

Adverse histopathological findings in glottic cancer with anterior commissure involvement

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Abstract Open partial horizontal laryngectomy (OPHL) specimens include cartilage and lymph nodes. Pathological adverse findings (PAF): perichondrium, cartilage, perineural invasion, microvessel spread and prelaryngeal metastases can be detected histologically. We aimed at examining PAF in OPHL specimens and examining the interdependence with oncological outcomes. Prospective analysis of 254 glottis cancers: 87-T2a, 77-T2b and 90-T3 with anterior commissure (AC) involvement treated by OPHL at tertiary referral centre between 2001 and 2008. In 38/254 patients (15 %) PAF were found (16 prelaryngeal metastases, 22 other); more often in stage T2b/T3 versus T2a ($p = 0.008$). PAF other than prelaryngeal metastases were found more often in T2b than T2a tumours ($p = 0.005$). Outcomes revealed that out of 36 patients with local recurrence, 19 had PAF. Comparison of 216 patients with no PAF and 16 patients with prelaryngeal metastases revealed, respectively: 7.9 versus 81.3 % local recurrences ($p = 0.034$), 3.2 versus 68.8 % nodal recurrences ($p = 0.011$), 90.7 versus 43.8 % of 5-year organ preservation ($p = 0.021$) and 92.6 versus 75 % 5-year overall survival ($p = 0.022$). Out of 10 patients with close margins, 1 developed the local recurrence; impact for organ preservation and overall survival was not significant. In

22/254 cases including the cartilage into the operating specimen were therapeutically meaningful; in 16/254 with prelaryngeal metastases, the impact for larynx preservation and overall survival was significant. T2b patients had higher probability of PAF than T2a. PAF significantly influenced higher local recurrence rate. This finding ensures the authors, that OPHL type II is not the “overtreatment” compared to the TLM.

Keywords Glottic cancer · Partial laryngectomy · Adverse histological findings · Anterior commissure

Introduction

The recent literature contains a limited number of reports devoted to treatment strategies in early glottic cancers with anterior commissure (AC) involvement [1–6]. In this subset of tumours, the therapy has to be successful, even though the AC region is underdiagnosed and undertreated. The AC represents a particular problem due to its anatomical specificity. The proximity of the thyroid cartilage to the mucosa, the absence of inner perichondrium at the insertion of the tendon into the thyroid cartilage, replaced by Broyle’s ligament, the small size of the region, early ossification which promotes tumour spread, and lack of effect on vocal fold mobility make this localization especially insidious [7]; however, AC involvement is not reflected in the T staging of glottic tumours.

A few reports in the recent literature have described histopathological assessments of intact early glottic cancer specimens generated by two predominant treatment modalities: trans-oral laser microsurgery (TLM) or radiotherapy (RT). When these are not feasible, open partial horizontal laryngectomy (OPHL) with or without neck

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dissection allows assessment of all structural components of the dissected area: the mucosa of the laryngeal inlet, inner and outer perichondrium, cartilage and excised lymph nodes. The questions arise: (1) what can be revealed in the open procedure not accessible for pathological examination in TLM or RT, and what pathological findings not accessible in TLM or RT can be found in OPHL specimens and how often? (2) Whether the route of tumour spread revealed in OPHL specimens is responsible for local and regional failures, and (3) whether the removal of anatomical structures not accessible in TLM may statistically improve the outcomes? The study goal was defined to answer all these questions. We aimed to examine the adverse intra-operative and pathological findings in open partial horizontal laryngectomy specimens and compare them with the rates of local and regional recurrence, organ preservation, disease free and overall survival rates.

Materials and methods

To address the purpose of the research, the investigators designed and implemented a prospective analysis of 254 patients with glottic cancer T2a, T2b and T3 with AC involvement. All patients were treated with curative intent surgically at the university department of otolaryngology, tertiary referral centre and Great Poland Oncology Centre, presenting for evaluation and management between 01.2001 and 12.2008. The study was approved by Poznań University's Ethics Committee. All documentation of the site and extent of disease as well as the recommendations for treatment were in conjoint agreement between an experienced head and neck surgeon, and a radiation oncologist. The treatment protocol for the neck and the primary tumour was based on Head & Neck NCCN version 1.2005, popularized in Polish literature in 2010 [8].

Tumour staging

To be included in the study sample, a patient had to have TNM stage evaluation according to the 2009 AJCC classification, a detailed description of tumour localization in medical charts and operative reports and histological structure assessment according to the WHO classification (2005). Ultrasound of the neck combined with fine needle aspiration cytology (FNAC) in case of suspicion of regional involvement was performed. All 254 patients underwent microlaryngoscopy for biopsy with larynx assessment under general anaesthesia and one of two imaging techniques (1 mm CT scan imaging or MRI). For accurate assessment of tumour extent, surface spread, anterior commissure involvement, subglottic extension, cricoarytenoid unit, and three-dimensional tumour load were

assessed. The mobility of the vocal cords was assessed using stroboscopy. To assess neck lymph nodes, ultrasonography, CT or MRI was performed. All patients had to be eligible for re-evaluation. Patients were excluded as study subjects when the data was insufficient, AC involvement or vocal cord mobility was unclear ($n = 3$), second primaries or distant metastases at the time of diagnosis were present ($n = 1$), or histology other than squamous cell carcinoma (adenoid cystic carcinoma and neuroendocrine $n = 2$) was evident.

The study population was composed of 254 consecutive patients: 87 T2a, 77 T2b and 90 T3 treated by means of OPHL. The age of the patients ranged from 25 to 79 years, with a mean of 55; 19 women and 235 men were treated. Medical conditions that could define patients as being unfit for surgery included a recent major cardiac or cardiovascular event, or necessity for anticoagulant intake. The group's characteristics are shown in Table 1.

Open partial horizontal laryngectomy (OPHL) type IIa, previously called supracricoid partial laryngectomy with cricohyoidoepiglottopexy (SCPL CHEP), the modification of this technique and OPHL type III (SCPL CHP) have been described elsewhere [9, 10].

Surgical specimen assessment

A pathologist examined all surgical specimens. The pathology reports of the surgical specimens were re-reviewed and staged according to the 2009 American Joint Committee on Cancer. Special attention was devoted to microscopic evaluation of the confluence of the vocal ligaments, thyroepiglottic ligament, conus elasticus, internal perichondrium of the thyroid and cartilage invasion, subglottic spread, and prelaryngeal node metastases. Adverse pathological findings were defined as: perichondrial infiltration, cartilage invasion, microvessel spread, perineural infiltration and prelaryngeal metastases. Samples were submitted to standard histology tissue processing involving rinsing, dehydrating with alcohol, saturating with xylene, embedding in paraffin blocks and

Table 1 Patients characteristics

	Total	T2a	T2b	T3
No. of pts	254	87	77	90
Mean age	55	52	55	58
Sex				
Male	235	80	72	83
Female	19	7	5	7
Nodal status preoperatively				
N0	25	4	10	11
N+	7	0	2	5

cutting on microtome. Histological slides were prepared, stained with hematoxylin and eosin and examined by pathology specialists. Presence and depth of infiltration, status of surgical margins, and presence of adverse pathological findings were assessed. Additional slides from existing paraffin blocks were prepared whenever deeper cuts or additional stains were ordained by pathologist.

Follow-up

The patients were routinely followed-up every 6 weeks in the first 2 years and every 3 months in the 3rd–5th years. The minimal duration of follow-up for each examined sample was 60 months.

Stroboscopy and, if needed, microlaryngoscopy to assess the glottis were the mainstays of the examination; the emphasis was on excluding local recurrence. Ultrasonography was used to assess neck nodes.

End points and statistical analysis

The main predictor variable was the histological findings in operative specimens. Age and gender were additional predictor variables. Patient characteristics were compared by Fisher's exact test, Chi square test and the Kruskal–Wallis test. Primary outcome variables were: local recurrence rate, 3 and 5 year local control rate, 5 year organ preservation rate and 5 year overall survival, calculated using Kaplan–Meier with the log-rank test to assess the equality of distributions. Student's *t* test was used for comparing proportions; all analyses were performed by SPSS for windows, version 15.0.

Results

Findings in preoperative versus intra-operative assessment

Preoperative work-up and intra-operative findings revealed neoplastic infiltration either adjacent to the anterior commissure or infiltrating this crucial structure in all 87 T2a, 77 T2b and 90 T3 patients. There was no case with infiltration of the subglottic area with an extension exceeding 3 mm pre- or intra-operatively. No thyroid cartilage invasion was revealed in pretreatment imaging. Lateral neck metastases were found and histologically confirmed in 2 T2b and 5 T3 patients. Enlarged prelaryngeal nodes were not found using either CT or US. Intraoperatively, in 48/254 patients, prelaryngeal nodes were visualized and taken out; in 16/254, metastases were histopathologically confirmed (5.3 %). The interdependence between the variables describing the group and node metastases is presented in Table 2.

Adverse histological findings

Adverse pathological findings (16 prelaryngeal metastases and 22 others) were noted in 38/254 patients (15 %). Prelaryngeal node metastases were found in 4 T2a, 5 T2b and 7 T3 patients; thus, statistically more often in stage T2b and T3 versus T2a ($p = 0.008$) and in more extensive surgeries OPHLIII and OPHLIIb versus OPHLIIa ($p = 0.0001$). The surgical margins were assessed in every surgical specimen. There were 10/254 patients with close margins <2 mm (3.9 %). Adverse pathological findings other than prelaryngeal metastases were found in

Table 2 Interdependence between variables describing the group and node metastases

	Whole group (254 pts)	Prelaryngeal node metastases pN+		Lateral neck metastases pN+	
		16 pts	<i>p</i> value	7 pts	<i>p</i> value
Mean age of pts (years)	55	54.2	0.606	53	0.414
Sex (no. of pts)					
Male	235	15	0.772	6	0.971
Female	19	1		1	
T status (no. of pts)					
T2a	87	4	0.335	0	0.082
T2b	77	5		2	
T3	90	7		5	
Surgery technique (no. of pts)					
Modified OPHL IIa	211	4	0.001	2	0.00001
OPHLIIa, OPHLIIb (CHEP)	36	6		3	
OPHLIII (CHP)	7	6		2	

Table 3 Adverse histological findings in OPHL specimens with regard to patients and tumor variables

No of pts	T grade				Patients age			Sex		
	T2a	T2b	T3	<i>p</i> value	>median	<median	<i>p</i>	235 male	19 female	<i>p</i>
Pathological adverse findings	8	13	17	–	22	16	–	35	3	–
Perichondrium infiltration	3	3	5	0.782	7	4	0.690	9	2	0.402
Cartilage invasion	0	3	5	0.244	5	3	0.966	8	0	0.853
Microvessel spread	1	1	0	0.383	1	1	–	2	0	0.363
Perineural infiltration	0	1	0	0.373	0	1	–	1	0	0.118
Prelaryngeal metastases	4	5	7	0.877	6	10	0.671	15	1	0.775

22/254 specimens (8.7 %); of this number: 11 patients had perichondrial infiltration and there were 8 patients with cartilage invasion, 2 patients with microvessel spread and 1 with perineural infiltration. Adverse histological findings in OPHL specimens with regard to patients and tumour variables are presented in Table 3. Adverse pathological findings were found in 4 T2a, 8 T2b and 10 T3 laryngeal specimens, i.e., statistically more often in T2b than T2a tumours (13/77 and 8/87, respectively, $p = 0.005$).

Oncological outcomes in the group

Oncological outcomes with regard to patient details (sex, age) and histological data (free margins, adverse histological findings and prelaryngeal node metastases) are presented in Table 4.

Local control and larynx preservation

Of the 254 patients, 36 failed primary treatment (14.2 %). The disease control and survival outcomes with regard to patient details (sex, age) and histological data (free margins, adverse histological findings and prelaryngeal node metastases) are listed in Table 4. Salvage therapy of the recurrences consisted of total laryngectomy in all 36 patients. Out of 10/254 patients with close margins, none developed local relapse; thus, this subgroup was not further analysed separately.

In our series, patients treated for T2a and T2b achieved local control rates of 98 % (82/87) and 95 % (65/77), respectively, 3-year organ preservation rates were 96.6 % (84/87) and 95 % (67/77) and 5-year organ preservation was 94.3 % (82/87) and 98.5 % (66/67), respectively. Patients treated for T3, achieved a local control rate of 79 % (71/90), while 3 and 5 year organ preservation rates were 81.1 % (73/90) and 77.8 % (70/90), respectively. There were no statistical differences in organ preservation and local control between T2a, T2b and T3 patients operated by means of appropriate OPHL.

Regional control

Out of 32 patients undergoing elective neck dissection at the time of treatment of the laryngeal primary, 25 were pN0 and 7 pN1. Neck dissection was required and metastases were confirmed in 7 patients during follow-up. The nodal recurrence rate for the whole group was 9.4 %. There were no statistically significant differences in nodal recurrence rates between T2a, T2b and T3 patients operated by means of appropriate OPHL combined with primary neck dissection.

Survival

3-year disease specific and overall survival for the whole group was 94.9 and 92.9 %, respectively. 5-year disease specific and overall survival for the whole group was 91.8 and 90.9 %, respectively. The 3-year overall survival rates for T2a, T2b and T3 were: 100, 93.5 and 85.6 %, respectively. The 5-year overall survival rates for T2a, T2b and T3 were 98.9, 92.2 and 82.2 %, respectively. There were significant differences in oncologic outcomes and 3- and 5-year survival between T2a/T2b ($p = 0.009$, $p = 0.007$), and T2a/T3 ($p = 0.0001$, $p = 0.0002$), but there were no differences between T2b/T3 ($p = 0.243$, $p = 0.285$). The Kaplan–Mayer curves of the survival rates are presented in Figs. 1, 2.

The impact of adverse pathologic findings for the outcomes

Out of 254 patients, 36 had local recurrence. Of these, 9 had adverse pathological findings in pathological assessment of the surgical specimens: Thirteen had prelaryngeal metastases, 6 had other adverse histological findings and 1 patient had both these risk factors. A total of 216 patients with no adverse findings had 7.9 % local recurrences, 3.2 % nodal recurrences, a 90.7 % 5-year organ preservation rate and a 92.6 % 5-year overall survival. Sixteen patients with prelaryngeal metastases had 81.3 % local

Table 4 The disease control and survival outcomes with regard to patient details and histological data

	Recurrence		Larynx preservation		Overall survival	
	Local	Nodal	3-year	5-year	3-year	5-year
254 pts	36	7	224	218	236	231
Age > median	22	4	108	104	113	107
Age < median	14	3	116	114	121	124
<i>p</i>	0.834		0.912		0.866	0.854
T2a	5	2	84	82	87	86
T2b	12	2	67	66	72	71
T3	19	3	73	70	77	74
No adverse pathology (216 pts)	17	3	197	196	202	200
Adverse pathological findings (38 pts)	19	4	27	22	34	31
<i>p</i>	0.165		0.512		0.035	0.036
No adverse pathology (216 pts)	17	3	197	196	202	200
Adverse pathological findings (other than prelaryngeal N+) (22 pts)	6	2	19	15	21	19
<i>p</i>	0.392		0.516		0.191	0.270
Prelaryngeal N+ (16 pts)	13	2	8	7	13	12
Prelaryngeal N- (238 pts)	23	5	216	211	223	219
<i>p</i>	0.031		0.034		0.011	0.022

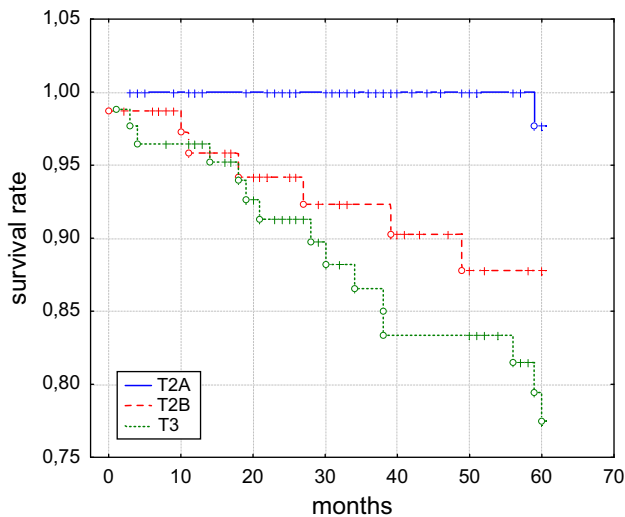


Fig. 1 Kaplan–Meier curves of the survival rates in T2a, T2b and T3 patients

recurrences, 68.8 % nodal recurrences, a 43.8 % 5-year organ preservation rate and a 75 % 5-year overall survival. Twenty-two patients with other adverse pathological findings had 27.3 % local recurrences, 27.3 % nodal recurrences, a 68.2 % 5-year organ preservation rate and a 86.4 % 5-year overall survival.

Prelaryngeal metastases were found in tested laryngeal specimens in 16 patients; 13 of them, comprising 81.3 % had local recurrence. Eight of the 16 patients with

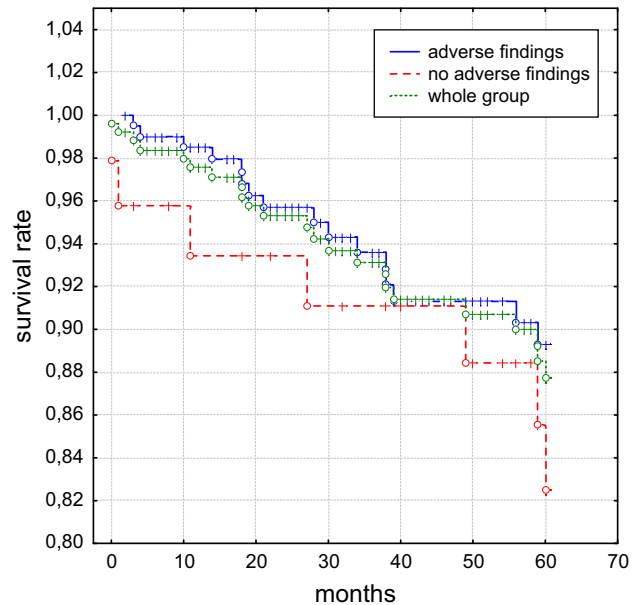


Fig. 2 Kaplan–Meier curves of the survival rates in patients with pathological adverse findings, without pathological adverse findings and in the whole group of patients

prelaryngeal node metastases had undergone total laryngectomy in 3 years of follow-up. The impact of prelaryngeal metastases for the local recurrence rate and organ preservation was significant ($p = 0.031$, $p = 0.034$). The 3- and 5-year overall survival for the group with prelaryngeal metastases were 81.3 and 75 %, respectively, and

were significantly worse than for the rest of the group (93.7 and 92.0 %) ($p = 0.011$, $p = 0.022$).

Other adverse histological findings which constituted: cartilage invasion, perichondrial infiltration, microvessel spread and perineural infiltration were found in the surgical specimens of 22 patients. Six of them (27 %) developed local recurrence, but the impact of the aforementioned pathological findings on local recurrence ($p = 0.516$) and survival rates ($p = 0.270$) turned out not to be statistically significant.

Taking into consideration both risk factors: prelaryngeal metastases and other adverse histological findings, the differences in local recurrence frequency between the patients with and without adverse pathologic findings was significant ($p = 0.000$). Local recurrence was noted in 5 patients with a T2a primary tumour; among them, 4 had adverse findings (1 perichondrial infiltration and 3 prelaryngeal metastases). The impact of adverse pathologic findings on local recurrence was significant ($p = 0.000$). In the T2b subgroup, 12 patients had local recurrence; of this 6 had adverse findings (1 cartilage infiltration, 1 microvessel spread, 4 prelaryngeal metastases) and the difference was significant ($p = 0.0009$). Out of 19 T3 patients with local recurrence, 10 had no pathologically adverse findings and 9 did: perichondrial infiltration (1), cartilage infiltration (2) and prelaryngeal metastases (6); the difference was significant ($p = 0.025$). Thus, for every advance between T2a, T2b and T3 tumours treated by means of OPHL, adverse pathological findings significantly increased the morbidity.

The 3-year disease specific survival of the subgroups with and without adverse histological findings was 89.5 and 95.8 %, respectively, and the 5-year disease specific survival was 81.6 and 93.5 %, respectively; these differences were also significant ($p = 0.032$). The 3-year overall survival for the subgroups with and without adverse histological findings was 89.5 and 93.5 %, respectively, and the 5-year overall survival was 81.6 and 92.6 %. The differences were again significant ($p = 0.035$, $p = 0.036$). To conclude, the impact of adverse pathologic findings on survival was significant.

Out of 10 patients with close margins, 1 developed local recurrence; the impact of this variable on organ preservation and overall survival was not statistically significant ($p = 0.630$ and $p = 0.580$, respectively).

Discussion

The success of any laryngeal preservation treatment modality is based on accurate assessment of tumour extent, multidisciplinary decision-making, choice with regards to patient expectations and competence in performing the

chosen surgical technique [11]. A decline in open larynx surgery for early and moderately advanced glottic cancers was announced by Silver et al. in 2009 [12]. Mendelhall et al. went even further, stating that open surgery should be reserved only for locally recurrent tumours [13]. Numerous controversies regarding the optimal treatment of early and moderately advanced glottic cancer with AC involvement and some disagreement about the utilization of open partial laryngectomies prompted our study. The authors present a group of 254 patients with T2a, T2b and T3 glottic cancers primarily treated by means of different OPHL techniques; the common denominator of the whole group was AC involvement.

Controversy regarding the optimal treatment modality in early glottic cancer with AC involvement may be explained by the variety of lesions included under the umbrella of early glottic cancer, especially with regard to location [14, 15]: (1) Superficial T1 glottic lesions extending to the ipsilateral half of the AC, (2) Bicordal “horseshoe” lesions, (3) Lesions rising to the AC with or without subglottic or supraglottic invasion, (4) Ulcerating lesions arising at the AC, (5) Extension to the petiole of the epiglottis. Thus, a separate AC staging system was presented in 1996 by Rucci [16]. The entity of T2 tumours is also highly heterogeneous in terms of superficial or deep invasion and possible impaired vocal cord mobility, defined as T2b by McCoul [17]. Other authors have emphasized the need for a TNM classification more suitable for prognostic stratification and treatment planning of laryngeal carcinomas [18].

As to current trends, in early glottic cancer treatment, TLM or RT predominate [3]. In 2007, a new endoscopic cordectomy type VI for AC cancers was proposed by the European Laryngeal Society [19]. Nevertheless, Silver [12] stated that in laser surgery thyroid cartilage is not systematically resected. Anterior extension of glottic tumours is associated with a higher recurrence rate compared to middle vocal fold extension [2]. Poor local control of T2 with AC invasion treated by TLM alone (70.8 %) was shown by Peretti et al. [20], and Roh [21]. Local relapses were found in more than 25 %; thus, second-look endoscopic operations were advocated. In contrast, in the Lee et al. [22] series, neither the surgical margin nor tumour extension to the AC, arytenoid, subglottis, and ventricle showed any significant impact on local control or survival. Hakaam et al. [4] found that 34.8 % of T2 lesions with AC involvement developed local recurrence, as compared to only 10.26 % of cases of T2 without AC involvement. The larynx preservation rate was 95.8 versus 93.26 %. He concluded that TLM was an excellent treatment option in patients with early glottic cancer irrespective of whether or not the AC is involved, but in this location it requires adequate exposure, proper assessment, experience, and advanced surgical skills.

Tumours invading the AC are considered a predictor of poor response to RT due to under-dosage Zauhair et al. [23]. One explanation is related to the possibility of ‘understaging’, as patients might have a larger tumour burden anteriorly and in some cases an unrecognized subglottic extension. Another is poorer coverage of the dose to the tumour because of the thin diameter of anterior neck soft tissues, as well as lack of electronic equilibrium at the air-tissue interface with high energy photon treatment with a small field size. Maheshwar et al. [24] showed a series of 53 T1 patients: 57 % with AC involvement developed local recurrence whereas in the subgroup with tumour arising from the anterior half of the fold, no AC invasion recurrence was observed in 15.8 %. Others, Spiridovich [25], Sjögren [26] Mendenhall et al. [27] and Persky et al. [28] stated that AC involvement did not affect local control. The negative impact of AC involvement could be overcome by delivering a higher biologically effective dose to the tumours using a fraction size of >2.0 Gy [29]. The study of Al-Mamgani et al. [30] reported retrospective outcomes of 1050 patients with T1-2N0 glottic cancer but poor outcomes were only correlated with continued smoking and T2b advancement. Similar findings were presented by Khan et al. [31] in 141 patients. Definitive radiotherapy provides excellent local control with excellent voice preservation and minimal long-term toxicity, but alternative management strategies should be pursued for T2b glottic carcinomas.

In the material presented by the authors, 3- and 5-year disease specific survival for the whole group treated with OPHL was 94.9 and 91.8 %, respectively. There were significant differences in 3 and 5-year survival between T2a (100, 93.5 %) and T2b (98.9, 92.2 %) and between T2a and T3 (85.6, 82.2 %); there was no difference between T2b and T3 entities. These findings showed, how close T2b and T3 glottic cancers are. In addition, the presented results proved the difference between the T2a and T2b tumours. In T2b versus T2a, adverse pathological findings were found statistically more often (13/77 v 8/87), the local recurrence rates were higher (12/77 v 5/87) and survival rates significantly worse. Thus, the distinction between T2a and T2b is useful and important for the surgical decision-making.

In early glottic cancer, particular attention has been paid to the depth of invasion [32]. According to Hartl et al. [33], in early stage tumours involving AC, the incidence of thyroid cartilage invasion was 8.5 %, and vocal fold mobility was the only significant factor related to this finding; it should therefore be taken into consideration when planning transoral or open surgery. For some questions, like the depth of invasion, perineural spread, or the presence of micrometastases, no answers can be supported even by the best clinical investigation or the newest imaging

techniques. Surgical specimen examination remains the unique and most important method in final staging of early glottic cancer advancement and in these terms open surgery still has an advantage over the other methods.

Thus, the aim of the presented study was to analyse adverse pathological findings in laryngeal specimens, their impact for outcomes, to define in which patients the probability of adverse histology was higher and select candidates for OPHL in future decision-making. Perichondrial infiltration, cartilage invasion, microvessel spread, and perineural infiltration were identified in 22/254 specimens. In all these cases including cartilage in the operating specimen was therapeutically meaningful. For the whole group, the impact of these adverse pathologic findings for larynx preservation, 3- and 5-year survival was not significant. There were also no statistically significant differences in organ preservation and local control between T2a, T2b and T3 patients operated by means of appropriate OPHL. However, for every advance in staging through T2a, T2b and T3, adverse pathological findings significantly influenced the higher local recurrence rates. Adverse histological findings were significantly more frequent in T2b and T3 than in T2a. T2b patients, treated with OPHL, gained more benefit.

The additional findings provided by the open technique are detection of prelaryngeal metastases. Surprisingly, prelaryngeal metastases have even greater impact for larynx preservation and overall survival than the other adverse pathological findings. This frequency of metastatic prelaryngeal nodes (16/254 patients) confirms previous findings [34]. In this series, 13 of them, which compromised 81.3 % of the total, had local recurrence and the changes in 3- and 5-year overall survivals (81.3 and 75 %, respectively) were statistically significantly worthwhile. Thus, in the T2 entity nearly ¼ of patients had risk factors undetected by preoperative diagnostics but with significant impact for the outcomes. This finding assures the authors that OPHL type II is not an “overtreatment” compared to TLM.

TLM and open partial surgery have been compared in a few papers. Mantsopoulos et al. [35] found no statistical difference between the laser and open surgery (frontolateral laryngectomy) with regards to oncological outcomes; AC invasion did not seem to influence the oncological results. Barbossa et al. [36] were in opposition, where up to 60 % of AC invasions were under-staged on endoscopy. According to Sigston et al. [37], local control with single laser intervention was lower (89 %) than with partial external laryngectomy (95 %). Similarly, in Sachse et al. [38], the sample’s local recurrence rate with external partial surgery was 12 % and with TLM 16 %, and 5-year local control was 88 and 70 %, respectively; taken together, initial AC involvement was associated with a high

risk of local recurrence. For T2 with impaired mobility level IV, evidence seems to favour an open conservative surgery over RT or TLM laser when local control is an endpoint [39]. Our observations based on survival rates confirm that T2a are “true” early glottic cancer but T2b tumours are very close to T3 regarding their outcomes.

Our study has numerous potential limitations. It includes the small number of patients with PAF. But every patient with early glottis cancer has had the preoperative imaging, and they constitute strictly selected group, in whom we try to avoid the underestimation. Another doubt concerns the grading: the presence of cartilage infiltration upgrades the T2 to T4. Thus, low number of PAF other than prelaryngeal nodes, was a desirable outcome. Pathological examination of the surgical specimen is the benefit of open partial laryngectomies and an important point in final staging of early glottic cancer advancement. OPHL resection definitely prevents cancer micro spread along the perichondrium or cartilage, perineural invasion, and microvascular spread, and thus also has a great therapeutic role. Additionally, histologically confirmed node metastases are a valuable predictive factor indicating the need for adjuvant treatment. In the presented material, the pathologic assessment of the OPHL specimens allowed for upgrading of tumour advancement in 38/254 patients. In the authors’ opinion, OPHL was of benefit for oncological outcomes in 8/87 of T2a, 13/77 of T2b and 17/90 of T3 cancers with AC involvement and adverse pathology.

To summarize, the limited popularity of OPHL in early and moderately advanced glottic cancer with AC involvement due to its oncological efficacy should undergo revision. According to our findings concerning the rates of PAF, percentage of recurrences and survival rate in T2B glottis cancers, we strongly recommend the OPHL rather than TLM.

Conflict of interest None.

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