A suitable test for identifying high risk adult patients of moderate-severe obstructive sleep apnea syndrome

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Abstract. – The aim of this study was the evaluation of the usefulness of a 7-items questionnaire, Rome Questionnaire (RQ), in identifying adult patients at risk of obstructive sleep apnoea syndrome (OSAS).

136 adults (76 M, 60 F) with snoring were enrolled. Each patient underwent to an overnight polysomnography (PSG) study and the patient’s bed partner answered the “RQ”. RQ survey items mainly addressed the presence and frequency of snoring behaviour, breathing pauses, sore throat, oral breathing and wake time sleepiness.

Of the 136 initial patients, 111 (63 M, 48 F; mean age 54.6 ± 10.84) with a complete PSG examination were included in the study. They were divided according to apnea-hypopnea index (AHI) into two groups: group A with a primary snoring or mild OSAS (AHI ≤ 15) and group B with moderate-severe OSAS (AHI > 15). The RQ final score was 25.27 ± 16.1 for group A and 42.29 ± 15.2 for group B, with a statistically significant (p < 0.0001) difference. Analyzing the RQ score of group B (moderate-severe OSAS) we surprisingly noticed that most of patients (66%) showed an high RQ score (> 40). No patients with moderate-severe OSAS showed a RQ score < 20 and for every point scored in the questionnaire there is an extra 1.07 (0.7%) risk of belonging to group B.

Group B showed a mean body mass index (BMI) of 31.53 (± 4.95), significantly (p < 0.001) higher than BMI of group A (26.86 ± 3.28) and BMI results a good predictive factor (p = 0.013) of mild-severe OSAS.

In conclusion, the “RQ”, together with BMI, seems to be an useful tool to make a selection of the patients at higher risk of moderate-severe OSAS, who need a prompt PSG evaluation. Our findings will require further validation in larger sample of subjects.

Key Words: Moderate-severe sleep apnoea syndrome, Snoring, Obesity, Questionnaire, Polysomnography, Screening tool.

Introduction

Obstructive sleep apnea syndrome (OSAS) is a potentially disabling condition characterized by excessive daytime sleepiness, disruptive snoring, repeated episodes of upper airway obstruction during sleep, and nocturnal hypoxemia.

Daytime consequences include excessive sleepiness, impaired cognitive performance, disturbed moods with a reduced quality of life1-3. Excessive daytime sleepiness is reported to be associated with a higher risk of motor vehicle accidents and work place injuries or poor work performance4. If not adequately diagnosed and treated, OSAS is associated with severe complications such as hypertension, metabolic syndrome, type 2 diabetes mellitus, strokes, coronary disease, neurobehavioral complaints and it is probably a predictor of premature death5. It is known that at least 50% of patients with heart failure have sleep respiratory apneas and moderate-severe OSAS is associated with a 3-fold increased risk of developing hypertension6.

The prevalence of OSAS in the United States is estimated between 5% and 10% and increases with age, but the “at-risk” population is much larger7. At the present, OSAS is considered a ma-
A major health problem, not only because of its consequences in terms of morbidity and mortality, but also because of the costs of its social impact. More than 800,000 drivers were involved in OSAS-related motor-vehicle collisions in the year 2000 and the costs in the year 2000 alone reached 15.9 billion dollars. Polysomnography (PSG) remains the conventional diagnostic “gold standard” test for OSAS, but it has several limits including the necessity to perform the test in a sleep laboratory with specialized personnel, high costs, long waiting lists and long analysing time by the operator.

Our common experience suggests that people with clinical features of OSAS often present negative polysomnographic tracing, because of the complexity of the test and the patients difficult tolerance of the electrodes, contributing to the increase of waiting-lists. Otherwise, not rarely, on the base of only clinical criteria some physicians exclude the necessity to carry out a PSG assessment, with possible serious consequences for the patient’s health.

Therefore, it has become necessary to characterize a new methodical approach which can select high risk moderate-severe OSAS-patients who can derive major benefit from the execution of the PSG. Currently, a limited number of screening tools are available to detect sleep disorder in adults. The Berlin questionnaire, which was designed to identify patients as being at ‘high’ or ‘low’ risk for OSAS, assesses the patient’s risk level based on approximately 11 questions addressing three symptom categories: snoring, sleepiness, and high blood pressure/weight. The Sleep Disorders Questionnaire (SDQ) is a valid tool to diagnose common sleep disorders but for its length (176 items) the author concluded that it is not a practical instrument in primary settings. The Pittsburgh Sleep Quality Index (PSQI) is a 24-item questionnaire useful for measuring changes in sleep quality over time in patients, alerting physicians of the need of further evaluation.

Roth et al purposed the Global Sleep Assessment Questionnaire (GSAQ) as a suitable screening tool for sleep disorders in general primary care population, although the authors declared some study-limitations.

More recently some authors have purposed the SA-SDQ, a 12-item validated measure of sleep-related breathing disorders, as a possible useful tool to screen epilepsy patients for OSA, although appropriate cut-off points have not been established.

We evaluated the usefulness of a 7-items questionnaire, named Rome questionnaire (RQ), in identifying adult patients at risk for moderate-severe OSAS.

**Materials and Methods**

Between May 2004 and April 2006, 136 (M = 76; F = 60) patients with a history of snoring were enrolled in the study. All of them underwent an overnight PSG at the area of Otolaryngology of the Campus Bio-Medico University of Rome. Each patient’s bed partner answered the “RQ”, following written consensus of the patient.

**Sleep Studies**

Modified portable sleep apnoea monitoring was performed in all patients with a polysomnograph Mesam-8 Polymesam, with recording of abdominal and chest movements, body position, snoring, oxygen blood saturation, pulse rate, oronasal airflow (nasal air pressure).

All exams were performed in the Otolaryngology Department under the control of the hospital nursing-staff, instructed to put the electrodes and to turn the recording device on at bedtime and turn it off upon rising. The PSG records were considered acceptable if the patients spent at least 6 hours in bed and good to excellent recording of SaO$_2$ and respiration was achieved. A single researcher who had no knowledge of the questionnaire results performed the scoring.

A respiratory event suggestive of OSAS was defined as a decrease in nasal and oral airflow, alone or with thoraco-abdominal movements, > 90% (apnea) or > 50% and < 90% (hypopnea) that lasted for at least 10 seconds. A decrease in SaO$_2$ of 4% or more was considered significant oxygen desaturation.

According to international guidelines, we considered the AHI (apnea-hypopnea-index) per hour of sleep ≤ 5 suggestive of simple snoring with no OSAS, > 5 and ≤ 15 suggestive of mild OSAS, > 15 and ≤ 30 suggestive of moderate OSAS and > 30 suggestive of severe OSAS.

**The “RQ”**

The “RQ” (Appendix 1) is a structured quick and simple self-administered questionnaire...
Based on 7 closed questions. Questions thought to be predictive of OSAS in adults were formulated on the basis of our clinical experience and recent literature. These questions investigate the presence of OSAS’s risk factors (episodes of apnea during sleep, daytime sleepiness, nasal respiratory disturbances) and consist of short and clear phrases, prepared using simple and common words. The first two questions regard the presence of episodes of apnea and breathing disorders during sleep; the third and fourth questions address the partners for the patient’s respiratory distress; the fifth and the sixth explore the eventual obstructive nasal symptoms; the last question investigates daytime sleepiness. For each question only one response is allowed: questions from 1 to 4 have two possible answers, while in questions from 5 to 7 six options are given. A score is awarded to each response (Appendix 1). A physician who had no knowledge of the PSG results analysed the RQ. The total score (min 0; max 65) is calculated by adding the scores given for each question.

**Statistical Analysis**

The quantitative distribution of individual patients variables, responses to the questionnaire and polysomnographic results are expressed by parameters of descriptive statistic (frequencies, mean ± SD, and range). Significance analysis of scores of the 4 diagnostic classes (absent, mild, moderate and severe OSAS) were performed with a variance analysis (ANOVA). A t-test was used in order to evaluate the presence of significative differences between the scores of the diagnostic groups.

Test-retest reliability was measured using the intra-class correlation coefficient (ICC), and was assessed by comparing the correlations between two administrations of the RQ for a subset of our study sample. A correlation of 0.70 or greater is considered acceptable.

We performed a logistic regression that examined the possible existence of significative correlations between scores and diagnostic groups and the relative effects of sex, age and BMI on those correlations. Statistical elaboration was performed with STATA 7.0.

**Appendix 1. The “Rome Questionnaire (RQ)”.

1. Have you ever noticed apneas (breathing pauses) during your husband/wife’s sleep?
   - Yes (= 10 points) □
   - No (= 0 points) □

2. Have you ever noticed respiratory distress during your husband/wife’s sleep?
   - Yes (= 10 points) □
   - No (= 0 points) □

3. Have you ever had to shake your husband/wife while sleeping in order to make him/her resume breathing?
   - Yes (= 10 points) □
   - No (= 0 points) □

4. When you observe your husband/wife sleeping, do you fear he/she can have an apnea?
   - Yes (= 10 points) □
   - No (= 0 points) □

5. How frequently does your husband/wife suffer badly from a sore throat?
   - Never (= 0 points) □
   - Once a week (= 4 points) □
   - Once a month (= 2 points) □
   - More than once a week (= 6 points) □
   - Nearly every day (= 8 points) □
   - Always (= 10 points) □

6. Does your husband/wife breath with their mouth during the day?
   - Never (= 0 points) □
   - Rarely (= 2 points) □
   - Sometimes (= 4 points) □
   - Occasionally (= 6 points) □
   - Nearly always (= 8 points) □
   - Always (= 10 points) □

7. Does your husband/wife complain of daytime sleepiness while he/she driving the car?
   - Never (= 0 points) □
   - Rarely (= 1 points) □
   - Sometimes (= 2 points) □
   - Occasionally (= 3 points) □
   - Nearly always (= 4 points) □
   - Always (= 5 points) □
Results

Of the 136 enrolled patients, 111 patients had an acceptable PSG records and were included in the study. Their main characteristics are shown in Table I.

Of the 111 patients’ partners, 56.75% reported breathing pauses during the patient’s sleep, 73.87% reported that the patients presented gasps while sleeping, 49.54% have waked the patient up trying to stop a sleep apnoea and 44.14% were in anxiety for the breathing pauses during the patient’s sleep. At least one episode of somnolence while driving was reported in 48.73% patients and in 23.1% of the cases the disturbance was described with a frequency of “often” or “nearly always”.

We divided the 111 patients into 4 classes (0, 1, 2 and 3) according to the PSG results. Comparing the PSG results with the scores of the RQ, a statistically significant difference ($p = 0.013$) between the scores (23.07 ± 15.3) of the 60 patients of class 0 (absent OSAS) and the scores (45.86 ± 14.9) of the 17 patients of class 3 (severe OSAS) was found, while no significant differences were observed between the scores of the 18 patients of class 1 (mild OSAS) and those of the 16 patients of class 2 (moderate OSAS) (Table II; Figure 1).

Patients were thus divided according to the PSG results into two groups: group A (78 patients, 42 M and 36 F; mean age 54.23 years; range 25-79) including patients belonging to classes 0 and 1 (mean AHI 2.64; range 0-15) and group B (33 patients; 21 M and 12 F; mean age 55.74; range 37-79) including patients with OSAS, class 2 and 3 (mean AHI 34.51; range 17-67).

Performing a t-test we observed a statistically significant difference ($p < 0.0001$) between final scores of RQ in A (25.27 ± 16.1) and B (42.29 ± 15.2) groups (Figure 2).

The minimum and maximum RQ score were 0 and 44 in group A, 22 and 62 in group B respectively. In the group A, the 38/78 (48.7%) showed a RQ score between 20 and 40, the 24/78 (30.7%) lower than 20 and only the 16/78 (20.5%) with a RQ score higher than 40. The 22/33 (66.6%) of patients belonging group B showed a RQ score higher than 40, 11/33 (33.3%) between 20 and 40 points, nobody with a RQ score lower than 20.

Through a logistic regression analysis adjusted for sex, age and BMI of data we noticed that for every point scored in the questionnaire there is an extra 1.07 (0.7%) risk of belonging to group B (moderate-severe OSAS). The logistic regression analysis of data showed that BMI is also an independent predictive factor ($p = 0.013$) of mild-severe OSAS. Group B showed a mean body mass index (BMI) of 31.53 (± 4.95), significantly ($p < 0.001$) higher than BMI of group A (26.86 ± 3.28). Sex and age did not represent a predictive factor of OSAS in our patient-setting.

Of all 111 patients only in 62 cases (55%) the partners completed a second re-test questionnaire (re-administered after two weeks). Acceptable test-retest reliability (indicated by ICC values) was found for our patient group (0.82).

Discussion

OSAS represents one of the major social health problem not only because of its consequences in terms of morbidity and mortality, but also because of its social costs\(^8\). OSAS prevalence is increasing

<table>
<thead>
<tr>
<th>Diagnostic classes</th>
<th>N</th>
<th>Mean AHI (range)</th>
<th>&quot;RQ&quot; mean scores ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 0 (= simple snoring)</td>
<td>60</td>
<td>1.41 (0-5)</td>
<td>23.07 ± 15.3</td>
</tr>
<tr>
<td>Class 1 (= mild OSAS)</td>
<td>18</td>
<td>8.78 (6-15)</td>
<td>36.64 ± 15.6</td>
</tr>
<tr>
<td>Class 2 (= moderate OSAS)</td>
<td>16</td>
<td>21.33 (17-28)</td>
<td>37.83 ± 16.5</td>
</tr>
<tr>
<td>Class 3 (= severe OSAS)</td>
<td>17</td>
<td>45.06 (31-67)</td>
<td>45.86 ± 14.9</td>
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</tbody>
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Table I. Symptoms at presentation.

<table>
<thead>
<tr>
<th>Characteristics of the patients</th>
<th>Data</th>
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<tbody>
<tr>
<td>Mean age ± SD, yrs</td>
<td>54.6 ± 10.84</td>
</tr>
<tr>
<td>Male (n. 63)</td>
<td>54.4 ± 11.19</td>
</tr>
<tr>
<td>Female (n. 48)</td>
<td>55.8 ± 8.97</td>
</tr>
<tr>
<td>Body mass index, n. (%)</td>
<td></td>
</tr>
<tr>
<td>&lt; 30 kg/m(^2)</td>
<td>70 (63.0)</td>
</tr>
<tr>
<td>&gt; 30 kg/m(^2)</td>
<td>41 (37.0)</td>
</tr>
</tbody>
</table>
and more than one third of patients visited in primary care practice report symptoms suggestive of OSAS. OSAS is more frequent and typically more severe in obese subjects.

The prevalence of the typical symptoms of OSAS is very high, but most patients remain undiagnosed, especially patients with normal weight; approximately 1 in every 5 adults has at least mild OSAS, and 1 in every 15 adults has at least moderate OSA. Patients with a AHI >20 have higher mortality rates versus the general population. Daytime sleepiness and fatigue are common symptoms suggestive of OSAS, and they are related to poor health status and car accidents. In spite of the necessity of identifying OSAS patients to prevent acute and chronic effects, there are still few Sleep Medicine Centres (especially in rural regions) and normally these have long waiting lists for PSG.

Therefore, screening tools such RQ are gaining increasing because of importance of the high prevalence of OSAS in the general population, the high cost and the long waiting lists of PSG, examination still few popular especially in rural setting.

Our study shows that the RQ could be a useful screening tool to identify those patients at higher risk of having moderate-severe OSAS. In fact, for every point scored in the questionnaire there is an extra 1.07 (0.7%) risk of belonging to group of moderate-severe OSAS. Analyzing the RQ score of group B (moderate-severe OSAS) we noticed that most of patients (66%) showed an high RQ score (>40), while no patients with moderate-severe OSAS showed a RQ score <20. However, the questionnaire seems to be less helpful in those patients scoring between 20 and 40.

On the other hand, our data confirm previous reports about the importance of several symptoms suggestive of OSAS in adults, such as episodes of apnoea during sleep, daytime sleepiness, nasal respiratory disturbances. Most of bed-partners reported gasps while sleeping and about half of patients had at least one episode of somnolence while driving.

In comparison to other screening test for OSAS previously cited, as Berlin and PSQI questionnaire, RQ is more simple and its compilation takes only 5 minutes. Because of its low costs and short administration time, the RQ seems to be a particularly suitable test for epidemiological studies and clinical trials in large populations and in geographical areas that are medically underserved.

The prevalence of obesity (defined in our study as a body mass index >30 kg/m²) in OSAS patients typically increases with the severity of disease, as reported in previous studies. In our study the group of moderate-severe OSAS also had a significant higher BMI index than the group without or with mild OSAS. However, the RQ score, once adjusted for BMI, still was able to identify higher risk of having moderate-severe OSAS. Therefore, since the prevalence of obesity in the general population is increasing, the RQ could represent a very interesting tool to identify those obese patients that have a higher risk of having moderate-severe OSAS.

The goal of our study was not to identify an instrument able to achieve the reliability of PSG, but to be able to make a rapid selection of the patients at higher risk of moderate-severe OSAS,

Figure 1. Box-plot concerning the 4 diagnostic classes.

Figure 2. Box-plot concerning the 2 diagnostic group A (simple snoring and mild OSAS) and B (moderate and severe OSAS).
who need a prompt PSG, which remains the gold standard diagnostic tool. Our findings will require further validation in larger sample of subjects to establish the RQ utility to identify adults with high risk for moderate-severe OSAS. It is important to note that RQ, that absolutely need a further validation in larger studies, is not a diagnostic test and should be used only to select a subset of population with a major risk to have moderate-severe OSAS. The RQ should be combined with a comprehensive clinical examination by a trained sleep professional and, if indicated, a PSG should be performed to rule out OSAS.

In conclusion, these preliminary results support that RQ could help the physician to identify patients with high risk of moderate-severe OSAS, who need a PSG and an adequate treatment more prompt than other patients. This would reduce OSAS-related complications since it is known, for example, that at least 50% of patients with heart failure have sleep respiratory apneas and that moderate-severe OSAS is associated with a 3-fold increased risk of developing hypertension, ameliorating, in the same time, the patient and bed-partner quality of life.

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