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IMPACT OF ADENOTONSILLECTOMY ON ASTHMA CONTROL IN PEDIATRIC PATIENTS: A SYSTEMATIC REVIEW

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Contributions:
A Study design/planning
B Data collection/entry
C Data analysis/statistics
D Data interpretation
E Preparation of manuscript
F Literature analysis/search
G Funds collection

Abstract

Introduction: This systematic review investigates the influence of adenotonsillectomy (AT) on asthma control in pediatric patients.

Material and methods: A literature review from 2000 to 2023 based on the databases PubMed, the Cochrane Library, and Web of Science. The analysis is distilled down to four studies that revealed positive outcomes in asthma control as gauged by the Asthma Control Test (ACT), the Childhood Asthma Control Test (C-ACT), clinical outcomes, and asthma-related chitinase levels.

Results: The four studies consistently demonstrated improved asthma control postoperatively in terms of improved ACT scores, reductions in acute asthma exacerbations, emergency room visits, hospitalisations, and medication usage. Notably, the correlation between improved asthma control and decreased chitinase activity suggests that AT has an impact on molecular markers associated with asthma.

Conclusions: The findings underline the potential benefits of AT in pediatric asthma management. However, the limitations of this study include a small number of studies and potential biases related to asthma's natural course and seasonal variations. While the review provides evidence for the positive impact of AT on asthma control, further research with longer follow-up periods, case-matched controls, and consideration of seasonal factors is recommended.

Keywords: chitinase • asthma control • ACT • pediatric astma • adenotonsillectomy • C-ACT

WPŁYW ADENOTONSILLEKTOMII NA KONTROLĘ ASTMY U PACJENTÓW PEDIATRYCZNYCH – PRZEGLĄD SYSTEMATYCZNY

Streszczenie

Wstęp: Celem tej pracy jest dokonanie przeglądu literatury dotyczącej wpływu zabiegu adenotonsillektomii na jakość kontroli astmy u pacjentów pediatrycznych.

Materiał i metody: Przeprowadzono przegląd literatury naukowej z wykorzystaniem baz PubMed, Cochrane Library i Web of Science, uwzględniając publikacje z lat 2000–2023. Analiza objęła ostatecznie cztery publikacje ukazujące poprawę jakości kontroli astmy w takich miarach jak Asthma Control Test (ACT) i Childhood Asthma Control Test (C-ACT), a także zawierające rezultaty leczenia oraz poziomy chitynazy związanej z astmą.

Wyniki: Cztery zaprezentowane badania konsekwentnie wykazały pooperacyjną poprawę jakości kontroli astmy, manifestującą się jako poprawa wyników testu ACT lub C-ACT, ograniczenie liczby zaostrzeń astmy, wizyt w oddziałach ratunkowych i hospitalizacji oraz zmniejszenie przyjmowania leków. Warto zauważyć, że związek pomiędzy poprawą kontroli astmy a obniżeniem aktywności chitynazy sugeruje wpływ adenotonsillektomii na markery molekularne związane z astmą.

Wnioski: Wyniki świadczą o potencjalnych korzyściach z zastosowania adenotonsillektomii w leczeniu astmy u dzieci, jednak należy wziąć pod uwagę jego pewne ograniczenia, takie jak niewielka liczba uwzględnionych badań oraz potencjalne błędy związane z naturalnym przebiegiem

astmy oraz sezonowymi zmianami. Mimo że przegląd dostarcza dowodów na pozytywny wpływ adenotonsillektomii na jakość kontroli astmy, zaleca się dalsze badania z uwzględnieniem nie tylko dłuższego czasu obserwacji i grupy kontrolnej dopasowanej do przypadków, lecz także czynników sezonowych.

Słowa kluczowe: chitynaza • kontrola astmy • ACT • astma dziecięca • adenotonsillektomia • C-ACT

Key for abbreviations	
A	adenoidectomy
AAE	acute asthma exacerbation
ACT	Asthma Control Test
ARER	emergency room visits related to asthma
ARH	asthma-related hospitalisations
ASA	acute status asthmaticus
AT	adenotonsillectomy
C-ACT	Childhood Asthma Control Test

Introduction

Asthma is one of the most common respiratory diseases in Poland. According to a BUPAS study of children aged 7–13 years, 3.5% of them who lived in rural areas and 4.1% of them who lived in urban areas suffered from asthma symptoms [1]. The total value of reimbursement for provided services with a diagnosis of asthma (J45, J46 according to ICD-10) amounted to PLN 257.1 million in 2019 [2,3]. Asthma is a chronic respiratory disease characterised by variable airflow obstruction, bronchial hyperresponsiveness, and airway inflammation.

The most important factor contributing to asthma development is considered to be the presence of allergic rhinitis, especially among individuals with additional confirmed bronchial hyperresponsiveness [4]. Epidemiological studies have also shown several demographic, developmental, and environmental factors that appear to influence the onset of the disease. The most crucial are low birth weight, parental smoking, use of antibiotics, and paracetamol. Additionally, individuals living in urban areas, which are more exposed to breathing polluted air, are more prone to the condition.

The most effective and basic treatment for bronchial asthma is therapy with inhaled glucocorticosteroids. This treatment, consisting of small doses taken regularly, is sufficient for the majority of patients. Additionally, in pharmacological therapy, bronchodilator drugs are also used. These are most commonly long-acting and short-acting beta2-agonists. These drugs are used as needed and should not be the base of pharmacological therapy. According to current recommendations, the preferred method for the emergency treatment of a sudden breathlessness attack is the use of small doses of inhaled glucocorticosteroid with a long-acting beta2-agonist [2,5].

Adenoidectomy (A) alone or combined with tonsillectomy as an adenotonsillectomy (AT) is one of the most common surgeries performed in Poland. Based on statistics from 2017, approximately 43,192 of these surgeries are performed annually [6]. Adenoidectomy involves surgical removal of the adenoid, and adenotonsillectomy is the removal of the adenoid and both tonsils. Two primary categories of indications for these procedures are recurrent upper respiratory tract infections and sleep-related breathing disorders [7].

While observational studies suggest a potential improvement in asthma management after undergoing AT, the existing literature lacks a comprehensive analysis and synthesis. The objective of this study was to perform a systematic review of all relevant studies investigating the impact of AT on asthma control in pediatric patients. By synthesising findings, this review aims to help identify those children who are most likely to benefit from AT, supporting the rationale of using AT as an intervention for asthma in pediatric patients. Additionally, considering the dynamic nature of medical research and the continuous evolution of clinical practice, updating our understanding of the role of AT in asthma management is crucial. Thus, this review seeks to refine knowledge and inform evidence-based decisionmaking in pediatric asthma care.

Material and methods

We conducted a comprehensive literature review using the databases PubMed, the Cochrane Library, and Web of Science. The search strategy involved the use of keywords "adenoid and asthma", "adenoidectomy and asthma", "adenotonsillectomy and asthma", and "tonsillectomy and asthma". We limited the time frame to the years 2000–2023 and restricted the search to English-language articles. Our inclusion criteria were pediatric patients aged 18 years or younger, diagnosed with asthma, and undergoing adenotonsillectomy as a treatment for recurrent infections or obstructive sleep apnea. Based on the keywords, a total of 507 records were obtained. Of these, 194 were excluded before screening as duplicates, and 300 were excluded due to not meeting the inclusion criteria. We assessed 13 articles for full-text access, and after applying all exclusion criteria, 4 articles were left for qualitative synthesis. The results and specific exclusion criteria are summarised in the PRISMA chart of **Figure 1** [8].

To assess and minimise bias, we conducted a thorough evaluation of the study design, methodology, and potential sources of bias of each study involved in the review. **Table 1** compares key characteristics of the four included studies, setting out number of patients, control group characteristics, results analysed, and study character.

Results

Asthma clinical outcomes

All four studies included in the review took into consideration various aspects of asthma clinical outcomes. The clinical outcomes differed between the studies.

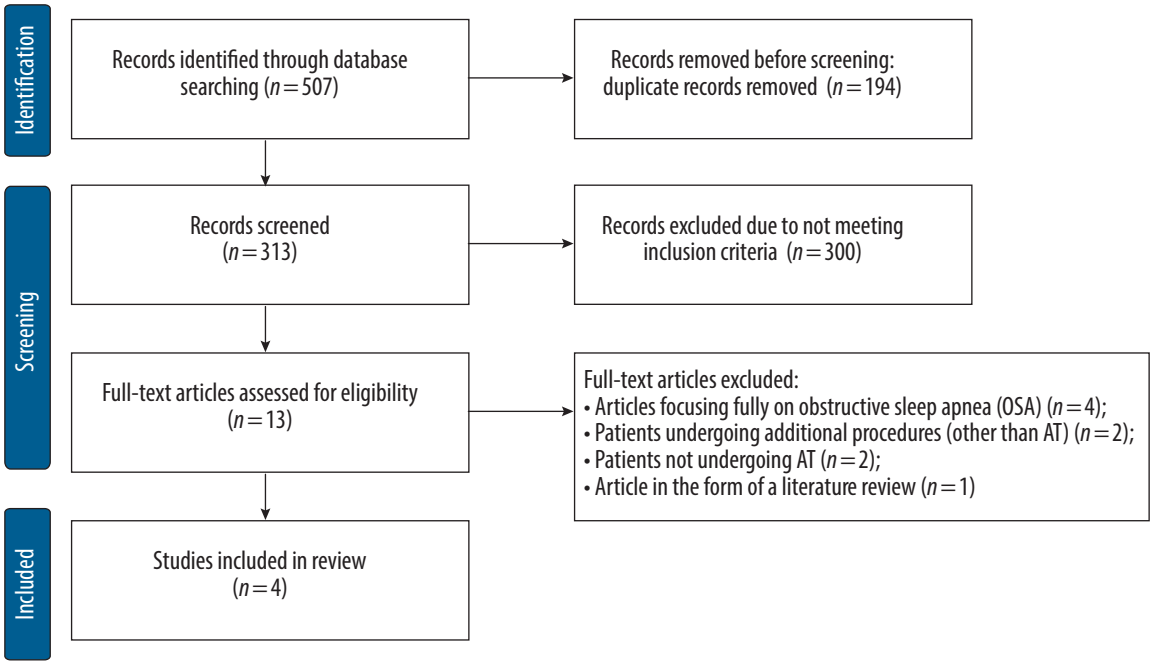

Figure 1. PRISMA 2020 flow diagram

Table 1. Comparison of the four key studies

Study	Bhattacharjee et al.	Goldstein et al.	Levin et al.	Busino et al.
Number of patients	Intervention: 13,506 Control: 27,012	Intervention: 80 Control: 62	Intervention: 64 Control: 66	Intervention: 93 Control: 372
Control group characteristics	Asthmatic children not undergoing AT procedure	Asthmatic children not undergoing AT procedure	Children without asthma diagnosis undergoing AT procedure	Children without asthma diagnosis undergoing AT procedure
Results analysed	Frequency of acute asthma exacerbation, acute status asthmaticus, emergency room visits related to asthma, asthma-related hospitalisations, changes in prescriptions for asthma medications	C-ACT score, count of asthma exacerbations, number of courses of systemic steroids, emergency room visits, and hospitalisations over 6 months	C-ACT score, frequency of emergency room visits/urgent care visits for asthma, oral corticosteroid courses, hospitalisation for asthma, missed days due to asthma, chitinase activity	ACT score, frequency of hospital visits, systemic steroid use, asthma medication use
Study character	Longitudinal database analysis	Prospective, controlled study	Longitudinal observational study	Retrospective chart review

The biggest study group was that of the Bhattacharjee et al. study [9]. Using the 2003–10 MarketScan database, they analysed 13,506 children with asthma who underwent AT matched with 27,012 asthmatic children not undergoing the AT procedure. Asthmatic children were identified from the MarketScan database using the ICD-9 code for asthma. From this cohort, asthmatic children who had undergone AT were identified using current procedural terminology codes for AT. Control group patients were chosen based on meeting the criteria for asthma but did not have a history of any current procedural terminology codes for AT, adenoidectomy, and tonsillectomy. Patients from the control group were matched with patients undergoing AT by age, sex, home location, and geographical state of residence. MarketScan is a large database of over 180 million patients including a large cohort of children that collects payment information, capturing reimbursements from health insurance plans and payments accrued by patients in the USA [9].

The primary outcomes focused on the presence of a diagnostic code indicating acute asthma exacerbation (AAE) or acute status asthmaticus (ASA). Secondary outcomes involved temporal changes in prescriptions for asthma medications, the frequency of emergency room visits related to asthma (ARERs), and asthma-related hospitalisations (ARHs). The frequency of outcomes for patients with asthma who underwent adenotonsillectomy (AT+)

was assessed for the 1-year period preceding the AT date and compared to the 1-year period following the AT date. For the control group AT– patients, the frequency of outcomes was examined over a corresponding 2-year duration. The occurrence of acute asthma exacerbation (AAE) and acute status asthmaticus (ASA) episodes significantly decreased in children who underwent adenotonsillectomy (AT+) compared to those who did not (AT–) between the first year and the second year of follow-up. Specifically, the frequency of AAE decreased from 2,243 before AT to 1,566 after AT in AT+ children compared to a decrease from 3,403 in the first year to 3,336 in the second year in the AT– group, resulting in a relative risk reduction of 30% versus 2% (p<0.0001).

The occurrence of acute status asthmaticus (ASA) declined in AT+ patients, decreasing from 562 incidents before AT to 349 after AT. In comparison, in AT– patients, the frequency went from 837 in the first year to 778 in the second year. This resulted in a relative risk reduction of 38% versus 7% (p<0.0001).

The reductions in both AAE and ASA were present across all age groups of AT+ patients. Comparing prescription refills of AT+ patients to AT– patients, the former experienced significant decreases in most classes of asthma prescriptions during the 1-year period following the procedure. Analysis showed a 16.7% reduction in prescription refills for bronchodilators, a 21.5% reduction for inhaled corticosteroids, and a 13.4% reduction for leukotriene receptor antagonists. In terms of the number of children per 1,000 who obtained various asthma prescriptions before AT, more AT+ children required prescriptions for bronchodilators, inhaled corticosteroids, and leukotriene receptor antagonists compared to the AT– control group. After the AT, the number of AT+ children requiring these therapies decreased to levels comparable to those of AT– children. The number of prescription refills of systemic corticosteroids, potentially indicative of an asthma exacerbation, showed a significant decrease in the AT+ group compared to the corresponding second year of follow-up in AT– patients (23.7% versus 7.3% reduction; $p = 0.003$). The occurrences of asthma-related emergency room visits (ARERs) and asthma-related hospitalisations (ARHs) were markedly decreased in the AT+ group after AT compared to the AT– group (25.6% versus 0.0% reduction; $p < 0.0001$; and 35.8% versus 12.2% reduction; $p = 0.0025$) [9].

The study by Levin et al. [10] analysed 66 patients diagnosed with asthma, alongside a control group comprising 64 patients without asthma (both undergoing AT). Some 75% of the study participants underwent surgery primarily due to tonsillar hypertrophy, including symptoms of sleep-disordered breathing, whereas 23% of participants underwent surgery primarily due to recurrent tonsillitis/infection. Follow-up was achieved in 81% of all enrolled patients, with the mean time to follow-up after surgery being 7 months (range 5–12; SD = 1.5); the rate was not statistically different between groups. The analysis focused on changes in clinical characteristics in the asthmatic cohort. Significant reductions were observed in the mean frequency of events per 12 months – events comprising emergency room visits/urgent care visits for asthma (1.88 in baseline versus 0.40 in follow-up; $p < 0.05$), oral corticosteroid courses (1.11 in baseline versus 0.21 in follow-up; $p < 0.01$), hospitalisation for asthma (0.09 in baseline versus 0.00 in follow-up), and missed days due to asthma (3.86 in baseline versus 2.00 in follow-up; $p < 0.05$). Improvement in asthma control was specified as an increase in ACT score of 3 or greater, a decreased rate of emergency/urgent care visits, a decreased rate of oral corticosteroid courses, or a decrease in rescue short-acting beta2-agonists usage in the previous month. In terms of clinical outcomes, patients with fully controlled asthma were excluded. Not fully controlled asthma was characterised as pediatric ACT < 25, adult ACT < 23, one or more ED/urgent care visits in the previous year, one or more oral corticosteroid courses in the last year, or using SABA medication in the last month. In the cohort of asthmatic patients, there were 48 patients without fully controlled asthma. Of these 48 patients, 36 (75%) had an improvement in symptoms in at least one category after AT. When restricted to the 34 subjects with poorly controlled asthma at baseline, 29 individuals (85%) experienced an improvement in symptoms in at least one category [10].

In the study by Busino et al. [11], the study group consisted of 465 children who underwent adenotonsillectomy. Of this number, 93 had asthma while 372 did not have an asthma diagnosis. Outcome measures of asthma control were assessed during the 12 months preoperatively and 12 months postoperatively. They included hospital visits, systemic steroid use, asthma medication use, and scores on the Asthma Control Test (which are analysed later in this review). They observed a statistically significant reduction in the number of postoperative hospital visits ($p < 0.01$). Systemic steroid usage was significantly decreased postoperatively ($p < 0.01$). Medication usage also exhibited a significant decrease after surgery, with a notable reduction in the number of daily medications required per patient ($p < 0.01$) [11].

Goldstein et al. [12] performed a prospective, controlled study of asthma control in 80 asthmatic patients undergoing AT matched by sex, age, and asthma severity to a control group consisting of 62 patients not undergoing AT. Asthma outcomes were measured based on the count of asthma exacerbations, number of courses of systemic steroids, emergency room visits, and hospitalisations, over a period of 6 months. The median count of asthma exacerbations was 1 for both groups at the beginning and decreased to 0 for both groups during the follow-up period, along with median counts of other outcomes remaining at 0 at both the start and follow-up for both groups. When the analysis was limited only to patients with moderate or severe persistent asthma, there was an increase in the number of asthma exacerbations and courses of systemic steroids; however, each group consisted of only 8 patients. Due to the prevalence of 0 values, for analysis the asthma outcomes were split into 0 versus > 0. There were no significant differences between the groups at either time point for the occurrence of any asthma exacerbations (entry $p = 0.367$; follow-up $p = 0.327$), and both groups exhibited significant improvement over time (AT $p < 0.001$; control $p = 0.002$). Regarding use of any steroids, there were no significant group differences at entry ($p = 0.802$) but they differed at follow-up ($p = 0.043$). There was significant improvement over time in the AT group ($p < 0.001$) but not in the control

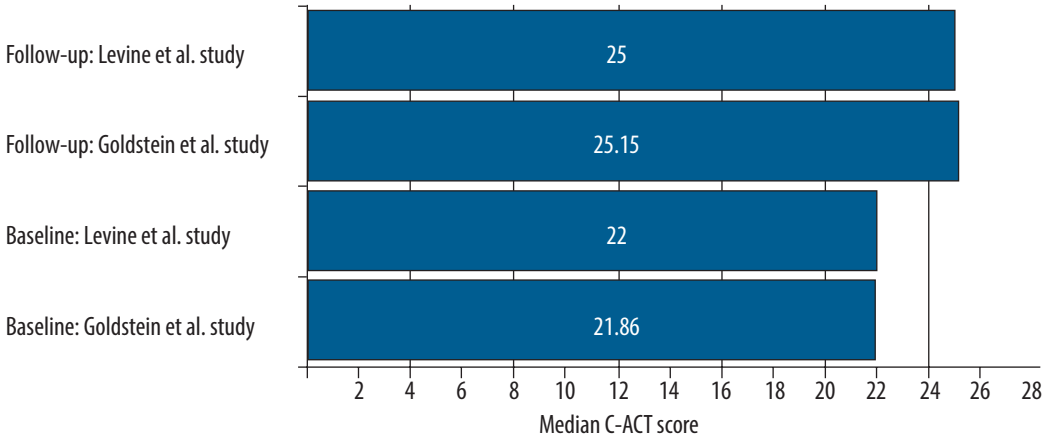

Figure 2. Median C-ACT scores in the studies by Goldstein et al. and by Levin et al.

group ($p = 0.083$). Concerning any emergency room visits, group differences were noted at entry ($p = 0.034$), but not at follow-up ($p = 0.053$). Both groups demonstrated significant improvement over time ($p = 0.005$ for both tests). For any hospitalisation, the groups differed significantly at entry ($p = 0.035$) but not at follow-up ($p = 0.347$) [12].

Improvement in asthma control scores

Three of the four studies included in the review used some form of a patient-reported questionnaire to obtain information about asthma control quality. Busino et al. [11] used the Asthma Control Test (ACT) which is a validated and widely used tool designed to assess the level of asthma control. It consists of 5 questions, each answered with a number on a scale of 1 to 5. Total score ranges from 5 to 25, with higher scores indicating better asthma control.

Goldstein et al. [12] used the Childhood Asthma Control Test (C-ACT), which is a questionnaire designed to assess the level of asthma control in children aged 4 to 11 years [14]. It consists of 7 questions, 4 of which are answered by the child with the help of a parent, and 3 by the parent. Responses are summed to a score ranging from 0 (poor control of asthma) to 27 (complete control of asthma); a score ≤19 is defined as uncontrolled asthma [14]. Levin et al. [10] used both C-ACT and ACT for relatively older pediatric patients. In that case, ACT scores were rescaled from a maximum of 25 to 27, in order to compare them with C-ACT scores that also have a maximum score of 27.

Goldstein et al. [12] presented research material covering a group of 80 children with diagnosed asthma who were undergoing AT and 62 controls matched by age, sex, and asthma severity. They demonstrated significant improvement in C-ACT scores in asthmatic children after undergoing AT compared to asthmatic control children not undergoing the procedure. The adjusted mean entry C-ACT score for the AT group was 21.9 (20.9–22.7) and 22.4 (21.5–23.3) for the control group. The adjusted mean follow-up C-ACT score for the AT group was 25.2 (24.6–25.7) and 23.6 (22.8–24.3) for the control group. There was significant group-by-time interaction ($p < 0.001$). Their simple effects analysis showed that group means did not differ at entry ($p = 1.00$) but did differ at follow-up ($p = 0.006$). Some 47% of the AT group had C-ACT scores < 19 at entry, whereas only 15% had scores < 19 at follow-up after undergoing AT. In the control group, scores < 19 were obtained from 37% of patients at entry and 32% at follow-up [12]. The results are shown in **Figure 2**.

In their studies, Levin et al. [10] used pediatric ACT (C-ACT) for 46 patients and adult ACT for 5 patients. As mentioned earlier, ACT scores were rescaled to allow comparison with C-ACT scores. Some 15 of their asthmatic patients never completed baseline C-ACT. Baseline C-ACT scores ranged from 6 to 27 with a median of 22. In their studies, they also described a subgroup of patients with poorly controlled asthma. Key requirements were a C-ACT score below 20, ≥ 2 emergency department/urgent care visits in the last year, ≥ 2 oral corticosteroid courses in the last year, or use of short-acting bronchodilators more than twice per week in the last month. These requirements were met by 38 patients. Follow-up was achieved for 81% of all enrolled subjects ($n = 105$), 58 asthmatic patients, and 47 control patients. The mean time to follow-up was 7 months. There was a significant improvement in C-ACT scores at the follow-up visit, with the median score increasing from 22 to 25 ($p < 0.001$). In the case of the subgroup with poorly controlled asthma at baseline, the analysis of ACT scores after undergoing AT demonstrated a median increase of 6 ($p = 0.02$). An analysis of responses to C-ACT showed that there were noteworthy pairwise increases in responses to 6 of 7 questions. These included the child's self-assessment of asthma symptoms on that day (question 1; $p < 0.01$), cough (question 3; $p < 0.0001$), and nighttime symptoms (question 4; $p < 0.0001$). There were also significant pairwise increases in the three questions evaluated by parents (questions 5–7; frequency of daytime symptoms, $p = 0.0001$; frequency of wheeze, $p < 0.01$; and frequency of nighttime symptoms, $p < 0.001$) [10]. These results are also shown in **Figure 2**.

In the Busino et al. [11] study, they measured ACT scores of 93 asthmatic children 12 months pre-operatively and compared them to scores obtained from follow-up 12 months after the AT. They showed that ACT scores significantly improved following surgery (there was no

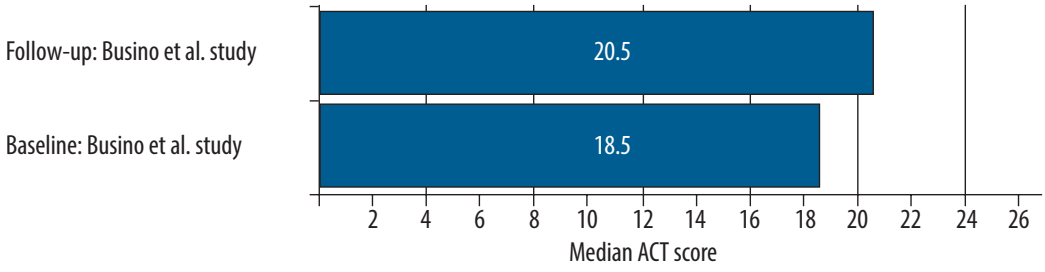

Figure 3. Median ACT scores in the study by Busino et al.

comparison with a control group). The mean preoperative ACT score was 18.5 compared to 20.5 postoperatively. The results are shown in **Figure 3**. Overall, all of the studies using a patient-reported questionnaire to obtain information about asthma control quality consistently demonstrated improvements in such control tests.

Decreased level of asthma-related chitinase

The study by Levin et al. [10] focused on one additional aspect of monitoring asthma control: they measured chitinase activity in circulation on baseline and during follow-up. Chitinase binds to or cleaves chitin, while many chitin-containing substances serve as common allergic triggers in asthma. Chitinase activity level is correlated with inflammation and disease activity in chronic diseases such as asthma [15]. Compared to subjects without concomitant upper airway disease, the actively enzymatic chitinase, chitotriosidase (CHIT1), exhibits overexpression in the adenoid tissue of children undergoing adenotonsillectomy because of concurrent chronic rhinosinusitis, otitis media with effusion, or allergic rhinitis [16]. Chitinase levels were assessed both at baseline and during follow-up. Children with asthma exhibited a significant reduction in circulating chitinase activity post-AT (median decrease of 0.4 nmol/l/ml*h, $p < 0.01$). Control group patients showed no significant change after surgery (median no change, $p = 0.83$). In the case of the asthmatic children, those with improved asthma control showed a notable decrease in chitinase activity following adenotonsillectomy ($p = 0.001$), while those without improvement showed no significant change ($p = 0.73$). Similar findings were observed in children with poorly controlled asthma: chitinase activity significantly decreased with improved asthma control (median decrease of 0.9 nmol/l/ml*h, $p < 0.01$), but remained unchanged when control was not improved (median no change, $p = 1.00$).

Discussion

In this review, we explored the impact of AT on asthma control in pediatric patients. The findings from the four included studies shed light on various aspects of asthma outcomes such as clinical outcomes, asthma control tests, and chitinase levels. The findings from the four studies confirm improvements after undergoing AT procedures, with three of the four showing significant enhancements in clinical outcomes.

Bhattacharjee et al. [9] reported a significant decrease in the occurrence of acute asthma exacerbations, acute status asthmaticus, asthma-related emergency room visits, and asthma-related hospitalisations. They also showed that AT+ patients experienced significant decreases in most classes of asthma prescriptions during the 1-year period following the procedure.

Levin et al. [10] demonstrated that 75% of patients had improvements in symptoms in at least one category, but when specifically considering the subgroup with poorly controlled asthma at baseline, 85% experienced improvements. This might indicate that in pediatric asthma the impact of AT on clinical outcomes depends on the severity of the initial asthma condition, emphasising the need for tailored interventions based on an individual's baseline asthma severity.

Busino et al. [11] revealed that both systemic steroid usage and the number of daily medications decreased after AT.

The Goldstein et al. [12] study demonstrated significant improvement in the primary outcome measure, the C-ACT score. But despite notable improvements in C-ACT scores, the study found minimal changes in asthma clinical outcomes. So, based on the C-ACT scores, patients demonstrated better self-reported asthma control, but this improvement did not translate into substantial changes in objective clinical measures of asthma. Given that 89% of AT+ patients, and 87% of control group patients, had intermittent or mild persistent asthma, the study acknowledges the limited number of outcomes. The distribution of asthma severity in the study population suggests there was a predominance of milder forms of asthma, and this might create difficulties in detecting clinical outcomes.

It is important to note that two of the four studies involved a control group consisting of asthmatic patients [9,12] while the two other studies included a control group involving non-asthmatic patients [10,11]. This raises important questions on the ability to reach firm conclusions about the impact of AT. Thus, an argument can be made for considering the natural history of the disease as a control group. This perspective provides a valuable reference point for interpreting the observed effects of AT. However, it is crucial to acknowledge the potential biases associated with using the natural disease course as a control group. All of the included studies using the Asthma Control Test (ACT) and Childhood Asthma Control Test (C-ACT) [10–12] consistently demonstrated improvements in

asthma control postoperatively. The increase in scores present in all three studies supports the notion that AT positively affects the overall management of asthma in pediatric patients.

In the context of monitoring asthma control, the assessment of chitinase activity, as investigated by Levin et al. [10], provides a unique perspective on the molecular mechanisms associated with AT in pediatric patients with asthma. The fact that improved asthma control correlated with a significant decrease in chitinase activity emphasises the potential of AT to affect not only clinical manifestations but also the molecular markers associated with severe asthma.

This systematic review has limitations, and a critical evaluation is necessary for accurately interpreting the findings. The use of strong inclusion and exclusion criteria, while creating study rigor, resulted in a relatively small number of papers meeting the eligibility criteria. In our case, only 4 of an initial pool of 507 studies were deemed relevant. Moreover, assessing asthma outcomes after surgical intervention is complicated by the natural course of the disease. Because it is atopic, asthma may decrease or disappear in adolescence. We attempted to limit this bias by including studies with a maximum one-year follow-up after surgery. However, the limitation remains, and the long-term effects of adenoidectomy on asthma outcomes requires further investigation. Another problem with assessing information about asthma exacerbations is the fact that the presentation of this disease tends to increase during the winter months, coinciding with the prevalence of viral respiratory infections [17]. The inclusion of studies with varying follow-up durations might therefore inadvertently introduce biases related to the seasonal variation of symptoms. Future research should consider accounting for seasonal factors when evaluating the impact of surgical interventions on asthma outcomes.

Finally, it is noteworthy that while AT appears to positively affect asthma outcomes, the absence of AT from international asthma management guidelines – such as the Global Strategy for Asthma Management and Prevention (GINA) [5], the NICE guideline for diagnosis, monitoring, and chronic asthma management [18], and the Asthma Care Quick Reference prepared by the National Institutes of Health [19] – raises questions about recognising it as a standard intervention. The lack of inclusion of AT in international guidelines may stem from various factors, including insufficient high-quality evidence and the need for further research to elucidate its long-term outcomes. Addressing the gap between empirical evidence and guideline recommendations for AT in asthma management requires rigorous research studies, systematic reviews, and meta-analyses to provide robust evidence supporting its efficacy and safety. In conclusion, while the positive impact of AT on asthma outcomes is evident based on four included studies, its absence from international asthma management guidelines underscores the need for further research.

Conclusions

This systematic review highlights the potential benefits of adenotonsillectomy on asthma control in pediatric patients. The four included studies consistently demonstrated positive outcomes in terms of asthma control, with improvements observed in measures such as the Asthma Control Test, clinical outcomes, and chitinase levels.

Our analysis of the included studies suggests that AT contributes to a reduction in acute asthma exacerbations, emergency room visits, hospitalisations, and use of asthma medication. We also highlight the importance of considering the severity of initial asthma conditions, emphasising that the impact of AT on clinical outcomes may depend on the baseline severity of asthma.

Notably, the review highlights the molecular impact of AT, as evidenced by the assessment of chitinase activity. The correlation between improved asthma control and decreased chitinase activity suggests that AT not only influences clinical manifestations but also molecular markers associated with severe asthma.

In conclusion, despite indicating a positive impact, our study is limited by the small number of studies included in the qualitative synthesis. To fully understand the sustained effects of AT, the review emphasises the need for further research with longer follow-ups, case-matched controls, and seasonal considerations. It is essential to recognise the multifactorial nature of asthma exacerbations. Factors contributing to the natural course of asthma and its exacerbations should be carefully considered in future research. The findings of this review provide valuable insights for clinicians working towards innovative management strategies and support the rationale behind adenotonsillectomy as an intervention for asthma in pediatric patients.

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