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# Selective neck dissection in the management of squamous cell carcinoma of the upper digestive tract

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**Abstract** Selective neck dissection has been used clinically in elective treatment of carcinoma, although many surgeons continue to advocate modified radical or radical neck dissection for therapeutic management of the neck. In a retrospective study 167 previously untreated patients were reviewed following curative laser microsurgical resections of oral or pharyngeal primary tumors and a uni- or bilateral selective neck dissection. In all, 221 (54 bilateral) neck dissections were performed. In patients with oral primary disease lymph nodes of levels I–III were removed, while nodes in levels II and III were removed in patients with pharyngeal tumors. Level IV was dissected when several metastases were suspected during operation. The posterior triangle was not dissected. Lymph nodes were histopathologically negative in 73 patients and positive in 94 patients. Twenty-five of these latter cases had pN1 disease, 55 had pN2b disease and 10 had bilateral lymph node metastases. Twenty patients in the pN0 group and 63 patients in the $pN^+$ group received postoperative radiotherapy (to 56.7 Gy to the primary site and 52.5 Gy to the neck). With a median follow-up interval of 34 months, recurrence in the dissected neck occurred in 3 of 73 patients (4.1%) with pN0 disease and 6 of 90 patients (6.6%) with $pN^+$ necks. Four patients with $pN^+$ necks had simultaneous recurrences at the primary site. The addition of adjuvant radiotherapy seemed to improve disease control in the neck and improve overall survival in patients with an unfavorable prognosis due to multiple metastases or metastases with extracapsular spread.

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**Key words** Squamous cell carcinoma · Selective neck dissection · Upper digestive tract

## Introduction

It is well recognized that the status of the cervical lymph nodes is a most important prognostic factor for patients with squamous cell carcinoma of the upper aerodigestive tract. In general, the presence, number, size, level and extranodal spread of cervical lymph node metastases significantly reduce locoregional control and survival rates of the patients.

Until the late 1960s the classical radical neck dissection described by Crile [7] in 1906 remained the unquestioned surgical approach to the neck nodes in patients with carcinoma. In 1963 a conservative technique for neck dissection was proposed by Suarez and then popularized by Bocca et al. [1]. The rationale for this operation was based on anatomical observations showing that the lymphatic system of the neck is located in the adipose tissue with no lymphatic pathways existing beyond the aponeurotic sheaths of the neck. By stripping the aponeurotic covering from muscles and vessels, the whole soft tissue together with the lymphatic system could be dissected oncologically radical with preservation of the sternocleidomastoid muscle, the internal jugular vein and the spinal accessory, hypoglossal and recurrent nerves.

Besides functional and cosmetic advantages the modified neck operation allows simultaneous bilateral dissections to be performed and widens the indications for elective treatment. The operation with removal of the lymph nodes at levels I–V and preservation of one or more non-lymphatic structures has now been defined as the "modified" radical neck dissection by the American Academy of Otolaryngology, Head and Neck Surgery [17].

The concept of "selective" neck dissections is based on several large clinical [12] and postsurgical studies on prevalence and distribution of lymph node metastases in specimens from complete, mostly elective, radical neck dissections for previously untreated primary tumors of the

upper aerodigestive tract [3–5, 19–21]. In selective neck dissections only the lymph node groups at highest risk to contain metastases are removed and the non-lymphatic structures are usually preserved.

Modified radical and selective neck dissections are now widely performed, especially in the clinically negative neck. However, clinicians are divided in their opinions as to when modified or selective procedures should be carried out in the clinically positive neck. We have analyzed our experience with selective neck dissection in order to assess its efficacy when performed in N0 patients and patients with lymph node metastases.

## Patients and methods

Between August 1986 and June 1993, 181 patients with previously untreated squamous cell carcinomas of the oral cavity, oropharynx or hypopharynx were treated for cure by endoral or transoral laser microsurgical resection of the primary tumor and a discontinuous and delayed uni- or bilateral neck dissection, by the ENT staff at University Hospital, Göttingen. Patients with fixed neck node metastases (N3), distant metastases and simultaneous second primaries were excluded from this analysis. Fourteen of the 181 patients were not clinically considered to have N3 necks, but underwent either a classical or a modified radical neck dissection because of their disease. These latter patients were also excluded from the analysis of the present study. In order to achieve a homogeneous group, patients with laryngeal carcinomas were not included, since these latter tumors in general were considered to have a lesser tendency to metastasize.

### Patients

The 167 patients reviewed ranged in age from 20 to 84 years (mean age 55 years). One hundred and thirty-nine were men and 28 were women. Primary tumors were located in the oral cavity (56 patients), oropharynx (72 patients) and hypopharynx (39 patients). Staging was done according to the 1992 UICC criteria (Table 1).

Neck dissection was performed electively in 82 patients who had clinically uninvolved necks (N0). Therapeutic neck dissections were performed in 85 patients when metastatic nodes were suspected clinically. For clinical staging of the neck nodes, palpation and (since 1989) ultrasonography were used. Fine-needle aspiration cytology, computed tomography and magnetic resonance imaging were not routinely employed.

Two hundred and twenty-one selective neck dissections were performed in 167 patients. Fifty-four patients underwent synchronous bilateral procedures. Of the latter patients, all had primary tumors extending to or across the midline. As the $CO_2$-laser microsurgical resection of the primary tumor was accomplished endorally or transorally without defect repair by flaps, neck dissection was carried out discontinuously and delayed. The time delay incurred had a mean interval of 10 days and was required for different reasons, as – for example – to prevent fistula formation after extensive primary resections.

**Table 1** Distribution of pT categories according to the UICC 1992 classification ($n$ = 167)

| Site | pT1 | pT2 | pT3 | pT4 | Total |
|---|---|---|---|---|---|
| Oral cavity | 9 | 27 | 14 | 6 | 56 |
| Oropharynx | 10 | 25 | 22 | 15 | 72 |
| Hypopharynx | 7 | 20 | 7 | 5 | 39 |
| Total | 26 | 72 | 43 | 26 | 167 |

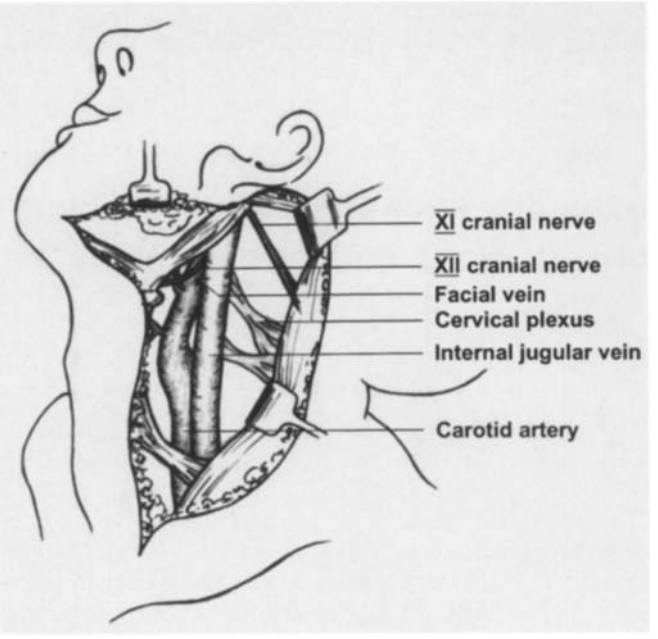


**Fig. 1** Schematic artist's drawing of the selective neck dissection with clearing of surgical levels II and III

### Operative technique

Each selective neck dissection was carried out as described by Bocca et al. [1] and was limited to certain lymph node levels. The operation began with incision and elevation of the external cervical fascia to expose the sternocleidomastoid muscle. The spinal accessory nerve was identified at its entrance into the muscle. The internal jugular vein was skeletonized and the medial margin of the sternocleidomastoid muscle retracted posteriorly. The node-bearing tissue was then dissected from the prevertebral fascia from the posterior belly of the digastric muscle and the anterior border of the levator scapulae muscle. The specimen was slid under the spinal accessory nerve and the dissection completed by exposure of the prevertebral fascia. The roots of the cervical plexus were preserved as possible. The dissection was then carried down to the omohyoid muscle to clear levels II and III (Fig. 1). The muscle was transsected at the tendon and the dissection carried down to the clavicle if level IV was also cleared. When indicated, the submandibular and submental nodes (level I) were removed together with the fascia and submandibular gland.

A total of 221 dissections were performed: in 52% the dissection was confined to all lymph nodes of levels II and III, in 38% to levels I, II and III and in 10% lymph nodes of level IV were included in the operation (Fig. 2). In patients with oral primary tumors, lymph nodes of levels I, II and III were usually removed (as a supraomohyoid neck dissection). In the majority of oropharyngeal and hypopharyngeal primaries the lymph nodes of levels II and III were dissected. When several metastases were suspected during the neck dissection, lymph nodes of level IV were additionally removed.

### Histopathology

The specimens of the neck dissections were fixed in 4% formalin. All lymph nodes visible or palpable were dissected from fat. All nodes that were 5 mm or larger were cut in halves. From each node

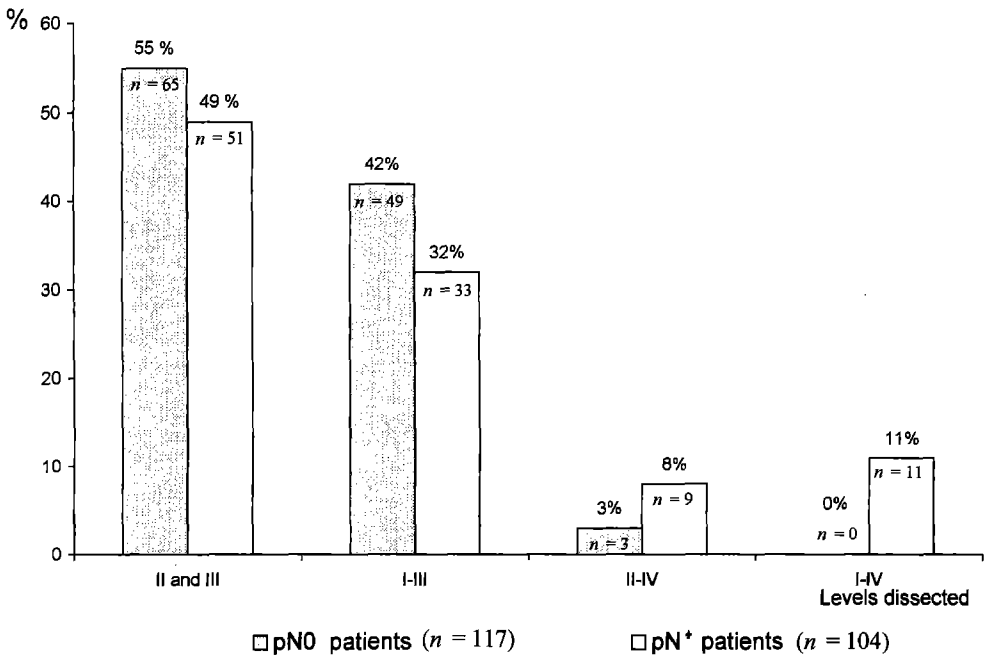


**Fig. 2** Distribution of the types of selective neck dissection performed in pN0 patients ($n$ = 117) and in $pN^+$ patients ($n$ = 104)

two or three 1-μm-thick sections were obtained and stained with hematoxylin and eosin.

### Postoperative radiotherapy

Eighty-three patients underwent postoperative adjuvant radiotherapy at the Department of Radiation Medicine, University Hospital, Göttingen. The radiotherapy was directed at the primary site, the dissected and contralateral necks. Indications for irradiation included advanced pT stage of the primary tumor with inadequate surgical margins despite re-resection (R1 resection), one or more lymph node metastases, lymph node metastases with extracapsular spread and suspect occult retropharyngeal lymph node metastases from primary tumors likely to metastasize to those nodes (i.e., carcinoma of the oro- or hypopharynx with midline origin). Since many patients declined adjuvant radiotherapy despite clinical recommendations for further treatment, fewer patients were irradiated than met the above criteria. A split-course accelerated treatment was utilized. The single dose was 2.1 Gy per fraction applied twice daily with four sessions a week. This schedule was repeated after a 2-week interval. The total radiation dose was 56.7 Gy to the primary site and 52.5 Gy to both sides of the neck.

### Adjunctive chemotherapy

Cisplatinum (6 mg/m$^2$) or carboplatinum (50 mg/m$^2$) was infused over 60 min prior to the first fraction of each radiation day in selected patients. Eight patients received cisplatinum and 45 patients carboplatinum. Thirty patients had no chemotherapy because of reduced renal function or poor general condition.

### Statistical methods

The median follow-up period was 34 months (range 20–97 months). Survival calculations were determined by the Kaplan-Meier method [9]. The overall survival time was defined as the interval between the date of surgery and the date of the last consultation, or date of death. Multivariate analysis was carried out by Cox proportional hazards regression to determine the influence of pT and pN categories, extracapsular spread and postoperative radiotherapy on overall survival [6]. Variable selection was done by backward elimination.

## Results

Among the 82 patients undergoing elective neck dissection (N0), excised nodes were free of disease in 62 cases (76%). Metastases were found in the remaining 20 patients (24%). Nodal metastases were confirmed in 74 of the 85 patients (87%) who were staged clinically as node-positive ($N^+$).

The average number of nodes examined was 25 per specimen. Histologically, the surgical specimens of 117 neck sides were node-negative. One or more lymph node metastases were found in 104 neck dissection specimens, with nodal metastases varying from 0.5 to 5 cm in size (median diameter, 2.0 cm). With the method of histopathological work-up used, one or more metastases with extranodal spread were detected in 30 of 104 node-positive neck dissections. The incidence of extranodal spread was distributed equally among all primary sites: oral cavity 28.5%, oropharynx 34%, hypopharynx 30.4%. In neck dis-

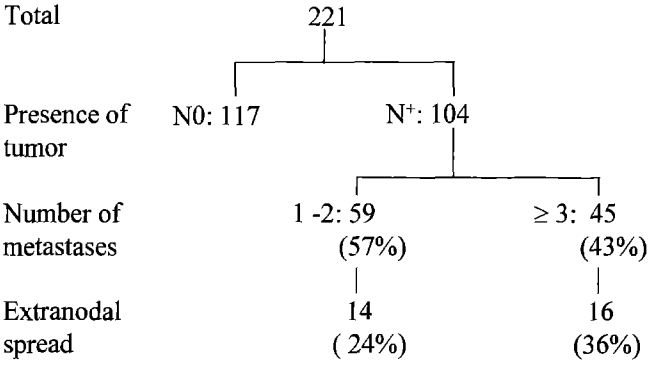


**Fig. 3** Histopathological findings in 221 selective neck dissection specimens

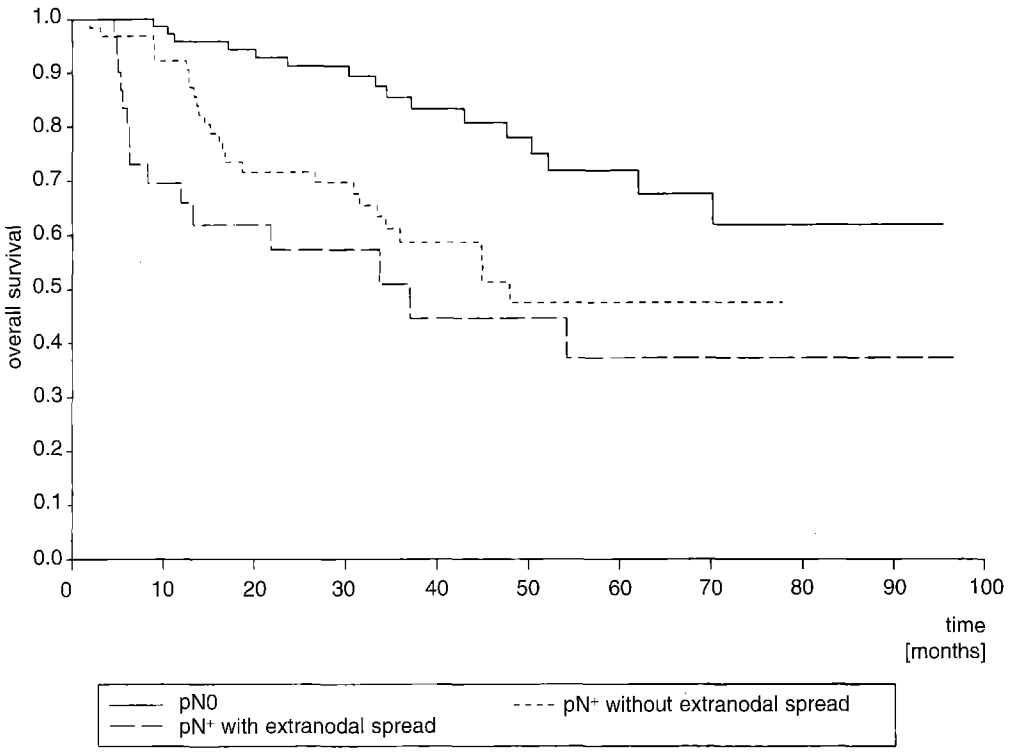


**Fig. 4** Kaplan-Meier estimates of overall survival of patients staged pN0 ($n$ = 73), pN+ without extranodal tumor spread ($n$ = 64) and pN+ with extranodal tumor spread ($n$ = 30)

section specimens with one or two positive nodes, extranodal spread was present in 24% and increased to 36% in specimens with three or more positive nodes (Fig. 3). Furthermore, there was an overall positive correlation between the incidence of extranodal spread and pT category of the primary tumor (pT1 18%; pT2 26%; pT3 36%; pT4 47%).

The distribution of the pN categories according to the 1992 UICC classification is shown in Table 2. Among the 73 patients with histologically uninvolved lymph nodes, 20 patients received postoperative radiotherapy. The indications were advanced pT stage (pT3 and pT4) with positive resection margins despite re-resection (12 patients) and the prophylactic treatment of retropharyngeal lymph nodes (8 patients).

Postoperative radiotherapy was given to 63 of 94 patients with histologically proven lymph node metastases. These included 14 of 25 patients with pN1 disease, 2 of 4 patients with pN2a disease, 38 of 55 patients with pN2b disease, and 9 of 10 patients with pN2c disease. Twenty-four of 30 patients with extracapsular spread underwent postoperative radiotherapy.

**Table 2** Distribution of pN categories according to the UICC 1992 classification ($n$ = 167)

| | pN0 | pN1 | pN2a | pN2b | pN2c | pN+ |
|---|---|---|---|---|---|---|
| Oral cavity | 35 | 10 | 0 | 9 | 2 | 21 |
| Oropharynx | 22 | 12 | 3 | 29 | 6 | 50 |
| Hypopharynx | 16 | 3 | 1 | 17 | 2 | 23 |
| Total | 73 | 25 | 4 | 55 | 10 | 94 |

In the group of patients with tumor-free neck dissection specimens (pN0; $n$ = 73), recurrence in the operated neck with local control occurred in 3 patients (4.1%) within 12 months. The primary site was the oral cavity in 2 patients and the hypopharynx in 1 patient.

In the group of patients with tumor-positive neck dissection specimens (pN+; $n$ = 94), 4 patients developed locoregional recurrences. These patients were excluded from our calculation of the recurrence rate, since failure in the neck was assumed to be a result of failure to control the primary tumor, with subsequent reseeding in the neck. In the group of patients with tumor-positive neck dissection specimens having their primary tumors controlled ($n$ = 90), 6 patients (6.6%) developed recurrent metastases after an average of 9 months. The primary site was the oropharynx in 5 patients and the hypopharynx in 1 patient. Four recurrences developed in necks staged pN1 and 2 recurrences in necks staged pN2b. In a patient staged pN1, extracapsular spread was present.

Eight of 9 patients with late (pN0/rN+) or recurrent (pN+/rN+) metastases developed a recurrence in the ipsilateral neck in the dissected levels II and III. One patient with a carcinoma of the uvula had a recurrence in the retropharyngeal lymph nodes outside the dissected area. Recurrent metastases in level V or in the contralateral, unoperated neck were not observed.

The overall treatment failure in the necks of patients initially treated with surgery alone was 7.2% (6 of 83 patients, with 1 patient excluded whose primary tumor was uncontrolled at the time of neck recurrence). The overall failure rate after combined therapy was 3.8% (3 of 80 patients, excluding 3 patients with locoregional recurrences). In the pN0 group none of the 3 patients with late

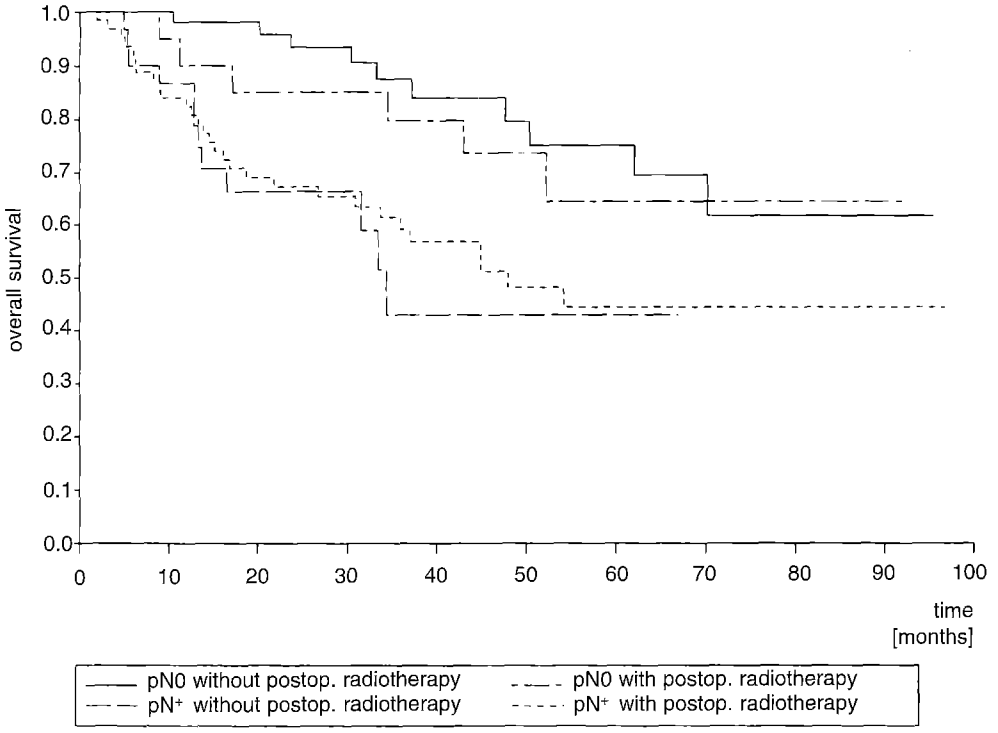


**Fig. 5** Kaplan-Meier estimates of overall survival of patients staged pN0 after postoperative radiotherapy ($n = 20$), pN0 without postoperative radiotherapy ($n = 53$), pN+ with postoperative radiotherapy ($n = 63$) and pN+ without postoperative radiotherapy ($n = 31$)

metastases had postoperative radiotherapy. In the pN+ group, 6 patients developed recurrent metastases, with 3 of the patients receiving postoperative radiotherapy. These latter patients died due to uncontrolled tumor in the neck. The 6 patients who had not been irradiated were salvaged by radical neck dissection and postoperative radiotherapy. Five patients are still alive, but 1 patient died due to a second cancer that occurred in the lung.

There were significant differences in overall survival for patients with uninvolved nodes, and patients with involved nodes without and with extracapsular spread (Fig. 4). The survival rates for irradiated and non-irradiated patients are similar in the node-negative and node-positive groups (Fig. 5). The findings of the Cox regression were in concordance with the results of the Kaplan-Meier estimates of the overall survival time. The variables of pT and pN categories combined with extracapsular spread were selected as significant predictors for overall survival of the patients (Table 3), although no significant effect could be proven for radiotherapy. The risk of death was 2.2 times greater for patients with pT3 and pT4 tumors than for patients with pT1 and pT2 tumors. Node-positive patients with extranodal spread had a 3.2 times greater risk, while node-positive patients without extracapsular spread had a 2.3 times greater risk of dying compared with node-negative patients.

**Table 3** Prognostic factors in a Cox proportional hazards model ($n = 167$)

| | | Risk ratio | 95% confidence interval | $p$ value |
|---|---|---|---|---|
| pT category | T1, T2 | 1.0 | | |
| | T3, T4 | 2.2 | 1.3–3.8 | 0.0040 |
| pN category and extranodal spread (ENS) | pN0 | 1.0 | | |
| | pN+ without ENS | 2.3 | 1.2–4.2 | 0.0108 |
| | pN+ with ENS | 3.2 | 1.5–6.5 | 0.0016 |

## Discussion

Since the early metastasizing of head and neck carcinomas commonly follows predictable routes, the practice of performing selective, mostly supraomohyoid, dissections in the clinically N0 neck has become a standard practice in some institutions. In general a modified radical neck dissection is preferred for such cases.

In several large studies it was found that the majority of occult metastases in specimens of elective radical neck dissections occurred in levels I, II and III. Candela et al. [4] found that level V involvement was always associated with metastases at other levels. This observation was also reported by others [19–21]. Shah [19] observed involvement of level IV in 3% in N0 necks versus 17% in N+ necks and level V involvement in < 1% in N0 necks versus 6% in N+ necks. He concluded that his data supported the trend for "selective limited" neck dissections in both N0 and N+ patients. Supraomohyoid neck dissection (clearing levels I, II and III) was recommended for N0 patients with carcinoma of the oral cavity and anterolateral neck dissection (clearing levels II, III and IV) for N0 patients with carcinoma of the oropharynx, hypopharynx and larynx.

The favorable results achieved with "complete" functional neck dissections (i.e., modified radical neck dissections) in elective and therapeutic treatment of the cervical lymph nodes in laryngeal carcinomas and the observation that the majority of metastases were located in the jugular nodes encouraged Steiner [24] to perform "limited" (selective) functional neck dissections with clearing of levels II and III for these indications. Such surgery has been done routinely since 1979.

In the present study, selective neck dissection was performed as an elective or therapeutic procedure. Twenty-four per cent of the clinically N0 patients had lymph node metastases in the neck postoperatively. The relatively high rate of undetected metastases may be attributable to the fact that ultrasonography was used routinely in patients at our hospital only after 1989.

It is difficult to compare the results of the various studies on the efficacy of neck treatment published by different institutions because of differences in patient selection, varying treatment modalities for primary tumor and the neck, whether or not adjuvant radiotherapy was used and the way of reporting the results. To us, the most important criterion for the efficacy of treatment was the regional relapse rate after neck treatment.

For the histopathological tumor-negative neck a recurrence rate of 4.1% was found in our study. This is in accordance with other reports. Byers et al. [3] reported an incidence of neck recurrences in 6.9% of pN0 patients undergoing various types of selective neck dissections. Spiro et al. [22] reported a neck failure rate of 5% (i.e., 3 of 64 patients) in pN0 patients undergoing supraomohyoid neck dissections. The incidence of neck recurrences in similarly operated patients has varied from 4.7% to 10.3% [8, 10, 16, 22, 23]. In general, there seem to be no great differences in results reported for selective and modified radical neck dissections in histopathologically tumor-negative necks [2, 11].

As the majority of head and neck surgeons use modified radical or classical radical neck dissection in cases of proven metastases, there is only limited information available about the efficacy of selective neck dissection as a therapeutic procedure. Its value still remains controversial. Many head and neck surgeons use selective neck dissection as a "staging procedure." In the case of metastases proven by frozen section biopsy [13] or suspected clinically, surgery is performed as a modified radical or radical neck dissection. Additionally, postoperative radiotherapy is commonly used in node-positive patients after selective neck dissections [23].

It should be understood that selective neck dissection was originally designed for the elective treatment of the neck. As such, most reports on its efficacy in the treatment of metastases are concerned with cases operated on electively that turned out node-positive postoperatively. Spiro et al. [22] reported a 15% failure rate in the necks of patients with occult metastases (4 of 26 cases). When neck nodes were involved both clinically and pathologically, neck recurrences developed in 29% (5 of 17 cases) despite the addition of postoperative radiotherapy. Comparable results have been reported at other centers [2, 10, 16]. In cases with multiple positive nodes Byers et al. [2] found an incidence of 24% (5 of 21 cases) neck recurrences after surgery and 15% after surgery and radiotherapy (6 of 41 cases). After selective node dissections alone, Spiro et al. [23] were able to salvage 4 of 6 patients with recurrent disease by further surgery or surgery and radiotherapy. The recurrences were located in each instance at or beyond the posterior limit of the jugular node dissection. Spiro then concluded that in some of the patients the initial dissections had been less than complete. For the node-positive neck a similar failure rate has been reported following modified radical neck dissection with or without adjuvant radiotherapy [11].

In our present study, a neck failure rate of 6.6% was found for histopathological node-positive necks. This is comparable to the failure rates after modified radical and after various forms of selective neck dissections reported in the literature.

Eight of nine recurrences occurred in the ipsilateral neck in dissected levels II and III. That no recurrence was found in the contralateral undissected neck suggests that patients requiring bilateral dissections were properly selected. In the series reported by O'Brien et al. [15] the incidence of contralateral recurrences in the N0 neck was 12%. Byers et al. [2] observed a recurrence rate of 2.8% (3 of 106 patients) in the clinically N0 contralateral necks, but these necks were included in the radiotherapy field. A somewhat greater recurrence rate was found in the contralateral N0 neck not dissected or irradiated (6.6%; 12 of 182 patients).

Spiro's group [22] reported a neck failure rate of 3.1% outside the dissected area in pN0 patients undergoing supraomohyoid neck dissections. However, in the majority of reports, no data are available as to whether metastases recurred within or outside the previously dissected fields.

Histological factors increasing the likelihood of neck recurrences are the presence of extracapsular spread and the involvement of multiple nodes at multiple levels. The addition of postoperative radiotherapy is considered to improve disease control at the primary site and in the neck [14, 25, 26], but some reports have suggested that survival may not be greatly influenced [14, 27].

In our study, the overall treatment failure rate in the necks of patients initially treated with surgery alone was 7.2%. The overall failure rate after combined therapy was 3.8%. Survival rates were similar with or without adjuvant radiotherapy in both postoperatively node-negative and node-positive patients (Fig. 5).

Our results must be interpreted in view of an inherent selection bias. The patients of the node-negative and node-positive groups who were treated by a combined approach had several unfavorable prognostic factors. In contrast, the group treated by surgery alone had fewer patients with more than one histologically proven lymph node metastasis or metastases with extranodal spread. Still, our findings demonstrate a trend towards improved survival by the addition of radiotherapy to those patients

with a known unfavorable prognosis. Based on the number of cases presented here, it is not possible to determine whether or not the addition of chemotherapy concurrently with the accelerated radiotherapy had any influence on neck recurrence rates or prognosis.

In conclusion, our present study has shown that the surgically demanding selective neck dissection, if performed with care, is efficient in both the elective and therapeutic treatment of cervical lymph nodes in patients with oral, oropharyngeal and hypopharyngeal cancers. The main advantage is that selective approaches further reduce postoperative disfigurement and dysfunction, which can still be significant after modified radical neck dissections [18].

With respect to regional control our results achieved with selective neck dissections with or without postoperative radiotherapy were comparable to the results reported after (modified) radical neck dissections with or without postoperative radiotherapy. With regard to overall survival it seems possible that the addition of postoperative radiotherapy does improve survival of those patients with generally poor prognoses. Thus, when critically indicated, the selective neck dissection is a significant contribution to the concept of less invasive surgery in the cancer patient, offering functional and aesthetic advantages without oncological compromise.

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