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Surgical options in radiotherapy-failed early glottic cancer

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Abstract After failure of curative radiotherapy (RT), surgery is the main therapeutic option to control recurrent laryngeal cancer. Recurrences after RT for T1–T2 tumours of the glottic larynx are often diagnosed at a more severe stage than the original disease and, thus, usually treated by *radical* approaches. Our aim is to investigate the feasibility of more conservative strategies for proper treatment of post-RT recurred glottic cancer. We collected and reviewed our files from 1990 to 2006, selecting 75 patients which matched the following inclusion criteria: (1) patient was originally diagnosed with early stage squamous cell carcinoma of the glottic larynx (stage I–II according to 2010 TNM), (2) patient was treated by RT with curative intent, (3) patient presented a recurrence of disease after RT which was surgically treated at our Institution. T stage at first diagnosis was T1a in 41 cases (55 %), T1b in 12 (16 %) and T2 in 22 (29 %). At clinical examination of RT-recurred lesions, we documented advanced lesions (rT3–rT4) in 29 out of 75 patients (39 %). Overall, an upstage was reported for 56 % RT-recurred cancers, while 37.3 % remained at the same stage than the original tumour and 6.7 % were downstaged. Twelve patients (16 %) underwent salvage partial laryngectomy (SPL), while 63 (84 %) received a salvage total laryngectomy (STL). Multivariate analysis showed that rTNM according to the AJCC-UICC of 2010 was the only prognostic factor for both disease-free survival ($p = 0.042$) and overall survival ($p = 0.004$). Considering the prognostic impact of rT and rN we documented a statistical significance only in terms of overall survival for both factors ($p = 0.004$ and $p = 0.04$, respectively). Although STL remains the most frequent treatment choice for failures after RT in laryngeal carcinomas, SPL represents a valid option for selected patients with limited recurrence and can deliver good oncologic and functional results if performed according to careful indications.

Keywords Salvage · Surgery · Radiotherapy · Failure · Glottic · Cancer

Introduction

Early glottic cancer is a malignant neoplasm which develops in the glottic laryngeal region and it is characterized by normal cord mobility [1]. According to the new TNM classification for head and neck cancer updated in 2010 by the American Joint Committee for Cancer (AJCC) and the Union Internationale Contre le Cancer (UICC), this category includes neoplasms classified as T1aN0M0, T1bN0M0 (stage I), and T2N0M0 (stage II) [2–4]. As promoted by guidelines and medical evidence [5, 6], early glottic cancer can be treated either with curative radiotherapy (RT) or with surgery, guaranteeing a comparable overall survival. RT is often preferred as primary treatment because it grants a better anatomical preservation and, thus, functional integrity of the larynx [7–9]. However, the risk of local recurrence after primary RT is estimated in literature to be as high as 5–10 % for T1 lesions and 20–40 % for T2 lesions [10]. In case of recurrence, surgery is the

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only salvage treatment option and, for the past decades, this directly translated to salvage total laryngectomy (STL) [10].

Until mid-nineties total laryngectomy represented the most performed type of salvage surgery. This was mainly due to a higher rate of complications associated with partial laryngectomy after RT and to the opinion that these procedures were unable to achieve good oncological results due to increased aggressiveness of RT-recurred cancer.

Since second mid-nineties, several authors [5, 10, 11] have proposed in selected cases salvage partial laryngectomies (SPLs), that include supracricoid partial laryngectomy (SCPL, such as cricohyoidopexy, cricohyoidoepiglottopexy, tracheohyoidopexy, tracheohyoidoepiglottopexy) and endoscopic CO2 laser cordectomy, as an alternative to STL in the treatment of laryngeal recurrence after RT, allowing to preserve laryngeal functions [10]. Even if the common indications for salvage laryngeal surgery after radiotherapy treatment are the same of those recommended for primary laryngeal cancer treatment, the correct staging of the recurrent tumour is the real challenge to select the most suitable surgical indication.

The aim of this study is to review the experience of our Institution from the second mid-nineties and to report functional and oncological outcomes of salvage surgery for early glottic cancer after RT failure.

Methods

Between 1990 and 2006 we identified 75 patients, previously treated by radiotherapy for early glottic cancer, which underwent, under general anaesthesia, diagnostic direct laryngoscopy to confirm the presence of a recurred laryngeal squamous cell carcinoma, at the ENT Clinic of the University of Florence. The diagnosis was completed by CT and chest radiography, to better evaluate laryngeal recurrence and to exclude lung metastases. TNM staging was corrected using the 2010 edition based on the clinical records available [12]. In Table 1, an overview of the clinical series is shown.

All patients except one were male and mean age was 63.2 years (range 40–80, median 65.6) ($p = 0.562$).

Prior to RT, 41 patients (55 %) presented with T1a staged tumours, 12 (16 %) with T1b and 22 (29 %) with T2 lesions, ($p = 0.292$).

Primary treatment consisted of a median total radiation dose of 6,600 cGy (range 5,600–7,200 cGy) in 32 fractions (range 27–49 fractions) in 47 days (range 29–75 days) on the primary laryngeal tumours. Follow-up included indirect laryngoscopy at regular intervals, monthly for the first year and every second month from the second year, supplemented by regular 6 months CT scan for the first 3 years.

Table 1 Clinical data of 75 patients

	Overall ($n = 75$)	SPL ($n = 12$)	STL ($n = 63$)	p Value
Age group (years)				
<60	18 (24 %)	3 (25 %)	15 (24 %)	0.562
≥60	57 (76 %)	9 (75 %)	48 (76 %)	
Sex				1
Female	1 (1.3 %)	0	1 (2 %)	
Male	74 (98.7 %)	12 (100 %)	62 (98 %)	
Clinical T stage, initial				
1a	41 (55 %)	5 (42 %)	36 (57 %)	0.292
1b	12 (16 %)	4 (33 %)	8 (13 %)	
2	22 (29 %)	3 (25 %)	19 (30 %)	
Clinical rT-stage, salvage				
1a	17 (23 %)	6 (50 %)	11(17 %)	<0.001
1b	7 (9 %)	2 (17 %)	5 (8 %)	
2	22 (29 %)	2 (17 %)	20 (31 %)	
3	20 (27 %)	1 (8 %)	19 (30 %)	
4	9 (12 %)	1 (8 %)	8 (12 %)	

Table 2 Type of salvage surgery performed

Type of salvage surgery	$N = 75$ (%)
Endoscopic laser CO2 cordectomy tipe IV	6 (8 %)
CHP	1 (1.3 %)
CHEP	3 (4 %)
THP	1 (1.3 %)
THEP	1 (1.3 %)
Total laryngectomy	63 (84 %)

The diagnosis of local recurrence and restaging were performed using the same criteria used to stage the original laryngeal tumours, which consisted in clinical examination, direct laryngoscopy under general anaesthesia with multiple biopsies and CT of neck and thorax. According to the above-reported diagnostic procedures, patients with histologically documented laryngeal recurrence after RT were surgically treated at our Institution either by STL or SPL. Table 2 shows the type of salvage surgery performed in our series.

Disease-free survival (DFS) and overall survival (OS) were calculated using the Kaplan-Meier curves. Predictive factors of survival were identified by univariate and multivariate analysis considering the following variables: age, T and N stage, rT and rN stage, field of irradiation (glottic region, larynx or concurrent larynx and neck), extension of lesion at first diagnosis and at restaging (glottic, supraglottic, hypoglottic, transglottic), disease-free interval between RT and local recurrence. Results were statistically evaluated using the Fisher exact test. Statistical analysis

has been performed with STATA statistical software for Windows version 10.0 (Stata Corporation: College Station, Texas USA). We have considered statistically significant values with $p < 0.05$.

Results

The time of recurrence after primary RT ranged from 3 to 39 months starting from the end of initial RT treatment, with a median disease-free interval of 13.5 months. Statistical analysis did not show a significative association between T stage at the time of first diagnosis and time of recurrence ($p = 0.900$).

After confirmation of relapse, lesions were rT-staged and the results are shown in Table 3. According to our procedure, we classified an advanced laryngeal lesion (rT3–rT4) in 29 out of 75 patients (39 %). Overall, we documented an upstage in 56 % RT-recurred cancer, the same stage of primary tumour in 37.3 % and only a 6.7 % of downstaged lesions.

As shown in Table 2, STL was performed in 63 cases (84 %) while SPL was attempted in only 12 (16 %) recurred patients.

Most of the RT-recurred cases were rN0 and only 4 patients presented with clinical N+ disease (5.3 %), all staged as rcN1, which underwent modified radical neck dissection (mRND type III), except for one patient who underwent selective neck dissection (levels II–IV) for a single ipsilateral node less than 2 cm in size. Of these patients, one was previously irradiated on larynx and neck, one on the entire larynx and two on the glottic region alone for a small T1 lesion. We did not evidence a significant difference ($p = 0.47$) between extension of previous field of radiation and N+ risk. Of rN0, only 3 (4 %) patients underwent elective neck dissection (all selective neck dissection levels II–IV). In rN0 cases, we did not perform any neck adjuvant treatment, except for 6 patients (8 %) who underwent additional radio and/or chemotherapy due to an higher rT-stage (rT3, rT4) or a histologically documented highly aggressive recurrence (vascular and/or perineural invasion).

One patient (1 %) *had* pulmonary metastases 16 months after salvage surgery and was treated by cisplatinum-based chemotherapy.

Table 3 rT stage of recurrences

T	rT1a	rT1b	rT2	rT3	rT4	Total
1 a	11	1	9	14	6	41
1 b	4	3	4	1	0	12
2	2	3	9	5	3	22
Total	17	7	22	20	9	75

Survival

Comparing DFS and OS according to T-stage of original laryngeal cancer and rT-stage of the well-documented recurrence, we found that rT is the only prognostic factor with a statistical significance in both. This is more evident in OS ($p = 0.024$) (Figs. 1, 2). When we considered rTNM stage, we confirmed a statistically significant impact of stage only for OS ($p = 0.02$) (Figs. 3, 4).

According to type of salvage surgery, we compared survival results in patients who were treated by conservative instead of *radical* laryngeal surgery (i.e., SPL vs STL). In this series, patients who underwent STL had a worse prognosis in terms of DFS and OS than patients treated with SPL, although statistically not significant ($p = 0.798$ and $p = 0.182$, respectively).

Most of patients who underwent STL had a more advanced disease at the time of recurrence (27 patients, the 43 %, were rT3 or rT4), while the higher re-staged cancer in the SPL group were two patients (12.5 %) presenting with an rT3 and rT4 ($p < 0.001$, Table 1).

Seventeen patients (23 % of our series) experienced a second recurrence after first salvage surgery, within a median time of 10.3 months (range 4–47 months). In our series, a high rate of unsuccessful salvage surgery was documented in patients treated by salvage endoscopic cordectomy type IV by Laser CO2 (50 %, 3 out of 6 cases), while STL and SCPL showed a rate of failure of 21 % (13 out of 63 cases) and 17 % (1 out of 6 cases), respectively. The site of failure was local in 82 % (14 of 17 cases), regional in 12 % (2 cases) and loco-regional in 6 % (1 case). For 9 (53 %) of secondly recurred patients, no further salvage options were possible and patients died from their disease within 2 months; 5 (29 %) have been treated with an extra-boost radio and/or chemotherapy and the remaining 3 (18 %) underwent a second salvage surgery,

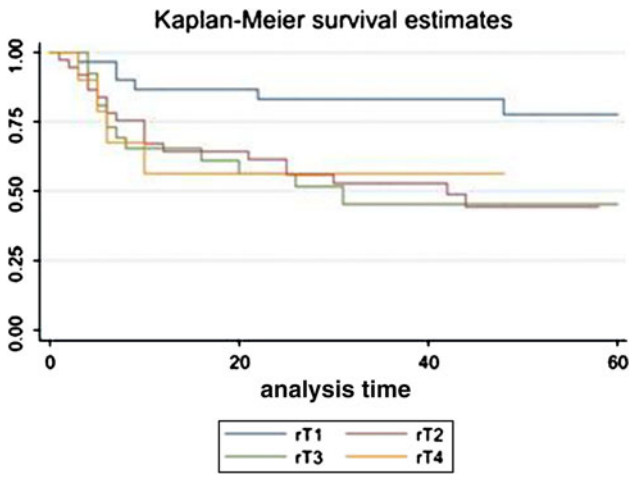

Fig. 1 DFS according to rT ($p = 0.069$)

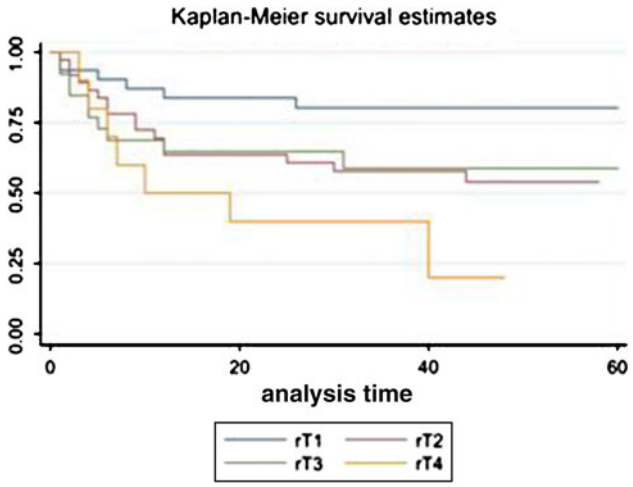

Fig. 2 OS according to rT ($p = 0.024$)

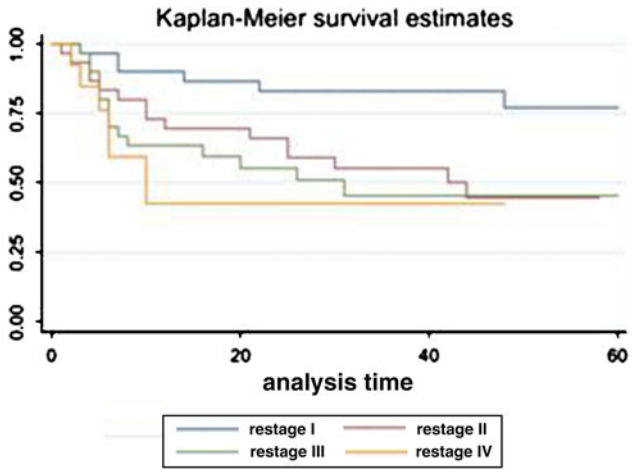

Fig. 3 DFS according to rTNM stage ($p = 0.082$)

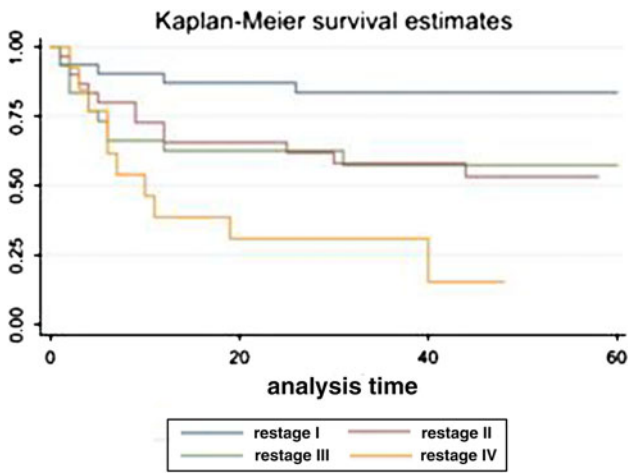

Fig. 4 OS according to rTNM stage ($p = 0.002$)

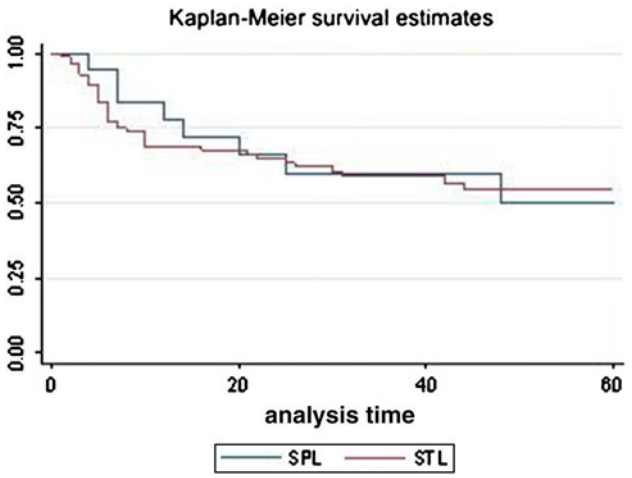

Fig. 5 DFS according to salvage surgery ($p = 0.798$)

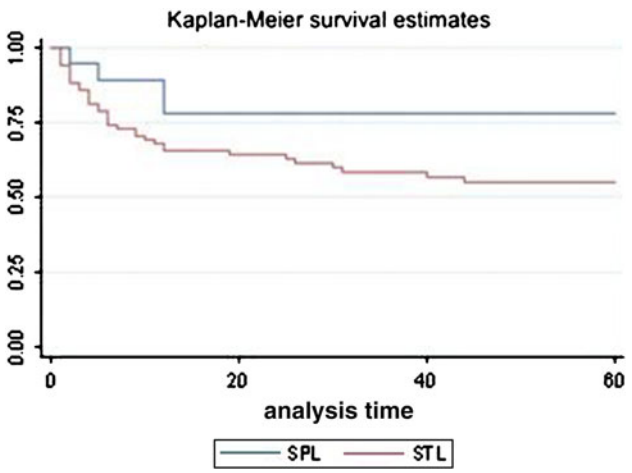

Fig. 6 OS according to salvage surgery ($p = 0.182$)

(67 % STL), and in only one patient (33 %) a SPL was successfully attempted (Figs. 5, 6).

Univariate and multivariate analysis were performed to identify prognostic factors in terms of DFS and OS. We have considered as variables T, rT, rN, stage, rTNM stage, field of radiation (glottic, larynx, larynx and neck), extension of lesion at first diagnosis and at restaging (glottic, supraglottic, hypoglottic, transglottic), disease-free interval between RT therapy and local recurrence. Tables 4, 5 and 6 show the results. According to these, univariate analysis evidenced that rT, rN and rTNM staging were prognostic factors for OS with a statistical significance in our series ($p = 0.004$, $p = 0.04$ and $p = 0.002$, respectively). In multivariate analysis, rT and rTNM stage were the prognostic factors for both DFS ($p = 0.043$ and $p = 0.042$) and OS ($p = 0.009$ and $p = 0.004$).

Functional results

Functional outcomes of salvage SCPL were estimated in our study through two parameters: mean time of removal of nasogastric feeding and mean time of decannulation. Median time of removal of nasogastric tube was 28.9 days. Median value of time of decannulation was 40 days. Among salvage SCPL group statistical analysis did not show a significant difference in terms of functional results between the group of patients where both arytenoids were spared versus those who required surgical sacrifice of one arytenoid ($p = 0.78$).

For patients who underwent STL mean time of removal of nasogastric feeding was 43 days (min 9, max 230) and mean time of removal of tracheal cannula was 56 days (min 4, max 450). We also analyzed the influence of neck surgery (mRND type III or selective neck dissection) on restoration of physiological functions: mean time of removal of nasogastric feeding and of tracheal cannula in neck dissected patients were, respectively, 24 days (min 14 max 55) and 63 days (min 4 max 240), while for patients who did not receive additional neck surgery were 42 days (min 4 max 230) and 53 days (min 5, max 450), respectively, ($p = 0.573$ and $p = 0.463$, respectively).

Table 4 Univariate analysis for DFS and OS in 75 patients surgically salvaged after RT failure

	DFS	OS
T	0.085	0.172
rT	0.069	**0.004**
rN	0.109	**0.040**
RT field	0.782	0.751
Site T	0.679	0.650
Site rT	0.553	0.716
DFI	0.575	0.207
rTNM stage	0.082	**0.002**

Bold values indicate statistical significance at $p < 0.005$

Complications

Postoperative complications after salvage surgery are classified in early and late, as shown in Table 7.

The most common complication is pharyngocutaneous fistula (36 patients, 32.7 %) and belonged to patients who all underwent STL.

The management of fistula was in 29 cases out of 36 (80.5 %) conservative, with compressive dressings and routine wounds care with wet-to-dry dressing medications; usually, in the absence of major vessel exposure, these strategies will result in spontaneous closure through healing from secondary intention [13]. For two STL patients (8.3 %) closure of the fistula required additional surgery with a pectoralis major myocutaneuous flap while, five more patients (21 %) underwent reparative surgery with local flaps. On the other hand, hyperbaric therapy was performed in 13 out of 29 conservative managed cases (45 %) and 2 out of 7 surgically managed patients (28.5 %), to improve wound closure, due to patients' comorbidities, such as diabetes or poor systemic conditions, preoperative

Table 5 Multivariate analysis for DFS in our series of RT-failed 75 patients

DFS	Odds ratio	Standard error	z	$p > \|z\|$	[95 % CI]
Stage	5.271068	3.8211	2.29	0.223	1.273052 21.82485
RT field	0.7521513	0.1467973	−1.46	0.144	0.5130696 1.102641
Site T	1.071633	.1258449	0.59	0.556	0.8513087 1.348979
Site rT	3.296749	2.3486373	1.32	0.564	0.5734632 1.2475479
DFI </> 12 months	0.9999905	0.0058987	−0.343	0.899	0.9884958 1.011619
rTNM stage	1.533217	0.3220548	2.03	**0.042**	1.015798 2.314195

Bold value indicates statistical significance at $p < 0.005$

Table 6 Multivariate analysis for OS in our series of RT-failed 75 patients

OS	Odds ratio	Standard error	z	$p > \|z\|$	[95 % CI]
Stage	3.061133	2.141879	1.60	0.110	0.7767754 12.06338
RT field	1.221417	0.7696101	0.32	0.751	−355243 4.19955
Site T	0.7253025	0.2141722	−1.09	0.277	0.4066031 1.293802
Site rT	0.988151	0.145368	−0.08	0.935	0.7406314 1.318392
DFI </> 12 months	0.7334798	0.1220414	−1.86	0.628	0.5293701 1.016288
rTNM stage	2.023096	0.4592999	3.10	**0.004**	1.296492 3.156918

Bold value indicates statistical significance at $p < 0.005$

Table 7 Early and late complications according to type of salvage surgery

Early complications	Overall ($n = 75$)	SPL ($n = 12$)	STL ($n = 63$)	p value
Peri-operatory bleeding	2 (2.7 %)	0	2 (3.2 %)	0.576
Late complications	**Overall ($n = 75$)**	**SPL ($n = 12$)**	**STL ($n = 63$)**	
Aspiration pneumonia	1 (1.3 %)	1 (8.3 %)		0.82
Stoma stenosis	3 (4 %)		3 (4.7 %)	0.98
Pharyngocutaneous fistula	24 (32 %)	0	24 (38 %)	**0.003**

Bold value indicates statistical significance at $p < 0.005$

radio-chemo therapy. Besides, in few cases (6 cases) the hyperbaric treatment was refused because of psychological problems as well as a disagreement to undergo daily therapy for 10–14 days [14].

Definitive closure of the fistula was confirmed by contrast-enhanced transit X-ray. Patients who experienced a pharyngocutaneous fistula had longer mean time of decannulation and of removal of nasogastric feeding if compared to mean time of removal of tracheal cannula in patients without this complication (101 days versus 28 and 76 days versus 20 days, $p < 0.05$ for both). Pharyngocutaneous fistula is a negative prognostic factor in the restoration of normal physiological functions in terms of swallowing and respiration with a significant impact ($p < 0.0001$ both). We also tried to identify potential factors predictive of pharyngocutaneous fistula, but no potentially responsible factor for higher rate of pharyngocutaneous fistula was identified in a logistic regression analysis.

Only one patient in our series was affected by aspiration pneumonia. He had underwent a SCPL and was successfully treated with antibiotic therapy with no further episodes of aspiration.

Stoma stenosis was developed by 3 patients (4 %). All of them successfully underwent revision surgery with stomia plasty.

Two patients (2.7 %) died perioperatively because of myocardial infarction.

Discussion

Although STL remains the most frequently performed salvage technique after RT failure, in the recent decades SPLs have been used allowing to preserve laryngeal functions and to avoid permanent tracheostoma [15]. As widely reported in literature, the most important and difficult point is to perform a correct restaging of the tumour because strict oncological criteria must be considered before planning conservative treatment [15].

With the diffusion of more accurate imaging and endoscopic technologies, the possibility to better define the limits of RT recurrence in the larynx prompted several surgeons to successfully attempt conservative surgical approaches. The difficulty in identifying and staging the recurrent tumour correctly is strictly related to structural alterations of laryngeal mucosa due to the previous RT treatment, which could be macroscopically as well as microscopically indistinguishable from the local recurrence. For this reason, clinical examination should be implemented with biomolecular and histopathological research to identify the RT response of the individual tumour [16].

Survival

Disease-free survival and overall survival results vary in relation to the salvage surgical technique employed and are generally in agreement with similar studies published in literature.

Endoscopic laser CO2 cordectomy type IV represents a feasible treatment mostly for T1a and T1b lesions. Literature reveals satisfactory functional results in terms of deglutition and quality of voice for this endoscopic procedure, while 5-year DFS was extremely variable, ranging from 38 to 88 % [10]. Our limited number of endoscopic treated RT-recurred lesions reported 50 % of loco-regional control at 5 years and a 5-year overall survival rate of 67 %. Among those patients who experienced a second recurrence, only 12 % underwent a second salvage conservative surgery, in line with existing literature [17]. We observed that salvage endoscopic laser CO2 cordectomy seems to present a high risk of second laryngeal recurrence when compared with open partial laryngectomy approaches (usually up to 70 % according to review by Agra et al.) [10]. It is likely that the direct view of the neoplasia together with a more extended excision of involved and irradiated larynx in open approaches seems to guarantee a better local control after RT relapse than these achieved by endoscopic approaches.

Among patients treated by SCPL we recorded a 5-year DFS rate of 83 % and an OS rate of 100 %. These data match those present in current literature (Agra et al.) [10]

and show a better prognosis for these patients versus those receiving STLs, which record a 5-year DFS and OS rates of 0 and 62 %, respectively.

The apparent discrepancy is obviously justified by selection criteria for SPL (rT1–rT2 and selected rT3), which is a procedure dedicated, for its nature, to less aggressive or extended recurrences. These results support the use of SPL as an oncologically sound and functionally conservative surgical procedure for upstaged lesions encompassing rT2 and rT3, reserving STLs for the treatment of rT4 lesions or second (post salvage surgery) recurrences as previously reported [18].

During follow-up we diagnosed a second recurrence in 23 % of patients, of which only 33 % could be surgically treated by SPL. As evidenced in literature [19–22] and confirmed in our study, the prognosis in these secondly recurred patients is extremely negative and the only treatment option is STL with adjuvant treatment.

When we compare DFS and OS of patients who underwent STL and those who underwent total laryngectomy as primary surgery, DFS and OS of first group are 71 and 47.5 % in contrast with 0 and 62 % for the second group [5]. A worse prognosis is also reported for SPL as a salvage procedure rather than primary surgery, with a DFS of 100 % and OS of 94 % for the first-treatment group and both 83 and 100 %, respectively, for the salvage group.

Overall, in our study, 33.3 % of our patients died as a consequence of the post-RT recurrence, in 60 % of cases for a second recurrence despite a STL was attempted (84 %). As evidenced in literature [23] and confirmed in our study, the prognosis for these patients is extremely negative and the only option suitable is STL followed by adjuvant treatment or curative/palliative radio and chemotherapy. Minor causes of death were documented for 7.5 % of patients: 5.7 % experienced a second primary extra-laryngeal cancer, 3.8 % had pulmonary metastases and 2.7 % experienced fatal peri-operatory bleeding.

Indications for selective neck dissection in cN0 patients are still today object of discussion. According to Ganly [5] the decision must be based on a correct r-staging [24] to evidence extension of recurrence in higher risk areas such as supraglottic or hypoglottic larynx, or in case of extra-laryngeal tissues' involvement (which corresponds to rT3 and rT4), parameters which are predictive factors of N+ risk. Nonetheless, analyzing the data here reported we believed that selective neck dissections in N0 RT-recurred early glottic cancer have limited indications.

Complications and functional results

In our series we recorded an overall rate of postoperative complications of 40 % and an incidence of postoperative mortality of 2.7 %, while a similar report in literature reveals a postoperative complication rate of 20 % and no postoperative mortality [5]. SPL showed a lower rate of postoperative complications than STL (15 vs 45 %, $p = 0.005$). Comparing our results to Pellini's work [22], the incidence of complications for patients who underwent SPL was 15 and 38.5 %, respectively, while perioperative mortality was 0 and 1.3 %. The most common complication is aspiration pneumonia (17 %), a higher incidence than in Pellini's study (8.9 %), all treated with medical therapy, which is a better result than Makeieff's work where 8.7 % of patients with aspiration pneumonia died [24]. In our study, the incidence of early postoperative complications was 3 %, which consisted in only one bleeding without other complications such as neck abscesses as showed in Pellini's work (6.4 %). The same two works also reported the incidence of late complications, such as granuloma of the subglottis or oedema of the arytenoids, estimated around 17.9 %, which were not documented in our series.

Among the 12 patients who underwent SPL restoration of oral feeding was achieved in all patients with a mean time of 29 days. In other studies [18, 25–28] mean time of restoration a normal feeding was 25 days and in Pellini's study was in less than 1 month for 61.5 % of patients [22]. The time of removal of the feeding tube ranged in literature from 10–96 days [28] to 12–90 days [18], in our study was 4–230 days. Only one patient (5 %) was not able to restore normal swallowing functions and required percutaneous endoscopic gastrostomy, similar results to Makeieff's (4.4 %) and Pellini's (7.7 %) studies.

Mean time of decannulation was in our study 22.5 days with a range of 18–35 days, which ranged in literature from 14–90 [29] to 12–365 days [19]. Our results, when compared with literature, are characterized by a lower incidence of pneumonia and higher time of decannulation. This is mainly due to our philosophy (common to several Institutions in Italy) to grant a better protection of the airways during swallowing rehabilitation by maintaining the tracheal cannula for a longer time. This could justify a higher time of decannulation but a lower risk of aspiration pneumonia, even if this usually delays restoration of normal swallowing.

STL has been associated with high rates of postoperative complications in our study (45 %) and in many series in literature, especially after previous radiotherapy (from 29.4 [30] to 21.9 % [5]) and chemoradiotherapy (from 41.2 to 50 %) [29]. The incidence of late complications as stoma stenosis is estimated in literature about 9 % [5] while in our case study was 4 % and they all required surgical re-intervention. The most common complication is pharyngocutaneous fistula, which had an incidence of 32 % in our study, 11.9 % in Ganly's and 30 % in Weber's [25]. The rate of pharyngocutaneous fistula following STL in

irradiated patients is higher than that after total laryngectomy as primary treatment (from 68 to 8.69 % [30–32]). Because our series included only early glottic cancer, without any patient treated with a laryngeal preservation protocol for advanced disease, we found a higher rate of fistulas than reported in literature. In our Institute fistula was usually treated with a conservative approach based on the use of a scopolamine patch and medications to have good functional results but with long times of hospitalization, only 8.3 % underwent reparative surgery with a pectoralis major myocutaneous flap.

Conclusions

To our experience, the central point of surgical treatment recurrences after RT once the diagnosis is made is the difficulty of restaging, which might have a dramatic impact on planning the type of salvage surgery and prognosis, as demonstrated by our analysis. Therefore, an accurate evaluation of RT-recurred laryngeal carcinoma is mandatory to plan the surgical salvage treatment in RT-failed early glottic cancer, being not limited to STL.

Our experience suggests that conservative approaches are still feasible with good oncologic results, but in a selected RT-recurred cancer and at the price of some potential functional problems. In recurring early glottic cancer post radiotherapy, treatment of the neck does not usually present a hard decision for the surgeon, being the risk of lymph node involvement very low. Analogously, we documented for these patients a low rate of distant disease, in contrast with the reported high risk of distant metastases in failed patients after chemoradiation laryngeal preservation protocols for advanced laryngeal cancers.

Conflict of interest Any authors who developed this manuscript declare no conflict of interest.

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