

OSAS in developing age: Screening of a Southern Italy population



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Abstract

Aim The aim of this study was to determine the prevalence of OSAS' risk in children of the province of Catanzaro, Italy.

Materials and Methods A sample of 2445 schoolchildren aged 6 to 12 years of the province of Catanzaro (Italy) were administered the Pediatric Sleep Questionnaires (PSQs) in its validated Italian version. A total of 1772 questionnaires were collected; however, 130 of them were excluded, and 1642 questionnaires were accepted and scored.

Results According to final scores of questionnaires, 172 children (10.47%) were considered at risk for OSAS. No statistically significant association between sex and risk of OSAS was found ($p = 0.189$). The risk of OSAS was equally distributed in all ages ($p = 0.984$). It was found that the most common habits in children with risk of OSAS were: snoring, heavy or noisy breathing, oral breathing, xerostomia, difficulty waking up in the morning, behavioural disturbances during the day and excess weight.

Conclusion The study showed a high risk of OSAS, suggesting the importance of first-level screening and the need to pay special attention to the diagnosis of this syndrome.

Introduction

Obstructive Sleep Apnea Syndrome (OSAS) is comprised in sleep-related breathing disorders; it is characterised by repeated episodes of complete (apnoea) or partial (hypopnoea) cessation of respiratory airflow through the upper airways during sleep. The sleep of patients with OSAS is therefore fragmented, with hypoxemia and hypercapnia [Favero et al., 2013; Marino et al., 2012]. Obstructive sleep apnea affects children of all ages, from the newborn to the adolescent. OSAS is often undiagnosed, therefore epidemiological data in literature are still scarce and conflicting. The correct functioning of the upper airways is guaranteed by the simultaneous presence of four components: a physical, a neurological, a muscular and a structural component; from this we can understand how any factor that changes this complex system determines the establishment of a pathological picture. The aetiopathogenesis of OSAS is therefore multifactorial, which sees the combination of several factors [Bhattacharjee and Gozal, 2009].

The early interception of risk factors for OSAS appears to be an important preventative tool. Polysomnography (PSG) is the gold standard for confirming the presence of OSAS and evaluating its severity; it is a simultaneous recording of multiple physiological parameters during sleep [Aurora et al., 2012; Muzumdar and Arens, 2008]. However, conducting sleep studies using PSG is difficult and burdensome; in addition, waiting times between first analysis and final diagnostic report generally require from five to six months. An instrument that has proved to be an accurate means of screening, in the identification of risk factors for sleep-disordered breathing (SDB) is the PSQ (Pediatric Sleep Questionnaire) [Chervin et al., 2000].

The aim of this study was to determine the risk of OSAS in children of the province of Catanzaro (Italy), in order to prevent the potential evolution of this syndrome through multidisciplinary diagnostic and therapeutic approaches.

Materials and methods

Subjects

The study was carried out in Southern Italy, in the province

KEYWORDS Children; Obstructive sleep apnoea syndrome; Paediatric sleep questionnaire; Prevalence.

| | OSAS group | Control group | Total Sample |
|----------|------------|---------------|--------------|
| Subjects | 172 | 1470 | 1642 |
| Male | 93 | 717 | 810 |
| Female | 79 | 753 | 832 |
| Mean age | 9.48 | .47 | .47 |

TABLE 1 Distribution of the children by gender and score.

| | Mean of total positive answers |
|---------------|--------------------------------|
| Control group | 2.081 |
| OSAS group | 9.052 |
| p-value | <0.001 |

TABLE 2 Mean of the total positive answers for each group.

| | Mean of PSQ scores |
|---------------|--------------------|
| Control group | 0.09 |
| OSAS group | 0.44 |
| p-value | <0.001 |

TABLE 3 Mean of PSQ scores for each group.

of Catanzaro, which has a population of 90,240. The number of 6–12-year-olds is 5561, making up 6.16% of the population. We calculated that a minimum of 500 children must be entered in the study in order to have a level confidence of 95%. The sample was taken by the primary and secondary schools of the study area and classes were randomly selected. After the approval by the local ethics committee, questionnaires were distributed among students and a letter has been attached to every questionnaire in order to explain the parents the aim of the study and to obtain their informed consent.

Questionnaire

We used the Pediatric Sleep Questionnaire [Chervin et al., 2000] proposed by the University of Michigan in its Italian version translated by Ranieri et al. [2016]. It consists of 22 item questions divided into three domains: snoring (9 items), sleepiness (7 items), and behavioural (6 items). PSQ investigates symptoms including snoring characteristics such as duration, intensity, frequency, episodes of apnoea, mouth breathing, presence of enuresis, excessive sleepiness during the day, headache, weight and growth, symptoms of hyperactivity–impulsivity, and inattention. The PSQ score is calculated dividing the total number of positive answers by the total number of "Yes" and "No" answers. We used the previously validated cutoff value of 0.33, which would be most effective in identifying paediatric OSAS [Chervin et al., 2000].

Screening

Of the 2445 questionnaires distributed, 1772 were returned (72.47%), however 130 of those (7.33%) were considered invalid because of mistakes in completing or for the refusal of consent to the processing of personal information. The number of valid questionnaire was 1642.

Data analysis

Descriptive analysis of the data was used to report the mean of scores and of total positive answers; furthermore, the

percentage of the positive answers to each question of the questionnaire was calculated. Additionally, the prevalence of OSAS' risk in the population was evaluated. The association between the risk of OSAS and sex was detected by chi-square test, while that between the risk of OSAS and age by linear regression analysis. The Mann-Whitney U test was used to detect differences between OSAS group and control group regarding both the answers given and the final scores of questionnaires.

Results

Children who had a final score ≥ 0.33 and therefore considered at risk for OSAS, were 172 and represented 10.47% of the total. The sample was divided into two groups: OSAS group and control group. Among 1642 children (mean age 9.47 years), 810 were males and 832 females; of these, 93 males and 79 females were included in the OSAS group (Table 1).

The chi-square test showed no statistically significant association between sex and risk of OSAS ($p = 0.189$). The regression test also noted that the risk of OSAS is equally distributed in all age groups ($p = 0.984$).

The mean of the total positive answers for each group is shown in Table 2. The mean score of the PSQ was 0.09 for the control group, and 0.44 for the OSAS group (Table 3).

The percentage of positive answers to each question of the questionnaire was calculated for both groups, as shown in Table 4. The factors that were most common in children with risk of OSAS were: snoring, heavy or noisy breathing, oral breathing, xerostomia, difficulty waking up in the morning, behavioural disturbances during the day and weight excess. Among the factors investigated, those that showed a lower frequency were: nocturnal enuresis, daytime sleepiness, headache and deficit of statural growth, but in any case, they were found to a greater extent in the OSAS group compared to the control group.

Discussion

Several epidemiological studies have examined the oral health status of children in the province of Catanzaro (Italy) [Paduano et al., 2018]; however, this is the first study on paediatric OSAS.

The prevalence of OSAS is still controversial, several studies report different values ranging from 0.5% to 3% [Ali, et al., 1993; Gislason and Benediktsdóttir, 1995; Bixler et al., 2009]. However, in this study we found a higher prevalence of OSAS' risk (10%).

In order to investigate the presence of symptoms usually related to obstructive sleep-related breathing disorders (SRBDs), we referred to PSQ (Pediatric Sleep Questionnaire), a validated questionnaire developed by Chervin et al. [2000], which has a sensitivity and specificity of 0.81% and 0.83%, respectively [Ranieri et al., 2016; De Luca Canto et al., 2014]. Furthermore, De Luca Canto et al. [2014] report that it has the best diagnostic accuracy and it can be used as screening tool. We used the Italian version of PSQ, translated and validated by Ranieri et al. [2016]. It consists of ten sections and twenty-two questions on the quality of sleep, snoring, breathing, growth, weight and behaviours of the child. It can be easily filled by parent choosing between "Yes", "No" and "Don't know" answers. A letter

| Questions | OSAS group | Control group |
|--|------------|---------------|
| Snore more than half the time? | 35.3% | 3.7% |
| Always snore? | 22.1% | 0.8% |
| Snore loudly? | 23.8% | 1.6% |
| Have "heavy" or loud breathing? | 52.9% | 10.1% |
| Have trouble breathing or struggle to breathe? | 29.1% | 2.4% |
| Have you ever seen your child stop breathing during the night? | 33.1% | 3.5% |
| Does your child tend to breathe through the mouth during the day? | 52.3% | 10.4% |
| Have a dry mouth on waking up in the morning? | 64% | 17.2% |
| Occasionally wet the bed? | 20.3% | 4.6% |
| Wake up feeling un-refreshed in the morning? | 55.2% | 13.1% |
| Have a problem with sleepiness during the day? | 20.9% | 3.2% |
| Has a teacher or other supervisor commented that your child appears sleepy during the day? | 8.7% | 1.9% |
| Is it hard to wake your child up in the morning? | 76.2% | 22.4% |
| Does your child wake up with headaches in the morning? | 11% | 2% |
| Did your child stop growing at a normal rate at any time since birth? | 10.5% | 2.7% |
| Is your child overweight? | 29.1% | 11.6% |
| The child often does not seem to listen when spoken to directly | 55.8% | 8.3% |
| The child often has difficulty organizing tasks and activities | 45.3% | 6.1% |
| The child often is easily distracted by extraneous stimuli | 73.8% | 25.9% |
| The child often fidgets with hands or feet or squirms in seat | 61% | 12.7% |
| The child often is "on the go" or often acts as if "driven by a motor" | 51.2% | 10.1% |
| The child often interrupts or intrudes on others (e.g. Butts into conversations or games) | 73.2% | 33.9% |

TABLE 4 Percentage of the positive responses to each question for OSAS group and control group.

explaining the aims of the study was attached to every questionnaire in order to increase awareness of the parents and reduce the possibility of mistakes during filling.

According to previous studies, we found that some symptoms of OSAS were commonly reported in children of the study population, such as difficulty waking up in the morning, snoring [Brunetti et al., 2001], oral breathing [Brunetti et al., 2001], behavioural disturbances during the day [de Carvalho et al., 2013; Marcus et al., 2012; O'Brien et al., 2011; Beebe et al., 2010] and weight excess [McNicholas, 1998]. Among the other symptoms of OSAS described in the literature, we found a lower frequency of nocturnal enuresis [Bascom et al., 2011], daytime sleepiness [Owens et al., 1998], headache [Vendrame et al., 2008] and deficit of statural growth [Marcus et al., 1994]; however, they were more common in the OSAS group than in control group.

In developmental age, OSAS involves neurocognitive changes

that impair behaviour, emotional regulation, school performance, memory and alertness [Beebe et al., 2010]; the results of our study are in agreement with these findings. Some studies also show that IQ scores are significantly reduced in children with OSAS compared to controls [Kheirandish-Gozal et al., 2010]. The cause of neuro-behavioural deficits in the developmental age is still the subject of many studies; the hypothesis is that OSAS might be linked not only to alterations of sleeping pattern, but also to the intermittent and episodic hypoxia that characterises the condition and that leads to biochemical alterations in the prefrontal cortex and the hippocampus [Beebe, 2006; Halbower et al., 2006]. However, cognitive or behavioural changes do not occur in all children with OSAS and do not seem to be related to the severity of the disease; the hypothesis that has been put forward highlights rather an individual genetic susceptibility. These alterations can be partly irreversible if the disease is not treated or completely resolved [Kheirandish-Gozal et al., 2006].

Conclusions

The results of our study revealed that the prevalence of OSAS' risk in in children of the province of Catanzaro is of 10%. This result stresses the importance of paying special attention to the diagnosis of this syndrome, in order to prevent its potential negative effects on the life and health of the child. PSQ may be useful to identify SDBs when PSG is not viable, and it could be used in clinical practice because of its intelligibility, sensitivity and specificity. We aim to continue the study by performing a second level screening, consisting of both physical and instrumental examinations.

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