International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Review Article

Schooling Performance Outcomes after Elective Tonsillectomy in Children: A Review Article

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ABSTRACT

Tonsillectomy is still one of the most frequent surgical interventions in children. The main indications for this treatment are Obstructive Sleeping Apnoea (OSA) and recurrent acute tonsillitis. These disorders have previously been shown to have deleterious effects on neurocognition, which can influence the children's school performance. Many studies have tried to address the possibility of tonsillectomy having a positive effect on school performance. However, until now, no conclusive results have been attained. In this literature review we will analyse the most recent work published on this issue, summarize the main results and indicate limitations and possible future directions that could help clarify this important question.

Keywords: Performance, Elective, Tonsillectomy, Children.

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Article History:

Received: 03-10-2018, **Revised:** 16-11-2018, **Accepted:** 28-12-2018

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2019.5.1.001	

INTRODUCTION

Tonsillectomy, accompanied or not by adenoidectomy, is considered a first-line treatment in paediatric acute tonsillitis and obstructive sleep apnoea syndrome.[1,2] These conditions have been shown to have negative impacts on the quality of life of children Obstructive sleep apnoea (OSA) is common in the paediatric population, and it has been shown to affect, amongst others, blood pressure and learning.[3–6] On the other hand, recurrent infections of the ear canal and airways are a common cause for school absence in children. Although less research is available for this condition, some studies have indicated that there is a negative impact in the children and the families of children suffering recurrent tonsillitis.[7]

Difficulties in school performance may lower the confidence of the child in his potential and affect his self-esteem, thus bringing him suffering, which can have a negative impact in his development.

The aim of this literature review is to assess whether tonsillectomy, accompanied or not by adenoidectomy, has a positive effect on school performance. Since most studies include paediatric OSA patients, we will focus our review on this condition, and the effects that surgery to treat may have on cognition and school performance.

TONSILLECTOMY IN CHILDREN

Tonsillectomy is one of the most common surgical procedures in children. Considering the frequency of this intervention, studies describe variations from country to country[8,9] and these differences seem to be related to the diversity of clinical practices of general practitioners. The number of tonsillectomies has declined progressively in the United States as well as in other parts of the world, as shown by studies demonstrating a decrease in this kind of intervention in the US in children under 15 from 970,000 in 1965 to 289,000 in 2010.[10] A similar study in England also showed a declined, with 28,309 interventions performed in 1960 to 6,327 in 2014.[11]

Obstruction and infection are the two most common indications for this procedure.[1,12] Infection includes recurrent infections of the middle ears, mastoid air cells, nose, nasopharynx, adenoids, paranasal sinuses, oropharynx, tonsils, peritonsillar tissues, and cervical lymph nodes.

On the other hand, obstruction involves the nasopharyngeal airway, oropharyngeal airway, and the oropharyngeal deglutory pathway. According to guidelines, a number of factors need to be considered regarding elective tonsillectomy as a treatment option in children, namely:

- The potential benefits and risks of surgery in comparison with appropriate alternative strategies (e.g., watchful waiting, antimicrobial therapy)
- The natural course of disease
- Clinical factors related to the disease process (e.g., frequency and severity of episodes of recurrent throat infection)
- The values and preferences of the family and child (e.g., anxieties, tolerance of illness)

- The child's tolerance of antimicrobial drugs and other conservative therapies
- The accessibility of health care services
- Out-of-pocket costs
- The nature of available anaesthetic and surgical services and facilities
- The child's school performance in relation to illness-related absence

Paediatric patients with no indications for surgery may consider modifying facts, such as antibiotic allergy or intolerance or existing comorbid conditions (e.g. poor school performance) to make this decision.[1]

OBSTRUCTIVE SLEEP APNOEA

Obstructive Sleep Apnoea (OSA) is the most prevalent diagnosis in children with sleep difficulties. OSA involves episodes of upper airway obstruction causing hypoxia, hypercapnia, and alterations of sleep patterns.[13] The prevalence of this disorder is 1 – 5.7% in paediatric populations (new-borns to teenagers), although higher prevalence have been described in children aged three to five years old.[3,14] Since the most common cause of OSA in children is adenotonsillar hypertrophy[1], tonsillectomy accompanied or not by adenoidectomy continues to be the primary treatment for this disorder.[3]

Children with sleep disorders such as OSA often experience cognitive and behavioural impairments such as inattention, restlessness, aggressiveness and learning difficulties.[15] Given the relevance of these findings, several studies have addressed the the question of whether tonsillectomy, accompanied or not by adenoidectomy, could produce a significant change in school performance, as well as related factors such as behaviour, attention and overall quality of life. However these studies often have had low sample sizes or have failed to use standardized questionnaires to assess the aforementioned items.[16]

In one of the first such works, Gozal and colleagues conducted a study that included 297 first-grade children ranking in the lowest 10th percentile of their classes.[17] Children were screened for sleep disorders through a parental-guided questionnaire and a single night recording of pulse oximetry and and transcutaneous partial pressure of carbon dioxide. Parents of children showing sleep associated gas exchange abnormalities (SAGEA) were encouraged to seek medical intervention. Researchers recorded school grades of participating children from before and after the study. Of the 297 included, SAGEA were found in 54 children, of which 24 underwent adenotonsillectomy surgery. In children undergoing surgery, mean grades during second grade increased, and no significant differences were found in the no-treatment group or in children without SAGEA. There were some significant limitations to this study, such as not using a standardized neurocognitive testing questionnaire or not using polysomnography, the standard gold for the diagnosis of OSA.[3] Despite these, the study described a relationship between sleeping disorders and school performance, which improved after treatment.

In a more recent work published in 2016, Song et al. performed a meta-analysis and systematic review to better understand neurocognitive outcomes after paediatric adenotonsillectomy for the treatment of obstructive sleep apnoea.[18] They found 19 prospective studies matching their initial criteria for inclusion, which considered paediatric patients who underwent tonsillectomy accompanied or not by adenoidectomy. Studies had to be prospective and include pre- and post-operative data and report quantitative outcomes for neurocognition. Altogether, the studies included 898 paediatric patients (age range: 2.5 -14 years) undergoing elective adenotonsillectomy. From these, researcher could conclude that there is a significant cognitive improvement after surgery, as assessed through various standardized instruments. We will here review the most relevant findings of the studies included in the systematic review.

The CHAT (Childhood Adenotonsillectomy Trial), was designed to compare the effect of early adenotonsillectomy or watchful waiting with supportive care on cognitive, behavioural and quality of sleep factors.[19,20] CHAT was a randomized, single-blinded, multicentre trial that included 464 children aged 5 to 9 with OSA. Participants were randomly assigned to early adenotonsillectomy or a strategy of watchful waiting. Results of the main outcome, changes in the score on the Developmental Neuropsychological Assessment (NEPSY), did not show significant differences between the two groups. However, changes were found when testing behaviour. According to the findings of this study, adenotonsillectomy surgery significantly improved outcomes of behaviour, quality of life, and polysomnography findings. In the light of these results, researchers concluded that early adenotonsillectomy has beneficial effects on the outcomes of OSA, which could explain improved scholar performance after surgery.

Montgomery-Downs and colleagues analysed the effect of adenotonsillectomy surgery in children with OSA attending state-funded pre-school programmes.[21] The aim of their study was to reveal the effect of other OSA-associated comorbidities on neurocognitive and behavioural deficits. In 19 children undergoing AT, subjects showed improved cognitive scores as measured by the Differential Ability Scales (DAS). However, the mean scores of OSA patients and matched healthy controls remained below standard means. These findings indicate that environmental impoverishment could enhance the negative effects of sleep disorders in pre-school aged children. In 2003 Friedman et al. also demonstrated the efficacy of adenotonsillectomy on the neurocognitive function in children with OSA. Their study included 39 children aged 5 to 9 and 20 healthy controls. All subjects took neurocognitive tests with process-oriented intelligence scales. Polysomnography was also performed to assess sleep profiles of the participants.[22] Twenty-seven children with OSA took the same tests 6 to 10 months after adenotonsillectomy surgery. Fourteen children in the control group also repeated the tests 6 to 10 months later. Results showed improved neurocognition, as evidenced by improved scores in most neurocognitive tests, reaching levels of the control group. A clear limitation of this study is the small sample size, specially in the control group. This could represent a bias in the interpretation of results. Another, less relevant limitation is that PSG was not repeated after surgery. PSG results could have represented a step forward in understanding sleep characteristics that lead to neurocognitive impairment. In this same line of research, Ezzat et al. concluded that the IQ of children with OSA was reduced, compared to healthy controls, and that this reduction could be reversed by adenotonsillectomy. Surprisingly, in that study, differences could be seen as early as 10 to 12 weeks after surgery.[23]

Another study, not included in the meta-analysis by Song and colleagues, addressed, evaluated school performance before and after surgery in 83 children with OSA between the ages of 7 and 11.[24] The main criticism to this study was the lack of a healthy control group, in order to rule out the possibility that any improvement could be explained by normal child development. Interestingly, in this case, children were tested once before surgery and twice afterwards, the first at one month and the second six months after tonsillectomy or adenotonsillectomy. Researchers found evidence of improvement in all tests, thus confirming previous findings by other experts.

ACUTE RECURRENT TONSILLITIS

According to available data, tonsillectomy, usually accompanied by adenoidectomy does not have as strong an effect for the treatment of acute recurrent tonsillitis. Evidence suggests that in patients with severe symptoms only a moderate reduction in the number of episodes of pharyngeal pain is experienced after surgery.[25–27]

Despite this moderate effect on the condition, some studies found improvements in the quality of life of children undergoing adenotonsillectomy as a treatment for recurrent tonsillitis. Researchers addressing this issue often use questionnaires specifically designed for pharyngeal disorders, such as the Paediatric Throat Disorders Outcome Measure (IT-14) o others more generally related to the children's quality of life, such as the Paediatric QoL inventory, the Pre-School Children's QoL Questionnaire, amongst others.[28–30] These studies are difficult to compare because of the small sample sizes and variety of instruments used to analyse outcomes. Lock and colleagues analysed psychic and psychosocial component by means of the Paediatric QoL inventory and described a slight difference in patients who had undergone surgery.[29] However, van Staaij et al. could not find a statistically significant difference 24 months after surgery, using the Pre-school Children's QoL Questionnaire and the and the Child Health Questionnaire Parental Form.28 Considering the lack of evidence and the contradictory results, the question of whether tonsillectomy has a positive effect on school performance and general quality of life of children requires further efforts, including larger sample sizes and standardized instruments that allow for comparison.

DISCUSSION AND CONCLUSIONS

Although there has been a global decrease in the number of interventions, tonsillectomy or adenotonsillectomy are still one of the most frequent surgical procedures in children aged 6 to 14. The main indications for tonsillectomy in children are obstruction, leading to sleep disorders such as Obstructive Sleep Apnoea and recurrent acute tonsillitis. Many studies have described the deleterious effect of OSA on cognition in children.[13] This leads to a decreased Quality of Life and has a negative effect on school performance. Given these findings, studies addressing the question of whether surgery has any positive effect on school performance are at hand. Many such works have been published, as described previously in this review. However, despite the efforts, concluding evidence is still lacking regarding this important question. The most recent meta-analysis did only include 19 previous studies, and these were also difficult to compare. A major limitation to this seems to be the high number of different instruments used to assess both Quality of Life and school performance, very different amongst studies and not always standardized. Moreover, some of the studies reviewed above were lacking an appropriate control group that included a suitable number of matched subjects that could also be followed up properly. All reviewed studies seem to point towards a positive effect of surgery for the treatment of OSA on the neurocognitive effects caused by this disease. Despite this cumulative evidence, limitations described above force us to be cautious when considering improvement in school performance as a deciding factor for elective tonsillectomy surgery in children with OSA or related diseases.

Similar conclusions can be drawn regarding the other main indication for tonsillectomy/adenotonsillectomy, recurrent acute tonsillitis. As we described above, the number of surgeries for this indication has been decreasing in the last years, since efficacy has not been conclusively demonstrated. Very few studies have addressed school performance after tonsillectomy surgery for recurrent acute tonsillitis. In this case, results are contradictory, with some works showing no improvement, while others, using parent-reported questionnaires, found slight improvements. However, most times quality of life or school performance improvements did not necessarily correlate with improvements of disease.

Altogether, although results seem promising, further studies are required that include a larger number of patients, with standardized questionnaires and matching group controls. A possible solution would be creating large consortiums of international research groups and developing studies at the international level. Additionally, this would also bring the benefit of including mixed populations, thus reinforcing results.

ACKNOWLEDGEMENT

For Dr. Sultan Al Dalbhi, a clinical researcher associate for his great help and recommendations in the methodology.

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Source of Support: Nil. **Conflict of Interest:** None Declared.

Cite this article as: Reem Saleh Alrasheed, Lama Hameed Alhumaid, Jawaher Ali Alherabi, Rufaydah Ali Alkhowaiter, Yara Mahdi BinSaleh. Schooling Performance Outcomes after Elective Tonsillectomy in Children: A Review Article. Int J Med Res Prof. 2019 Jan; 5(1):1-4. DOI:10.21276/ijmrp.2019.5.1.001