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Review article

A systematic review and meta-analysis of cohort studies of echocardiographic findings in OSA children after adenotonsilectomy

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ABSTRACT

Context: There is evidence that OSA in children can be associated with acute and chronic effects on the cardiovascular system due to repetitive episodes of apnea and hypoxemia.
Objective: To assess whether there is an association between OSA and echocardiographic findings in children and whether that association persists after adenotonsillectomy.
Data sources: A literature search was conducted based on PUBMED, EMBASE and LILACS.
Study selection: Children with OSA and children who did not have OSA, who were aged ≤12 years.
Data extraction: Two reviewers extracted data independently; the risk of bias was assessed by examining the selected sample, the recruitment method, completeness of follow up, and blinding.
Results: Seven studies met all the inclusion criteria and methodological requirements. There was a significant difference with elevated mean pulmonary arterial pressure levels in OSA participants compared to those without OSA at preoperative assessment [mean difference (MD) 8.67; confidential interval (CI) 95% 6.09, 11.25]. OSA participants showed a statistically significant increased interventricular septum (IVS) thickness (mm) [MD 0.60; CI 95% 0.09, 1.11]; and right ventricular (RV) dimension (cm/m) [MD 0.19; CI 95% 0.10, 0.28]. There was also a significant increase in right ventricular (RV) dimension (cm/m) [MD 0.10; CI 95% 0.05, 0.14] in OSA children.
Conclusion: There is moderate quality evidence regarding possible association between OSA and right heart repercussions. More prognosis studies are needed, to allow the combination of results in a meta-analysis.

Contents

Abbreviations: CI, confidential interval; IVS, increased interventricular septum; BMI, body mass index; OSA, obstructive sleep apnea; mPAP, pulmonary arterial pressure; RV, right ventricular.

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1. Introduction

The term sleep disordered breathing is used for a spectrum of pathologies that involve the increase of resistance or even an alteration of airflow through the upper airway during sleep. These disorders show a high prevalence in the pediatric population, 3–12% of the children present snoring during sleep [1] and in some studies the rates are as high as 27%.

Obstructive sleep apnea (OSA) is considered the most severe form of sleep disordered breathing. OSA is characterized by repetitive episodes of upper airway obstruction, usually associated with hemoglobin dessaturation due to a partial or total interruption of respiratory flow. Its reported prevalence in children has varied from 0.7% to 3% [2,3]. The peak incidence is observed in preschool age when the upper airway obstruction is more common due to the hypertrophy of palatine and pharyngeal tonsils [4]. A polysomnographic description of OSA in children was first published by Guilleminault et al. [5]. Clinical symptoms include respiratory pauses, breathing difficulty, restless sleep, sweating, weight-height growth delays, nocturnal enuresis and neurocognitive disorders [6–8].

There is evidence that OSA in children can be associated with acute and chronic effects on the cardiovascular system [9,10] such as systemic and pulmonary blood pressure oscillation [11,12] and repetitive episodes of apnea and hypoxemia associated with right heart repercussions and *cor pulmonale* [13–15]. Some authors suggest that the findings are similar to cardiovascular injuries found in adult OSA [16–19].

Recently, in a systematic review, Teo and Mitchell (2013) strengthened the evidence of the improvement of cardiovascular parameter (blood pressure, heart rate, cardiac morphology and cardiac function) after adenotonsillectomy in OSA children [20].

But still there are only few well-designed studies which associate the presence of upper airway obstruction due to tonsillar hypertrophy or which discuss the role of adenotonsillectomy on cardiovascular outcome.

Based on these data, we proposed to assess whether there is an association between OSA (exposure) and echocardiographic findings (outcome) in children and whether the association persists after adenotonsillectomy.

2. Methods

2.1. Types of participants

Studies were included if they included children with OSA (exposure group) and children who did not have OSA. Participants with OSA had received a diagnosis of obstructive sleep apnea by full night polysomnography and/or clinical evaluation, who were aged $\leq$12 years and that have undergone surgery for adenotonsillar hypertrophy, regardless of gender. The non exposed group was composed by children without OSA, aged $\leq$12 years, regardless of gender. We excluded studies that evaluated children with congenital heart disease.

2.2. Types of studies

This systematic review included both cohort and case-control studies, in an effort to open the search strategy.

2.3. Types of outcome measures

Our primary outcome of interest was any cardiac abnormalities such as, acute lung edema, right ventricular hypertrophy, interventricular septum thickness, mean pulmonary arterial pressure, measured by echocardiography and/or any other validated tests.

2.4. Search strategy for identification of studies

A literature search was conducted based on PUBMED (1966 to December 2013), EMBASE (1980 to December 2013) and LILACS (1982 to December 2013), to identify studies evaluating the relationship between obstructive sleep apnea and echocardiographic findings with a minimum time of follow-up of three months. There was no language restriction. The search strategy was composed of terms for OSA, echocardiographic findings and prognosis in order to maximize sensitivity (Table 1). In addition, reference lists of the identified relevant studies were scrutinized for additional citations and, specialists in the field and authors of the included trials were contacted for any possible unpublished data. The date of last search was on 21st December 2013.

2.5. Data collection and extraction

Two reviewers independently screened the studies identified by the literature search and extracted data. Subsequently, disagreements between the examiners were discussed with other two authors to reach consensus.

Table 1
Search strategy.

((tonsillar hypertrophy) OR (upper airway obstruction) OR (upper airway obstructions) OR (nocturnal upper airway obstruction) OR (nocturnal upper airway obstructions) OR (obstructive sleep apnoea syndrome) OR (obstructive sleep apnea syndrome) OR (snoring in children) OR (throat infections) OR (throat infection) OR (adenotonsillar hypertrophy) OR (pediatric obstructive sleep apnoea) OR (pediatric obstructive sleep apnea) OR (sleep related breathing disorder) OR (sleep related breathing disorders) OR (enlarged adenoids) OR (obstructive sleep-related respiratory disturbances) OR (sleepdisordered breathing) OR (sleep disturbance) OR (sleep disturbances) OR (obstructive sleep apneas) OR (obstructive sleep apnea) OR (obstructive sleep apnoeas) OR (obstructive sleep apnoea) OR (Sleepdisordered breathing) OR (obstructive breathing disorder) OR (obstructive breathing disorders) OR snoring) **AND** (heart OR hearts OR (Cardiac Sudden Death) OR (Cardiac Sudden Deaths) OR (Sudden Cardiac Death) OR (Sudden Cardiac Deaths) OR (Sudden Cardiac Arrest) OR (Sudden Cardiac Arrests) OR (cardiovascular disease) OR (cardiovascular diseases) OR (acute lung edema) OR (acute lung edema) OR (negative pressure lung edema) OR (negative pressure lung edema) OR (heart failure) OR (acute heart failure) OR (right heart failure) OR (acute right heart failure) OR (right ventricular hyperthrophy))