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ORIGINAL ARTICLE

The influence of tonsilar hypertrophy on child growth development

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Keywords:
Growth and development, Adenoids, Palatine tonsil, Hypertrophy, Tonsillectomy.

Abstract

Objective: To compare the weight-height development of children with adenotonsillar hypertrophy in relation to the normal growth curve. **Method:** Prospective study with a target population of children with tonsil hypertrophy submitted to adenoidectomy and/or tonsillectomy. The information was acquired before the surgical procedure through a questionnaire for those responsible, who evaluated gender, age, weight, height, body mass index and main complaint. **Result:** We analyzed 52 patients with indication of tonsillectomy between three and eleven years. Most children were eutrophic, 30.8% of the children were above ideal weight and 3.8% were under the ideal weight. Regarding the height-by-age ratio, 96.15% of the children had adequate height and 3.85% had short stature for age. The main complaints that led children to medical care were snoring, chronic tonsillitis, mouth breathing and recurrent airway infections. The main complementary examination requested was cavum radiography. **Conclusion:** There was no direct relationship between tonsil hypertrophy and weight-height growth deficit in the studied children. Only a small increase in the rate of overweight and obesity was observed in older children, but without statistical significance.

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INTRODUCTION

The pharyngeal and palatine tonsils, better known as adenoids and tonsils, respectively, are clusters of lymphoid tissue located in the upper airway and are stimulated by antigens. It is known that immunity increases with the development and growth of the individual. Thus, the lymphoid organs grow approximately 200% during the early childhood phase and begin to regress between the ages of eight and ten.[1]

In some individuals, the adenoids and tonsils remain hypertrophied, not undergoing the physiological process of involution of the lymphoid tissue. When hypertrophy persists, craniofacial and body growth in general are affected. There are studies that demonstrate that tonsil hypertrophy can lead to reduced height growth, weight gain and cardiopulmonary function impair.[1]

In some children, excessive tonsil growth can lead to obstruction of the pharyngeal airway space, which can cause respiratory problems, deficits in height growth and body weight, changes in energy metabolism, cardiovascular abnormalities, neurobehavioral disorders and increased use of health services.[2] The impairment of nasal respiratory function causes the child to become a mouth breather, which can have undesirable effects on craniofacial growth and development.[3]

Furthermore, tonsillar hypertrophy, by compromising sleep quality, can cause poor school performance, behavioral and attention disorders, daytime sleepiness, enuresis and cor pulmonale, and may be related to poor sleep quality, in addition to chewing and swallowing problems.[4]

Therefore, one of its main consequences is obstructive sleep apnea syndrome (OSAS), characterized by partial or complete collapse of the upper airways during sleep, caused by obstruction, leading to a reduction in airflow, which results in snoring and apneic events in mouth-breathing patients.[5] OSAS is most prevalent between the ages of two and eight, when the volume of the tonsils is larger in relation to the diameter of the upper airway. In children, this reduction in flow is considered one of the main causes of decreased adequate weight and height growth. This occurs because, during the deepest phases of sleep, growth hormone (GH) is synthesized and secreted by the pituitary gland and its primary function is to promote growth mainly through the synthesis of insulin-like growth factor type 1 (IGF-1 or somatomedin C).[3] In patients who are unable to maintain an adequate sleep pattern, such as children with OSAS, GH secretion is affected and growth, assessed by weight, height and Body Mass Index (BMI), is reduced. There is an alteration in the GH-IGF-1 axis, reducing serum levels of IGF-1 and insulin growth factor binding protein (IGFPB-3), factors that act on child growth.[5]

Adenotonsillectomy is considered an important treatment modality in patients with tonsil hypertrophy.[6] Absolute indications for adenotonsillectomy include adenotonsillar hypertrophy with obstructive sleep apnea, growth deficit, aberrant dentofacial growth, suspected malignancy, and hemorrhagic tonsillitis. Relative indications for the procedure include adenotonsillar hypertrophy with upper airway blockage, dysphagia, speech impairment, halitosis, recurrent or chronic pharyngotonsillitis, peritonsillar abscess, and association with Streptococcus carriage status.[7]

The objective of this study is to evaluate the weight and height growth of children with adenotonsillar hypertrophy.

METHODOLOGY

This is a prospective, quantitative, observational, cross-sectional study that obtained information regarding the weight and height growth of children with adenoid and/or tonsil hypertrophy who were to undergo adenoidectomy and/or tonsillectomy compared to the normal growth expected for each age and sex, according to the parameters of the World Health Organization (WHO).[8]

The study included children between three and 11 years old who were consulted to assess the need for tonsillectomy between November 4, 2019 and March 9, 2020 with an indication for surgery. Children with previously known congenital anomalies, such as upper respiratory tract malformations, craniofacial abnormalities and Down syndrome, were excluded.

A questionnaire (APPENDIX A) intended for the patients' guardians was used to collect data, which was completed before the surgical procedure. The questionnaire was specifically designed for the problem under investigation, to assess the relationship between weight and height growth in children with tonsil hypertrophy. The variables assessed in the questionnaire were sex, age, weight, height, BMI, main complaint, associated symptoms, reason for surgical indication, tests requested in the investigation, and presence of previous anomalies.

The data collected were compared with the normal growth established by the graphs of the 2019 Child Health Record and the 2013 Adolescent Health Record from the Ministry of Health, according to WHO parameters (age x BMI x sex)[8-10].

During the data collection period, which ended up being reduced due to the onset of the COVID-19 pandemic, a total of 52 patients were selected for the study.

After completing the questionnaires during the medical consultation, the data were exported to an EXCEL spreadsheet. Descriptive statistical analysis of the data was performed using the Statistical Packages for Social Sciences (SPSS) version 25. Qualitative variables were organized by frequencies and percentages, and quantitative variables were summarized by descriptive statistics measures such as mean, standard deviation, median, minimum, and maximum.

This study was approved by the Research Ethics Committee (CEP), under number: 3,669,350, dated October 29, 2019.

RESULTS

A total of 52 patients with indications for adenoidectomy, palatine tonsillectomy, or both due to hypertrophy of the palatine glands in a pediatric hospital in the interior of the state were analyzed. Among the patients who required surgical intervention for adenoidectomy with or without tonsillectomy, 57.7% were male and 42.3% were female.

The children's ages ranged from three to 11 years, with an average age of six years. The maximum, minimum and average weight, height and BMI values of the study were represented in Table 1.

The minimum weight of the patients was 12.7 kg and the maximum weight was 55.9 kg, with the average weight of the children being 24.3 kg. The minimum height in the present study was 1 meter and the maximum height was 1.6 meters, with the average height of the patients being 1.2 meters. And the BMI ranged from 13.1 to 26.5, with the average BMI of the study population being 16.8.

To classify the BMI of each child and adolescent, the analysis was performed based on the Z-score of the Child Health Booklet and the Adolescent Health Booklet of the Ministry of Health.[9,10]

The "Severely Thin" and "Thin" groups were combined into the "Below Ideal Weight" group; The groups "Overweight", "Risk of Overweight", "Obesity" and "Severe Obesity" were grouped into the group "Above Ideal Weight"; and the group "Eutrophic" was grouped into the group "Eutrophic". The grouping was done with the intention of facilitating the reader's understanding and visualization and assisting in the analysis of the impact of adenotonsillectomy in children with adenoid and tonsil hypertrophy. Only 3.8% of the children were below ideal weight, 30.8% of them were above ideal weight and 65.4% were eutrophic. Of the 30.8% of patients above ideal weight, 50% were female and 50% were male. However, in the age group of nine to eleven years, which represents 19.2% of the total number of participants, 11.52% were overweight. Meanwhile, in the age group between three and eight years old, which represents 80.8% of the participants, only 19.2% were overweight.

To classify the Height x Age of each child and adolescent, the analysis was also performed based on the Z-Score of the Child Health Booklet and the Adolescent Health Booklet of the Ministry of Health.[9,10]

Of the 52 patients eligible to participate in the study, only 3.85% had low height for their age, with the remaining 96.15% having adequate height for their age.

The most frequent complaints of children treated at the preoperative outpatient clinic of a pediatric hospital in the interior of the state between 11/04/2019 and 03/09/2020 were evaluated. It is important to note that the same child could present more than one complaint associated with tonsil hypertrophy. The frequency of occurrence of each complaint is shown in Graph 1.

The main symptoms were snoring with or without apnea (27.6%) and chronic tonsillitis (24.1%). Other complaints such as mouth breathing (19.5%) and recurrent upper respiratory tract infection (URTI) (11.5%) were also frequently reported by guardians. The other complaints reported were compiled as "others" (17.2%).

The main reasons for surgical indication in the children included in the study are represented in Graph 2.

Most patients (61.5%) were indicated for both adenoid and tonsil removal. In 30.8% of the children, surgery was indicated due to adenoid hypertrophy, and in 7.7% of them, it was indicated due to tonsil hypertrophy.

Among the tests requested in the investigation of tonsillar hypertrophy, the cavum radiography was the most ordered, being requested in 63.5% of the cases. In 19.2% of the cases, the diagnosis was only clinical, with no type of complementary test being performed. Nasal video-endoscopy was requested in 9.6% of the cases, paranasal sinus radiography in 3.8% of the cases, facial tomography in 1.9% of the cases, and cavum and paranasal sinus radiography in 1.9% of the cases.

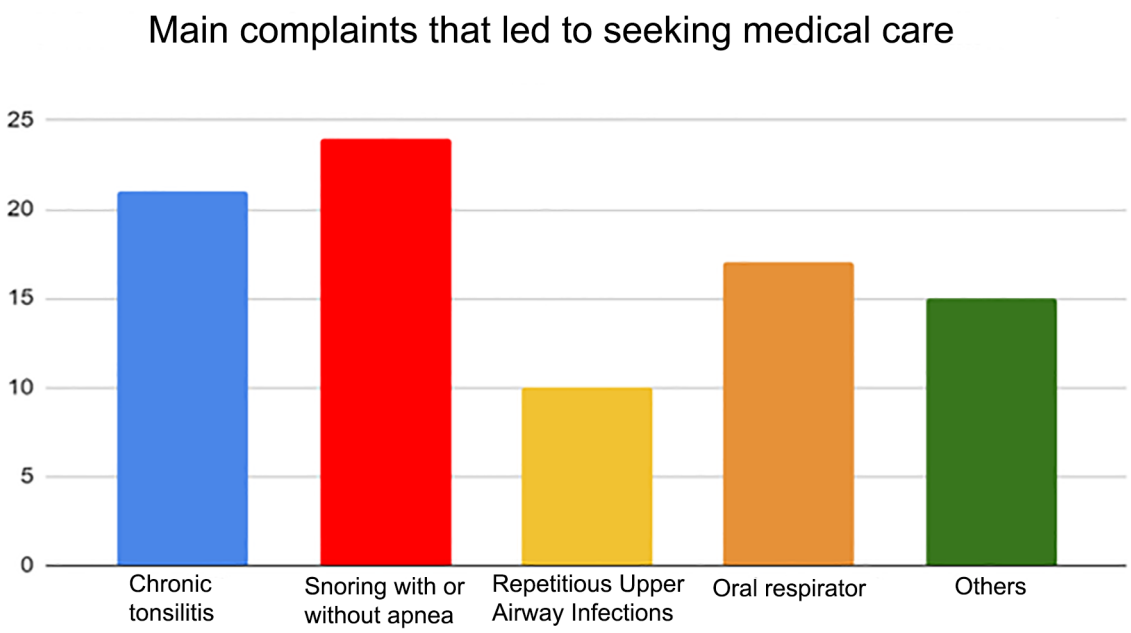
DISCUSSION

Hypertrophy of the tonsils, especially the tonsils and adenoids, can affect the craniofacial and weight-height growth of patients with this disorder.[1] There are studies that prove that impaired respiratory function and mouth breathing with or without nasal obstruction can alter the craniofacial growth and development of children.[3] Tonsil removal is the treatment of choice for this hypertrophy in most cases, and is one of the main procedures performed by otorhinolaryngologists in children.[1]

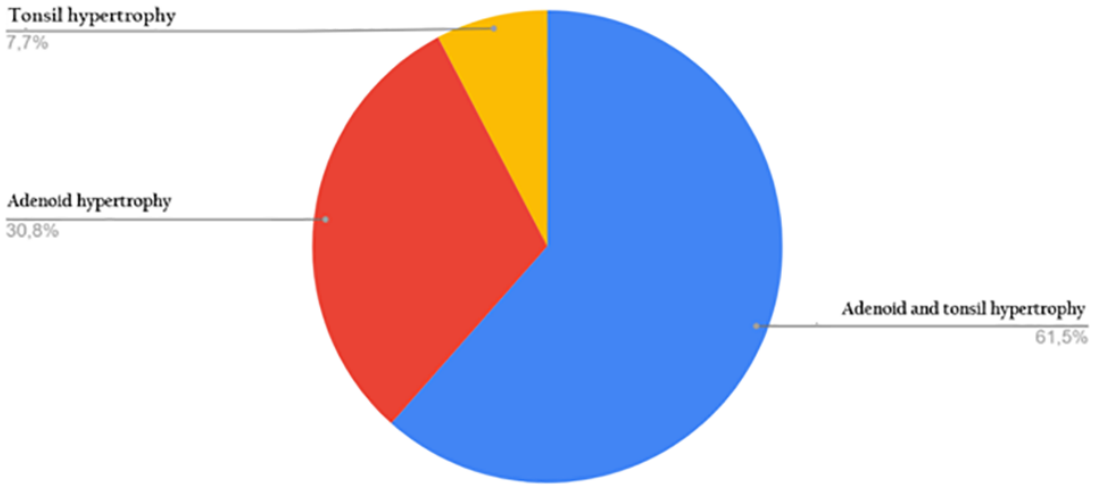
Table 1. Anthropometric data of children evaluated in the preoperative outpatient clinic in pediatric otorhinolaryngology - in a pediatric hospital in the interior of the state 2019/2020.

	Weight (Kg)	Z-score	Height (meters)	Z-score	BMI (Kg/m²)	Z-score
Minimum	12.7	-1.45	1	-2.44	13.1	-2.17
Maximum	55.9	3.44	1.6	4.45	26.5	2.84
Medium	24.3	0.46	1.2	0.47	16.8	0.23

Source: Prepared by the authors, 2021.



Graph 1. Most frequent complaints of children seen at the pediatric otorhinolaryngology preoperative outpatient clinic - in a pediatric hospital in the interior of the state 2019/2020.



Graph 2. Main reasons for surgical indication in children evaluated in the preoperative outpatient clinic in pediatric otorhinolaryngology - in a pediatric hospital in the interior of the state 2019/2020.

Failure to treat these disorders can lead to a series of consequences, such as problems with chewing, swallowing, mouth breathing, sleep apnea, daytime sleepiness, cardiovascular problems, neurocognitive changes, and weight-height deficit, which was the focus of this research.[4,11]

Adenotonsillectomy leads to a significant improvement in the patient's quality of life and is the preferred treatment because it is easy to adapt to compared to other techniques such as Continuous Positive Airway Pressure. Airway (CPAP), which would be equally effective in treating the symptoms of tonsillar hypertrophy in children.[12] In addition, tonsillectomy favors the growth and development of children by promoting height and weight gain.[11] This procedure is curative, in most cases, and can promote improvements in symptoms such as snoring, sleep apnea and physical changes in children.[12] Despite these data, this study did not evaluate children after surgery and its results in improving the quality of life and weight and height growth of patients. However, studies with

children treated non-surgically suggest that anthropometric data normalize within seven months, and the risks and benefits of adenotonsillectomy versus watchful waiting in these children should be carefully evaluated.[12]

In addition, recent analyses have shown that children who are obese or overweight may further increase their obesity/overweight index when undergoing adenotonsillectomy surgery, since an average increase of 20% in weight gain normally predicted for their age is expected after surgery.[11] In children with weight and height deficits, this increase may favor growth and development.[11] Therefore, the procedure should be evaluated with caution in patients who are already obese or overweight, reviewing the risks and benefits of performing it in comparison with non-surgical treatment.[11]

The presence of mouth breathing caused by tonsil hypertrophy can lead to changes in craniofacial growth and development, by generating morphological changes and craniofacial disproportion, such as an adenoid face (elongated), maxilla atresia, and mandibular retrognathia.[3] Nasal breathing is essential for maintaining the health of orofacial structures, since the adequate use of facial muscles stimulates harmonious bone growth.[3] However, in the present study, no assessments of craniofacial changes were performed in children.

Tonsil and adenoid hypertrophy was the most frequent indication for surgical treatment. However, it was always associated with other conditions, which together motivated the search for medical care. In addition to mouth breathing, other symptoms appeared constantly in the questionnaire applied, such as snoring, recurrent URTI, in particular tonsillitis, nasal obstruction, sleep apnea, and delay in school development. There were also complaints of decreased appetite, but only 3.8% of patients were below the expected weight for their age. These same symptoms have also been demonstrated in several previously published studies, such as that of Barros-Filho et al.[11], whose main diagnoses were OSA, snoring, adenoid and tonsil hypertrophy, adenotonsillar hyperplasia and recurrent tonsillitis. Furthermore, Beraldin et al.[4] also observed important correlations between symptoms and tonsillar hypertrophy, with the main preoperative findings being: nasal obstruction (41.29%), daytime fatigue (22.19%), low weight (14.33%), dyspnea (22.19%), snoring (38.77%), choking/suffocating (19.39%), poor sleep (20.09%), difficulty waking up (13.24%), chest sinking (8.51%), dysphagia for solids (24.42%), muffled speech (19.19%), hyponasal voice (26.74%), dyslalia (15.41%), irritability (25.89%), impatience (28.57%), hyporexia (24.11%), inattention (15.18%), ridiculed for snoring (6.25%), plays normally (7.14%), participates in sports (12.86%), plays with friends (4.29%), attends school/daycare (44.29%), and performs well in school (31.43%).

Analyzing the statistical results using the chi-square calculation, the presence of tonsil hypertrophy and associated symptoms were not related to the decrease in BMI (0.46) and height (0.37) of these children, that is, the children who needed to have their tonsils and adenoids removed did not have their growth or BMI altered in relation to children who were only indicated for adenoidectomy or tonsillectomy. Contrary to expectations, more eutrophic and overweight children were found. Among the 52 patients included in the study, 30.8% were above the ideal weight and 65.4% were eutrophic. In addition, only two patients had low height for their age, with the other 50 patients having adequate height for their age. Thus, we can observe that tonsil hypertrophy did not have significant repercussions on the growth and development of the individuals in the study. Furthermore, there was no relationship between sex and adenoid and tonsil hypertrophy.

Therefore, contrary to what was expected, since several previously published studies have demonstrated a relationship between tonsil hypertrophy and the weight and height development of children, the present study was unable to prove such a relationship.

We were also able to observe that most patients eligible for the study were between four and seven years old, in which the lymphoid tissue would still be in the growth phase for subsequent regression in size. This fact may raise the question of what the appropriate age would be to operate on children, since there could be spontaneous regression of the tonsils with consequent improvement in symptoms. Therefore, when faced with a child with apnea, snoring, recurrent respiratory infections and tonsil hypertrophy, an adequate and detailed evaluation is extremely important to consider performing surgery in comparison to non-surgical treatment. The relationship between obesity/overweight among females and males does not appear to be significant. However, we observed that the percentage of children with obesity or overweight is higher in children over eight years of age than in younger children. Thus, there may be a relationship between performing the procedure later and changes in the child's growth and development.

In the vast majority of cases, the only complementary examination that should be requested to assess the need for adenoid and tonsil surgery is a facial (cavum) X-ray.[1,13] Nasal video-endoscopy can be used instead of a cavum X-ray, but other examinations, such as facial tomography and sinus X-ray, are unnecessary for adequate analysis of treatment choice.[13] In the present study, in agreement with previous studies, most patients underwent facial (cavum) X-ray or nasal video-endoscopy. However, a few patients did not have any complementary examination for indication of surgery, with the indication being made only by the clinic and the physical examination performed by the otorhinolaryngologist.

Due to the time limitations of the study and the lack of follow-up of patients after surgery, it was not possible to observe the benefits caused by surgery in the development and growth of children, especially in those who were already overweight or obese. This study may also be biased due to the limited number of participants and the fact that it did not relate diet and physical activity to the child's BMI.

CONCLUSION

The presence of tonsillar hypertrophy in children with indication for surgical treatment did not significantly modify the course of children's weight and height growth appropriate for the sex and age of the patients studied. Furthermore, there was no difference in anthropometric data between males and females. It is also important to emphasize that most of the children who underwent surgery in our study were between four and seven years of age.

However, there was a small increase in the rate of overweight and obesity, mainly in the age group of nine to eleven years, but without statistical significance. Therefore, there is a possibility that there is a tendency for changes in growth and development in patients who underwent adenotonsillectomy later.

Furthermore, the main complementary exams to be requested to assess tonsil hypertrophy are the cavum radiography and nasal video-endoscopy. However, the clinical and physical examination by an appropriate otorhinolaryngologist are more important than any other exam to indicate whether to perform the surgical procedure.

Due to the limitations of the study, it was not possible to evaluate the patients after the surgical procedure to verify the benefits caused in the development and growth of the children, especially in those who already had weight changes.

Therefore, future studies are needed to better understand these findings.

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