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ORIGINAL RESEARCH

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Adoption of otolaryngologist-head neck surgeons toward transoral robotic surgery: An international survey

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Abstract

Objective: To investigate perception, adoption and awareness of otolaryngologist-head neck surgeons (OTO-HNS) toward transoral robotic surgery (TORS).

Methods: An online survey was sent to 1383 OTO-HNS on the perception, adoption and awareness about TORS to members of many otolaryngological societies. The following aspects were assessed: TORS access; training; awareness/perception; indications and advantages/barriers to TORS practice. The responses were presented for the entire cohort and regarding the TORS experience of OTO-HNS.

Results: A total of 359 completed the survey (26%); including 115 TORS surgeons. TORS-surgeons carry out a mean number of 34.4 annual TORS procedures. The primary barriers to TORS were the cost of the robot (74%) and disposable accessories (69%), and the lack of training opportunity (38%). The 3D view of the surgical field (66%), the postoperative quality of life outcomes (63%) and the shorter hospital stay (56%) were the most important benefits of TORS. TORS-surgeons believed more frequently that TORS is indicated for cT1-T2 oropharyngeal and supraglottic cancers than non-TORS surgeons ($p < .005$). Participants believed that the priorities for the future consisted of the reduction of the robot arm size and the incorporation of flexible instruments (28%); the integration of laser (25%) or GPS tracking based on imaging (18%), all of them to improve accesses to hypopharynx (24%), supraglottic larynx (23%) and vocal folds (22%).

Conclusions: The perception, adoption and knowledges toward TORS depend on the access to robot. The findings of this survey may help guide decisions on how improve the dissemination of TORS interest and awareness.

KEYWORDS
awareness, head neck, otolaryngology, robotic, surgery, survey, Transoral

Dr Hans and Dr Mendelsohn have equally contributed to the paper and are co-senior authors.

Level of evidence: IV.

1 | INTRODUCTION

The first transoral robotic surgery (TORS) was carried out in 2005.[1] Since then, there was an increase of the number of publications dedicated to TORS.[2] Nowadays, TORS is an established approach for oropharyngeal squamous cell carcinoma (OSCC),[3,4] and is increasingly used in head and neck surgery for some selected supraglottic squamous cell carcinoma,[5] or some minimal invasive thyroid surgeries.[6] Despite of the benefits associated with TORS, including comparable overall survivals than open approaches or radiotherapy, minimal scar and shorter hospital stay,[5–8] robot remains less used in otolaryngology compared with other specialties, such as urology or gynecology.[9] To date, there is no international survey evaluating the awareness, perception, attitudes and barriers of otolaryngologist-head and neck surgeons (OTO-HNS) toward TORS. However, this kind of survey may make particularly sense to understand the potential barriers and thoughts of physicians about TORS.

The aim of this international survey was to investigate awareness, perception, and adoption of OTO-HNS toward TORS.

2 | METHODS

2.1 | Survey development

The survey was developed in iterative fashion by the Robotic Study Group of the Young Otolaryngologists of the International Federation of Oto-rhino-laryngological Societies (YO-IFOS), which includes robotic surgeons and experts from all the continents. The questions were chosen to study physician knowledge, practice, adoption, perception and barriers toward TORS. The final version of the survey included 18 questions dedicated to: demographic information (5); TORS experience and practice (3); training (2); access (1); perception of TORS (1); barriers/disadvantages/benefits (2); indications (1); setting (2) and improvements (1). The questions are available in Appendix 1. The participants were invited to evaluate the best indications of TORS with a 5-point scale ranging from "no indication" (0) to "perfect indication" (4) in a predefined list of conditions, including benign neck tumors, thyroid surgery, sleep apnea surgery and oropharyngeal, laryngeal, hypopharyngeal and nasopharyngeal malignancies. Institutional Review Board (CHU Saint-Pierre, Brussels) was not required for the study (IRB-Brussels, 2022).

2.2 | Survey spread

The survey was created with SurveyMonkey® (SurveyMonkey Inc., San Mateo, California, USA), so that each participant could complete the survey only once. The survey was emailed on two occasions to a list of members of the YO-IFOS/IFOS, which is the world ear, nose and throat federation. The federation includes members from Europe, North America, South America, East and West Asia, Oceania, and Africa. The email list includes 1383 members.

2.2.1 | Collection and analysis

The participant responses were collected anonymously. Incomplete responses were excluded from the final analysis. The responses were described considering the entire cohort (all participants) and two groups of participants: OTO-HNS who performs TORS in their practice (TORS surgeons) versus those who do not/never perform TORS procedures (non-TORS surgeons). Statistical analyses were performed with the Statistical Package for the Social Sciences for Windows (SPSS version 22.0; IBM Corp, Armonk, NY, USA). The differences in response between groups were evaluated using a Kruskal-Wallis test or $\chi 2$ test, depending on type of data. A p-value <.05 was considered as significant.

3 | RESULTS

According to the response and refusal rate definitions of the Council of American Survey Research Organizations (CASRO), the survey invitation was sent to 1383 and 1295 OTO-HNS in the first and second round, respectively. The 1295 emails of the second rounds were all included in the email list of the first round. A total of 237 OTO-HNS responded to the first-round invitation, while there were 122 to respond to the second round, accounting for 359 responders (26% response rate). In the first and the second round, 1735 and 1843 OTO-HNS did not open the email. Among the 359 OTO-HNS who completed the survey, 115 (32%) were TORS surgeons. European, Asian and South American OTO-HNS were the most represented participants (Table 1). Participants worked in academic centers (58%), private practices (14%) or both (28%). Thirty-two participants were residents. The board-certified participants reported a mean experience of 15.6 (14.4) years. World region, gender and place of practice differences between groups are described in Table 1. TORS surgeons reported significant higher years of experience compared to participants who do not use TORS ($p = .02$; Table 1).

3.1 | Robot access and training

In the non-TORS surgeon group, 27% of participants ($N = 66/244$) may have access to TORS in their center, while 73% of participants ($N = 178/244$) do not have access. Among them, 80% of non-TORS surgeons ($N = 143/178$) were interested to learn to use TORS; the remaining 20% being not interested ($N = 35/178$).

The training of TORS surgeons ($N = 115$) was provided by the robotic system manufacturer (Intuitive Surgical, Sunnyval, CA, USA; $N = 62/115$; 54%), senior TORS surgeon(s) from the department ($N = 25/115$; 22%), senior TORS surgeon(s) from another department ($N = 31/115$; 27%), or in University/Congress courses ($N = 28/115$; 24%). Seventy-seven TORS surgeons (67%) considered that their training to be adequate. TORS surgeons reported that they received sufficient support ($N = 40/115$; 35%) and encouragement ($N = 44/115$; 38%) from their hospital, whereas 16 TORS surgeons

TABLE 1 Cohort features

Outcomes	All (359)	TORS (115)	Non-TORS (244)	*p*-value
Gender (F/M)	96/263	20/95	76/168	.01
Year of experience (SD, years)	15.6 (14.4)	17.6 (14.9)	14.7 (14.1)	.02
World regions				
Europe	120 (33)	44 (38)	76 (31)	.01
North America	35 (10)	20 (17)	15 (6)	
Asia	96 (27)	28 (24)	78 (32)	
South America	84 (23)	19 (16)	65 (27)	
Africa	16 (4)	1 (1)	15 (6)	
Oceania	8 (2)	3 (3)	5 (2)	
Places of practice				
Academic/University	209 (58)	79 (69)	130 (53)	.01
Private	50 (14)	6 (5)	44 (18)	
Academic and private	100 (28)	29 (25)	71 (29)	

Note: The results are reported in number of responders (%).
Abbreviations: F/M, female/male; NS, non-significant; TORS, transoral robotic surgery.

(14%) believed the opposite. In the group of non-TORS surgeons, 13% of participants ($N = 33/244$) reported that their hospital did not support the adoption of TORS.

3.2 | Perception, benefits, and barriers

The participant perception, barriers and benefits toward TORS are described in Table 2. There were significant differences between TORS and non-TORS surgeons regarding the opinion, awareness and thoughts to TORS. Most of TORS surgeons ($N = 84/115$; 73%) believed that there are many benefits to use TORS, while 55% ($N = 133/244$) of non-TORS surgeons believed the opposite ($p < .001$, Table 2). However, most TORS and non-TORS surgeons did not think that there are more disadvantages than advantages. The majority of TORS surgeons believed that TORS is important for the future of the minimal invasive surgery in otolaryngology-head and neck surgery, and reported higher feeling of trust and advocate outcomes compared to non-TORS surgeons.

Irrespective to the use of TORS, participants reported that the primary barriers to use TORS were the cost of the robot system ($N = 267/359$; 74%), the cost related to the robot disposable accessories ($N = 247/359$; 69%), and the lack of personal training ($N = 136/359$; 38%). The lack of personal training was more important in non-TORS surgeon compared to TORS-surgeon group ($P < .001$). Non-TORS surgeons considered the docking time (setting) as a more important barrier than TORS-surgeons ($p = .02$). Participants believed that the most important benefits of TORS were the better view of the surgical field ($N = 236/359$; 66%), the better postoperative quality of life outcomes ($N = 227/359$; 63%) and the shorter hospital stay ($N = 201/359$; 56%). The thought about the better view of the surgical field related to the use of TORS was significantly more prevalent in TORS compared with non-TORS surgeons (76% vs. 61%; $p = .004$; Table 2).

3.3 | TORS surgical indications

Surveyed TORS surgeons carry out a mean number of 34.4 annual TORS procedures. Diseases thought to be highly indicated for TORS were cT1-T2 oropharyngeal cancers, tongue-base resection in sleep apnea syndrome, and cT1-T2 supraglottic cancers (Table 3). There were significant differences in the surveyed indications between groups for cT1-T2, cT4a oropharyngeal cancers, cT1-T2, cT4a supraglottic cancers; cT1-T2 vocal fold cancers, cT1-T3 nasopharyngeal cancers and cT3-T4a hypopharyngeal cancers. The contribution of TORS to cT1-T2 oropharyngeal and supraglottic cancers were judged as significantly higher in TORS surgeon compared with non-TORS surgeon group (Table 3). By contrast, a higher proportion of TORS surgeons thought that TORS is not indicated for cT4a oropharyngeal and supraglottic cancers; cT1-T2 vocal fold cancers; cT3 and cT4a hypopharyngeal cancers and nasopharyngeal cancers (Table 3). Note that 56% of non-TORS surgeons ($N = 137/244$) recognized to accept to address a patient to a robotic center if there is an indication, while 14% of responders ($N = 34/244$) preferred to carry out the surgery through open or endoscopic approach. Thirty percent of non-TORS surgeons ($N = 73/244$) did not respond to this question.

3.4 | Setting and instruments

The most used instruments by TORS surgeons are summarized in Appendix 2. TORS surgeons used the following mouth retractors: FK retractor ($N = 83/115$; 50%), Boyle Davis ($N = 46/115$; 28%), LARS ($N = 15/115$; 9%), Digman ($N = 11/115$; 7%), M from integra

TABLE 2 Perception, barriers and benefits of TORS according to participants

Overall opinion	All (359)	TORS (115)	Non-TORS (244)	*p*-value
There are many surgical and hospital stay benefits	195 (54)	84 (73)	111 (45)	<.001
There are more disadvantages to TORS than advantages	22 (6)	7 (6)	15 (6)	.982
I trust in TORS for the future	155 (43)	69 (60)	86 (35)	<.001
I advocate TORS to my colleagues	66 (18)	43 (37)	23 (9)	<.001
I encourage colleagues to use TORS in the future	96 (27)	54 (47)	42 (17)	<.001
TORS has affected me positively since adoption	69 (19)	56 (49)	13 (5)	<.001
TORS has affected me negatively since adoption	6 (2)	3 (3)	3 (1)	.342
The adoption of TORS by colleagues affected me positively	53 (15)	33 (29)	20 (8)	<.001
The lack of adoption of TORS by colleagues affected me negatively	9 (2)	1 (1)	8 (3)	.173
TORS is important for the future of the minimal invasive surgery	178 (50)	71 (62)	107 (44)	<.001
Main barriers of TORS				
Robot cost and availability	267 (74)	87 (76)	180 (74)	.703
Cost related to TORS in my healthcare system.	247 (69)	73 (63)	174 (71)	.135
Time restraint	75 (21)	24 (21)	51 (21)	.994
Low volumes of procedures performed in my center	98 (27)	28 (24)	70 (29)	.389
Low theoretical volumes of procedures performed with TORS	97 (27)	39 (34)	58 (24)	.04
Lack of personal training.	136 (38)	14 (12)	122 (50)	<.001
Lack of interest.	22 (6)	2 (2)	20 (8)	.01
Docking time (setting robot)	51 (14)	10 (9)	41 (17)	.02
Difficulty of exposure of the surgical field	66 (18)	27 (23)	39 (16)	.09
Main benefits				
Esthetic benefit (scar)	179 (50)	57 (50)	122 (50)	.939
Avoid of tracheotomy in some selected cases	189 (53)	66 (57)	123 (50)	.216
Shorter hospital stay time	201 (56)	71 (62)	130 (53)	.132
Better patient postoperative quality of life	227 (63)	75 (65)	152 (62)	.592
Better view of the operative field	236 (66)	87 (76)	149 (61)	.004
Better movements of robot arm in the operative field	199 (55)	67 (58)	132 (54)	.459

Note: The results are reported in number of responders (%).
Abbreviations: NS, non-significant; TORS, transoral robotic surgery.

($N = 3/115$; 2%), flex retractor ($N = 2/115$; 1%) and Moriniere retractor ($N = 2/115$; 1%). In 4% of cases ($N = 4/115$), the retractor used was developed by the local team and was not available on market. The following instruments were used by TORS surgeons: monopolar spatula ($N = 97/115$; 84%); bipolar forceps ($N = 65/115$; 56%); curved bipolar ($N = 37/115$; 32%), fenestrated forceps ($N = 26/115$; 23%), monopolar hook ($N = 18/115$; 16%), DualGrip bipolar ($N = 10/115$; 9%), harmonic ($N = 2/115$; 1%) and scissors ($N = 1/115$; 1%; Appendix 2).

3.5 | Improvement and future

Participants were surveyed about the most important issues for the improvement of device, robots and TORS procedures. Participants believed that the priorities for the future consisted of the reduction of the robot arm size and the incorporation of flexible instruments ($N = 99/359$; 28%); the integration of laser ($N = 91/359$; 25%) or GPS tracking based on imaging ($N = 64/359$; 18%; Table 4). According to participants, the development/improvement of robotic device/system had to lead to better accesses to hypopharynx ($N = 88/359$; 24%), supraglottic larynx ($N = 81/359$; 23%) and vocal folds ($N = 80/359$; 22%). All device and access improvement outcomes were judged as more important by TORS surgeons compared with non-TORS surgeons (Table 4). The summary of key points of improvement regarding TORS surgeons is available in Figure 1.

4 | DISCUSSION

The number of robotic procedures has increased in otolaryngology—head and neck surgery over the past two decades.[10] As with all

TABLE 3 Indications of TORS according to practitioners

Indications	All participants					TORS surgeons					Non-TORS surgeons					*P-value*
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	
Oropharynx																
cT1-T2 oropharyngeal cancer	2.2	1.7	8.1	43.2	44.8	0.9	0.9	1.7	33.0	63.5	2.9	2.0	11.1	48.0	36.1	<.001
cT3 oropharyngeal cancer	6.1	20.6	32.6	31.8	8.9	0.9	21.7	38.3	32.2	7.0	8.6	20.1	29.9	31.6	9.8	.04
cT4a oropharyngeal cancer	33.7	37.3	15.9	9.7	3.3	42.6	40.0	7.8	7.8	1.7	29.5	36.1	19.7	10.7	4.1	.002
Base of tongue																
Sleep apnea syndrome	3.6	1.7	14.8	46.0	34.0	5.2	2.6	14.8	36.5	40.9	2.9	1.2	14.8	50.4	30.7	.102
Unknown primary cancer	3.3	4.7	18.4	44.3	29.2	4.3	6.1	13.9	37.4	38.3	2.9	4.1	20.5	47.5	25.0	.05
Larynx																
cT1-T2 supraglottic cancer	2.5	2.8	13.1	48.5	33.1	1.7	3.5	7.0	41.7	46.1	2.9	2.5	16.0	51.6	27.0	.004
cT3 supraglottic cancer	8.1	28.7	31.5	26.2	5.6	6.1	33.9	37.4	20.9	1.7	9.0	26.2	28.7	28.7	7.4	.03
cT4a supraglottic cancer	33.7	37.0	18.9	7.2	3.1	45.2	40.9	11.3	0.9	1.7	28.3	35.2	22.5	10.2	3.7	<.001
Total laryngectomy	31.5	30.4	24.2	11.7	2.2	30.4	29.6	27.8	10.4	1.7	32.0	30.7	22.5	12.3	2.5	.843
cT1-T2 vocal fold cancer	14.8	21.4	22.6	29.0	12.3	20.9	26.1	26.1	21.7	5.2	11.9	19.3	20.9	32.4	15.6	<.001
Hypopharynx																
cT1-T2 hypopharyngeal cancer	5.3	8.6	25.3	43.7	17.0	5.2	10.4	22.6	36.5	25.2	5.3	7.8	26.6	47.1	13.1	.04
cT3 hypopharyngeal cancer	17.3	39.0	28.4	11.7	3.6	19.1	48.7	25.2	5.2	1.7	16.4	34.4	29.9	14.8	4.5	.003
cT4a hypopharyngeal cancer	41.2	32.6	20.3	3.3	2.5	55.7	35.7	7.8	0.0	0.9	34.4	31.1	26.2	4.9	3.3	<.001
Others																
Nasopharyngeal cancer	13.1	26.5	38.4	17.3	4.7	15.7	33.9	36.5	13.0	0.9	11.9	23.0	39.3	19.3	6.6	.02
Neck dissection	20.6	29.8	28.4	15.9	5.3	19.1	32.3	27.8	13.9	7.0	21.3	28.7	28.7	16.8	4.5	.770
Partial thyroidectomy (lobectomy)	16.2	18.7	25.9	27.9	11.4	20.0	13.0	27.0	23.5	16.5	14.3	21.3	25.4	29.9	9.0	.05
Total thyroidectomy	18.1	20.3	29.8	24.0	7.8	21.7	18.3	29.6	20.0	10.4	16.4	21.3	29.9	25.8	6.6	.379
Branchial cyst	19.2	24.2	31.8	19.8	5.0	22.6	20.9	31.1	18.3	7.0	17.6	25.8	32.0	20.5	4.1	.512
Pharyngeal flap	12.3	18.7	46.0	19.2	3.9	12.2	17.4	46.1	18.3	6.1	12.3	19.3	45.9	19.7	2.9	.680

Note: The numbers in the table consist of the % of surgeons who rated the indication as perfect (4), good (3), 2 (neutral), 1 (not good) or 0 (contra-indication).
Abbreviations: NS, non-significant; TORS, transoral robotic surgery.

TABLE 4 Improvement and priorities for future

Propositions of improvement	All (359)	TORS (115)	Non-TORS (244)	*p*-value
Access outcomes				
Better access to oropharynx	68 (19)	39 (34)	29 (12)	<.001
Better access to supraglottic larynx	81 (23)	56 (49)	25 (10)	<.001
Better access to glottis	80 (22)	58 (50)	22 (9)	<.001
Better access to hypopharynx	88 (24)	65 (56)	23 (9)	<.001
Better access to nasal fossae	35 (10)	24 (21)	11 (4)	<.001
Better access to nasopharynx	50 (14)	33 (29)	17 (7)	<.001
Devices				
GPS tracking based on MRI/CT	64 (18)	48 (42)	16 (7)	<.001
Laser (i.e., CO2)	91 (25)	74 (64)	17 (7)	<.001
Integration of NBI system.	47 (13)	36 (31)	11 (4)	<.001
Better strength back	34 (9)	26 (23)	8 (3)	<.001
Flexible instruments/smaller arms	99 (28)	73 (63)	26 (11)	<.001

Abbreviations: MRI/CT, magnetic resonance imaging/computed tomodensitometry; NBI, narrow banded imaging; NS, non-significant; TORS, transoral robotic surgery.

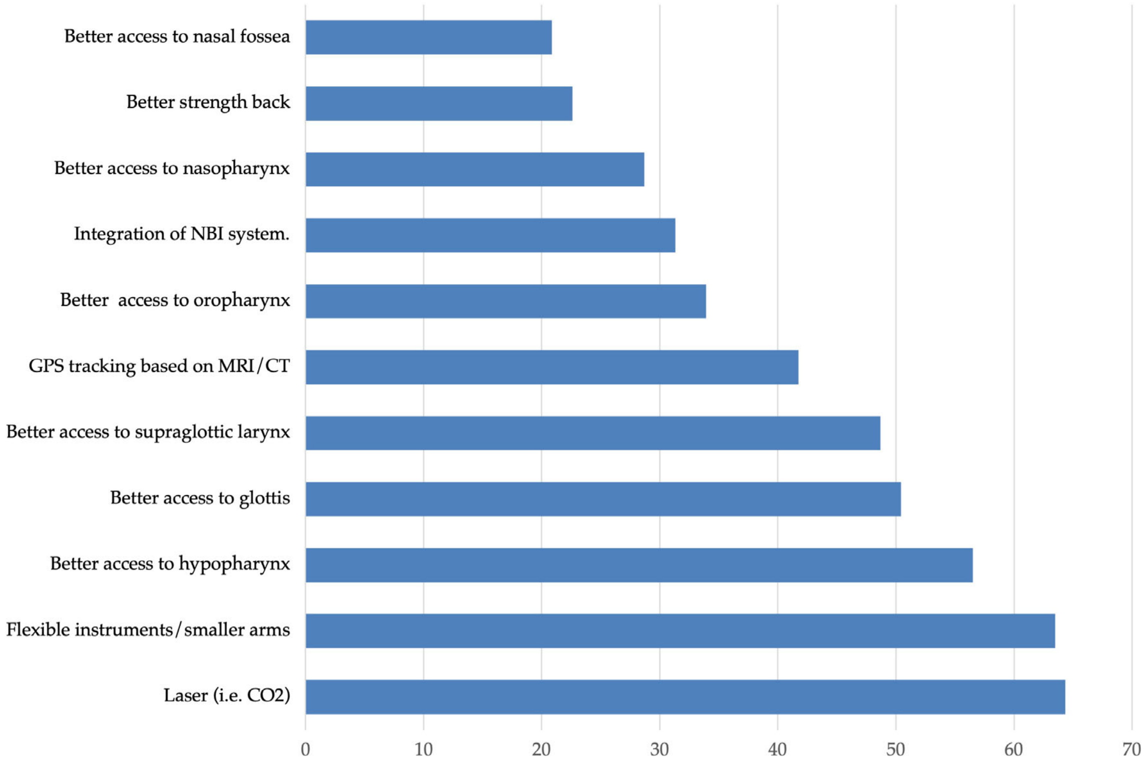

FIGURE 1 Key points of improvement regarding TORS surgeons. The x axis consists of percentage of TORS surgeons who reported that the proposition is a priority for the future. MRI/CT, magnetic resonance imaging/computed tomodensitometry; NBI, narrow banded imaging; NS, non-significant; TORS, transoral robotic surgery

surgical innovation, the adoption of practitioners may take time due to the dissemination of the new material, the get of first positive results and modification of practice habits.[11] To the best of our knowledge, this survey is the first international cross-sectional evaluation of the perception and adoption of OTO-HNS toward TORS.

In this study, our primary finding was the significant differences seen between TORS and non-TORS surgeons in the awareness and adoption outcomes of TORS. If the greater adoption outcomes of TORS surgeons were expected, our data support that most non-TORS surgeons were interested to have access to this technology and the associated training, while presenting less trust and advocate outcomes compared with TORS-surgeons. Many factors may support the adoption of a new procedure in surgery. First, the robotic programs are mainly developed in academic centers with experienced head and neck surgeon teams and with the support of the hospital.[12,13] Chen et al. demonstrated a 67% increase in the use of TORS at U.S. academic centers in which surgeons reported high-volume and experience, which was moreover associated with a lower rate of positive margins compared to non-robotic surgery.[12] According to studies, the development of robotic program and the support of academic centers are the first important steps to have an adequate adoption of the technology by OTO-HNS.[12–14] In the study of Mandapathil and Meyer, German OTO-HNS reported that the lack of available cooperation with academic centers, and the lack of support by their hospital played a negative role in the acceptation of TORS.[14] Second, both habits and experience (training) of surgeon seem to play a key role in the adoption of a new procedure.[15] Kim et al. observed in an U.S. survey that non-fellowship-trained surgeons and those in community practices favored radiotherapy for cT1-T2 oropharyngeal cancer more than fellowship-trained and experienced TORS surgeons.[16] The exposure to TORS or simulators during residency, clinical rotations, or surgical courses may consist of additional important issues to gain experiences with robotic surgery early on in the career of the OTO-HNS. For example, Sobel et al. proposed cadaveric training program to develop competency with oropharyngeal resections before transition to the operating room, which was found to be an effective approach to improve adoption of TORS.[17]

Participants reported that other important barriers to TORS access were the cost of both robot and related disposable accessories. In a German survey, Mandapathil and Meyer reported that the main reasons for not adopting TORS were costs, lack of interest and available hospital cooperation, which supported our observation.[14] The obstacles highlighted in the present study and in others, especially the lack of training support, must be addressed by Otolaryngology-Head & Neck Surgery programs to facilitate and support the use of TORS. Another issue that may be investigated as TORS barrier is the habits of local oncological board. Indeed, in some regions, the oncological board prefers to propose chemo/radiotherapy in place of surgery. This point was not investigated in the present survey while it is important. An adequate training improves TORS indications, skills surgical and oncological outcomes, which are important points to increase the surgeon satisfaction and motivation in the use of a new procedure. According to the literature, the most accepted indications of TORS remain cT1-T2 and selected cT3 oropharyngeal and supraglottic cancers,[3,5,18] tongue-base surgery (sleep apnea and unknown primary head and neck cancer),[19,20] and, particularly in Asia, thyroid surgeries.[21] In the present survey, we observed that the theoretical TORS indications reported by TORS surgeons were closer to the literature indications compared to non-TORS surgeons. Similar findings were found in an Australian survey-study assessing the development and adoption of TORS in Oceania.[22] The inconsistencies between TORS and non-TORS surgeons were less highlighted for some more rare indications of TORS, including neck dissection, branchial cyst or pharyngeal flap, which may be explained by the fact that these indications are not a routine practice by most TORS surgeons.[22–25]

In this study, we investigated the awareness of OTO-HNS toward TORS without questioning them about their opinion regarding transoral laser microsurgery (TLM) or radiation. Contrarily to urology where robotic prostatectomy became the gold standard approach, the use of *Da Vinci* robot in otolaryngology needs future investigations. Thus, future studies are needed to determine the place of TORS in head and neck surgery, and its superiority over radiation or TLM in some indications.

Although this study is the largest survey-based study on TORS adoption and practice in several world regions, the low number of participants remains the primary limitation. This kind of voluntary survey is vulnerable to sampling error and respondent bias. Our federation (IFOS) includes most scientific otorhinolaryngological societies but our member (mailing list) are mainly located in Europe, Asia and South America, which explains the large representation of these world regions. A substantial number of general OTO-HNS recognized that they are not sufficiently knowledgeable about robotic surgery, which, in addition to the lack of interest on the topic, may support the low number of OTO-HNS who agreed to participate. A second limitation is the poor representation of some world regions, such as Africa or Oceania. Our federation counts fewer members in some of these regions (Oceania) compared with other regions. Moreover, other regions (Africa) have lower number of OTO-HNS and a very limited access to robot technologies compared with industrialized Western countries.

5 | CONCLUSION

The present study supports that perception, adoption and knowledges toward TORS depend on the access to robot. Surgeons who have access to TORS report more trust, adoption and advocate outcomes than those without adequate access. The findings of this survey may help guide decisions on how improve the dissemination of TORS interest and awareness.

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CONFLICT OF INTEREST

The authors have no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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