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Artículo Original

Adenotonsillectomy effect in children with asthma and allergic rhinitis

Efeito da Adenoamigdalectomia em crianças com asma e rinite alérgica

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Abstract

Purpose: Assess the relation between Adenotonsillectomy (AT) and symptomatic asthma control in asthmatic children with or without Allergic Rhinitis (AR) and also verify if the presence of AR plays a role in this presumed association.

Material and Methods: Retrospective study, including 56 asthmatic children, 24 with asthma and AR and 32 only with asthma. All underwent AT between January 2010 and December 2013 in our department. The asthma control was assessed through the application of a validated questionnaire, Asthma Control Test (ACT), aimed to the parents, corresponding to the 12 months preceding and following surgery. The statistical analysis has been performed in SPSS program.

Results: After surgery, we observed an improvement in asthma control and decrease of habitual medication. We achieved significant statistical difference between global ACT scores (12,20 preoperative vs 20,82 postoperative) and in each variable of the questionnaire. The analyze of the subgroup with asthma and AR, show similar results to those of children only with asthma (12,46 preoperative vs 20,92 postoperative and 12,00 preoperative vs 20,75 postoperative, respectively).

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Discussion and conclusion: This study suggests a beneficial relationship between AT and improvement in asthma control, even in children with other airway co-morbidities like AR, what is in agreement with literature data.

The truly nature of such relationship has not been totally established yet, so it is of utmost importance that prospective studies are conducted to define new strategies and therapeutic approaches in this area.

Keywords: Adenotonsillectomy; Asthma; Allergic Rhinitis; Airway; Sleep apnea.

Resumo

Objetivo: Avaliar a relação entre a realização de Adenoamigdalectomia (AVA) e o controlo sintomático da asma em crianças asmáticas com ou sem Rinite Alérgica (RA).

Material e Métodos: Estudo retrospectivo que incluiu 56 crianças asmáticas, 24 com asma e RA e 32 apenas com asma. Todas foram submetidas a AVA entre Janeiro de 2010 e Dezembro de 2013, no nosso Serviço. O controlo da asma foi aferido através da aplicação de um questionário validado, Asthma Control Test (ACT), realizado aos pais, relativo ao ano anterior e posterior à cirurgia. A análise estatística foi realizada com o programa SPSS.

Resultados: Após cirurgia, verificou-se melhoria do controlo asmático e redução da medicação habitual. Obteve-se diferença estatisticamente significativa entre a variação global do ACT (12,20 pré-operatório vs 20,82 pós operatório) e para cada variável do questionário. Quando se analisaram individualmente os subgrupos, as crianças com asma e RA obtiveram resultados similares às crianças apenas com asma (12,46 pré-operatório vs 20,92 pós-operatório e 12,00 pré-operatório vs 20,75 pós-operatório, respetivamente).

Discussão e Conclusão: Este estudo sugere a existência de uma relação favorável entre a AVA e a melhoria do controlo asmático, mesmo em crianças com outras co-morbilidades da via aérea (VA), como a RA, o que está de acordo com os dados da literatura. A verdadeira natureza desta relação ainda não está totalmente estabelecida, pelo que, é importante que se realizem estudos prospetivos no sentido de se estabelecerem novas estratégias e intervenções terapêuticas nesta área.

Palavras-chave: Adenoamigdalectomia; Asma; Rinite Alérgica; Via Aérea; Apneia do sono.

Introduction

The childhood sleep apnea (OSA) is one of the most common diseases in pediatric age, most of the times directly related with hypertrophy of Waldeyer's ring lymphoid tissue, which pick of growth occurs between 3 and 7 years.

reasons to the need of urgent cares, hospitalizations, chronic medication and loss of quality of life in this age group¹. It's pathophysiology is related with lower airway (LA) hyperactivity.

Allergic rhinitis (AR) involves inflammation of the mucous membranes of the nose, eyes, eustachian tubes, middle ear, sinuses, and pharynx, being characterized by a complex interaction of inflammatory mediators but ultimately is triggered by an immunoglobulin E (IgE). It is extremely common, affecting approximately 30% of the children population. Although is not a life-threatening condition, complications can occur and can also significantly impair quality of life².

Asthma and Allergic Rhinitis (AR) are chronic heterogeneous disorders, with overlapping prevalence, health care, social costs and decrease in children's quality of life^{1,2}.

OSA, asthma and AR are airway inflammatory disorders with similar pathophysiology, which is aligned with the current concept of "one airway, one disease"³.

Many pathways are known to play a role in genesis of this inflammation, like systemic inflammatory mechanisms activation and oxidative stress increase. Together they promote additional lymphoid tissue hypertrophy which is directly linked with upper airways infection (UAI) usual in children and that may constitute an asthma trigger, creating a vicious cycle^{3,4}.

Recent evidence suggests that AT could be associated not only with the improvement in ventilator parameters but also with the reduction of inflammatory markers, which could bring better asthma control in asthmatic children submitted to surgery⁵.

In the light of these new ideas born the hypothesis that AT could be associated with improvement of the disease status and better asthma control in asthmatic children submitted to surgery⁵.

This perspective is sustained by most recent studies whose show that about 88% of asthmatic children with AT surgery have a better symptomatic control, decrease of number of crises and relief medication needs^{5,6}. This study aimed to assess the relation between AT and symptomatic asthma control in asthmatic children with or without associated AR, verify if the presence of AR plays a role in this presumed association and also compare the present data with actual scientific evidences.

Materials and Methods

A retrospective and longitudinal study has been conducted, in ENT, Cervical and Plastic Department of Braga's Hospital (Portugal), between January of 2010 to December of 2013.

The study includes asthmatic children in accordance with clinical features of "Global Initiative for Asthma" (GINA) of 2014, followed by a pediatric physician, submitted to AT surgery in the study period, with ages ranging from 3 to 17 years⁷.

The study does not include children which asthma diagnostic features was not clear or not in accordance with GINA criteria, children with craniofacial abnormalities, syndromic, with history of pulmonary or neuromuscular disease and/or prematurity.

The following data were analyzed: gender, age, surgery indication, asthma medication before and after surgery.

Asthma control was assessed by a validated questionnaire, Asthma Control Test (ACT), aimed to the par-

ents, with questions about the previous and following year of surgery, allowing the comparison between the symptomatic control in these two periods.

We chose a total observation period of 24 months, 12 months before and 12 months after surgery, to cover the typical seasonal variability of asthma and AR symptoms.

The questionnaire ACT includes the following variables: school missing days, number of dyspnea episodes, number of asthma crises resulting in children wake up, number of times that children needed relief medication and the global control of asthma. It has 5 questions of quantitative answer, with scores ranging from 1 to 5 in each question and 5 to 25 in total. The highest score represents best asthma control. Total score equal or higher than 20 suggests controlled asthma and lower than 20 suggests uncontrolled asthma. The defined criteria of asthma improvement is the global ACT score variation equal or higher than 3 points.

After answering the questionnaire, the parents also have been questioned about the habitual scheme medication for asthma in the 12 months before and after surgery.

The statistical analyses of the data was realized through SPSS program, by application of *T test Student*, with a degree of confidence $p < 0,05$.

Results

The studied group included 56 asthmatic children, 24 with asthma and AR and 32 only with asthma.

The sample has 44 males (78,6%) and 12 females (21,4%); with average age of 7 years and median age of 6,50 (SD±4); with surgical indication for OSA in 27 cases (48%), OSA and repeated infection in 22 cases (39%) and only for repeated infection in 7 cases (13%) (table 1).

In the 12 months preceding the surgery, 55 children had uncontrolled asthma (ACT score lower than 20 points) and 1 child had a well-controlled asthma (ACT score equal or higher than 20 points). In the 12 months following the surgery, 40 children had well-controlled asthma and 16 children uncontrolled asthma (table 1).

Table 1: Sample features

Dimension (N)	56 32 - Asthma 24- Asthma+AR
Age average	7 years (SD ±4)
Gender (M/F)	44 / 12
Surgical Indication	
OSA - 27 (48%) OSA and Repeated Infections - 22 (39%) Repeated Infection - 7 (13%)	
Grade of Asthma Control (Score ACT ≥20), 12 months previous to AT	
- Control	1
- Uncontrolled	55
Grade of Asthma Control (Score ACT ≥20), 12 months after AT	
- Control	40
- Uncontrolled	16

After surgery, the ACT scores improved in global way (figure 1) and in each evaluated variables. Using T Student test, we achieved a significant statistical difference between global ACT scores (12,20 preoperative vs 20,82 postoperative) and in each individually studied variables of the questionnaire (school missing: 2,54 vs 4,27; number of breathlessness episodes: 2,45 vs 4,13; number of night awake episodes: 2,38 vs 4,30; need of relief medication: 2,59 vs 3,91; global asthma control: 2,30 vs 4,13) (table 2) (figures 2 and 3).

When we individually analyze the subgroup with asthma and AR, we observed similar results to those achieved in children only with asthma (12,46 preoperative vs 20,42 postoperative in first group and 12,00 preoperative vs 20,75 postoperative in second group) (figures 4a and 4b).

Regarding asthma clinical features before and after surgery, shown by variation scores of each studied variables, the need to wake up in the night was the variable that showed higher variation (2,38 to 4,30) and the need of relief medication lower variation (2,59 to 3,91) (table 2).

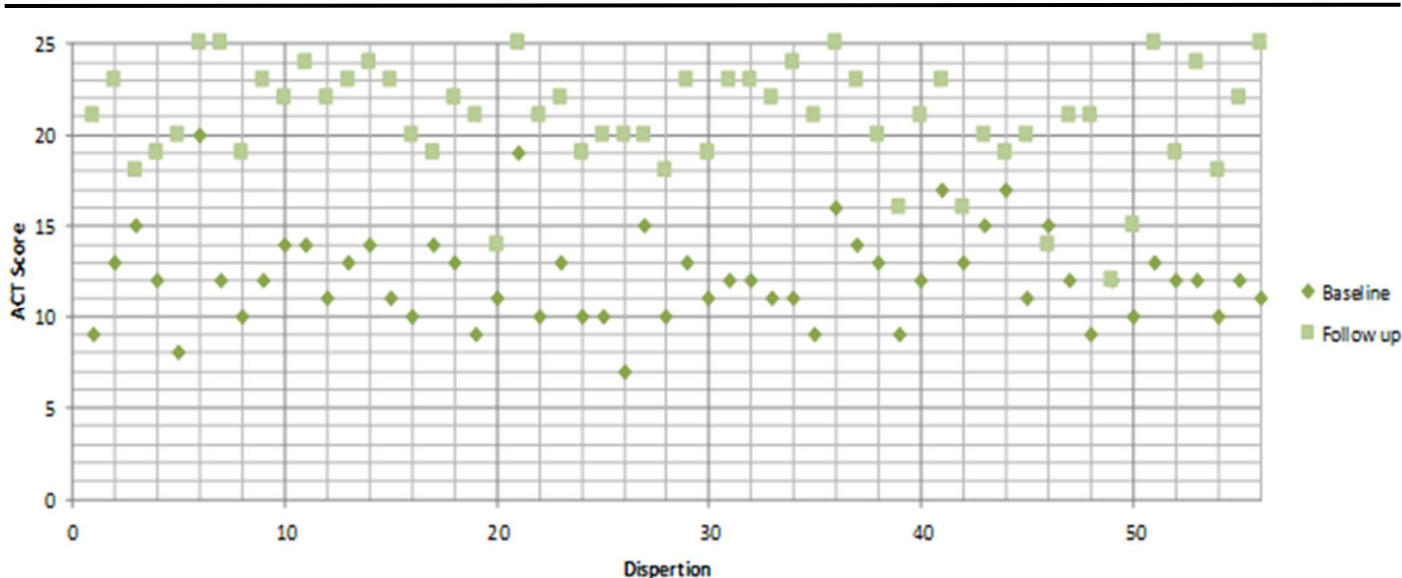


Figure 1: Global ACT score variation from baseline to post surgery period (Follow-up).

Table 2: Variation of each variable included in ACT, that reflects the variation of asthma clinical features in the 12 months before and after AT.

Episodes frequency in 12 months	Prior AT	Post AT
School missing days	2,54	4,27
Number of dyspnea crises	2,45	4,13
Number of asthma crises resulting in children waking up	2,38	4,3
Need of relief medication	2,59	3,91
Global asthma control	2,3	4,13

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Q1pos - Q1pre	1,732	,981	,131	1,469	1,995	13,207	55	,000
Pair 2	Q2pos - Q2pre	1,679	1,011	,135	1,408	1,949	12,425	55	,000
Pair 3	Q3pos - Q3pre	1,929	1,006	,134	1,659	2,198	14,339	55	,000
Pair 4	Q4pos - Q4pre	1,321	1,064	,142	1,037	1,606	9,298	55	,000
Pair 5	Q5pos - Q5pre	1,821	,876	,117	1,587	2,056	15,558	55	,000

Figure 2: *T Student test* showed a significant statistical difference between pre and post surgery ACT scores for each question, $p < 0,05$.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair	QGpos - QGpre	8,482	3,638	,486	7,508	9,456	17,447	55	,000

Figure 3: *T Student test* showed a significant statistical difference between global ACT scores before and after surgery, $p < 0,05$

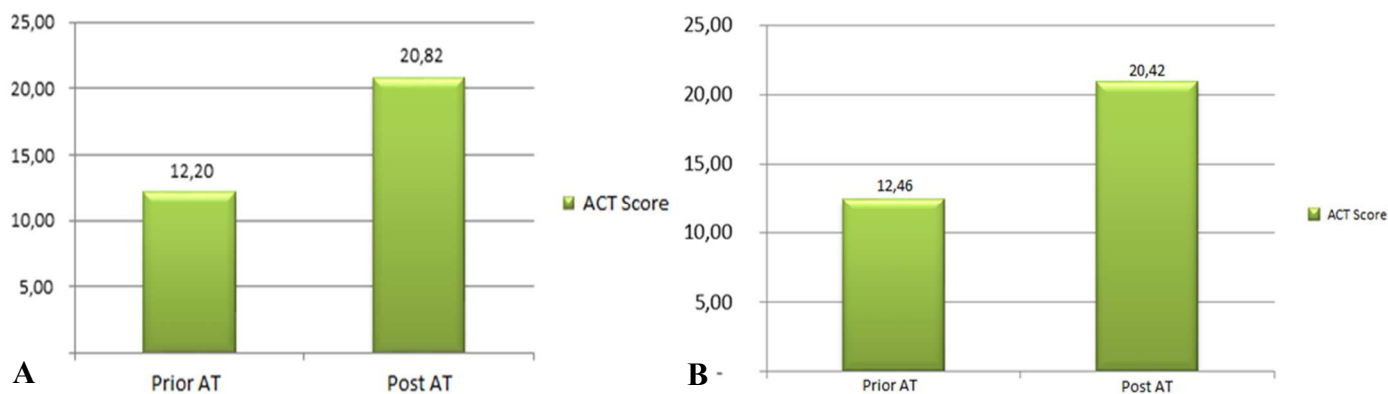


Figure 4A: Score ACT variation in global sample. **Figure 4B:** Score ACT variation in patients with Asthma and AR.

In general, we observed improvement in asthma control in 51 children and reduction of habitual medication scheme in 45 children.

We do not achieved a significant statistical difference between gender, surgery indication and presence of concomitant AR in improvement of asthma control after doing the surgery.

Discussion

The present study is in accordance with the results of other recent studies performed under the same scope, that sustain the existence of a favorable and positive association between AT surgery and improvement of asthma control in these children^{5,6}.

Our study supports a beneficial relationship between AT surgery and improvement in asthma control, even in children with other airway co-morbidities like AR, what is in agreement with other studies and literature data².

In general, we observed a statistical significant improvement in asthma control after surgery.

The asthma control after AT surgery strategically reports to the 12 months post surgery to minimize potentially biases associated with asthma symptoms seasonality. At the same time, it allows an adequate timeframe to occur the presumable favorable modulation of airway inflammation.

The asthma control improvement wasn't observed in five children, two of which had criteria of childhood obesity (body weight index equal or higher than 95 percentile) and three with known and proven food allergic history. Both of these conditions are known as co-morbidities that difficult asthma control⁸.

Obese children carry more difficult asthma control because they have metabolic alterations like activation of inflammatory pathways, higher likelihood of having OSA, gastro esophageal reflux and altered mechanic factors like lung volume reduction arising from more deposition of abdominal fat tissue^{9,10}.

There is a strong and proven relation between asthma and food allergies that may act as a trigger to this respiratory condition. Children with food allergies have a four times higher risk of developing asthma and higher severity of the disease¹¹.

Most of our patients showed a reduction in their habitual asthma medication scheme after doing the surgery. Only 11 children maintained their habitual scheme, and these ones, have worse global ACT scores before AT surgery. This may suggest that poor asthma control before surgery is related with higher resistance in medication reduction by physicians, despite the fact of this being the group that has the most notable variation in ACT scores.

An interest point in our study is that it suggests that the surgical benefit is higher in children with poor asthmatic base control, once this group is the one that reached higher variation in global ACT scores after doing the surgery, which is directly related with a higher impact in asthma symptoms control.

Despite these positive associations that our study reveals, there are some limitations that we should mention.

First of all, the design of study, because it is retrospective, and also the sample dimension.

Secondly, it only includes asthmatic children with indication for surgery and not the general population of asthmatic children.

Lastly, it does not include a control group of asthmatic children not submitted to surgery. So it is possible to argue that some of the results could be related with natural disease evolution and grow of the child.

Despite these mentioned limitations, this study shows results that support the beneficial effect of AT surgery in asthmatic children, with or without associated AR, with surgical indication for AT because OSA or repeated infections.

We aimed to bring new perspectives and help to exceed the paradigm of doing AT in asthmatic children, classically reported to be doubtful and with questionable value.

Conclusion

This study suggests and emphasizes the favorable relation between AT and asthma improvement control in asthmatic children even in the presence of other airway co-morbidities like AR.

In future it would be helpful the conduction of prospective studies within this scope, capable of establishing prognosis on which asthmatic children could eventually have the highest benefit in doing surgery.

We also need additional evidence to better understand the biological plausibility and the exact mechanism that links asthma to adenotonsillar disease, in order to contribute for the development of new strategies and therapeutic approaches to optimize asthma control and evolution in children population.

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Conflict of Interest: The authors have no conflict of interest to declare.

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