Oral Oncology 102 (2020) 104565

Contents lists available at ScienceDirect

Oral Oncology

journal homepage: www.elsevier.com/locate/oraloncology

Selective neck dissection in the treatment of head and neck squamous cell carcinoma patients with a clinically positive neck

Fernando López (MD, PhD, FEBORL-HNS)*, Laura Fernández-Vañes (MD, MSc), Patricia García-Cabo (MD, PhD), Gianluigi Grilli (MD), César Álvarez-Marcos (MD, PhD), José Luis Llorente (MD, PhD), Juan Pablo Rodrigo (MD, PhD)

Department of Otolaryngology, Hospital Universitario Central de Asturias, ISPA, IUOPA, University of Oviedo, CIBERONC, Oviedo, Spain

ARTICLE INFO

Keywords:
Head and neck cancer
Neck dissection
Selective neck dissection
Nodal metastases

ABSTRACT

Objective: To determine the effectiveness and outcomes of SND in the treatment of patients with squamous cell carcinoma of the head and neck (SCCHN) with clinically positive neck (cN+) at diagnosis.
Material and Methods: We retrospectively reviewed 159 patients with SCCHN with cN+ at diagnosis, who underwent a SND with curative intent at a tertiary care academic teaching hospital in Spain. We registered patient and tumor characteristics, date and site of recurrences, together with the outcomes. Survival rates were calculated by the Kaplan-Meier method. The minimum follow-up was 18 months or till death.
Results: A total of 28 neck recurrences were found in the whole series but only 10 neck recurrences occurred in absence of local recurrence. The regional control in the neck in absence of local recurrence was observed in 94% of patients. The neck recurrence rates did not correlated with the pN classification (P = 0.49), the administration of postoperative radiotherapy (P = 0.49) or extranodal extension (P = 0.43). The 5-year regional recurrence-free survival rate was 80% and 92% if only isolated neck recurrences are considered.
Conclusions: SND offers an effective and oncologically safe surgical procedure in selected patients with clinically positive metastatic nodes in the neck. Our findings suggest that in cN1 and cN2 tumors, SND could replace the modified radical neck dissection without compromising oncologic efficacy.

Introduction

The existence of nodal metastases is considered the most important clinic and pathological prognostic factor in patients with squamous cell carcinomas of the head and neck (SCCHN) in the absence of distant metastases [1]. The presence of even one positive lymphatic node is associated with a 50% reduction in the overall survival rate [2]. Thus, adequate treatment of the neck is essential in order to obtain better oncologic results. The neck is usually treated with the same modality of treatment than the primary tumor (i.e. surgery or chemo-radiotherapy). In the cases surgically treated, a cervical lymphadenectomy must be performed, with or without postoperative radiotherapy (RT) or concomitant chemotherapy [3].

Radical neck dissection (RND) initially and subsequently modified radical neck dissection (MRND), both considered comprehensive neck dissections (CND), are the 2 main surgical approaches in the treatment of neck metastases [4,5]. However, the surgical technique has shifted towards less radical procedures focused on achieving complete oncological lymph node resection with less morbidity and better postoperative quality of life.

Selective neck dissection (SND) refers to the preservation of one or more lymph node levels, in addition to muscle, nerve and vascular neck structures. The selective dissection can be performed in different ways depending on the levels resected: lateral, supraomohyoid, extended supraomohyoid, posterior or central [6]. Selective dissection is based on the concept that the primary tumor follows a well-known and defined metastatic spread pattern according to its location [7], so nodal metastases will be found in certain expected territories according to the primary tumor.

Elective SND is a generally accepted approach in patients with cN0 necks in order to treat occult nodal metastases [8,9], and it could be hypothesized that the same rationale could be used in some cases of clinically positive necks (with limited nodal involvement) at diagnosis. Lymphadenectomy of the nodal areas at risk of metastatic spread, preserving the non-lymphatic structures and the remaining lymphatic drainage territories non suspect of malignancy, would not endanger the

* Corresponding author at: Department of Otolaryngology, Hospital Universitario Central de Asturias, Av. Roma SN, 33011 Oviedo, Spain.
E-mail address: fernandolopezphd@gmail.com (F. López).

https://doi.org/10.1016/j.oraloncology.2020.104565
Received 16 November 2019; Received in revised form 24 December 2019; Accepted 6 January 2020

oncological outcomes and would reduce the postoperative morbidity. Moreover, in many cases considered to be clinical or radiologically positive, neither all detectable or palpable lymphadenopathies are pathological, nor are all neck levels involved. Therefore, radical and modified radical neck dissection may be considered an overtreatment in many cases [10].

However, the role of SND in cases of clinically positive necks remains unclear. While some authors support its use both at cN1 and cN2 necks [11-15], others, however, report that it is unknown if patients undergoing this procedure have more risk of neck recurrence [16-18]. Furthermore, some authors argue that an inadequate lymphadenectomy could compromise the locoregional control and survival by inadequate surgery or by omitting adjuvant therapy based on misleading pathology [3,19].

The aim of this retrospective study was to assess the effectiveness and outcomes of the SND in the treatment of patients with SCCHN with clinically positive cervical lymph node metastases at diagnosis.

Material and methods

The clinical data of 159 patients with SCCHN who underwent a SND with curative intent from 1998 to 2009 at the Department of Otolaryngology-Head and Neck Surgery in the Hospital Universitario Central de Asturias were reviewed for this retrospective study. The minimum follow-up was 18 months or till death.

This retrospective study was approved by the Institutional Review Board of our Institution. Informed consent or an acceptable substitute was obtained from all patients before treatment. Given the retrospective and observational characteristics of the study, informed consent for study inclusion was not necessary.

All patients had been diagnosed with a SCCHN (oropharyngeal, hypopharyngeal or laryngeal carcinoma) and had clinical nodal metastases (cN+) at diagnosis, which were subsequently confirmed to be pathologically positive. Patients who were classified as cN+ and were pN0 after pathological examination were excluded.

The variables included in the study were: age, sex, tobacco and alcohol consumption, location of the primary tumor, type of surgery and the incidence of recurrence. Tumors were classified according the TNM classification of the International Union Against Cancer (7th Edition) [20]. Also, the following histologic characteristics were gathered: tumor grade, pathological nodal stage (pN), and extranodal extension (ENE). HPV status was analyzed using p16-immunohistochemistry, high-risk HPV DNA detection by in situ hybridization and genotyping by GP5+/6+-PCR, as previously reported [21]. Given the low incidence of HPV-positive oropharyngeal carcinomas in our environment, in order to have a more homogeneous cohort, these cases were also excluded.

In all patients the SND was performed as initial treatment. The indications were: surgically treated patients with cN1-cN2 necks, without clinical and/or radiological evidence of ENE, without nodes at levels IV-V, and with no multiple positive nodes at more than 2 levels. The type of SND performed was dependent upon the site, size and extent of the primary tumor and nodal disease, which was diagnosed by clinical signs, including physical examination, and imaging techniques, such as CT scanning and PET-CT. The SNDs performed included the levels II to IV in all patients. A unilateral neck dissection was performed unless there were metastases in both sides of the neck, the primary tumor crossed the midline or in those arising from the base of the tongue, supraglottis or hypopharyngeal. Every neck dissection was performed according the anatomical and surgical boundaries suggested by Robbins et al. [22] Frozen sections were not routinely taken during surgery.

The indications for performing postoperative RT were locally advanced primary tumors (pT4), pN2b cases (when more than 2 lymph nodes were involved), pN2c cases and if there was ENE or if surgical margins were positive [3,23].

The statistical analysis was performed with IBM SPSS Statistics V22.0 software package. Survival rate was calculated through the non-parametric statistical method of Kaplan-Meier. It was taken into consideration the following main variables: death or the last follow-up for overall survival (OS), death due to cancer recurrence for the disease specific survival (DSS) and neck relapse for regional-free survival rate. Differences between survival curves were analyzed with the Log-Rank method. The following prognostic factors were correlated with the regional-free survival rate: pN stage, ENE, and postoperative RT. Differences were tested with a univariate and multivariate analysis using the Cox proportional-hazards model for the relative risk (RR) and the 95% confidence interval (CI). All results were considered statistically significant if p-value was < 0.05.

Table 1
Demographic and Clinical Characteristics.

	No. (%)
Sex	
Male	150 (94)
Female	9 (6)
Age (years)	
Mean (range)	58 (39–84)
Tobacco consumption	
Unknown	2 (1)
Never	2 (1)
< 10 packs-year	1 (1)
10–40 packs-year	38 (24)
> 40 packs-year	116 (73)
Alcohol consumption	
Unknown	2 (1)
Never	13 (8)
< 50 g/day	22 (13)
50–100 g/day	43 (27)
> 100 g/day	79 (50)
Primary location	
Oropharynx	53 (33)
Hypopharynx	47 (30)
Supraglottis	45 (28)
Glottis	14 (9)
pT classification	
T1	9 (6)
T2	32 (20)
T3	68 (43)
T4	50 (31)
pN classification	
N1	48 (30)
N2a	7 (4)
N2b	61 (38)
N2c	43 (27)
Disease stage	
III	35 (22)
IVA	120 (45.5)
IVB	4 (2.5)
Histological grade	
GX	2 (1)
G1	52 (33)
G2	66 (41)
G3	36 (23)
G4	3 (2)
Surgical Margins	
Unknown	1 (1)
Free	128 (80)
Microscopic involvement	30 (19)

Results

159 histologically confirmed SCCHN with clinically positive necks that were subsequently confirmed in the final pathological analysis were included in the study. Table 1 shows the demographic and clinical characteristics of the patients. 150 patients (94%) were male and 9 (6%) female, with a mean age of 58 years (range 39–84). 155 patients were smokers (97%) and 144 (91%) had history of alcohol consumption. The most common location of the tumor was the oropharynx

(33%), followed by the hypopharynx (30%), supraglottis (28%) and glottis (9%). Most patients presented primary tumors in advanced stages (74% of them had T3-T4 tumors) and 65% of the cases were classified as pN2b or pN2c. Most tumors were moderately differentiated (41%). Thirty (19%) patients had microscopic involvement of the surgical margins.

A total of 288 SND were performed, including 129 bilateral SND (81%) and 30 unilateral SND (19%). ENE was observed in 33 patients (21%). The mean number of metastatic nodes was 3 (range 1 to 20). Postoperative RT was administered in 104 patients (65%), with a mean dose of 59 Gy (45–70 Gy) over the neck.

The mean follow-up was 52 months (18–247 months).

Oncologic results

Recurrent disease (including loco-regional recurrence and distant metastasis) developed in 92 patients (58%): 31 of them had a local recurrence (20%), 10 regional recurrence (6%), 18 had loco-regional recurrence (11%), and 33 had distant metastases (21%). 13 patients developed a second primary tumor (8%). Therefore, the regional control in the neck in absence of local recurrence was observed in 94% of patients. In all cases, isolated regional recurrence occurred in the previously dissected nodal levels. Table 2 summarizes the distribution of the recurrences. Considering the patients with neck recurrence alone, the neck recurrence rates were not correlated with the pN classification: 8%, 0%, 3%, and 9% for pN1, pN2a, pN2b, and pN2c, respectively (P = 0.49). The cases with ENE had a higher incidence of neck recurrence, but without statistical significance (9% *vs*. 5.5%, P = 0.43). Neck recurrence was also not correlated with the administration of postoperative RT (7.6% in irradiated *vs*. 3.6% in non-irradiated patients, P = 0.49). If we consider only the 45 pN1 cases without ENE, 17 of them received postoperative RT due to advanced primary tumor or surgical margin involvement; in these cases, no significant differences were found in regional recurrences between irradiated and non-irradiated patients (11% *vs* 7% respectively; P = 0.62).

The 3- and 5-year overall survival (OS) rates according to the Kaplan–Meier method for all 159 patients were 51% and 37%, respectively (Fig. 1A), and the 3- and 5-year disease specific survival (DSS) rates were 57% and 50%, respectively (Fig. 1B).

The 3- and 5-year regional recurrence-free survival rates were 82% and 80%, respectively (Fig. 2A). If we consider only isolated neck recurrences, the 3- and 5-year regional recurrence-free survival rates were 94% and 92%, respectively (Fig. 2B). In multivariate analysis, no differences were observed in regional recurrence-free survival rates depending on pN classification (HR = 1.25, 95% CI: 0.28–5.51 for pN1 cases; P = 0.52, Fig. 3A), ENE (HR = 2.13, 95% CI: 0.46–9.94 for cases with ENE; P = 0.33, Fig. 3B), or the administration of postoperative RT (HR = 2.02, 95%CI:0.43–9.53 for cases that received postoperative RT; P = 0.37, Fig. 3C).

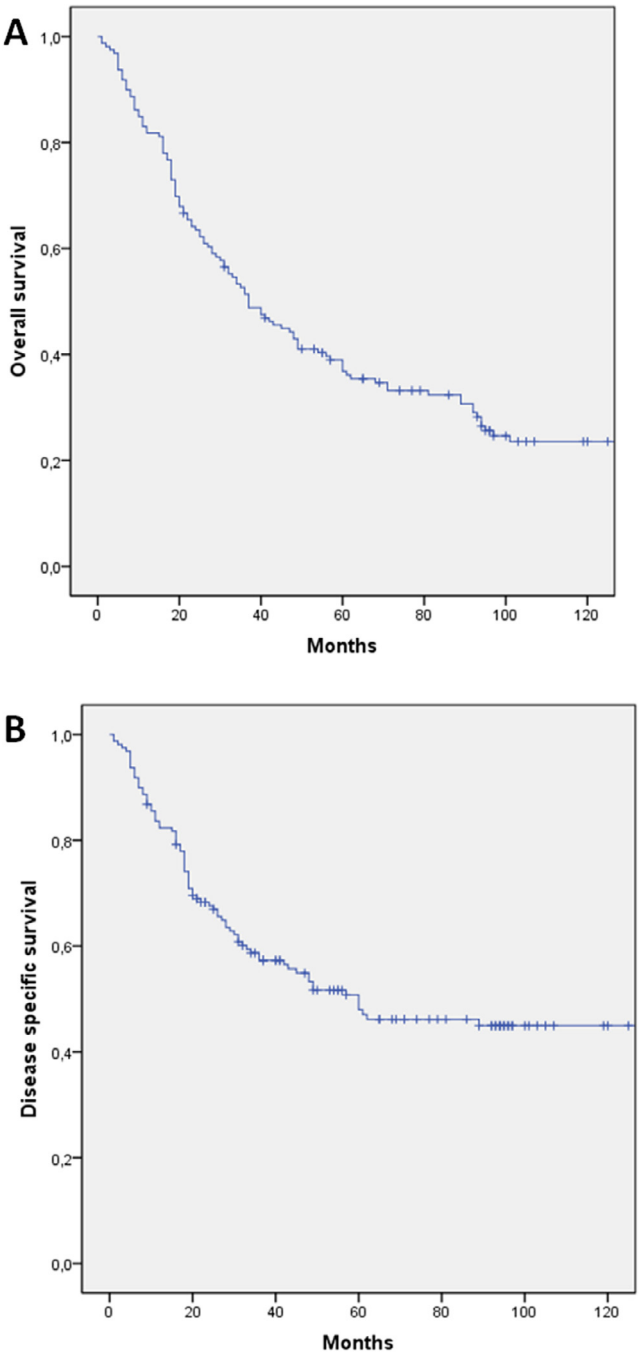

Fig. 1. Kaplan–Meier curves of overall survival (a) and disease-specific survival (b).

Discussion

The surgical management of regional lymphatics is dictated by the extent of the nodal involvement at initial tumor staging. The type of neck dissection (RND, MRND or SND) is based on the initial preoperative staging and, until recently, a CND was generally indicated in patients with clinically positive necks. However, several authors reported good regional control rates in patients with clinically positive necks treated with a SND [reviewed in 12]. In this study, we report the second largest series of SCCHN patients with clinically (and pathologically) positive necks that were treated with a SND. Our results show that SND (with postoperative RT in high risk cases) offer an excellent regional control, comparable to that obtained with CND.

A recent systematic review and meta-analysis has shown the excellent results of SND as therapy for patients with clinically positive metastatic nodes in the neck [12]. The regional control rate using a SND varies between 85% and 100% (with postoperative adjuvant treatment) across the different studies. The studies that included the greatest

Table 2
Site of first Level of recurrence.

	No. (%)
No recurrence	54 (34)
Local recurrence	31 (19)
Regional recurrence	10 (6)
Local + regional recurrence	18 (11)
Distant metastasis	33 (21)
Second primary tumor	13 (8)

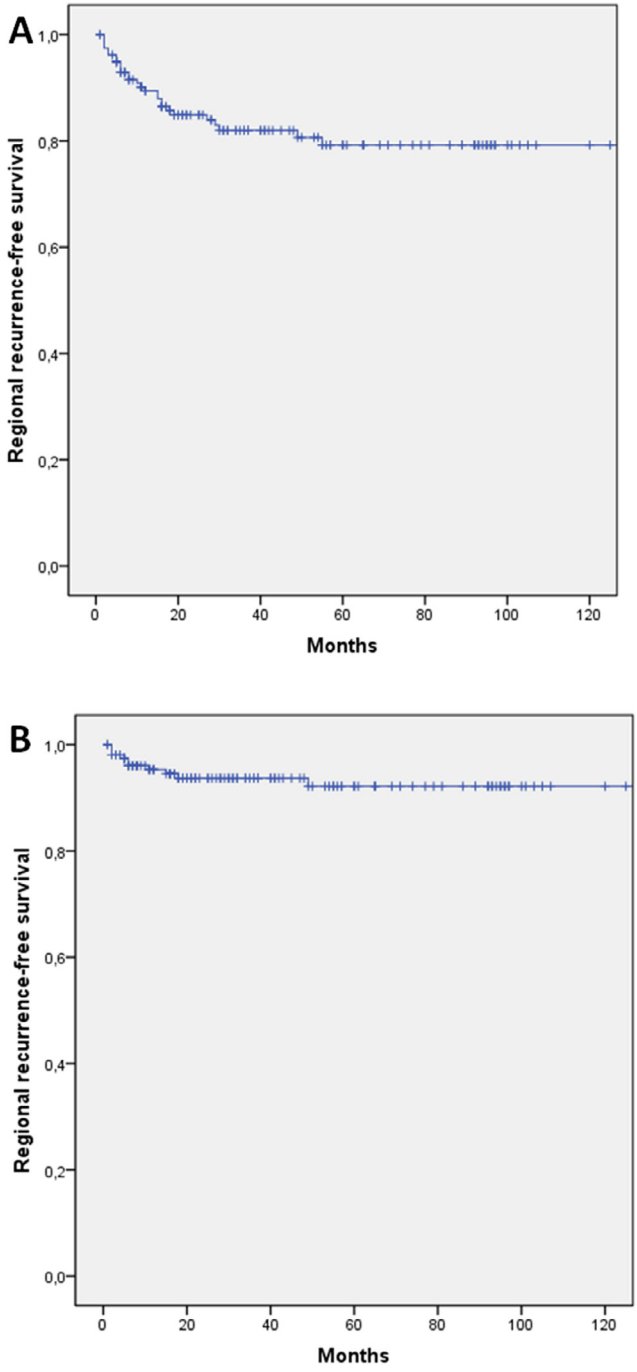

Fig. 2. Kaplan–Meier curves of overall regional recurrence-free survival (a) and isolated regional recurrence-free survival (b).

number of cases showed regional recurrence rates as low as 6–8% [15,24–26]. In our series we observed a regional recurrence rate of 17%, but if we only consider the cases with local control of the disease, the regional recurrence rate decreases to 6%. Moreover, the results obtained with SND are similar to those reported with the RND or MRND [8,15]. Also, studies that compared SND with CND in patients treated at the same institution failed to show an advantage to CND in terms of regional control [12,27–29]. Therefore, SND offers an effective and oncologically safe surgical procedure in selected patients with clinically positive metastatic nodes in the neck. In fact, this is now reflected in the current NCCN guidelines (version 2.2019), which state that a SND could be indicated as a treatment of the neck in N1-N2a-c patients [30].

The extent of the lymph node levels included in the SND varies

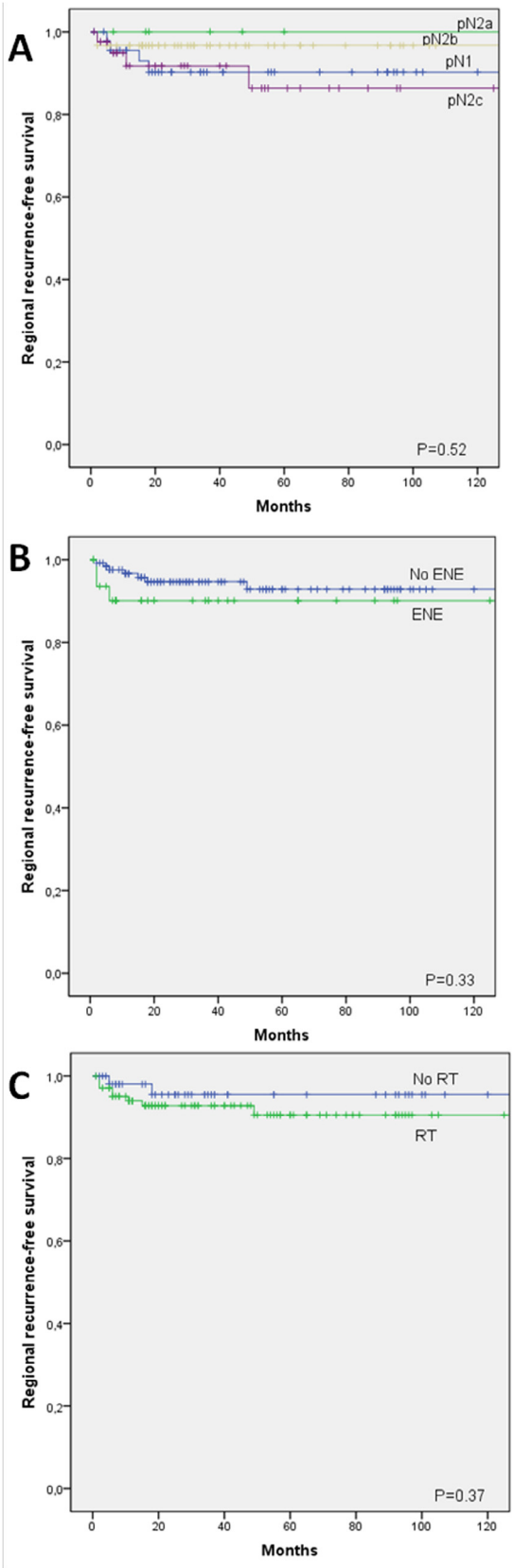

Fig. 3. Kaplan–Meier curves of overall regional recurrence-free survival according pN stage (a), extranodal extension (ENE) (b) and the use of radiotherapy (RT) (c).

according to the different series. The most frequently spared levels are level V in all primary tumor locations, level I in cases of laryngeal tumors, and level IV in oral cavity tumors. Although there is a need for more accurate, systematic and homogeneous recommendations on nodal levels that should be dissected in the different head and neck tumors, most recurrences occurred in the dissected levels, as it happened in our patients. This suggests that the levels at risk of nodal metastasis are generally fairly included in the SNDs.

Careful selection of patients is very important. An adequate preoperative imaging must be performed to obtain precise details regarding detection or exclusion of lymph node metastasis, to identify the adverse features and to select the appropriate surgical technique. Selection criteria for SND candidates vary among published studies. Some authors do not have strict criteria for indicating a SND and their philosophy is to offer a SND to all those patients with low tumor burden (N1 or N2) and no clinical or radiological evidence of ENE [26]. Other authors are more restrictive in the indications of SND. Schmitz et al. [15] only include patients with N1, N2a and very selected N2b with limited size of lymphadenopathies (< 2 cm). These strict criteria could explain the low rate of regional recurrences in its series (2.8%). We also indicated the SND in patients with low tumor burden (cN1 and cN2 patients without evidence of ENE and with no multiple nodes at more than 2 levels). In our series most patients (65%) were finally classified as pN2b or pN2c, which did not prevent good oncological results. In general, nodal fixation, gross extracapsular spread, large nodes (> 3 cm), nodes at multiple levels, palpable metastases at level IV or V, metastatic disease in lymph nodes other than expected first echelon lymph nodes and history of previous neck surgery are considered as contraindications for SND [12]. Occasionally, some authors advocate to perform a SND extended to the internal jugular vein, the XI cranial nerve or the sternocleidomatoid muscle, if necessary [31]. There is insufficient information to support the use of SND in the treatment of nodes larger than 6 cm (> N3) [12,25,28]. In these cases, we perform at least CND, and extended CND if required.

The analysis of prognostic factors for regional recurrence was limited by the very low recurrence rate. The presence of ENE has been proposed in multiple studies as a poor prognostic factor, despite postoperative RT [12,15,25,32–34]. A significant proportion of cases in our study presented ENE (21%), and these patients had a higher incidence of nodal recurrences (9% *vs*. 5.5%), but without statistical significant ($p = 0.43$). These results is also observed by other authors [13,24,35], and could be explained by the fact that ENE was microscopic in all the cases and the administration of postoperative RT. Byers *et al.* [13] report that classic risk factors such as extracapsular dissemination, location of the primary tumor or the level of the neck metastasis are not associated with the risk of cervical recurrence. Herein, SND could be effective although it may be necessary to include adjacent non-lymphatic structures for advanced nodal metastasis with extracapsular spread and confined to ≤ 2 nodal levels [36].

Postoperative RT is advocated to achieve a satisfactory regional control rates in high- risk patients (mainly pN2 patients and patients with ENE), and it should also include the undissected levels of lymph nodes in the radiation fields [12]. The addition of concurrent chemotherapy could further improve tumor control, but this issue is controversial because there are authors who report that the regional control rates are similar to that reported in other studies that used only RT [12,29,37]. In our study, despite the significant number of cases with surgical margin involvement and/or ENE, none of the patients received adjuvant chemoradiotherapy because during the period of study our protocol only included the administration of RT to these cases. In the previously mentioned systematic review, the regional control in the cases that received adjuvant RT was 93%, compared with 86% in the cases that did not, highlighting the importance of postoperative RT [12]. Our results also show the importance of adequate adjuvant treatment, as the regional control in high risk cases (pN2 cases or cases with ENE), who received postoperative RT, was similar to that obtained in low risk cases (93.4% *vs*. 96.4%, respectively). The absence of differences between the 2 groups reflects that a correct indication for RT allows significant regional control with selective neck dissection, resulting in decreased morbidity. However, the benefit of RT after surgery for pN1 necks without ENE is debated. Postoperative RT would not be indicated for pN1 necks without ENE since the reduction of the regional recurrence is less than 8% [11,13,15]. Our results also points to this direction, since in these cases we could not find significant differences between irradiated and non-irradiated patients. However, other authors recommend post-surgical RT in all N+ patients, as the regional recurrence rate observed was also higher in N1 patients without RT [2].

Our study has several limitations. In addition to the retrospective nature of the study, the main weakness is the failure to use a control group treated with a CND. Another limitation is the inclusion of tumors of different sites. However, as neck dissection is a fundamental component of surgical treatment of tumors originated in all the head and neck area, the inclusion of all subsites that received the same type of SND in this study seems justified.

Conclusion

Our work confirms previous reports and suggest that SND offers an effective and oncologically safe surgical procedure in selected patients with clinically positive metastatic nodes in the neck. In our experience, patients with clinically N1 and N2 necks without involvement of levels IV-V, absence of clinical ENE, and absence of multiple nodes at more than two levels could be safely treated with a SND (with adequate postoperative RT).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

This work was supported by grants from CIBERONC- Instituto de Salud Carlos III (Spain) (CB16/12/00390 to JPR), the Instituto de Investigación Sanitaria del Principado de Asturias (ISPA) (Asturias -Spain), Ayudas a Grupos PCTI Principado de Asturias (Spain) (IDI2018/155 to JPR) and the FEDER Funding Program from the European Union (Spain).

References

[1] Mamelle G, Pampurik J, Luboinski B, Lancar R, Lusinchi A, Bosq J. Lymph node prognostic factors in head and neck squamous cell carcinomas. Am J Surg 1994;168:494–8.
[2] Cerezo L, Millan I, Torre A, Aragon G, Otero J. Prognostic factors for survival and tumor control in cervical lymph node metastases from head and neck cancer. A multivariate study of 492 cases. Cancer 1992;69:1224–34.
[3] Strojan P, Ferlito A, Langendijk J, Silver CE. Indications for radiotherapy after neck dissection. Head Neck 2012;34:113–9.
[4] Hamoir M, Silver CE, Schmitz S, et al. Radical neck dissection: is it still indicated? Eur Arch Otorhinolaryngol 2013;270:1–4.
[5] Ferlito A, Rinaldo A. Is radical neck dissection a current option for neck disease? Laryngoscope 2008;118:1717–8.
[6] Ferlito A, Robbins KT, Shah JP, Medina JE, Silver CE, Al-Tamimi S, et al. Proposal for a rational classification of neck dissections. Head Neck 2011;33:445–50.
[7] Shah JP. Patterns of cervical lymph node metastasis from squamous carcinomas of the upper aerodigestive tract. Am J Surg 1990;160:405–9.
[8] Coskun HH, Medina JE, Robbins KT, Silver CE, Strojan P, Teymoortash A, et al. Current philosophy in the surgical management of neck metastases for head and neck squamous cell carcinoma. Head Neck 2015;37:915–26.
[9] Alvi A, Johnson JT. Extracapsular spread in the clinically negative neck (N0): implications and outcomes. Otolaryngol Head Neck Surg 1996;114:65–70.
[10] Bessell A, Glenny AM, Furness S, et al. Interventions for the treatment of oral and oropharyngeal cancers: surgical treatment. Cochrane Database Syst Rev 2011;7(9):CD006205.
[11] Barzan L, Talamini R, Franchin G, Clarkson JE, Oliver R, Conway DI, et al.

Effectiveness of selective neck dissection in head and neck cancer: the experience of two Italian centers. Laryngoscope 2015;125:1849–55.
[12] Rodrigo JP, Grilli G, Shah JP, Medina JE, Robbins KT, Takes RP, et al. Selective neck dissection in surgically treated head and neck squamous cell carcinoma patients with a clinically positive neck: Systematic review. Eur J Surg Oncol 2018;44:395–403.
[13] Byers RM, Clayman GL, McGill D, Andrews T, Kare RP, Roberts DB, et al. Selective neck dissections for squamous carcinoma of the upper aerodigestive tract: patterns of regional failure. Head Neck 1999;21:499–505.
[14] Spiro RH, Morgan GJ, Strong EW, Shah JP. Supraomohyoid neck dissection. Am J Surg 1996;172:650–3.
[15] Schmitz S, Machiels JP, Weynand B, Gregoire V, Hamoir M. Results of selective neck dissection in the primary management of head and neck squamous cell carcinoma. Eur Arch Otorhinolaryngol 2009;266:437–43.
[16] Ferlito A, Rinaldo A, Silver CE, Gourin CG, Shah JP, Clayman GL, et al. Elective and therapeutic selective neck dissection. Oral Oncol 2006;42:14–25.
[17] Bradford CR. Selective neck dissection is an option for early node-positive disease. Arch Otolaryngol Head Neck Surg 2004;130:1436.
[18] Gourin CG. Is selective neck dissection adequate treatment for node positive disease? Arch Otolaryngol Head Neck Surg 2004;130:1431–4.
[19] Bernier J, Cooper JS, Pajak TF, van Glabbeke M, Bourhis J, Forastiere A, et al. Defining risk levels in locally advanced head and neck cancers: a comparative analysis of concurrent postoperative radiation plus chemotherapy trials of the EORTC (#22931) and RTOG (#9501). Head Neck 2005;27:843–50.
[20] Patel S, Shah JP. Part II: Head and neck sites. In: Edge SB, Byrd DR, Compton CC, Fritz AG, Greene FL, Trotti A, editors. AJCC Cancer staging manual. 7th edNew York, NY: Springer; 2010.
[21] Rodrigo JP, Heideman DA, García-Pedrero JM, Fresno MF, Brakenhoff RH, Díaz Molina JP, et al. Time trends in the prevalence of HPV in oropharyngeal squamous cell carcinomas in northern Spain (1990–2009). Int J Cancer 2014;134:487–92.
[22] Robbins KT, Clayman G, Levine PA, Medina J, Sessions R, Shaha A, et al. Neck dissection classification update: revisions proposed by the American Head and Neck Society and the American Academy of Otolaryngology-Head and Neck Surgery. Arch Otolaryngol Head Neck Surg 2002;128:751–8.
[23] Ang KK, Trotti A, Brown BW, Garden AS, Foote RL, Morrison WH, et al. Randomized trial addressing risk features and time factors of surgery plus radiotherapy in advanced head and neck cancer. Int J Radiat Oncol Biol Phys 2001;51:571–8.
[24] Ambrosch P, Kron M, Pradier O, Steiner W. Efficacy of selective neck dissection: a review of 503 cases of elective and therapeutic treatment of the neck in squamous cell carcinoma of the upper aerodigestive tract. Otolaryngol Head Neck Surg 2001;124:180–7.
[25] Andersen PE, Warren F, Spiro J, Burningham A, Wong R, Wax MK, et al. Results of selective neck dissection in management of the node-positive neck. Arch Otolaryngol Head Neck Surg 2002;128:1180–4.
[26] Givi B, Linkov G, Ganly I, Patel SG, Wong RJ, Singh B, et al. Selective neck dissection in node- positive squamous cell carcinoma of the head and neck. Otolaryngol Head Neck Surg 2012;147:707–15.
[27] Schiff BA, Roberts DB, El-Naggar A, Garden AS, Myers JN. Selective vs modified radical neck dissection and postoperative radiotherapy vs observation in the treatment of squamous cell carcinoma of the oral tongue. Arch Otolaryngol Head Neck Surg 2005;131:874–8.
[28] Patel RS, Clark JR, Gao K, O'Brien CJ. Effectiveness of selective neck dissection in the treatment of the clinically positive neck. Head Neck 2008;30:1231–6.
[29] Feng Z, Gao Y, Niu LX, Peng X, Guo CB. Selective versus comprehensive neck dissection in the treatment of patients with a pathologically node-positive neck with or without microscopic extracapsular spread in oral squamous cell carcinoma. Int J Oral Maxillofac Surg 2014;43:1182–8.
[30] Comprehensive Cancer Network. Head and Neck Cancer (Version 2.2019). https://www.nccn.org/professionals/physician_gls/pdf/head-and-neck.pdf [accessed September 10, 2019].
[31] Hamoir M, Leemans CR, Dolivet G, Schmitz S, Gregoire V, Andry G. Selective neck dissection in the management of the neck after (chemo)radiotherapy for advanced head and neck cancer. Proposal for a classification update. Head Neck 2010;32:816–9.
[32] Woolgar JA. Histopathological prognosticators in oral and oropharyngeal squamous cell carcinoma. Oral Oncol 2006;42:229–39.
[33] Woolgar JA, Rogers SN, Lowe D, Brown JS, Vaughan ED. Cervical lymph node metastasis in oral cancer: the importance of even microscopic extracapsular spread. Oral Oncol 2003;39:130–7.
[34] Robbins KT, Ferlito A, Shah JP, Hamoir M, Takes RP, Strojan P, et al. The evolving role of selective neck dissection for head and neck squamous cell carcinoma. Eur Arch Otorhinolaryngol 2013;270:1195–202.
[35] Polat M, Celenk F, Baysal E, Durucu C, Kul S, Mumbuc S, et al. Effectiveness and safety of selective neck dissection in lymph node-positive squamous cell carcinoma of the head and neck. J Craniofac Surg 2015;26:e380–3.
[36] Dhiwakar M, Robbins KT, Rao K, Vieira F, Malone J. Efficacy of selective neck dissection for nodal metastasis with involvement of non lymphatic structures. Head Neck 2011;33:1099–105.
[37] Battoo AJ, Hedne N, Ahmad SZ, Thankappan K, Iyer S, Kuriakose MA. Selective neck dissection is effective in N1/N2 nodal stage oral cavity squamous cell carcinoma. J Oral Maxillofac Surg 2013;71:636–43.