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Transoral Robotic Surgery and Geriatric Population: Which Benefit?

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1. Abstract

1.1. Purpose: As a result of increased life expectancy, the proportion of elderly patients with head and neck cancer is constantly rising. Transoral robotic surgery has been developed over the last ten years as a minimal invasive surgical procedure. The purpose of this study is to evaluate the place of this technique for elderly patients.

1.2. Methods & material: Study data related to elderly (age over 75 years) patients who underwent TORS between March 2008 and March 2018 were analyzed. 28 elderly patients were included; the different locations were 18 laryngeal (10 glottic and 8 supraglottic), 3 hypopharyngeal, 2 oral cavities and 5 oropharyngeal carcinoma respectively.

1.3. Results: 28 patients, 23 men and 5 women, with an average of 79 years old were successfully operated without external conversion. The 3-year Disease-Specific Survival (DSS) rate is 87.3% and the 3-year overall survival (OS) rate is 65,6%. Surgery was completed in a mean of 131 minutes (including exposure). All patients were extubated the same day (56%) or the day after the surgery (44%). Except for total laryngectomies, three patients (10.7%) received transient tracheostomies. Oral feeding was started after an average of 11 days after surgery. The hospitalization stay was 27 days on average.

1.4. Conclusions: Trans-oral Robotic surgery is a valuable technical option to address *selected* head and neck carcinoma in the elderly population. Early postoperative rehabilitation limits swallowing disorders and pulmonary complications. The surgical time is reduced compared to conventional open surgery which is a great advantage for this fragile population.

2. Key words: Transoral; Robotic surgery; Geriatric; Oncology; Squamous Cell Carcinoma; Elderly.

Abbreviations: CGA: Comprehensive Geriatric Assessment; DSS: Disease-Specific Survival; FEES: Fiberoptic Endoscopic Evaluation of Swallowing; LARS: Laryngeal Advanced Retractor System; MBSS: Modified Barium Swallow Study; OS: Overall Survival; RFDSS: Relapse Free Disease Specific Survival; SCC: Squamous Cell Carcinoma; SLNB: Sentinel Lymph Node Biopsy; TLM: Transoral Laser Microsurgery; TORS: Trans-Oral Robotic Surgery.

3. Introduction

As a result of continuous medical improvement and increased life expectancy, elderly population continues to rise with implication for every healthcare systems. The World Health Organization (WHO) estimates a doubling of the population aged over 60 years between 2015 and 2050 [1]. One's can find a correlation between the onset of cancer and age group [2]. Indeed, between the ages of 60 and 69, about 1/7 men and 1/10 women will develop a cancer. After the age of 70, these rates increase to 1/3 for men and 1/4 for women [3]. More than 50% of new cases of head and neck cancer are diagnosed in the older people aged 65 and over [2].

Care providers supposed to differentiate the chronological age from the functional one. Indeed, chronological age is not a reliable predictor of functional reserve, life expectancy, or vulnerability to treatment side effects. Several 80 years-old people have physical and mental capacities similar to many 20 years-old people [1]. "Frailty" is a key concept in the elderly. It's a state of vulnerability with an increased risk of poor outcomes. The characteristics of frailty are well described like tiredness, involuntary weight loss, sarcopenia, weakness, slow walking speed, a decline in physical activity and body functions with an increased risk of falling [4]. The stress associated with illness, hospitalization and immobility is less tolerable and frail older people have a much longer time for recovering [4]. As a result, therapeutic management can be challenging for elderly patients. More than 10% of the elderly population can be considered as frail [2]. Geriatric population can be a challenge for oncologists, because of comorbidities, disabilities, polypharmacy, cognition and social issues.

With the evolution of surgical technologies and instruments, new surgeries by trans-oral approaches have emerged. First with transoral laser microsurgery and over the last decade with Trans-Oral Robotic Surgery (TORS). Several studies have shown that TORS procedures allow excellent oncological results with better functional results [5]. Indeed, with a less cervical dissection compared to the open surgery approach, the need of tracheostomy and gastrostomy is much reduced. The post-operative complications like fistula occur less, the hospitalization stay can be lower, and the swallowing is often safer.

Among elderly population, the prevalence of frailty population in head and neck location seems to be increased compared to other location (like breast, lung, …) [6]. Indeed, Kwon et al. reported frailty to be present in 43.6% of their study cohort [7]. This number can be explained by the tumoral location in the upper aerodigestive tract. This location is known as well innervated, which can generate more pain in pathologic situation. The size of the tumor can also engender obstruction and swallowing disorders. These troubles can exacerbate aspiration pneumonia and

malnutrition. In addition, patients are often addicted to tobacco and alcohol which increase the risk of chronic pulmonary and cardiovascular diseases. Therapeutic approaches can generate swallowing disorders and malnutrition because of their side effects like mucositis, xerostomia, dysgeusia, poor coordination of the swallowing mechanism or aspiration pneumonia [8]. The challenge in this population is to improve the oral intake and nutrition.

In this context, techniques minimal invasive likes TORS will probably be useful for this frailty population but need confirmation by studies. The trans-oral approach reduces the cervical dissection especially for the muscles, which are necessary to preserve the laryngo-pharyngeal suspension and motion. Our hypothesis is that less invasive technique could permit a better post-operative swallowing and could reduce the operative and anesthesia timing. In this study, we performed the first worldwide study to analyze the feasibility and the functional outcome of Squamous Cell Carcinoma (SCC) in elderly population treated by TORS approach.

4. Materials and Methods

The study protocol has been approved by institutional Ethics Review Committee.

TORS data has been prospectively collected in our institution since February 2008. Patients over 75 years-old with an indication of trans-oral robotic surgery were included in this study from March 2008 to March 2018. The majority of patients were treated in curative intent for a SCC, but 3 patients were also included for functional laryngectomies (for non-functional larynx after organ preservation chemoradiation with swallowing problems and aspiration). We assessed frailty of our study population by using validated onco-geriatric scale "G8" (Figure 1),

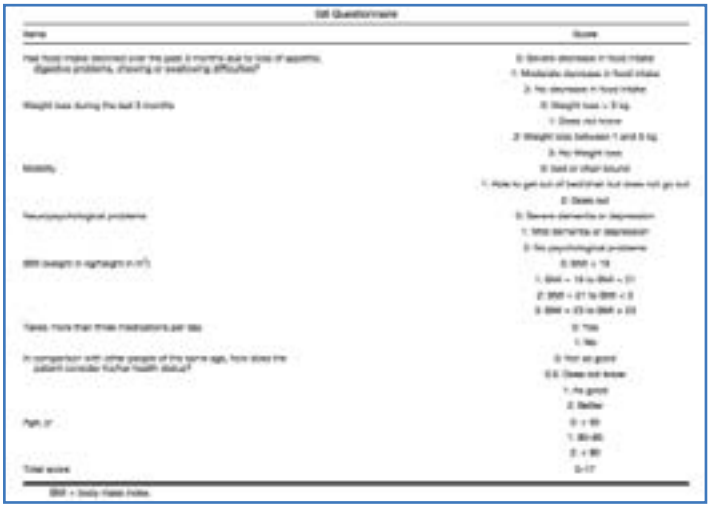

Figure 1: G8 questionnaire

ASA score (American Society of Anesthesiologists), analysis of their comorbidities and medication. All patients underwent a pre-operative workup including ENT video-fibroscopy, panendoscopy under general anesthesia and PET-CT. Patients with distant metastasis were excluded. During the panendoscopy session, tumor biopsy was taking and optimal trans-oral exposure was evaluated using the Laryngeal Advanced Retractor System (LARS; Fentex Medical, Neuhausen, Germany) [9]. All oncological therapeutic plans are discussed and validated by our institutional Multidisciplinary Tumor Board Committee including eligibility for transoral robotic surgery.

TORS was performed with the Da Vinci Surgical Robotic System Si (Intuitive Surgical, Sunnyvale, CA). In almost all cases, a 0° telescope was used, but for 5 patients a 30° telescope was needed (18%) depending of the patient anatomy to optimize vision and surgical free margin resection. Intra-operative safe margins confirmation was obtained after complete tumor resection, by a systematic tissue biopsy around the tumor resection bed for fresh frozen section analysis. TORS surgical procedures are well described for all locations in previous publications [10-16]. Swallowing function was assessed by Fiberoptic Endoscopic Evaluation of Swallowing (FEES) and Modified Barium Swallow Study (MBSS). Early and active speech therapy rehabilitation was started with all patients one day after extubation. A sufficient caloric intake was evaluated before feeding tube removal.

Post-operative adjuvant therapy decisions are discussed during Institutional Tumor Board Committee Meeting. based on the final histological results and surgeon comments. Decisional algorithm: 1- Clear surgical margins, oncological follow-up; 2- Close margins (<5mm) or Positive surgical margins (R1), surgical revision with fresh frozen section analysis; 3- Close margins (<5mm) without possibility for minimally surgical revision, post-operative adjuvant radiation alone; 4- Positive surgical margins without possibility for minimally surgical revision (R1), post-operative adjuvant chemo-radiation; 5- Peri-neural invasion or vascular embolism, post-operative adjuvant radiation alone; 6- More than 2 invaded lymph node (N2+) and/or extra-capsular nodal spread, post-operative adjuvant chemo-radiation. A systematic follow-up is organized for all patients, including FEES, NBI and swallowing assessment for five years.

Data were collected and recorded on the case reports forms. They were analyzed with Excel: MAC 2011 (Microsoft Corp.). Overall survival (OS), disease-specific survival (DSS), and disease-free survival (DFS) were computed for all patients as the time between surgery and death from any cause, death caused by cancer or an underlying effect, and the first relapse or death caused by cancer or underlying effect, respectively. Patients were right censored at the time of their last date of physical examination when they were still alive for OS and DSS and when they were still alive and without relapse for DFS. For DSS and DFS, patients who died from other causes were also right censored at the time of death. Kaplan-Meier survival curves were computed for each survival (i.e. OS, DSS and DFS) using the survival v.2.41-3 package of R v.3.4.0.

5. Results

5.1. Patients:

Twenty-eight patients were included from March 2008 to March 2018, with 23 men (82%) and 5 women (18%). The average age was 79 years old (range 75-87). The different locations and the patients' characteristics are summarized in (Table 1).

Table 1: Patients' characteristics.

Variable	No. (%)
Gender	
Male	23 (82)
Female	5 (18)
Age	
mean, yr.	79
Range, yr.	75 - 87
Primary site	
Oral	2 (7)
Oropharynx	5 (18)
Larynx	18 (64)
Supra-glottis	8[18]
Glottis	10[18]
Hypopharynx	3 (11)
G8 (mean)	10.4/17
ASA	
I-II	16 (57)
III-IV	12 (43)
Comorbidities (mean)	6.9
Drugs (mean)	5.6
0 – 2	5 (18)
≥ 3	23 (82)
BMI (mean)	24.17
Neck Treatment	
Sentinel lymph node biopsy	14 (56)
Neck dissection	6 (24)
Both	5 (20)
Margin status	
Negative	26 (93)
Positive	2 (7)
Adjuvant treatment	
Radiation	10 (36)
None	18 (64)

Yr.: year, No: number

The average of significant comorbidities was 6.9 (range 1-22), of which 18 cases of diabetes (64%). Comorbidities are defined as each different patient pathologies like cardiovascular (hypertension, hypercholesterolemia, heart attack, cardiopathy, vascular problems), diabetes, pulmonary diseases (BPCO, asthma, pneumonia history, …), neurologic diseases (stroke attack, dementia, …) surgical history and neoplasia history. The patients took between 1 – 14 different medications (average 5,6 drugs/patient). 5 patients took anticoagulant (18%) and 9 antiplatelet agents (32%). The average rate of G8 score was 10.4/17. Patients comorbidities are summarized in (Table 1).

About consumption history, 20 patients (71%) were smokers including 13 who quit smoking some years before the diagnosis. 9 patients (32%) drank alcohol every day and 4 occasionally. 14 patients (50%) already had history of ENT neoplasia, 7 underwent surgery, 3 (chemo)-radiation and 4 both surgery and (chemo)-radiation.

Among our 28 patients, 3 patients were operated for functional surgery (functional laryngectomies) and 25 for squamous cell carcinoma. Based on the guidelines set by the 8th Edition of American joint Committee on Cancer, the 25 patients staging was classified in (Table 2).

Table 2: cTNM Classification (AJCC 8th Edition).

T stage	N classification					Total
	0	1	2a	2b	2c	
1	6	0	0	1	1	8
2	5	2	0	1	0	8
3	6	0	0	1	0	7
4	2	0	0	0	0	2
Total	**19**	**2**	**0**	**3**	**1**	**25**

Stage I: 24%, Stage II: 20%, Stage III: 32%, Stage IV: 24%.

3 patients who beneficiated of a functional laryngectomy are not included in this table.

5.2. Peri-Operative Data

The average exposure time was 14.8 minutes (range: 5-30 minutes). The robotic surgical procedure took a mean of 116.4 minutes (range 16-290 minutes), including the time to assess the margins but not the cervical lymph nodes resection. The TORS was finished when all the margins were negatives by fresh frozen section. The surgical timing is summarized by location in (Table 3).

Table 3: Surgery's timing.

Location	Mean (min)	Range (min)
Oropharynx	69	30 – 140
Supra-glottis	75	45 - 98
Total Laryngectomy	235	165 - 320
Hypopharynx	67,5	47 - 88
All site	131	30 - 320

Min = minutes; The times includes the robotic procedure and exposition, and the management of the margins with the fresh frozen section; but excludes the cervical management.

No complication was noted during surgery, in particular no major bleeding and no transfusion was needed. No conversion to open surgery was required. In this cohort, neck management was planned according four options:

1. Clinical and radiological N0 patients (n = 17) beneficiated of a sentinel lymph node biopsy (SLNB) (1mCi of 99mTC-albumin nano-colloid) [17-18]. All the SLNB were sent for serially sectioned histopathology with immunohistochemistry staining. Among the 17 patients, 12 SLNB were negatives and 5 were positives. These 5 patients beneficiated of a cervical neck dissection between 2-3 weeks after the TORS procedure. None of the 12 negatives SLNB had cervical recurrence during their follow-up.
2. Positive lymph node patients N+ (n = 6), a simultaneous selective neck lymph dissection was performed on the same day as the TORS surgery.
3. Patients with cT4N0 (n=2, larynx location), beneficiated of a SLNB and a simultaneous cervical neck dissection in order to evaluate the SLNB in this indication. No lymph node metastasis was found in the final histopathology and no cervical recurrence occurs in their follow-up.
4. Patients with functional laryngectomies (n=3) didn't receive any neck treatment.

5.3. Early Post-operative Events :

Patients stayed at the Intensive Care Unit with a mean stay of 3 days (range 0-12 days). All patients were extubated after naso-fiberoptic examination the same day (56%) or the day after the surgery (44%). Post-operative bleeding occurred in 5 cases (17.8%), all managed by surgical revision: 5 by transoral approach (100%), none by cervical approach (0%). We performed preventive tracheostomy in 2 cases.

Five patients with total laryngectomy had a small fistula (50%): 4 were pharyngo-cutaneous with a cutaneous size less than 5 mm and 1 was a pharyngeal leak detected by video-fluoroscopy without skin visualization. All fistula were treated by local care, no flap was required. No fistula was found in the other location.

About final histological margins, 26 were negative and 2 were positive (7%) and need post-operative chemoradiation. Ten patients needed post-operative radiation (35.7%), 5 for cervical indications (50%), 2 for local radiation (20%) and 3 for both locations (30%). One patient refused his adjuvant treatment.

5.4. Oncologic outcomes

Average follow-up was 23.37 months (range 1-84,5 months). There were 2 local recurrences (7.14%), 4 second primaries (14.28%) and 2 lymph node recurrences (7.14%). About local recurrence, patients' characteristics are summarized in (Table 4). The patient number 4 had no adjuvant therapy because of his history of previous radiation for another ENT carcinoma. No clinical or histological factors were found to have a significant association with loco-regional failure, except for the patient number 2 who refused his adjuvant therapy.

The 3-year DSS rate is 87.3% and the 3-year OS rate is 65,6%. Three patients (10.7%) died for their recurrence, one for inhalation pneumonia (3.5%) and seven for other causes (25%). The 3-year relapse free disease specific survival (RFDSS) rate was 87,5%. Figure 2 shows the Kaplan-Meier curves for these rates.

Table 4: Tumor Recurrence Following TORS.

N°	Primary tumor	Neck Treatment	Adjuvant Therapy	Site to recurrence	Time (mo)	Recurrence treatment
1	pT2 N1	MRND	Yes	Neck	6	Immunotherapy
2	pT2 N3	MRND	No (refused)	Local	6	Surgery (radiation refused)
3	pT2 N1	SNLB and MRND	No	Neck	6	Surgery + chemoradiation
4	pT4a N0	SNLB and MRND	No	Local	4	BSC

Mo: month; SNLB: sentinel lymph node biopsy, MRND: modified radical neck dissection; BSC: best supportive care

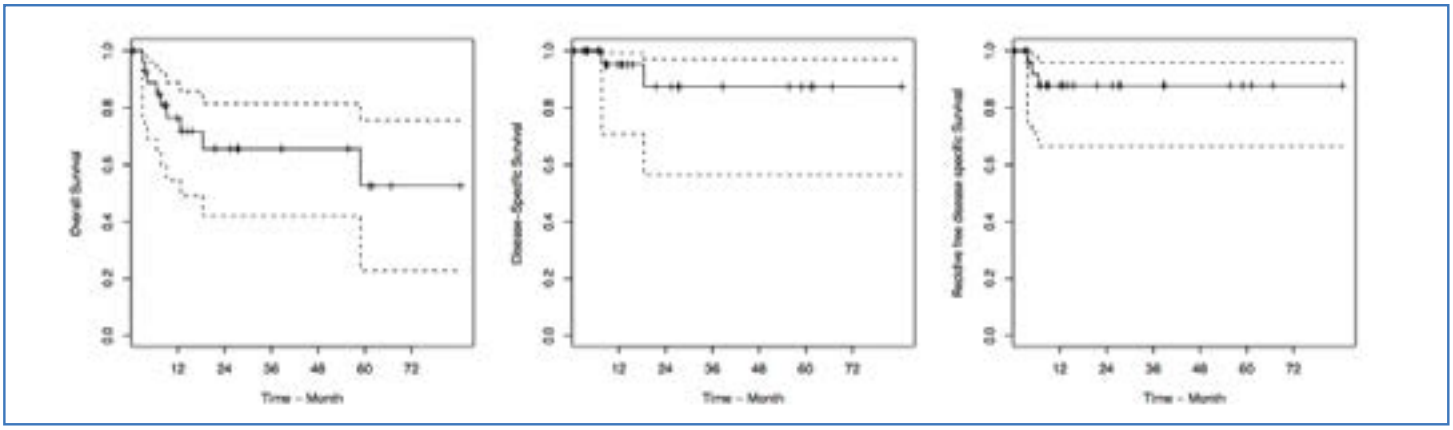

Figure 2

5.5. Functional outcomes

Except for total laryngectomies (n = 10), 2 patients received transient tracheostomies less than one month (7%). One patient kept a definitive tracheostomy (3%) because of a stroke attack 3 months after his surgery.

Oral feeding was started at an average of 11 days after surgery (median 10 days). Reeducation of swallowing was started early, only two patients had post-operative inhalation pneumonia.

Six patients needed gastrostomy (21.4%), including one for less than 6 months. The mean hospitalization stay was 27.2 days (range 2-61 days, median 23 days). Functional results are summarized in the (Table 5).

Table 5: Functional Outcomes.

	Extubation		Oral Diet	Hospitalization time
	Day 0	Day 1	(means – range in day)	(means – range in day)
Oropharynx	23%	5%	10 (1-20)	12 (2-28)
Posterior Oral Cavity	11%	0%	9 (3-13)	16 (11-21)
Supraglottic	17%	28%	8 (2-22)	27 (11-54)
Total Laryngectomy	/	/	13 (3-35)	32 (10-59)
Hypopharynx	5%	11%	11 (7-16)	42 (23-61)
All location	56%	44%	11 (1-35)	27 (2-61)

2 patients with transient tracheostomies were excluded on the part “extubation” of this table, but were waking up the first day after their surgeries.

6. Discussion

There is no universal definition of “elderly”. The National Institute on Aging and the National Institutes of Health classify the population into young-old (65–75 years), old-old (76–85 years), and oldest-old groups (>85 years) [2]. In our cohort, we decided to considerer patients above 75 years old as a cut-off defining the elderly, to study the most vulnerable population.

In the medical literature, there is no specific guidelines about the care management for elderly patient. About half of patients over 70 years of age can be treated with a standard oncology approach, while the other half will require more intensive care [2]. This underlines the importance of patient selection who will benefit from more or less aggressive therapy. In this context, geriatricians have developed specific scales. The Comprehensive Geriatric Assessment (CGA) is a gold standard to estimate the general health status of a geriatric oncologic patient. It has been shown that the initially proposed anti-cancer treatment can be modified in 49% of patients after assessment [2]. But CGA is time consuming and is difficult to apply for every patient in a busy clinic. Simplified tools are currently available like G8 score (Figure 1) which is a clinical scale validated in the literature for frailty screening for elderly patients [8,19]. The G8 score demonstrated high sensitivity (from 66 to 92%) and a moderate negative predictive value (61.3%) [8]. A scale less than 14/17 needs complementary assessment supported by geriatric considerations [8,20]. In our study population, the mean G8 score was 10.4/17 which demonstrate the frailty of our patients. All our vulnerable patients received a multidisciplinary care approach with geriatrics, anesthesiologists, nutritionist therapist before the robotic surgery to minimize the post-operative complication. The poly-medication was often present with an average of 5.6 drugs/patient and was also managed. About the treatment of elderly patients with SCC, currently, there is no specific treatment protocol. Therefore, conventional radiotherapy and/or surgery are still the treatment of choice, with a high loco-regional response and a limited toxicity. But geriatric population have often difficulties to tolerate aggressive treatments such as neoadjuvant or adjuvant chemotherapy due to the side effects related to cardiac and renal toxicity mainly. Radiotherapy can also be difficult to endure especially for the patient with previous dysphagia and nutritional problems. Indeed, the risk of inhalation pneumonia, xerostomia, mucositis, dysgeusia, nausea and anorexia can increase with this treatment option and can be challenging [8,19]. Sometimes, a short surgical procedure can be preferred for this population than a full course of 5 to 7 weeks of radiotherapy with major side effects [21]. So, the development of less invasive and shorter surgeries will be profitable for this elderly population.

There are no publications about endoscopic procedure in the elderly population, except for the early glottic cancer who beneficiated of a transoral laser cordectomies [21,22]. This population are not included in our study because early glottic cancer beneficiated also in our institution of a cordectomy by TLM. We only included T3/T4 glottic who beneficiated of a trans-oral total laryngectomy. So, the comparison with the other endoscopic approach and our population is not possible. In addition, there are no other specific publications about the use of transoral robotic surgery for the elderly patients in ENT. The team of Ceccarelli et al.

describes their experience in abdominal surgery for geriatric population (gastric resection, right colectomy and liver resections) and the safety and the efficacy of the robot-assisted surgery [4]. The present study is designed to evaluate the potential advantage of TORS in our ENT practice for elderly.

The first advantage of TORS is to reduce the surgical time which is particularly beneficial in this frailty population. Indeed, a longer intervention increase the morbidity risk, especially in this population with high comorbidities. Our robotic surgical procedure takes an average time of 116 minutes. No external conversion was needed which confirms the feasibility of this technic. Adequate exposure is the key of success and help to save time during the surgical procedure. Exposure failure can be identified in some anatomical consideration, as in limited mouth opening, large tongue volume or retrognathia [23]. Pre-operative evaluation is helpful. Our team also developed a retractor system (LARS) with several blades which reduced the failure [9]. In this study the average exposure time was 15 minutes. Our advice is to make an adequate exposure (with a correct view of all the tumor margins) from the surgical beginning to avoid changes during the procedure. Indeed, position changing is time consuming and can be confusing especially for the surgical margins.

The second advantage of TORS compared to TLM is the high definition in 3D camera, the systematic use of a retractor system which open the surgical field and a better manipulation with 7 degrees of freedom of the articulated. All of this allows an easier one-bloc resection and a better surgical margins control with 26 negatives margins on our final histological analysis. The use of fresh frozen section during the surgical procedure can partially explain our results. Weinstein et al. have carried out a multicentric study of the adequacy of surgical margin in 192 patients with TORS [5]. They found similar result to our study with an overall incidence of positive tumor margins in 4.3% [5]. Gorphe et al. also reports the advantage of intra-operative frozen section in order to access the margins [24].

Concerning our oncological outcomes, our results are similar to general TORS publications [25-27] with the 3-year DSS rate at 87.3 %. The 3-year OS rate is lower (65,6%), partly explained by the age of our study population. They also have other significant comorbidities and diseases, no cancer-related, and the death would have occurred regardless of the current study. Daly et al. studied 40 patients over 65 years old who underwent chemoradiation for head and neck cancer and found a 2-year OS around 55% [27]. In the elderly population, the survival without complications or comorbidities due to the surgery is more important that the number of years. Our goal in this study is to evaluate the benefits in term of functional post-operative recovery without reduce the overall and specific survival.

Furthermore, with the trans-oral approach, no cervical incision was needed which reduced surgical morbidities. The tissues are less dissected allowing faster healing and subsequently rapid recovery of patient functions [25,26,29]. This can also drastically reduce blood loss, wound infection, fistula, and tracheostomy which are significant advantages, especially for elderly patients. In our cohort, no complication was noted during surgery, in particular no major bleeding and no transfusion was needed. Five patients with total laryngectomy had a small fistula (50%): 4 were pharyngo-cutaneous with a cutaneous size less than 5 mm and 1 was a pharyngeal leak detected by video-fluoroscopy without skin visualization. All of them were treated by local care, like neck dressing and banding, IPP, antibiotic in cases of cutaneous infections and no oral intakes. No flap was required. Video-fluoroscopy were performed to control the total healing and to permit oral intakes. Finally, except for total laryngectomies (n = 10), 3 patients received transient tracheostomies less than one month (10.7%). One patient kept a definitive tracheostomy (3%) but he had a stroke attack 3 months after his surgery. All of these results confirm the minimal invasive character of TORS.

Post-operative bleeding occurred in 5 cases (17.8%), all managed by surgical revision: 5 by transoral approach (100%), none by cervical approach (0%). The bleeding was cauterized by the monopolar suction, except in one case or bleeding was not found. One patient had an anemia before the main surgery and needed a transfusion after his bleeding. No prophylactic lingual artery ligation was performed during the main surgery. Asher and al. published a study about hemorrhage after trans-oral robotic assisted surgery (in all locations) [30]. They found that the only relative bleeding risk is due to the use of antithrombotic medication. In our results, among the 5 bleeding cases, 2 patients had used anticoagulant agent and 1 antiplatelet before the surgery. Our advice is to take time during the surgery to carefully coagulated and used clips for every vessel. At the end of the surgery, we recommend the operative bed inspection with a meticulous attention and to take time for hemostasis.

Finally, the last advantage of TORS compared to open surgery is early post-operative mobilization, faster recovery of intestinal transit after the procedure and a reduction of swallowing problems. Our results are in line with findings of other publication about TORS for young people [25,26,29]. Oral feeding was started after an average of 13 days for total laryngectomy, 8 for supraglottic laryngectomy, 11 for hypopharynx, 9 for the oral cavity and 10 for oropharynx. Swallowing rehabilitation was started early with a speech therapist and nutritionist and evaluated by FEES. Two patients (7%) had post-operative inhalation pneumonia and one died. Nutritionist and medical staff worked together in order to improve the caloric intake before feeding tube removal. Furthermore, many patients suffered from malnutrition before surgery mostly because of their tumoral location. In this case more feeding supplementation time was needed. One patient needed a transient gastrostomy for less than 6 months and five patients (17.9%) needed a definitive one. Because of the rural location of our hospital, patients were kept hospitalized until autonomous swallowing with an average of 27.2 days.

The limitations of our study are related to the small number of patients but operated by the same senior surgeon, except three, follow-up by the same teams and it is a first promising data analysis in geriatric population. This study shows the feasibility of this technique and should motivate the ENT scientific community to organize others multicenter studies, which may include a larger cohort to provide enough volume of informative data.

7. Conclusions

Robotic surgery is a valuable option in the treatment of selected head and neck carcinoma for the elderly. The use of G8 scale and CGA is usefull for patient selection and to manage pre-operatively their comorbidities. Surgical procedure is feasible. Surgical time is reduced compared to conventional open surgery which particularly advantageous for the

elderly. Oncological outcomes are similar to the other therapeutic options. Thanks to the minimal invasive aspect of TORS, cervical dissection was reduced which allowed better healing and limited swallowing disorders and pulmonary complications. Early postoperative rehabilitation and mobilization related to TORS, help to reduce the hospitalization time.

Authors' contributions: All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Hassid Samantha, Delcour Lara, Van der Vorst Sébastien and Lawson Georges. Statistical analysis was done by Ambroise Jérome. The first draft of the manuscript was written by Hassid Samantha and Delcour Lara, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.
Ethics approval: Ethics Review Committee Institution of the CHU Namur approved the current research protocol.

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