Clinical Interventions in Aging Dovepress

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REVIEW

Transoral Laser Microsurgery and Transoral Robotic Surgery in Aging Patients: A State-of-The-Art Review

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Purpose: In the present study, the findings related to the epidemiology, clinical presentation, and therapeutic outcomes of elderly patients treated with transoral laser microsurgery (TOLM) and transoral robotic surgery (TORS) for supraglottic laryngeal squamous cell carcinoma (LSCC) have been reviewed.

Methods: A PubMed, Cochrane Library, and Scopus literature search was conducted according to the PRISMA statements. Critical literature analysis was carried out considering the last advancement in TOLS and TORS, and their related surgical, functional, and survival outcomes.

Findings: The mean age of patients with supraglottic LSCCs has progressively increased in the past decades. The data on post-operative complications in elderly patients with LSCC are heterogeneous and contradictory. The thought of the age-related high risk of complications was based on open supraglottic laryngectomy (SGL), but not on TOLM and TORS findings, which do not support an age-related increase of most postoperative complications. The only complication that could be associated with age is aspiration. The adequate selection of patients undergoing TOLM or TORS, and the pre- to postoperative evaluation of swallowing function can prevent this risk. The OS of elderly patients treated with TOLM or TORS SGL could be lower compared to younger patients. However, the disease-free survival was not influenced by age, highlighting the role of comorbidities and intercurrent diseases in the presumed lower survival. The survival analysis could definitively consider the physiological age rather than the chronological age to investigate the impact of age on survival outcomes.

Conclusion: The current literature supports an important place of TOLM and TORS in managing cT1-T3 supraglottic LSCC. The preoperative geriatric, nutritional, and swallowing evaluations are important for ensuring an adequate selection of patients treated with TORS or TOLM SGL.

Keywords: larynx, carcinoma, cancer, otolaryngology, head neck, surgery, transoral, laser, robotic, TORS, elderly, aging, age

Introduction

Head and neck squamous cell carcinoma (HNSCC) is the 6th most common adult cancer worldwide, corresponding to 5.3% of all cancers.[1] Of the HNSCC group, laryngeal squamous cell carcinoma (LSCC) is the second most common malignancy, accounting for 211,000 new cases and 126,000 deaths per year worldwide.[2,3] LSCC represents approximately 2% of all cancers.[2,3] As for many disorders, the age of the patient, the general health, comorbidities, and other aging-related features can influence the clinical presentation, the therapeutic options, and oncological, functional, and surgical outcomes.[4–6] The supraglottic LSCC corresponds to one-third of all LSCCs.[7] The treatment of this group of LSCCs is challenging because they are diagnosed in a more advanced stage than glottic cancer, which is associated with poorer survival outcomes compared to glottic LSCC.[1,6] Among surgical options, transoral laser microsurgery (TOLM) is the standard of care for treating cT1-T3 supraglottic LSCC.[6] However, TOLM can be challenging in elderly patients regarding several limitations, including anesthesiologic risks, comorbidity-related difficulty in exposing the larynx, and the risk of postoperative complications.[6] In the past decade, the minimal invasive surgical procedures for supraglottic

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cancer progressively change with the development of transoral robotic surgery (TORS) as an alternative to TOLM.[6] Due to the high prevalence of comorbidities in the aging population, the polypharmacy, and the potential related toxicity of some anticancer drugs, exploring the surgical, functional, and oncological outcomes of patients over 70 years old undergoing minimal invasive surgical treatment is relevant.

In the present review, the findings related to the epidemiology, clinical presentation, and therapeutic outcomes of elderly patients treated with transoral laser microsurgery (TOLM) and transoral robotic surgery (TORS) for supraglottic LSCC have been reviewed.

Methods

A PubMed, Cochrane Library, and Scopus database research was conducted for relevant peer-reviewed publications in English, Spanish, and French-language related to epidemiology, clinical presentation, therapeutic options, surgical, functional, and oncological outcomes of TOLM and TORS procedures in the elderly population. The PRISMA statements were used to conduct the literature review (Figure 1).[8] The following key words were associated (and/or): "larynx", "laryngeal", "cancer", "carcinoma", "transoral", "laser", "robotic", "aging", "old", "surgery", "findings", "treatment", "surgical", "survival", "oncological", "functional", and "outcomes". The following studies were included: clinical prospective/retrospective controlled/uncontrolled studies, systematic reviews, or meta-analyses. From this initial review, the papers were selected for inclusion in this state-of-The-art review if they focused on epidemiology, clinical presentation, TOLM and TORS approaches, and outcomes of the aging population with supraglottic LSCC. The authors should report inclusion and exclusion criteria, diagnostic methods, therapeutic outcomes, and the treatment regimen. Case reports were excluded. The patients needed to be followed for at least one year. At least one functional, oncological or surgical outcomes had to be reported in the study. No conflicting data were detected.

A critical analysis of this literature was carried out considering the last advancement in minimal invasive surgery (TOLS and TORS), micro-technologies, and artificial intelligence. From this review, implications for practice were summarized. Ethics committee approval was not required for this review.

Note that a systematic review or meta-analysis was not performed according to the few studies focusing on elderly populations with LSCC and the important heterogeneity in inclusion/exclusion criteria, indications, selection of patients, and surgical, functional, and survival outcomes.

Epidemiology

The overall incidence of LSCCs varies across the world regions, with South Asia, the Caribbean, and Central Europe having the highest incidence.[2] The male/female ratio is 6/1. Epidemiological studies showed that the incidence of LSCC decreased in males and remained unchanged in females in the past three decades, which is attributed to the gender-related differences in tobacco consumption.[2,3] HNSCC and LSCC are increasingly considered as an aging disease with approximately 30% of all patients diagnosed over the age of 70 years old.[9] Indeed, LSCCs are commonly diagnosed in the sixth or seventh decade of life in patients with a history of tobacco and alcohol abuse, the latter being a contributing factor of supraglottic LSCC.[10–13] The mean age of LSCC appears to have increased over the past three decades, with a higher proportion of young patients in females compared to males.[12] This global trend was not observed for oropharyngeal squamous cell carcinoma (OSCC), which is the only subsite to show a decrease in the mean age at diagnosis.[12] However, when focusing on the elderly population, the incidence of OPSCC is found to be increasing in the United States, likely driven by HPV-associated cancers.[14] The significant growth of elderly LSCC populations remains poorly considered in the development of therapeutic protocols for supraglottic LSCC because, to date, the aging population represents less than 5% of enrolled participants in HNSCC clinical trials, leading to a lack of validity in most clinical trials in older adults.[9,15] Thus, the current epidemiological findings support an increased importance for adapting the current practices, regimens, and guidelines for treating supraglottic LSCC to the aging population.

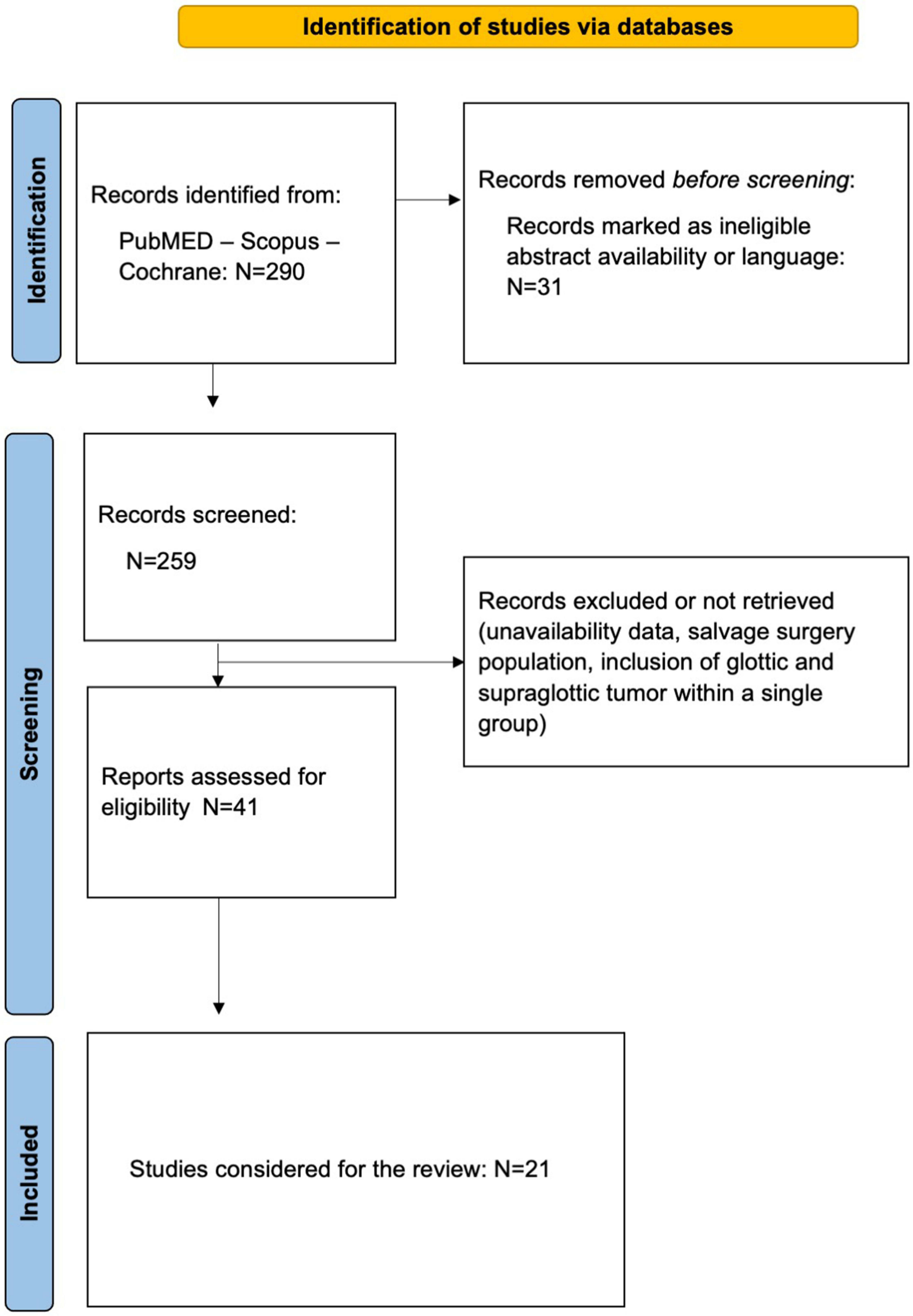

Figure 1 PRISMA Flow chart.

Clinical Presentation, Comorbidities, and Initial Work-Up

Clinical Presentation

The clinical presentation of supraglottic LSCC can be insidious, especially in elderly patients. The studies showed that glottic LSCCs are rapidly associated with dysphonia and voice-related disorders affecting the patient's quality of life (QoL), and, consequently, the diagnosis of glottic LSCC is performed at an early stage.[16] Given the indirect or delayed impact on voice quality and the age-induced laryngopharyngeal mucosa sensory disorders, the supraglottic LSCCs are associated with symptoms (eg, dysphagia, odynophagia, throat pain, globus sensation, otalgia, or neck mass) that impact the patient's QoL at a more advanced stage.[17] The insidious development of supraglottic malignancy symptoms, the atypical clinical presentation related to aging, and the social isolation of elderly patients can be important factors contributing to a delayed diagnosis in the elderly compared to the younger population.[18] In addition, symptoms of supraglottic cancer frequently occur in the context of a high prevalence of dysphagia in the elderly population,[19] and they are primarily attributed to various pre-existing diseases, such as laryngopharyngeal reflux, presbyphagia, neurological conditions, medication-adverse events, etc.[20] The progressive development of dysphagia and other throat-related symptoms in an aging patient with a history of tobacco and/or alcohol over-consumption needs to indicate the realization of a nasofibroscopy by an otolaryngologist.

Comorbidities

The medical and surgical comorbidities and the related polypharmacy are more prevalent in the elderly population. The comorbidities are even more prevalent in elderly patients with HNSCC given the history of tobacco and alcohol overuses, which commonly increase the risk of developing cardiovascular and respiratory disorders.[21] The comorbidities of aging patients are important to consider before proposing a surgical treatment for many reasons.

First, some comorbidities and related polypharmacy can interfere with surgical and potential postoperative medical treatment tolerability and recovery.[9] Thus, Mohamed et al reported a significant association between polypharmacy, postoperative complications, and chemotherapy-induced toxicities.[22] In the same way, van Deudekom et al demonstrated that neurological and cognitive disorders in elderly patients with HNSCC, significantly increase the risk of postoperative delirium in patients undergoing head and neck surgical procedures.[23]

Second, some comorbidities can be associated with poor surgical outcomes. The most blatant example is arthrosis, retrognathia, narrow mandibular arch, or macroglossia, or limited neck extension, which limit the neck extension and the laryngeal exposure in TOLM. Interestingly, this TOLM-limitation probably occurs less frequently in TORS regarding the 30° optic's view, and the ability of the Da Vinci robot (Surgical Intuitive®, Sunnyvale, USA) to work through an angulation view with flexible instruments.[24] Poor dental status of aging patients is an additional point that can be associated with a high risk of dental lesions during the larynx exposure or the placement of the tongue retractor in TORS. Aging patients also have a higher proportion of temporomandibular joint disorders compared to younger individuals,[25] which can limit mouth opening and transoral exposure of the surgical field.

Third, some TOLM and TORS procedures are associated with laryngopharyngeal tissue defects and related swallowing disorders.[26] The rehabilitation processes are crucial in elderly patients and contribute to functional and survival outcomes. In that way, before proposing surgical procedures, the oncological board can determine if postoperative rehabilitation could be possible according to the comorbidities, cognitive, and social statuses.

Initial Work-Up and Additional Examination

The several points outlined above strengthen the importance of geriatric evaluation before surgery. Several clinical instruments can be used in an overall geriatrics evaluation considering the cognitive, muscle, and nutrition status.[9] In addition to the geriatric evaluation, the TOLM and TORS can indicate a complete swallowing and voice quality assessment by a speech therapist before the surgical procedures. Finally, psychosocial factors play an important role in postoperative rehabilitation, functional, and survival outcomes, making important the role of the multidisciplinary team. Note that the exposure of the laryngeal surgical field can be assessed preoperatively in consultation through a careful evaluation of the mouth opening or in the operating room (initial work-up and tumor biopsies) where the surgeon can try to expose the tumor to evaluate the possibility of surgery.

Surgical Therapeutic Strategies

Global Trends for Treating Elderly Patients with Supraglottic Laryngeal Cancer

The poor global health outcomes, several comorbidities, and the theoretical risk of complications in patients over 65 years of age lead many oncological boards to favor radiation in place of surgery.[27] The complications of surgery can be particularly dangerous in elderly patients considering the age-related physiological changes, sarcopenia, decreased pulmonary function, cognitive disorders, and reduced immune function, but this thought can be similarly applied to some conservative treatments, such as chemoradiotherapy.[9] However, a few studies have investigated the rate of complications and the failure of surgical procedures in the elderly population compared to young patients. As proposed by Dickstein et al, it is unclear whether age is a confounder or a true independent risk factor of such complications.[9] This observation is particularly relevant when considering the minimal invasive approaches for cT1-T3 supraglottic LSCC. The development of robots can change the practice and the common ideas in the treatment of elderly patients. When determining a treatment plan for an aging adult with supraglottic LSCC, it is important to consider that elderly individuals are a heterogeneous cohort and chronological age alone is often a poor surrogate for treatment-related outcomes.[9] Finally, in the context of the development of deescalate treatments in head and neck oncology, the consideration of the advantages of minimal invasive surgical procedures (TOLM and TORS) is an important finding for elderly patients with supraglottic LSCC.

Transoral Laser Microsurgery in Elderly

The CO_2 TOLM was progressively spread as an alternative to external/open SGL for LSCC at the end of the nineties.[6] This approach has many advantages over open SGL in the elderly populations but requires some conditions. The microscope and the CO_2 laser are commonly available in most Western country hospitals, which facilitates the TOLM choice over open procedures. The benefits of performing SGL through TOLM include the preservation of healthy tissues involved in the voice and swallowing functions, the possibility of avoiding tracheotomy, the rapid oral diet re-start, the low postoperative complications, and the shorter hospital stay.[10] Indeed, during open procedures, muscles involved in swallowing, and voice, as well as the thyroid cartilage are dissected/injured resulting in immediate airway swelling, the need for tracheotomy, and more voice and swallowing disorders.[27] Despite these surgical and functional advantages, the number of studies dedicated to the comparison of TOLM and open SGL in elderly patients remains low. Chiesa-Estomba et al compared the surgical, functional, and oncological outcomes of patients over 65 years of age (mean=71.2 years) versus youngest patients (mean age=52.5 years) undergoing open and TOLM SGL.[27] Considering the surgical approaches (TOLM versus open SGL) and the age, the authors reported that the TOLM approach was associated with significantly lower hospital stay duration, tracheotomy rate, and mean time of decannulation compared to open SGL.[27] Except for the age-induced comorbidities associated with laryngeal exposure difficulties, the primary limitations of TOLM in elderly patients are not related to the age but they are associated with the procedure itself. Compared to TORS, the TOLM procedure depends on the laryngeal exposure, the small operative field view, and the lack of surgical instrument amplitude.[10,13] Finally, the learning curve of TOLM is long, which can be attributed to the above-mentioned limitations and difficulties.[10,28,29]

Transoral Robotic Surgery in the Elderly

The rationale for using TORS for SGL in elderly patients is related to the numerous advantages of robots, which significantly improve surgical, functional, and survival outcomes.[13,30] From a technical standpoint, the exposure of the surgical field with TORS is easier than TOLM regarding the 3D imaging and the 30° angulation of the optic's view. The TORS involves the anterior traction of the tongue out of the mouth, which moves the tongue base in a horizontal plane, elevating the laryngopharyngeal tissues.[13,30] Moreover, the console system and the configuration of instruments improve the dexterity of movements through a 180° angulation of instruments, and the filtration of physiological tremor. These advantages led many surgeons to report that the robotic technique is considerably more comfortable, and less fatiguing for the surgeon than the endoscopic technique and TOLM; the latter being associated with high rates of positive margins in some clinical studies.[10,13] The technical and surgical advantages of TORS can lead to a therapeutic deescalate, which is an important point in the elderly population.[10,13,31] Moreover, in the case of advanced LSCC (cT3 or N+), the use of TORS can lead to the realization of the contralateral neck dissection 3 weeks after the tumor and the ipsilateral neck dissection operating time, which can avoid the need for tracheotomy.[13,32] Interestingly, the few studies comparing TORS and TOLM suggested that the rates of positive margins in TORS-SGL are lower than those of TOLM-SGL, and, consequently, the overall survival, disease-free survival, local, regional, and relapse-free survival rates of TORS appear to be higher than those found for TOLM SGL.[30] The differences between TOLM and TORS in terms of surgical field view and instrument amplitude are described in Figure 2.

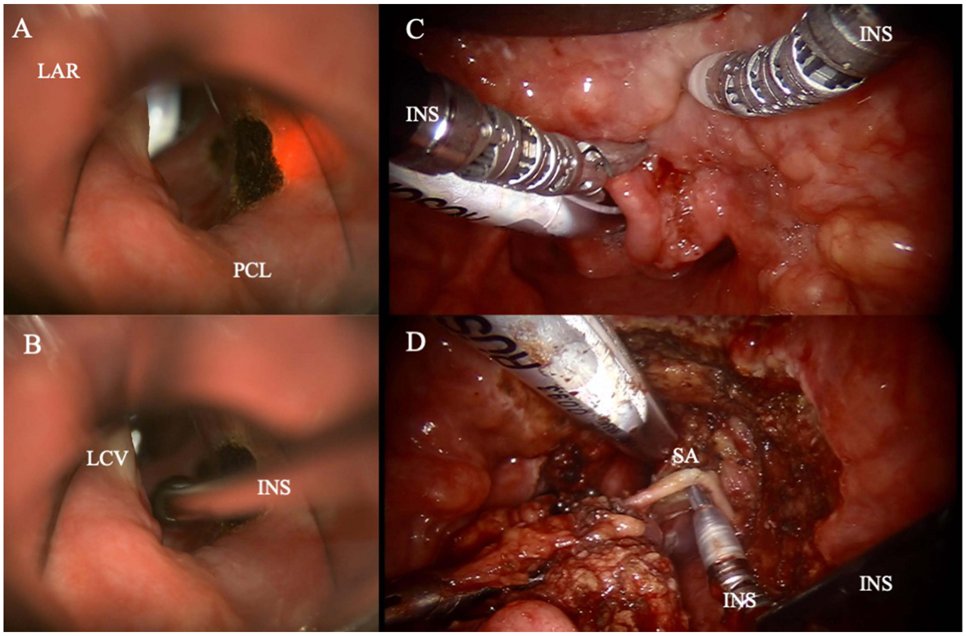

Figure 2 Operative Fields of TOLM and TORS. The view of an operative field (posterior laryngeal commissure (PLC) et back of the left vocal cord (LVC)) in transoral laser microsurgery (**A** and **B**). The view is limited by the width of the laryngoscope (LAR) and the instruments (INS) used are not flexible. In transoral robotic surgery (**C, D**), the width of the operative field is larger compared to TOLM and the 3-D view is better. The instruments are flexible, allowing the dissection of the superior laryngeal artery (SA).

Therapeutic Outcomes

A few studies compared surgical, functional, and oncological outcomes between old and young patients with TORS-TOLM SGL,[18,27,33] which limits the drawing of definitive conclusions. However, several studies have evaluated outcomes in cohorts of patients with an age over 60 years old, which can lead to a comparison between their outcomes with those of large systematic reviews.[10,13] The outcomes of these studies are described in Tables 1 and 2.[27,34–53]

Table 1 Surgical and Functional Outcomes of TOLM and TORS Cohort Studies

References	Design	EBL	Demographics		Adj. C/RT	Functional outcomes				Restart of
			N	Age (y)	N (%)	Tracheo.	Deca (d)	Feeding (N,%)	GA (N)	Oral Diet (d)
Transoral Laser Supraglottic laryngectomy										
Roh, 2008[34]	Prospective	C	21	68.0°	5 (23.8)	3 (14)	–	–	0 (0)	–
Ozturk, 2021[35]	Retrospective	D	17	66.5	8 (47.1)	2 (12)	14.5	17 (100)	1 (6)	
Ansarin, 2013[36]	Retrospective	D	10	65.0	3 (30.0)	8 (80)	–	4 (40)	0 (0)	8.0°
Piazza, 2016[37]	Retrospective	D	96	65.0	–	7 (7)	4.0	32 (33)	–	7.0
Peretti, 2010[38]	Retrospective	D	80	64.5	21 (26.3)	23 (29)	7.0°	33 (41)	0 (0)	7.0
Agrawal, 2007[39]	Prospective	C	34	64.0°	32 (94.1)	4 (12)	7.0	34 (100)	3 (14)	–
Puxeddu, 2003[40]	Retrospective	D	12	62.5	1 (8.3)	10 (83)	15.9	10 (83)	10 (91)	14.5
Panuganti, 2022[41]	Retrospective	D	45	63.2	0 (0)	–	–	–	–	–
			31	61.9	31 (100)	–		–	–	–
Carta, 2018[42]	Retrospective	D	42	61.8	8 (19.0)	23 (55)	9.7	36 (86)	0 (0)	5.9

(*Continued*)

Table 1 (Continued).

References	Design	EBL	Demographics		Adj. C/RT	Functional outcomes				Restart of
			N	Age (y)	N (%)	Tracheo.	Deca (d)	Feeding (N,%)	GA (N)	Oral Diet (d)
Pantazis, 2015[43]	Retrospective	D	24	61.4	10 (46.7)	11 (46)	7–10	–	0 (0)	–
Chiesa-Estomba, 2016[27]	Retrospective	D	31	61.5	24 (77.4)	–	–	25 (81)	4 (14)	1.5
Ambrosch, 1998[44]	Retrospective	D	48	61.0°	2 (4.2)	0 (0)	–	48 (100)	–	5.0°
Gokmen, 2020[45]	Retrospective	D	19	60.9	1 (5.3)	5 (21)	70.5	13 (68)	6 (32)	2.4
Sievert, 2020[46]	Retrospective	D	30	60.8	17 (56.7)	13 (43)	3.0 mo	–	17 (77)	30.1 mo
Gonzalez, 2012[47]	Retrospective	D	49	60.0	13 (26.5)	6 (12)	–	42 (86)	–	10.8
Transoral Robotic Supraglottic Laryngectomy										
Olsen, 2012[48]	Retrospective	D	9	61.9	6 (67)	9 (100)	2	4 (44)	–	0–30
Ansarin, 2013[36]	Retrospective	D	10	68.0	6 (60)	9 (90)	–	7 (70)	1 (10)	12°
Lallemant, 2013[49]	Retrospective	D	23	61.0	16-7-0	2 (9)	11.2	19 (83)	1 (4)	–
Park, 2013[50]	Prospective	C	16	66.0	7-5-4	16 (100)	11.2	16 (100)	2 (13)	–
Karabulut, 2018[51]	Retrospective	D	17	62.0	13 (76)	0 (0)	–	17 (100)	0 (0)	7
Doazan, 2018[52]	Retrospective	D	122	60.0	63 (52)	–	–	–	–	–
Dabas, 2019[53]	Retrospective	D	46	63.0	26 (56)	24 (53)	6.3	34 (74)	0 (0)	8.4

Notes: The studies included in this table are studies reporting a mean age of patients over 60 years. °=median.
Abbreviations: EBL, evidence-based level; N, number; C/RT, (chemo)radiotherapy; d, days; GA, gastrostomy; mo, month(s); TOLM, transoral laser microsurgery; TORS, transoral robotic surgery; Tracheo, tracheotomy.

Table 2 Survival Outcomes of TOLM and TORS Cohort Studies

References	Design	N	Age (y)	Stages (N)		Adj. C/RT	Survival outcomes				
				c/pT1-T2-T3	N+ (%)	N (%)	OS	DFS	LRec	NRec (N, %)	FU (mo)
Transoral Laser Supraglottic laryngectomy											
Roh, 2008[34]	Prospective	21	68.0°	5-5-11	15 (71.4)	5 (23.8)	79.0	71.0	2	2	41
Ozturk, 2021[35]	Retrospective	17	66.5	4–10–3	8 (47.1)	8 (47.1)	–	–	0	0	33.8
Piazza, 2016[37]	Retrospective	96	65.0	28–46-22	–	–	69.0	85.9	5	2	61
Ansarin, 2013[36]	Retrospective	10	65.0	2-8-0	4 (40.0)	3 (30.0)	–	–	2	0	88°
Peretti, 2010[38]	Retrospective	80	64.5	22–38-20	71 (88.8)	21 (26.3)	84.4	88.3	3	3	51.0
Agrawal, 2007[39]	Prospective	34	64.0°	7–27-0	10 (29.4)	32 (94.1)	88.0	79.0	1	2	69.0°
Panuganti, 2022[41]	Retrospective	45	63.2	0–45-0	0 (0)	0 (0)	91.9/67.8	–	–	–	44–58
		31	61.9	0-31-0	0 (0)	31 (100)	67.4/47.5	–	–	–	
Puxeddu, 2003[40]	Retrospective	12	62.5	3-9-0	3 (25.0)	1 (8.3)	–	–	0	–	33.3
Carta, 2018[42]	Retrospective	42	61.8	12–23-7	10 (23.8)	8 (19.0)	64.9	93.1	90.5#	83.0#	39
Chiesa-Estomba, 2016[27]	Retrospective	31	61.5	2–15-14	7 (22.6)	24 (77.4)	83.8	67.7	–	6	36
Pantazis, 2015[43]	Retrospective	24	61.4	0-0-24	14 (58.3)	10 (46.7)	87.5	91.7	87.5	–	76.8

(*Continued*)

Table 2 (Continued).

References	Design	N	Age (y)	Stages (N)		Adj. C/RT	Survival outcomes				
				c/pT1-T2-T3	N+ (%)	N (%)	OS	DFS	LRec	NRec (N, %)	FU (mo)
Ambrosch, 1998[44]	Retrospective	48	61.0°	12–36-0	–	2 (4.2)	85.0/76.0	87/83	97.0#	2	55.0°
Gokmen, 2020[45]	Retrospective	19	60.9	–	–	1 (5.3)	84.2	79.0	5	–	62.0
Sievert, 2020[46]	Retrospective	30	60.8	20–10-0	24 (80.0)	17 (56.7)	–	86.7	3	–	50.2
Gonzalez, 2012[47]	Retrospective	49	60.0	12–17-20	19 (38.8)	13 (26.5)	93.2/82.2	61.3	7	3	49
Transoral Robotic Supraglottic laryngectomy											
Olsen, 2012[48]	Retrospective	9	61.9	1-6-2	5 (56)	6 (67)	66.7	–	100	66.7	26
Ansarin, 2013[36]	Retrospective	10	68.0	2-6-2	6 (60)	4 (40)	–	–	–	1/10	25
Lallemant, 2013[49]	Retrospective	23	61.0	16-7-0	3 (13)	4 (17)	–	–	2	–	15
Park, 2013[50]	Prospective	16	66.0	7-5-4	7 (44)	8 (50)	–	91.0	–	–	16
Karabulut, 2018[51]	Retrospective	17	62.0	5-4-8	–	13 (76)	88.0	94.0	–	–	25
Doazan, 2018[52]	Retrospective	122	60.0	44–62-16	46 (38)	63 (52)	78.7	94.3	90.2	87.7	5y
Dabas, 2019[53]	Retrospective	46	63.0	22–24-0	0 (0)	26 (56)	88.9	84.4	–	–	41.0

Note: The studies included in this table are studies reporting a mean age of patients over 60 years. °=median.
Abbreviations: #local or FU, follow-up; L.Rec, local recurrence; mo, month(s); N, number; N+, nodes+; N.Rec, node recurrence; C/RT, (chemo)radiotherapy; d, days; mo, month(s); OS, overall survival; TOLM, transoral laser microsurgery; TORS, transoral robotic surgery; y, year.

Functional and Surgical Outcomes

Of functional outcomes, the tracheotomy rates in elderly patients with supraglottic LSCC range from 0% to 83% in the TOLM group, and 0% to 100% in the TORS group, respectively (Table 1). The large range found in both groups was related to the realization of preventive tracheotomy in all patients in some hospitals. In the TORS studies where tracheotomy was not performed in all patients, the rates varied from 0% to 9%.[49,51] Considering most studies, the decannulation occurred after 4.0 to 15.9 days in TOLM-SGL, and 2 to 11.3 days in TORS-SGL, respectively (Table 1). The feeding tubes were placed in all patients in some studies,[35,39,44] while others used feeding tube in 33% to 86% of TOLM-SGL, and 44% to 83% of TORS-SGL, respectively. Oral diet was restarted after 1.5 days to 14.5 days in TOLM-SGL, and 0 to 12 days in TORS-SGL. The comparison of functional outcomes of studies reporting data for aging populations with those considering all ages[10,13] reveals that the tracheotomy, feeding tube requirement, and oral diet re-start ranges of aging population studies corroborate the data of the literature. Chiesa-Estomba et al analyzed the functional outcomes in TOLM-SGL patients according to age.[27] They reported that the findings of feeding tubes, percutaneous gastrostomy, and tracheotomy did not differ between age groups, which supports the safety, and effectiveness of TOLM in elderly patients with supraglottic LSCC.[27] The lack of differences in functional outcomes between elderly and younger patients was similarly observed by Vilaseca et al, who reported similar findings of voice quality, tracheotomy, and gastrostomy rates across age groups.[18]

Surgical Outcomes

The complications and their related consequences in vulnerable-aging patients have long been an argument to propose organ preservation treatments rather than surgical procedures for supraglottic LSCCs. The support for proposing chemo/radiation in elderly patients was based on studies that have shown that complications of head and neck surgeries significantly increased in the elderly population.[54,55] However, the recent literature shows that data on postoperative complications in elderly patients with HNSCC are heterogeneous and contradictory, with some authors reporting an association between age and the occurrence of postoperative complications,[56,57] whereas other teams observed that frailty, a high rate of pre-existing comorbidities, an advanced tumor stage, the surgery time, the poor geriatric evaluation status, and smoking are correlated with perioperative complications independent of age.[58–60] In a large-cohort retrospective study, Paderno et al investigated the influence of age on TOLM outcomes in patients over 75 years old treated for a supraglottic LSCC. The cohort included cTis (5.2%), cT1 (55.3%), cT2 (18.7%), and cT3 (3.7%) LSCC, respectively. They found that 20.9% of patients reported surgical or medical postoperative complications, with hypertensive crisis, emesis, and delirium, as the most prevalent complications.[60] Importantly, the authors demonstrated that age and comorbidities were not significant risk factors for complications.[60] In the study of Chiesa et al, considering comparable procedures, postoperative adjunctive radiation, tumor, and node stages in elderly and young groups, there were no significant differences across age groups for postoperative hemorrhage, neck infection, chondritis, stenosis, or dysphagia.[27] However, elderly patients reported a higher rate of aspiration pneumonia compared to young patients, which should influence the mean time of tracheotomy decannulation, and the hospital stay duration (17.4 days versus 8.2 days) in this study. The potential increased risk of aspirations in elderly patients was corroborated by Cabanillas et al who observed a correlation between the mean age of patients treated with TOLM for a supraglottic LSCC and the development of aspiration pneumonia.[33] The potential high rates of postoperative aspirations and pneumonia can be attributed to age-induced sensory mucosa disorder. Interestingly, despite a high risk of aspiration and pneumonia, the mean hospital stay appeared to be not affected in the study of Cabanillas et al.[33] Finally, in the study of Vilaseca et al, the elderly LSCC group (age over 80 years) did not report a higher prevalence of postoperative complications (eg, local infection, emphysema, hemorrhage, dyspnea, pneumonia, fistula, seroma) than the younger patients.[18] The hospital stay was the only surgical outcome differing between groups because elderly patients had a longer hospital stays compared to young patients (10.0 days versus 12.8 days) when considering a cutoff of 70 years; this age-related difference was not significant with a cutoff of 80 years.[18] Note that the hospital stay duration can be influenced by many independent factors from complications and age, and it has been found that elderly patients are more likely to have longer hospital stays and longer length of intensive care unit stays when treated at lower volume head and neck cancer centers.[9,61] Vilaseca et al have shown that there were significant age-related differences regarding functional outcome, with a higher number of patients over 70 years of age requiring definitive gastrostomy (6.5%) compared to those under 70 years of age (0%),[18] which strengthened the importance of selecting patients and providing nutritional advice, specific deglutition studies (fiberoptic endoscopic evaluation of swallowing), and related adaptation of the diet.

In summary, the controversy in the literature about the safety of SGL in elderly patients is based on heterogeneous studies that were mostly conducted in open SGL, while the studies investigating functional and surgical outcomes in TOLM and TORS SGL have been slow to provide reliable data. Nowadays, it appears that there is no evidence about the potential role of age in the occurrence of postoperative complications. The age was suspected to be associated with a high rate of postoperative aspirations, but many confounding factors limit the drawing of definitive conclusions. In practice, the selection of patients, and the realization of preoperative and postoperative swallowing examinations can limit the risk.[18]

Survival Outcomes

A recent systematic review suggests that the OS and DSS of TOLM-SGL were 70.1% and 82.0%, respectively.[10] In TORS-SGL, the 5-year OS ranged from 78.7% to 80.2%, and the 5-year DSS was 94.3%.[13] The data of survival outcomes of TOLM and TORS-SGL studies with a population age over 60 years are summarized in Table 2. While it is difficult to compare these studies with the general trends of the literature given the heterogeneity and inclusion of some elderly patients in the studies of systematic reviews,[10,13] we can observe that the OS and DFS data of cohorts with the highest age did not substantially differ from the data of the general populations included in the two systematic reviews. However, this observation needs to be tempered by the findings of studies investigating specifically the influence of age on survival outcomes. In 2021, Paderno et al reported that the 5-year OS, DSS, recurrence-free survival, and laryngopharyngeal dysfunction-free survival, were 68.9%, 95.4%, 79.5%, and 66%, respectively.[60] The authors demonstrated that age and comorbidities were associated with OS and laryngopharyngeal dysfunction-free survival, while advanced T categories were negatively correlated with OS, DSS, recurrence-free survival, and laryngopharyngeal dysfunction-free survival. The findings of Paderno et al suggested two important points. The first outlines the importance of the comorbidities, and, indirectly, the physiological age of patients in the survival outcomes. As reported by Lechien et

Hans, the presence of intercurrent diseases and related risk of death in the follow-up period in elderly populations can significantly bias the OS data.[10] The second point is related to the association between the tumor stage, OS, and DSS. As mentioned above, the diagnosis needs to be made as soon as possible in elderly patients given its critical influence on the patient's survival rather than the age itself. In that way, Vilaseca et al showed that the 5-y OS was 68.5% in <70 years, and 47.6% in >70 years patient groups, and there were no significant differences related to age for the DFS, which support the role of comorbidities and intercurrent diseases rather than the age itself.[18]

Conclusion

The current literature supports an important place of TOLM and TORS in the management of cT1-T3 supraglottic LSCC. The higher rates of postoperative complications in elderly patients compared to younger patients cannot be supported regarding the recent data, while the doubt persists for postoperative aspiration. The better OS of younger patients compared to older ones can be related to comorbidities, and intercurrent diseases, rather than to the chronological age. The preoperative geriatric, nutritional, and swallowing evaluations are important for ensuring an adequate selection of patients treated with TORS or TOLM SGL.

Disclosure

The author reports no conflicts of interest in this work.

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