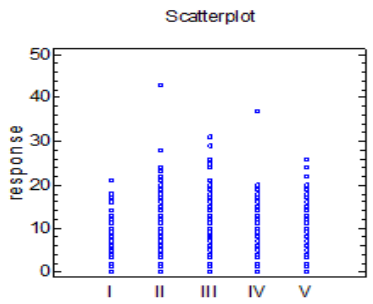

Figure 3: Box and Whisker plot showing each level and number of nodes in each box. Largest yield in level II mean of 8.1.

By 2002, several authorities and institutions revised the classification of neck dissections. Cervical nodal yield gaining popularity in multidisciplinary team discussions. Surprisingly few publications on the topic exist. There is, therefore, a need to define a standard with regards to nodal harvest per level that is deemed representative for staging purposes. This will give accurate prognostic information and guide adjuvant therapy appropriately, and facilitate data collection and research.

Methods and Materials

The pathology reports of 256 ND performed at St George's Hospital between January 2003 and December 2007 relating to 210 patients with HNMSCC of the H&N was analyzed. Patients with recurrences other than in the neck or had previous ND were excluded. All the pathology reports were analysed according to the Royal College of Pathologists Minimum Dataset [Datasets for histopathology reports on head and neck carcinomas and salivary neoplasm's (2nd edition) 2005]. All the neck dissections were performed or directly supervised by a Consultant of the H&N Surgical Services of SGH. The nodal yield per type of ND and per level of ND were analysed according to the HNSAOHNS 2002 classification. The data was introduced to a Microsoft Excel spread sheet and then exported to a Statgraphics Centurion statistics program and the results statistics validated by a teaching hospital reader and senior statistician at St Georges Hospital.

Results

Results of the nodal yield per level: The 'SnapStat', histograms, 'Box and Whisker' plot as well as time sequence were plotted for each level. The 95% confidence intervals and the Shapiro- Wills P-Value were calculated. The median number of nodes was found to be between 6.7 nodes per levels (Table 1, Figure 1,2 and 3).

Statistical summary of the analysis of all nodal yield per level demonstrate that with 95% certainty Range is 4 to 8 nodes per level were harvested in our sample. The median is a much more accurate as some data was skewed.

Analysis of variance results for yield by surgeon: Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the mean Total from one level of Surgeon to another at the 95.0 % confidence level (Figure 4).

Previous radio-chemotherapy and nodal yield: Multiple-Sample Comparison (previous radio-chemotherapy) sample was analyzed for each of the levels. Since the P-value of the F-test is greater than or equal to 0.05, there is not a statistically significant difference between the means of the 5 variables (Levels I -V) at the 95.0% confidence level.

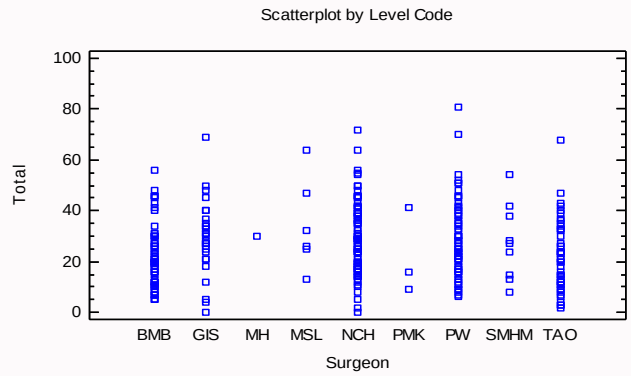

Figure 4: Consultants 2, 5, 7 & 9 show lymph node harvest >60 NODES in total per ND**.** 95% confidence level statistically significant p value of the f-test is less than 0.05. Analysis of variance results for yield by surgeon.

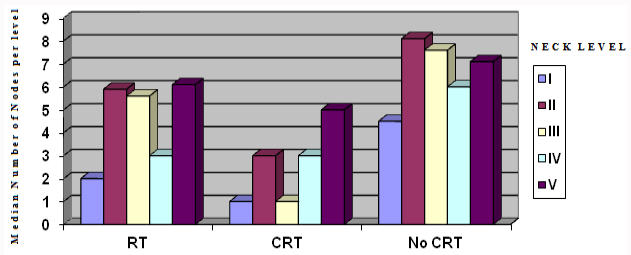

Figure 5: Previous Radio-chemotherapy and Nodal Yield.

Table 1: Results of the Nodal Yield per level.

Level	Range	Mean
I	4.1-5.1	4.5
II	7.5-8.5	8.1
III	7.1-8.0	7.6
IV	5.5-6.3	6
V	6.4-7.7	7.1

When the post op radio-chemotherapy group was compared with the previous radio-chemotherapy group, the small sample of 20 cases did yield a lower Lymph Node Yield in the previous radiotherapy sample with statistical significance for levels IV and V only (Figure 5).

Discussion

A preliminary clinico-pathological survey carried out by NSB Tanner et al. [15], presented radical neck dissections from 50 patients with advanced (T3, T4) squamous carcinomas of the head and neck,

previously treated by irradiation and combination chemotherapy. The total yield of lymph nodes (1411) from these dissections was high–mean of 28 nodes per dissection, range 8 to 60. This correlates with our study (Range 6 to 82). In terms of lymph node per level in irradiated neck our statistics show a median yield per level of 5 nodes. There were no statistical significance between non-irradiated and irradiated necks for SND level I, II and III. ND involving levels IV and V did show statistical significance $P < 0.05$ when using cluster analysis as well as multivariable analysis following radiotherapy or chemo-radiotherapy [16,17].

Conclusion

The total nodal yield differs among types of neck dissection, with comprehensive neck dissections yielding more nodes than the selective neck dissection. Furthermore, as expected, the rate of positive nodal yield is statistically different amongst different types of neck dissections. Comprehensive neck dissection yielding a higher rate of positive nodal yield compared to selective neck dissection. The rate of total nodal yield differs among different surgeons. It is in our opinion that this may be the case related to the number of neck dissections performed per year.

Radiotherapy does not achieve a significant reduction in the nodal content of the neck contrary to belief. In this study this was the case in selective neck dissection, however, in the comprehensive neck dissection there was a statistically significant reduction in particular levels IV and V. Bhattacharyya, who looked at 110 patients and concluded that radiotherapy significantly reduced Lymph Node yield never pointed out in their work whether there are any statistical differences between neck levels or types of necks dissected. A median of 5 nodes per level was harvested from all neck dissections. There is limited information in the literature regarding factors that may affect the yield of lymph nodes from neck dissection. We were able to show from this sample that factors such as operator/surgeon, previously irradiated necks and the type of neck dissection can affect the nodal yield. It is important to harvest a representative number of lymph nodes in order to stage the neck. Recording of nodal yield per level would allow the accurate and equitable comparison of surgeons in different surgical units, in order to identify good surgical and pathological practice, and the comparison of patients in clinical trials. Furthermore sufficiently accurate pathological information is essential in recording clinical data, for the patient to be given a prognosis. It is proposed that a minimum of five nodes per level dissected is required to stage the neck.

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