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ORIGINAL ARTICLE

Turbinate surgery in pediatric patients: A worldwide survey

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KEYWORDS
Turbinate radiofrequency ablation;
Rhinitis;
Turbinate surgery;
Turbinectomy;
Turbinoplasty

Abstract
Objective: Impaired nasal breathing is a common condition among pediatric patients, being rhinitis the most common cause. In recent years, turbinate surgery, mainly turbinate radiofrequency ablation (TRA), has increased in popularity amongst pediatric otolaryngologists and rhinologists as a safe and useful technique to address turbinate hypertrophy in pediatric patients. The present paper is designed with the aim of assessing the current worldwide clinical practice regarding turbinate surgery in pediatric patients.
Methods: The questionnaire was developed based on previous researches, by a group of 12 experts from the rhinology and pediatric otolaryngology research group belonging to the Young Otolaryngologists of the International Federation of Otorhinolaryngological societies (YO-IFOS). The survey was then translated to 7 languages and sent to 25 scientific otolaryngologic societies around the globe.

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Results: 15 scientific societies agreed to distribute the survey to their members. There were 678 responses from 51 countries. From them, 65% reported to usually perform turbinate surgery in pediatric patients. There was a statistically significant increased likelihood of performing turbinate surgery for those practicing rhinology, sleep medicine, and/or pediatric otolaryngology compared to other subspecialties. The main indication to perform turbinate surgery was nasal obstruction (93.20%); followed by sleep disordered breathing (53.28%), chronic rhinosinusitis (28.70%) and facial growth alterations (22.30%).
Conclusions: There is no general consensus on the indications and ideal technique for turbinate reduction in children. This dissension arises mainly from the lack of scientific evidence. The points with highest agreement (>75%) between respondents is the use of nasal steroids prior to surgery; reintroducing nasal steroids in allergic patients; and performing turbinate surgery as day-case surgery.

PALABRAS CLAVE
Radiofrecuencia de cornetes;
Rinitis;
Cirugía de cornetes;
Turbinectomía;
Turbinoplastia

Cirugía de cornetes en población pediátrica: una encuesta global

Resumen
Objetivo: La obstrucción nasal es una enfermedad habitual en pacientes pediátricos, siendo la rinitis la causa más frecuente. En los últimos años la cirugía de cornetes, especialmente la radiofrecuencia (RF), ha aumentado su popularidad entre los otorrinolaringólogos pediátricos y los rinólogos como una técnica segura y eficaz para tratar esta enfermedad en población pediátrica. Este artículo se diseña con el objetivo de evaluar la práctica clínica habitual a este respecto a nivel global.
Métodos: El cuestionario fue diseñado basado en trabajos previos por un grupo de 12 expertos del Grupo de Investigación en Rinología y en Otorrinolaringología Pediátrica de la Young Otolaryngologists of the International Federation of Otorhinolaryngological societies (YO-IFOS). La encuesta fue traducida a 7 idiomas y enviada a 25 sociedades científicas.
Resultados: Quince sociedades científicas aceptaron distribuir la encuesta entre sus miembros. Hubo 678 respuestas de 51 países. De ellos, el 65% comunicó realizar de manera habitual cirugía de cornetes en población pediátrica. Se observó una mayor probabilidad de realizar la intervención entre especialistas en Rinología, Medicina del sueño u Otorrinolaringología pediátrica comparado con el resto de las subespecialidades. La indicación más habitual para realizar la cirugía fue obstrucción nasal (93,20%), seguida por trastorno respiratorio del sueño (53,28%), rinosinusitis crónica (28,70%) y alteraciones del desarrollo facial (22,30%).
Conclusiones: No existe un consenso general en las indicaciones ni en la técnica quirúrgica de elección para esta cirugía en pacientes pediátricos. La desavenencia nace principalmente de la falta de evidencia científica. Los puntos con mayor acuerdo (> 75%) entre los respondedores fueron el uso de corticoide tópico nasal previo a la cirugía; reintroducir la medicación tópica en pacientes alérgicos, y realizar la cirugía de manera ambulatoria.

Introduction

Impaired nasal breathing (INB) is a common condition among pediatric patients.[1] INB has several consequences including sinusitis, worsening of sleep disordered breathing, or otitis media with effusion.[2] In addition, INB forces oral breathing, which may cause alterations in facial growth.[3,4] Excessive vertical facial growth has, in turn, further consequences including esthetic complaints (long face syndrome),[5] septal deviation, malocclusion,[6] temporomandibular joint disorders, sleep disordered breathing,[7] and head posture alterations.[8]

Nasal obstruction may be caused by several conditions, enlargement of the adenoids and rhinitis being the most common.[9] Different causes will often occur simultaneously in various combinations, such as septal deviation, adenoid or turbinate hypertrophy. Cassano et al. found that 77% of their sample of children with severe adenoid hypertrophy (AH) also had muco-purulent rhinitis.[10] AH has been associated with higher rhinitis severity and duration.[11–13]

Persistent allergic inflammation might lead to lymphoid hyperplasia of the adenoidal and turbinate tissue with a prominent eosinophilic inflammatory pattern.[11,12]

In recent years, turbinate surgery, mainly turbinate radiofrequency ablation (TRA), has increased in popularity amongst pediatric otolaryngologists and rhinologists as a safe and useful technique to address turbinate hypertrophy in pediatric patients.[14] In fact, 81% of pediatric otolaryngologists surveyed report performing turbinate surgery in children.[15] However, this previous survey included only American pediatric otolaryngologists. Monitoring the current practice among otolaryngologist is of utmost importance, as it could identify potential knowledge gaps in order to guide future research.

The present paper is designed with the aim of assessing the current worldwide clinical practice regarding turbinate surgery in pediatric patients.

Patients and methods

Sample

The questionnaire was developed based on previous researches,[14,15] by a group of 12 experts from the rhinology and pediatric otolaryngology research group belonging to the Young Otolaryngologists of the International Federation of Otorhinolaryngological societies (YO-IFOS). The questionnaire was modified until an agreement among all the authors was reached. The final English version can be found as supplementary file 1.

The survey was then translated to 7 languages by native speakers members of the research group (Spanish, German, English, Czech, Portuguese, Italian and French) and adapted to the Survey Monkey platform (SurveyMonkey Inc., San Mateo, California, USA).

The survey was sent to 25 scientific otolaryngologic societies around the globe (Spanish, Argentinian, Chilean, Colombian, Ecuadorian, Mexican, Uruguayan, Venezuelan, Dominican, Honduran, Peruvian, Panamerican Society, Galician, Czech, Italian, Brazilian, Portuguese, Belgian, French, South African, British, Egyptian, German, Panafrican society, and Suisse).

Statistical analysis

Comparisons between quantitative variables and dichotomic variables were performed with t-test when a normal distribution was demonstrated (comparison between postoperative U-Sniff and AST scores; comparison with the *U*-Test European controls) or with the non-parametric variation rank sum test when they did not follow a normal distribution (preoperative comparison between age; and postoperative comparison of sniffin' sticks threshold scores). Comparisons between quantitative variables and non-dichotomic variables were performed with the Kruskal–Wallis test (comparison between Camacho score, Cassano score and olfactory test scores). The relationship between qualitative variables was studied through a chi-square test (preoperative comparison of sex and allergy distribution; and the postoperative comparison of prevalence of hyposmia regarding AST). The correlation between quantitative variables was performed through the Spearman correlation analysis (age, AST score, U-sniff test score and SST score).

All quantitative variables were tested for normality with the Shapiro–Wilk test.

Results

Participants

15 scientific societies agreed to distribute the survey to their members (Spanish, Argentinian, Chilean, Mexican, Venezuelan, Galician, Czech, Italian, Portuguese, French, British, Egyptian, German, Panafrican society and Suisse). There were 678 responses from 51 countries, 55.01% from Europe, 34.96% from central and south America, 4.87% from Africa, 2.36% from Asia, 2.36% North America and 0.44% from Australia (Fig. 1).

The mean age was 44.97 ± 10.81 years, with no significant difference ($p = 0.88$) between those who perform and those who do not perform this surgery. A 35.05% work in a public hospital, 32.25% in private medicine, and 32.70% in both. There was an increased probability of performing this surgery for those who work in private medicine practice ($chi^2 = 8.13$; $p = 0.02$). Table 1 summarizes difference between public and private facilities.

From the respondents, 34.76% reported that they do not perform turbinate surgery in pediatric patients. The main reasons reported for not performing it were because there are no specific recommendations or clinical guidelines (58.70%), while 28.10% reported considering it a risky surgery in pediatrics; 26.34% have concerns of turbinate reduction surgery affecting facial growth; 27.50% believe that it offers no benefits in children and 13.92% felt that turbinate size will decrease after adenoidectomy (Fig. 2).

Ninety of all respondents felt that there should be specific recommendations or clinical guidelines. There was no difference in this belief between those who perform and who not perform turbinate surgery ($p = 0.15$).

From all respondents, 65.24% are currently performing turbinate surgery in pediatric patients. Among rhinologists, 73.87% report performing turbinate reduction surgery. This proportion increases to 79.62% among pediatric otolaryngologists, and to 82.73% for those who practice sleep apnea medicine. There was a statistically significant increased likelihood of performing turbinate surgery for those practicing rhinology, sleep medicine, and/or pediatric otolaryngology compared to other subspecialties ($p = 0.002$; $chi^2 = 9.77$). The mean number of yearly turbinate surgeries reported was 16.61 ± 17.39.

Indication for surgery

The main indication was nasal obstruction (93.20%); followed by sleep disordered breathing (53.28%), chronic rhinosinusitis (28.70%) and facial growth alterations (22.30%) (Fig. 3).

The mean youngest age limit to perform the surgery was 5.33 ± 3.82 years. Seventeen percent of respondents had no age limitation, while 69.20% would only perform inferior turbinate surgery in children older than 4 yo.

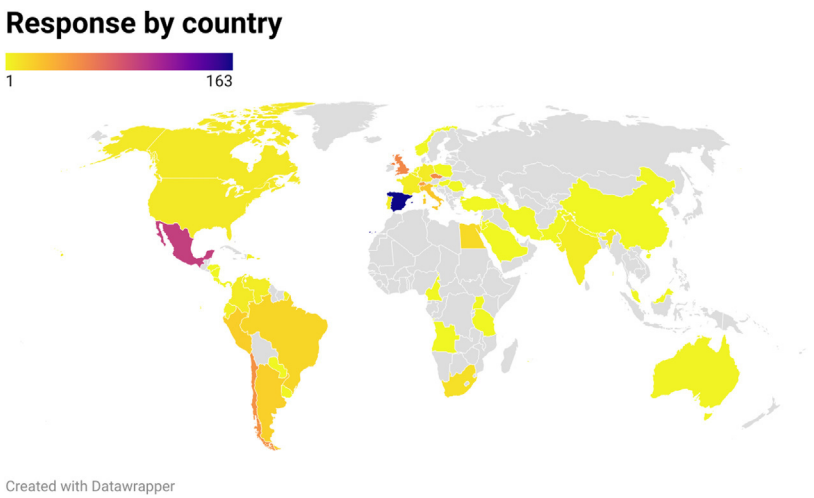

Figure 1 Response by country (*n*): Spain 163; Mexico 96; UK 56; Czech Republic 54; Chile 51; Switzerland 44; Italy 24; Peru 21; Argentina 20; Brazil 17; Egypt 15; South Africa 12; Canada 8; USA 8; Colombia 7; Germany 7; Portugal 6; Venezuela 6; India 6; France 6; Ecuador 5; Belgium 5; Dominican Republic 5; Australia 3; Netherlands 2; Jordan 2; Costa Rica 2; Panama 2; Lebanon 2; Uruguay 2; Paraguay 1; Nicaragua 1; Honduras 1; Cameroon 1; China 1; Saudi Arabia 1; Malaysia 1; Norway 1; Turkey 1; Iran 1; Poland 1; Slovenia 1; Israel 1; Rumania 1; Angola 1; Trinidad and Tobago 1; Nepal 1; Pakistan 1; Uganda 1; Hungary 1; Tanzania 1.

Table 1 Comparison between private and public facilities.

	Total	Private	Public	Statistics
Perform surgery (%)	65.24 ± 1.83	68.86 ± 2.21	58.40 ± 3.19	**$chi^2 = 7.45$; $p = 0.006$***
Number of surgeries (n)	15.98 ± 17.38	17.28 ± 18.88	13.23 ± 13.21	**$t = -2.29$; $p = 0.023$***
Age limit (years)	6.31 ± 6.60	6.80 ± 7.15	5.51 ± 5.57	$t = -5.12$; $p < 0.001$*
Steroids after surgery (%)	37.84 ± 2.66	40.37 ± 4.70	35.16 ± 4.22	$chi^2 = 0.75$; $p = 0.688$
Objective test (%)	29.16 ± 2.17	31.62 ± 2.73	24.66 ± 3.57	$chi^2 = 2.27$; $p = 0.132$
Day surgery (%)	79.18 ± 1.71	80.8 ± 2.03	75.54 ± 3.17	$chi^2 = 2.06$; $p = 0.151$
Sedation (%)	23.97 ± 1.81	25.99 ± 3.30	26.92 ± 3.29	$chi^2 = 3.13$; $p = 0.209$
Main surgical technique				
TRA	61.38 ± 2.19	64.97 ± 2.69	55.75 ± 3.77	**$chi^2 = 4.03$; $p = 0.045$***
MAIT	29.57 ± 2.52	32.47 ± 3.36	24.81 ± 3.80	$chi^2 = 2.19$; $p = 0.139$
Coblator	30.45 ± 2.51	37.74 ± 3.33	18.49 ± 3.56	**$chi^2 = 13.25$; $p < 0.001$***
Diathermy	39.14 ± 2.61	41.26 ± 3.43	37.14 ± 4.08	$chi^2 = 0.59$; $p = 0.442$
Turbinectomy	26.17 ± 2.55	30.11 ± 3.46	21.19 ± 3.76	$chi^2 = 2.89$; $p = 0.089$
Endoscope (%)	72.08 ± 19.16	82.08 ± 2.92	67.60 ± 3.50	**$chi^2 = 12.53$; $p = 0.002$***
Combine adenoidectomy (%)	74.68 ± 1.87	71.01 ± 3.49	74.16 ± 3.28	$chi^2 = 2.34$; $p = 0.311$
Nasal packing (%)	49.70 ± 2.22	47.73 ± 2.75	53.80 ± 3.81	$chi^2 = 1.66$; $p = 0.198$

Bold and asterisk if difference between groups is statistically significant ($p < 0.05$).
MAIT, microdebrider-assisted inferior turbinoplasty; TRA, turbinate radiofrequency ablation.

Almost half (44.23%) of respondents felt that both the indication and the surgical technique should be more conservative in children under eight years of age (e.g. longer nasal steroids, more comprehensive testing, less extent of resection or lower energy used); while 15.21% believe that they should be treated as older children. In contrast 18.53% reported believing that only the indications for surgery should be more restricted, and 22.03% that only the surgical technique should be more conservative but with the same indications.

Most authors try intranasal steroids before surgery (96.17%). Most of them for 3 months (39.46%), however this varied, with 27.21% recommending steroids for longer than 3 months; 21.80%for 2 months and 11.53% for 1 month.

Most authors believe that objective testing should be used in order to recommend surgery (63.65%) (Fig. 4). The most commonly recommended objective testing was rhinomanometry with and without nasal decongestant (53.66%) followed by acoustic rhinometry (35.71%) and inspiratory peak flow (24.23%). However, only 29.16% are currently using

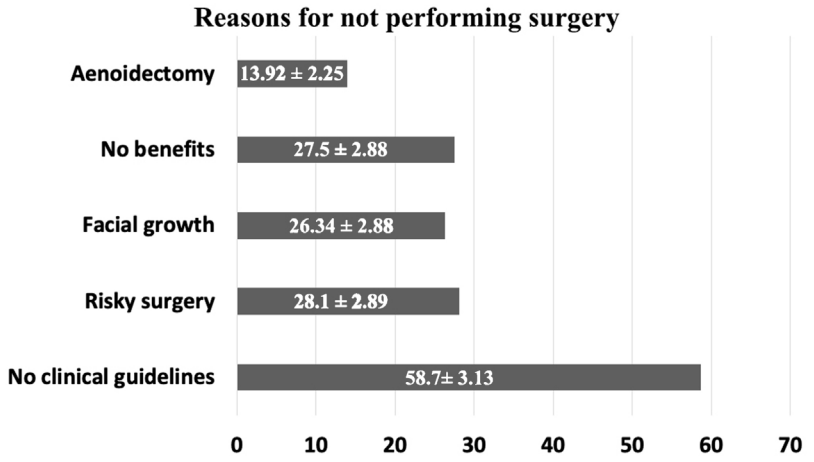

Figure 2 Reasons for not performing surgery (%) (proportion ± standard deviation). In decreasing order: turbinate size will decrease after adenoidectomy; it offers no benefits in children; risk of affecting facial growth; risky surgery in pediatric patients; and no specific recommendations or clinical guidelines.

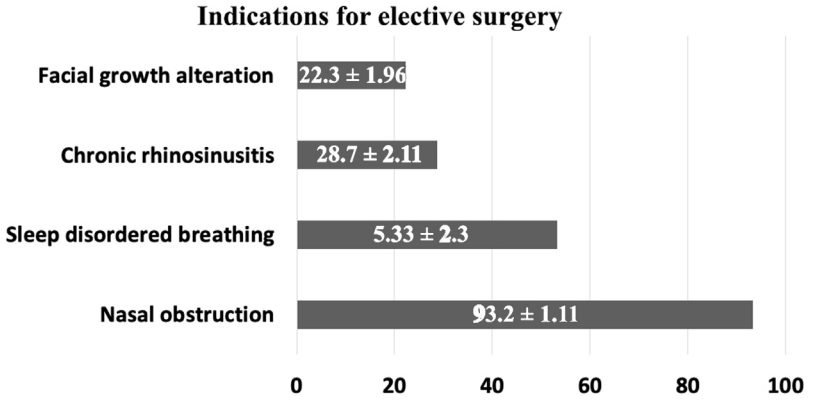

Figure 3 Indications for elective surgery (%) (proportion ± standard deviation).

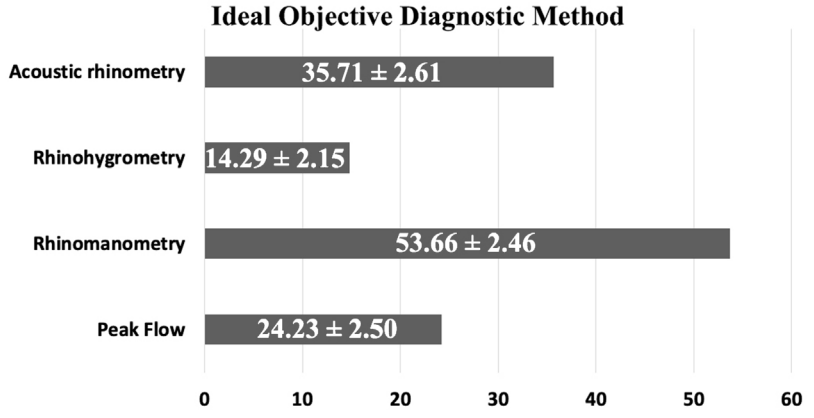

Figure 4 Ideal objective diagnostic method (%) (proportion ± standard deviation).

any preoperative objective testing. Of those objectively testing rhinomanometry with and without nasal decongestant remained the most common (23.23%) followed by rhinohygrometry with and without nasal decongestant (14.60%) and acoustic rhinometry (10.86%).

Surgical technique

Thirty-one percent of respondents perform different surgical techniques (Table 1). The main surgical technique reported was TRA (61.38%), followed by superficial

diathermy (39.14%), coblation (30.45%), microdebrider-assisted inferior turbinoplasty (MAIT) (29.57%), partial turbinectomy (26.17%) and others (22.64%). Thirty four percent reported that they have changed their surgical technique in the latest 5 years.

Eighty-five percent combine turbinate surgery with other procedures, being 54.21% the proportion of cases with associated adenoidectomy. Respondents reported that facing a child with both turbinate and adenoid enlargement, 66.73% would perform adenoidectomy and turbinate surgery, while 32.92% would perform only adenoidectomy and 0.36% only turbinate surgery.

Endoscopy is used by 71.78% of surgeons in their practice, most commonly transnasal (98.53%) followed by transoral for the posterior part of the turbinates (1.47%).

This surgery is performed as a day case under general anesthesia by 79.18% of participants, and 23.90% perform turbinate reduction surgery under sedation, with the mean lower limit for age in this technique reported at 6.31 year.

Postoperative care

Regarding postoperative medication, 77.40% prescribe nasal rinses, 37.07% nasal decongestant drops; 14.50% oral decongestants; 35.28% antibiotics; 37.84% nasal steroids and 62.01% oral analgesics.

Most respondents (85.27%) reintroduce nasal steroids after surgery in allergic patients, with 26.75% waiting at least 4 weeks for reintroduction; the rest reintroduce them between 2–4 weeks (26.54%), 1 week (18.11%), 2 weeks (16.67%), or immediately after surgery (11.93%).

Most authors do not use nasal packing (45.60%) or use packs only if significant bleeding (37.52%). While others use absorbable (7.54%) and non-absorbable packing (9.34%). Those who use nasal packing report removing it after 2 days (36.05%); the following day (30.95%); after few hours (21.43%); or immediately after surgery (11.56%).

Discussion

This is the first study to assess the current practice of turbinate surgery through a worldwide survey. Our current study was inspired by Jian et al., 2012 similar survey that included only American otolaryngologists.[15]

Data presented herein reveals several practice patterns among otolaryngologists, while also suggesting some inconsistencies later described in this paper, which should be better studied in order to help clinicians.

Most respondents perform turbinate surgery in pediatric patients. However, this may not reflect the actual proportion, as survey-based studies have the limitation that the most motivated participants might be more prone to spend time answering the survey. From this data, it seems that rhinologists, pediatric otolaryngologists and sleep apnea specialists are more prone to perform this surgery.

The main reason to not perform this surgery is that clinical guidelines have no specific recommendations for pediatric patients. This is similar to Jiang et al.,[15] who report the lack of clinical data for the benefits versus the risks of the surgery as the main reason turbinate reduction is not performed in pediatric patients. It is noteworthy that 89.88% believe that clinical guidelines should include recommendations for pediatric patients. We were unable to find any available clinical guideline assessing this point,[16–19] and we also note that no clinical guideline reports a lower limit for age.

The second reason some may choose not to perform this surgery is that they consider it to be risky. However, authors who perform this surgery report it to be a safe surgery, with a 4.26% minor complication rate and 0.72% major complication rate. These numbers are in line with a recent systematic review and meta-analysis,[14] reporting 2.55% rate of minor complication and 0.57% major complication rate.[14]

The third reason reported to not perform turbinate surgery in children is the concern of it affecting facial growth. It is interesting that altered facial growth is also a reported cause to perform turbinate reduction (22.30%). A recent systematic review and metanalysis demonstrated that there are currently no reports of turbinate surgery affecting facial growth.[14] The unique study performing CT scan after turbinate surgery in children was developed by Segal et al.[20] They could not demonstrate any major facial growth alteration, only minor maxillary hypoplasia in one case, hardly attributed to the turbinate surgery. However, there are numerous studies about impaired nasal breathing affecting facial growth.[5]

As also reported by Jiang et al.,[15] most authors try nasal steroids before surgery, being 3 months the most common (39.46%). Clinical guidelines suggest first try medical therapy before indicating surgery,[16–19] but they do not specify how long should one wait until proposing surgery to the patients. A Spanish position paper suggested waiting 3 months,[17] which is in line with the clinical practice of the majority of respondents.

Most respondents believe that a form of objective testing should be used to indicate the need for surgery, however only a minor proportion are currently using any. The most recommended testing is rhinomanometry with and without nasal decongestant (Fig. 4). This nasal decongestant test has the ability to simulate the effect of turbinate reduction.[21] It has been reported in children, and normative data is available.[22] The main complaint could be that rhinomanometry is not widely available, it is time consuming, and younger children (<4 yo) are less able to cooperate with testing. Affordable and less time-consuming techniques, such as peak nasal inspiratory flow or rhinohygrometry, could be used instead, however in these cases there are no normative data available in order to select these children who are most likely to benefit from surgery.

Similar to Jiang et al.,[15] we found that most respondents had an arbitrary lower age limitation, with the most common answers being 5 and 10 y.o. While Jiang et al. reported that 76% would offer surgery only after 4 yo,[15] we found a slightly decreased number of 69.20%. Also in our survey 16.74% of respondents had no lower age limitation while Jiang et al. reported 22% would perform surgery regardless of age.[15] This data suggest that our respondents tend to be a little bit more cautious. However, to date there is no evidence to limit the age of surgery as most published data has not stratified their complication rate according to the age of patients.[14]

The preferred surgical technique in the majority of patients is turbinate radiofrequency ablation, while Jiang et al. reported in USA pediatric otolaryngologists coblation

as the most preferred technique.[15] In contraposition, we found an increased number of otolaryngologists performing MAIT. Where Jiang et al. reported 16%, and we found 29.57%, in our study population. It could be attributed to the increased popularity and acceptance of this technique in the latest 10 years. Currently there are no clinical trials in pediatric patients, and only two cohort studies in children[23,24] comparing surgical techniques. Despite this lack of information, MAIT, TRA and coblation seem to report the lowest complication rates,[14] which supports them being the most used techniques.

Most respondents perform turbinate surgery in combination with other procedures, with the most common being adenoidectomy. This data is similar to that reported by Jiang et al.[15] This is an important point, but neglected in previous research. Cassano et al. reported that as the adenoids increase in size, rhinitis is more frequently associated.[10] Therefore, it could be suggested that both turbinate enlargement and rhinitis could be solved with adenoidectomy without any associated intervention to turbinates. However, this is not always the case, and several authors report cases of persistent nasal obstruction after adenoidectomy alone, especially in those children with higher gains in the nasal decongestant test.[25,26] In consequence, most of the respondents (66.73%) combine turbinate surgery with adenoidectomy when they found enlarged turbinates in children with adenoid enlargement. Future research could investigate if the decongestant test could be also used to select these children who are most likely to benefit from associating turbinate surgery with adenoidectomy, as proposed by Juliusson et al.[27]

Most surgeons (85.27%) reintroduce nasal steroids in allergic patients. Arganbright et al. reported this to be a major cause of surgical failure,[23] reporting that almost 50% of their patients required it. There is no clear attitude regarding when steroids should be reintroduced, with the most common attitude to wait at least 4 weeks. However there is no formal recommendation to date in clinical guidelines regarding steroid reintroduction.[17–19]There is wide variability in the medications used in the postoperative period. Therefore, 35.28% of respondents prescribe antibiotics, while there are no recommendations in clinical guidelines and available evidence only supports the use of topic antibiotics with nasal packing.[28] Previous studies in children have not reported significant infection,[14] therefore available data suggest that routine antibiotics should not be recommended. It is remarkable that 14.50% of respondents prescribe oral decongestant, and 37.07% nasal decongestant. There is no published data if these clinical practices are or not recommended.

This study has some limitations. Firstly, it is a survey based study, which has a volunteer bias, as those prone to participate in the study may not reflect the whole population. The second major limitation is the extensiveness of the survey. We tried to be comprehensive and explore the most relevant aspects of this procedure. However, the length of the survey has certainly limited the participation, and we only obtained a small proportion of answers.

Even with these limitations this study has strengths as well. This is the first worldwide survey exploring pediatric turbinate surgery. Our data is in line with a previous publish survey, which gives consistency to our results. This survey opens the path to future research and consensus documents in order to guide clinicians in this surgery.

Conclusion

There is no general consensus on the indications and ideal technique for turbinate reduction in children. This dissension arises mainly from the lack of scientific evidence. Most respondents agreed that there should be specific recommendations in clinical guidelines and position papers, which could help in creating a consensus. However, these guidelines cannot be developed without high quality evidence.

The points with highest agreement (>75%) between respondents is the use of nasal steroids prior to surgery; reintroducing nasal steroids in allergic patients; and performing turbinate surgery as day-case surgery. However, it is remarkable that there is no current consensus on what specific nasal steroid should be used, and it should be better studied in the future.

Compliance with ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Funding

None.

Conflict of interest

This work is part of the research completed by Christian Calvo-Henriquez, MD, to obtain a PhD degree. The rest of authors declare no disclosure or conflict of interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.otorri.2022.02.004.

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