

## ORIGINAL ARTICLE

# Patterns of practice regarding surgical site infection prevention in head & neck surgery: An international survey



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## KEYWORDS

Antibiotic;  
 Prophylaxis;  
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 Surgery;  
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 Guidelines

## Abstract

**Introduction:** Head & neck surgery encompasses a variety of surgical approaches for benign and malignant conditions. Due to the complexity in treating patients with head and neck pathology, it is necessary to adhere to basic surgical principles to decrease complications. Among them, surgical site infection can be prevented using a surgery quality protocol including the correct use of antibiotics and optimization of nutritional status.

**Materials and methods:** A survey was sent through the YO-IFOS and SEORL-CCC international mailing list.

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**Results:** A total of 435 surgeons completed the survey. Of the respondents, 97.7% confirm that they scrub their hands before surgery, 40.9% respondents recommend nutritional support according to sign and symptoms, 60.9% use of antibiotic prophylaxis in clean surgery and just 9.2% use clindamycin in combination.

**Conclusion:** This survey has broadened the scope regarding H&N surgical safety around the globe. Identifying innovative ways in which surgical care may be improved is mandatory.

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## PALABRAS CLAVE

Antibiótico;  
Profilaxis;  
Cabeza;  
Cuello;  
Cirugía;  
Infección quirúrgica;  
Protocolos

## Estrategias de prevención de infecciones del sitio quirúrgico en cirugía de cabeza y cuello: una encuesta internacional

### Resumen

**Introducción:** La cirugía de cabeza y cuello abarca una variedad de técnicas quirúrgicas dirigidas al tratamiento de un grupo de enfermedades benignas y malignas. Debido a la complejidad en el tratamiento de este tipo de pacientes el uso de protocolos quirúrgicos va a permitir disminuir las diversas complicaciones, entre ellas la infección del sitio quirúrgico, que será posible prevenirla mediante la adopción de protocolos de control quirúrgico que incluya, por ejemplo, el uso correcto de antibióticos y la optimización del estado nutricional.

**Materiales y métodos:** Para este estudio se envió una encuesta a través de la lista de correo electrónico del grupo internacional YO-IFOS y de la SEORL-CCC.

**Resultados:** Un total de 435 cirujanos completaron la encuesta. El 97,7% de los encuestados confirmó practicar el lavado de manos antes de la cirugía, el 40,9% refirió recomendar el apoyo nutricional en el periodo perioperatorio según los signos y síntomas del paciente, el 60,9% refirió utilizar profilaxis antibiótica en cirugía limpia y solo el 9,2% utilizar clindamicina en combinación.

**Conclusión:** Esta encuesta intenta analizar el alcance de los protocolos de seguridad quirúrgica a nivel mundial, con la intención de identificar formas innovadoras de mejorar los resultados quirúrgicos en cirugía de cabeza y cuello.

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## Introduction

Head & neck (H&N) surgery involves a variety of surgical approaches for the management of benign and malignant conditions. Owing to the highly functional nature of this anatomical region, additional reconstructive procedures are occasionally necessary. Notably, malignant tumors require adjuvant radiotherapy and/or chemotherapy. In view of the complexity of treating patients with H&N pathology, adherence to basic surgical principles is essential to minimize complications. Surgical site infection (SSI) is a complication that can be prevented by adopting a surgical quality protocol, which includes administration of the appropriate antibiotics and nutritional status optimization.

SSI is defined as an infection that occurs within 30 days after a surgical incision or intraoperative organ manipulation and is the most prevalent cause of healthcare-associated infections (HAI). The prevalence of SSI associated with clean H&N surgical procedures in patients who do not receive antimicrobial prophylaxis ranges between <1% and 3.8% in high-income countries (HICs).<sup>1,2</sup> SSI rates are higher (ranging from 24% to 87%) in patients who undergo complicated H&N

cancer surgery but without antimicrobial prophylaxis.<sup>3,4</sup> However, limited data regarding SSI are available in low- and middle-income countries (LMICs); SSI rates are usually estimates, and data from these countries may therefore be inaccurate. However, in 2010, the World Health Organization reported that the global prevalence of HAI was 20-fold higher in LMICs than in HICs.<sup>5</sup>

In 2016, 1.1 million new cases and 4.1 million prevalent cases of H&N cancer were reported worldwide, contributing to 512,770 deaths, which represented 5.7% of global cancer-related mortality. Approximately 70% of these deaths occurred in patients in LMICs.<sup>6</sup> The H&N cancer rates are expected to increase by nearly 38% in 2030 with an estimated 705,902 patients worldwide.<sup>6,7</sup> Moreover, global radiotherapy and chemotherapy capacity is limited<sup>8,9</sup>; therefore, surgery remains the first-line treatment in LMICs.<sup>10</sup>

Patients with H&N cancer present with several risk factors for SSIs,<sup>11</sup> including advanced age, poor nutritional status, and comorbidities (diabetes mellitus, anemia, and peripheral vascular disease).<sup>12,13</sup> Moreover, the use of tobacco,<sup>11,13</sup> alcohol,<sup>14</sup> or drugs<sup>4</sup> is known to be associated with a high risk of postoperative infections. A history of

radiotherapy and chemotherapy, as well as disease stage may be associated with the risk of infection in patients with H&N cancer.<sup>11</sup> Prolonged operative time and metal plate and screw implantation serve as additional risk factors for SSI.<sup>15</sup>

Injudicious antibiotic administration in recent years has led to a rapid increase in the varieties of antimicrobial-resistant pathogens, which necessitates the rational use of antibiotics in H&N surgery, particularly in patients with complex comorbidities. Other measures such as optimal nutritional support, patient preparation, and hand hygiene are important to reduce SSI rates.<sup>15</sup>

We investigated the international practice patterns of surgical control, antibiotic administration, and nutritional support in patients who undergo H&N surgery for benign and malignant conditions, in an attempt to develop newer strategies to prevent SSIs and antibiotic resistance.

## Materials and methods

This study is an initiative of the “Young Otolaryngologists of the International Federation of Otolaryngologic Societies” (YO-IFOS). We investigated the practice patterns of surgical control (nutritional status, antibiotic prophylaxis, and surgical site preparation, among other such variables) for detailed analysis of current practices employed globally. To improve the results obtained, we performed a systematic review of the literature,<sup>16</sup> and the study was performed using a four-step structure (Fig. 1). Low-, middle-, and high-income economies were defined based on their per capita national income using the World Bank Atlas methods.

Statistical analysis was performed using the IBM SPSS Statistics software, version 21.0 (Armonk, New York, USA). Data are presented using descriptive statistics; quantitative variables are presented as means and standard deviations. Associations between respondents’ answers and dependent variables were analyzed using the  $\chi^2$  test. Logistic regression analysis was performed with calculation of odds ratios (OR) to determine the magnitudes of the associations. A  $p$  value  $<0.05$  was considered statistically significant.

## Results

### Demographics

We emailed 1194 anonymous questionnaires globally based on the mailing list of the YO-IFOS and the Spanish Society of Otorhinolaryngology – Head & Neck Surgery (Supplementary material); we received a response to 435 surveys from 72 countries, with an overall response rate of 36.4% (Fig. 2). Table 1 shows the demographic data included in this study.

### Asepsis measures adopted

Table 1 shows data regarding preoperative measures, including surgical site disinfection and shaving methods. Comparison of data from the surgical specialties that performed shaving on the day of the surgery or when the patient was transferred to the operating room, showed that this practice was more common in LMICs than in HICs; however,

the difference was statistically nonsignificant (96 vs. 176, OR 1.31, 95% confidence interval [CI] 0.872–1.983,  $p=0.190$ ).

### Nutritional status evaluation

With regard to nutritional support, preoperative nutritional evaluation was more commonly performed in patients in HICs than in LMICs, although the difference was statistically nonsignificant (121/299 vs. 51/147, OR 1.27, 95% CI 0.84–1.92,  $p=0.239$ ). However, despite recommendations for a pre- or postoperative protocol, all hospitals do not necessarily offer nutritional support, and all patients who undergo H&N surgery may not receive such services (these services are more common in HICs than in LMICs), and the difference was statistically nonsignificant (117/299 vs. 26/136, OR 1.15, 95% CI 0.69–1.91,  $p=0.585$ ). Nutritional evaluation and support were more commonly provided to patients with malignant H&N cancers, particularly in HICs than in LMICs, and this difference was statistically significant (117/299 vs. 28/136, OR 2.47, 95% CI 1.54–3.99,  $p=0.0002$ ) (Table 1).

### Adherence to guidelines

We observed adherence to guidelines was more prevalent in academic than in non-academic settings, and the difference was statistically nonsignificant (168/299 vs. 67/136, OR 1.32, 95% CI 0.87–1.98,  $p=0.179$ ). Furthermore, 220 respondents (50.5%) were of the opinion that the surgical guidelines were established based on international recommendations (Table 1). The rate of antibiotic prophylaxis in clean H&N surgery was higher than expected but was lower and statistically significant in HICs than in LMICs (158/299 vs. 107/136, OR 3.29, 95% CI 2.06–5.26,  $p=0.0001$ ). Amoxicillin/clavulanate was the most commonly used antibiotic in clean H&N surgery setting. Antibiotic prophylaxis was administered by 424 respondents (97.4%) in cases of contaminated H&N surgery. The most common antibiotic used was amoxicillin/clavulanate (46.1% of respondents), similar to the clean H&N surgery setting. Table 2 shows the different types of antibiotics prescribed by respondents for patients without allergies in clean, clean-contaminated, and contaminated H&N surgery. Table 1 shows the factors that may affect decision-making regarding administration of antibiotic prophylaxis.

### Antibiotic choice and administration

With regard to the first-choice drug in patients with a true beta-lactam allergy, clindamycin was the most commonly used antibiotic (185, 42.5%), and only 40 (9.2%) were used in combination therapy (Table 3). Table 1 shows the timing of the first antibiotic dose, the duration of antibiotic treatment, and evaluation of a routine antibiogram (RA) in cases of SSI. A RA was obtained more commonly in patients in HICs, although the difference was statistically nonsignificant (226/299 vs. 88/136, OR 1.44, 95% CI 0.95–2.19,  $p=0.083$ ).

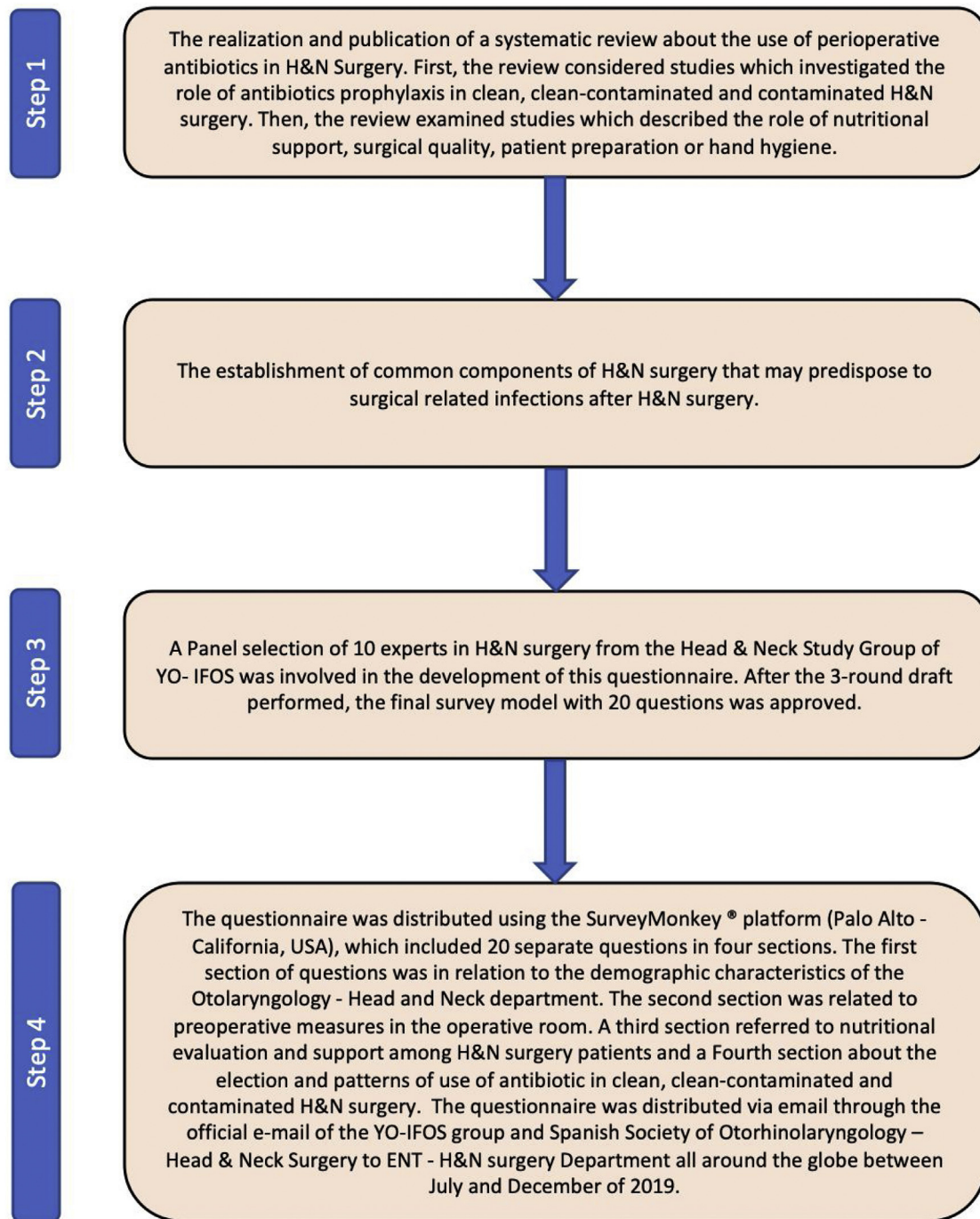


Figure 1 Study workflow.

## Discussion

Analysis of healthcare issues from a socioeconomic perspective is important to understand social disparities. Low-, middle-, and high-income economies are defined based on their per capita national income using the World Bank Atlas methods. Accordingly, 63% of the world's nations are classified as LMICs, which represent >75% of the world's population.<sup>17,18</sup> Social, educational, economic, and healthcare disparities are known to exist between LMICs and HICs. However, it is important to determine means to minimize

this gap. Additionally, it is necessary to establish recommendations that can be useful in both situations.

The results of this survey indicate some factors associated with surgical control, which require close attention. Hand sanitation is important in this regard. The current survey showed that 2.3% of H&N surgeons did not scrub their hands preoperatively. Although >70% of H&N surgeons prefer to perform surgical site disinfection themselves, with regard to surgical site hair shaving, 39% of respondents indicated that they performed hair shaving the day of the surgery in the operative room, although shaving hair is strongly



**Table 1** Demographic and study variables.

Demographic variables	N	%	Observations
<i>Country</i>			
HIC's	288	66.3	
LMIC's	147	33.7	
<i>Type of hospital</i>			
Public or private tertiary university hospital	299	68.7	
Community hospital	48	11	
Private non-university hospital	46	10.6	
Tertiary non-university hospital	42	9.6	
<i>Years of experience</i>			
<10 years	256	58.9	
>10 years	179	41.1	
<i>Asepsis measures</i>			
<i>Hands-scrub</i>			
Yes	425	97.7	
No	10	2.3	(7 = HIC's/3 from LMIC's)
<i>Surgical site cleaning</i>			
Surgeon	307	70.6	
Nurse	128	29.4	
<i>Surgical site shaving</i>			
The day of surgery in the operative room	170	39	124 = 72.9% TUH
The day before surgery	106	24.4	66 = 64.7% TUH
The day of surgery in the ward	102	23.5	
Not shaving	37	8.5	
All the options	20	4.6	
<i>Nutrition</i>			
<i>Nutritional evaluation</i>			
Preoperative nutritional evaluation	172	39.5	
Nutritional support according to signs and symptoms	178	40.9	
No	85	19.6	
Glycemic control	318	73	
Albumin	253	58	
Body mass index	287	65.9	
<i>Nutritional support</i>			
All cases	90	20.6	
Malignant histology cases	145	33.3	
Just in case of poor nutritional status	156	35.8	
Just in previously irradiated cases	20	4.6	
Don't offer	24	5.5	14 from LMIC's
<i>Guideline's adherence</i>			
<i>Use of specific guidelines for H&amp;N surgery</i>			
Yes	235	54	
No	175	40.2	
Unaware about the use of guidelines	25	5.8	
<i>Antibiotic prophylaxis in clean H&amp;N surgery</i>			
Yes	265	60.9	
No	170	39.1	
<i>Antibiotic prophylaxis in clean-contaminated H&amp;N surgery</i>			

Table 1 (Continued)

Guideline's adherence	N	%	Observations
Yes	399	91.7	
No	36	8.3	
<i>Timing of the first antibiotic dose</i>			
During anesthetic induction	291	66.9	
60 min before surgery	124	28.5	
After surgery	13	3	
<i>Antibiotic maintenance</i>			
First dose and second if surgery is longer than 2 h	145	33.4	
>48 h	290	66.6	
<i>Runtime antibiogram in case of SSI</i>			
Yes	314	72.2	
No	121	27.8	
<i>Main reason administers prophylaxis</i>			
Free flap	167	39.9	
Previous radiation therapy	132	30.3	

HIC's: high income countries; LMIC's: low, middle income countries; TUH: tertiary university hospital.

Table 2 Type of antibiotics according to type of surgery.

Type of antibiotic	Clean H&N surgery	Clean/contaminated H&N surgery	Contaminated H&N surgery
No antibiotic	39.1%	8.2%	2.5%
Amoxicillin/clavulanate	26.6%	48.3%	46.1%
Cefazolin	20.4%	19.3%	17.5%
Gentamycin	0.7%	2%	3.4%
Clindamycin	3%	5.2%	6.5%
Metronidazole	0.9%	4.5%	6.5%
Clarithromycin	0.9%	0.9%	1.6%
Vancomycin	0.4%	1.1%	0.9%
Teicoplanin	0.4%	0.4%	0.2%
Cefuroxime	7%	7.6%	10.5%
Moxifloxacin	0.2%	0%	0%
Ceftazidime	0.2%	0.2%	0%
Ceftriaxone	0.2%	1.3%	2%
Tobramycin	0%	0.2%	0.6%
Ampicillin-sulbactam	0%	0.9%	0.9%
Cefotaxime	0%	0%	0.4%
Ciprofloxacin	0%	0%	0.2%
Piperacillin/tazobactam	0%	0%	0.2%
Total	100%	100%	

H&N: head & neck.

The most common indication for antibiotic prophylaxis in patients who underwent H&N surgery was the use of a free flap (39.9%). Our results concur with those reported by previous studies, which consistently support the use of antibiotics in patients who undergo free flap microvascular reconstruction. It is well known that compared with soft tissue-only flaps, osteocutaneous free flaps are highly vulnerable to wound infection.<sup>26–31,20</sup> Factors that determine the association between free flap microvascular reconstruction and SSI include operative time, intraoperative blood loss, postoperative flap failure, need for reoperation and microsurgical revision, and antibiotic administration is

necessary in these patients.<sup>32–34</sup> We observed that 30.3% of respondents considered previous radiotherapy as the most rational indication for prolonged antibiotic therapy. Several studies have reported an association between previous radiotherapy and an increased risk of SSI.<sup>27,28,30,20,35–37</sup>

With regard to the duration of antibiotic prophylaxis, 33.3% of the respondents used a single dose of an antibiotic, and a second dose was administered only if the surgery was extended beyond 2 h. Prophylactic antibiotic use involves a single dose or continuation of the medication for <24 h postoperatively. A recent high-quality study reported no difference in the risk of SSI between patients randomized to a

**Table 3** Type of antibiotics used in true beta-lactam allergy.

Type of antibiotic	% of use	In combination with a second antibiotic
Clindamycin	42.5%	9.2%
Gentamycin	6%	ND
Metronidazole	6%	ND
Clarithromycin	18.8%	2.2%
Vancomycin	5%	ND
Teicoplanin	0.2%	ND
Levofloxacin	0.2%	ND
Ciprofloxacin	0.6%	ND
Ceftriaxone	0.6%	ND
Erythromycin	0.2%	ND
Azithromycin	0.2%	ND
Cefazolin	0.2%	ND

**Table 4** Pattern of practice and conformity with guidelines.

Pattern of practice	% of accordance to international guidelines or general recommendations	Conformity to guidelines
<i>Hand scrubbing</i>	97.7%	Yes
<i>Timing of administration of prophylactic antibiotics</i>	33.3%	No
<i>No use of antibiotics in clean H&amp;N surgery</i>	39.1%	No
<i>Choice of first-line antibiotics</i>		
Clean/contaminated H&N surgery	67.6%	Partially
Contaminated H&N surgery	63.6	Partially
<i>Choice of second-line antibiotics</i>		
<i>Choice of antibiotic in true beta-lactam allergy (in combination)</i>	9.2%	No
<i>Prophylactic antibiotics (one dose and a second dose if the surgery is longer than 2 h)</i>	33.3%	No
<i>Timing of shaving (in the OR)</i>	39%	No
<i>Runtime antibiogram</i>	72.2%	Partially

1-day vs. 5-day course of systemic antibiotic therapy.<sup>38</sup> Furthermore, an extended course of antibiotics (<7 days) was not shown to be superior to a 24-h postoperative course in patients who underwent clean neck dissection.<sup>39</sup>

Clindamycin was the most commonly used antibiotic (42.5%) in patients with true beta-lactam allergy, based on the recommendations of most guidelines for antimicrobial prophylaxis for H&N surgery. However, recent data suggest that clindamycin use is associated with an increased risk of SSI,<sup>40-43</sup> and clindamycin monotherapy should be avoided for prophylaxis in patients with true beta-lactam allergies.<sup>44</sup> However, only 9.2% of respondents used clindamycin combination therapy (Table 2). Therefore, surgeons should be familiar with various options such as clindamycin and gentamicin or tobramycin combination therapy, the use of clarithromycin + metronidazole or vancomycin alone or in combination with teicoplanin.

In this study, 72.2 of respondents obtained a RA in patients who developed SSI, which was more common in patients from HICs ( $p=0.06$ ). Local epidemiological factors

and bacterial resistance profiles vary across countries, and it is important to be aware of these details.

We emphasize that this survey was not aimed at establishing a standard of care. We attempted to create awareness regarding global SSI-prevention strategies that can be adopted in routine clinical practice. We cannot exclude a selection bias in this study (which is common in survey-based research) because our survey included only a specific group of surgeons, and respondents may be more prone to respond than non-respondents for a variety of reasons, which may introduce a bias in the results. In this study, we discuss the current practice patterns of surgical safety against SSI in patients who undergo H&N surgery (Table 4). Our current survey highlights that a certain percentage of surgeons are of the view that all surgical safety strategies are redundant. We emphasize the importance of adherence to surgical safety protocols in clinical practice. Our results underscore the need for effective and prompt intervention to improve surgical clinical practices and behavior to ensure safety of patients who undergo H&N surgery.



## Conclusion

This survey has broadened the scope of H&N surgical safety worldwide, and it is important to develop innovative approaches to improve global surgical care practices. In view of geographical and economic differences, each country/hospital should be motivated to establish their specific surgical safety guidelines or protocols based on local resources, guided by relevant published data. This research highlights the need for standardized international surgical guidelines in the management of patients who undergo H&N procedures.

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## Conflict of interests

The authors declare they have no conflict of interest.

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.otorri.2021.06.004](https://doi.org/10.1016/j.otorri.2021.06.004).

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