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Recommended Citation
Elsaid, Nada; Mosa, Ahmed A.H.; and Saied, Ahmed (2023) "Screening for obstructive sleep apnea in a sample of Egyptian idiopathic intracranial hypertension female patients using the Berlin questionnaire," Mansoura Medical Journal: Vol. 52 : Iss. 1 , Article 3.
Available at: https://doi.org/10.58775/2735-3990.1372

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ORIGINAL STUDY

Screening for Obstructive Sleep Apnea in a Sample of Egyptian Idiopathic Intracranial Hypertension Female Patients Using the Berlin Questionnaire

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Abstract

Background: Obstructive sleep apnea (OSA) is one of the risk factors for idiopathic intracranial hypertension (IIH). The Berlin questionnaire (BQ) is a validated reliable method for the identification of an increased likelihood of OSA. We aimed to screen a sample of female IIH patients for OSA using the BQ.

Patients and methods: This study included 40 females; 20 newly diagnosed IIH patients and 20 healthy controls. The BQ was obtained from all of the study participants, and it was divided into high or low risk for OSA.

Results: The patient and control cohorts were age-matched. The BMI was significantly higher in the IIH group (median 36, range 24–42) than in the control group (median 28, range 20–41) (P = 0.005). Of the IIH patient group, 45% had a high-risk BQ score, while only 15% of the healthy control group had a high-risk score (P = 0.038).

Conclusion: Stratifying the risk of OSA in IIH may be feasible using the BQ. A high likelihood for OSA in BQ is more common in patients of IIH. Polysomnography may be warranted in IIH patients with high-risk BQ scores to reduce the morbidities associated with OSA, especially in obese patients.

Keywords: Berlin questionnaire, Idiopathic intracranial hypertension, Sleep apnea

1. Introduction

Idiopathic intracranial hypertension (IIH) is characterized by raised intracranial pressure in the absence of an identifiable cause (Elsaid et al., 2020). Coexistence of obstructive sleep apnea (OSA) and IIH is previously reported in several studies (Marcus et al., 2001; Lee et al., 2002; Purvin et al., 2000; Thurtell et al., 2013; Yiangou et al., 2022). Typically, IIH occurs in middle-aged females; however, OSA is more common among older males (Yiangou et al., 2022).

The relation between obesity, OSA, and IIH is intercalated. Obesity is a common risk factor for both disorders. Both OSA and obesity are associated with increased cardiovascular comorbidities and are thought to increase intracranial pressure through different mechanisms. Both conditions are reported to be associated with higher levels of retinol-binding proteins that transport vitamin A or retinol in the blood with subsequent increased cerebrospinal fluid production and possible decreased absorption. Also, the associated raised intra-abdominal pressure led to increased central venous pressure, impending cerebrospinal fluid absorption. The OSA is also believed to worsen the visual outcomes of IIH through exacerbation of the optic nerve ischemia as a result of the intermittent nocturnal hypoxia (Fig. 1) (Lee et al., 2002; Purvin et al., 2000; Yiangou et al., 2022; Banerjee et al., 2020; Netzer et al., 1999; Thurtell et al., 2011; Punjabi et al., 2009; Jennum and Borgesen, 1989).

The Berlin questionnaire (BQ), which includes questions about snoring, daytime sleepiness, BMI,
and elevated blood pressure, is a short, practical, and previously validated screening tool for patients with a high risk of OSA (Netzer et al., 1999; Thurtell et al., 2011).

Using the BQ we aimed to assess the relationship between the estimated risk of OSA and IIH in females.

2. Patients and methods

Institutional Review Board approval was obtained from the Mansoura Faculty of Medicine Institutional Research Board (approval number: R.22.09.1806), and an informed consent from all of the study participants was obtained. This prospective study included 40 females; 20 newly diagnosed IIH patients according to the modified Dandy diagnostic criteria (Friedman et al., 2013) and 20 healthy controls with no symptoms or signs suggesting an intracranial pathology.

The patients' BMI were calculated by taking the patients' weight, in kilograms, divided by their height, in meter squared.

2.1. Berlin questionnaire

The BQ (Fig. 2) involves three categories of questions: the first category encompasses queries about snoring; the second category assesses daytime somnolence (category 2), while the third category questions about hypertension and BMI (category 3). Confirmation of the patient's response about the snoring was done by the patient's family member or bed partner. The overall BQ score was deduced based on the responses to the three categories: the first and second categories were considered positive.
if 2 or more positive responses were reported indicating highly recurrent symptoms (>3–4 times/week), whereas the score from the third category was considered positive if there was a history of elevated blood pressure or a BMI of more than 30 kg/m². The risk of OSA was considered high if two or more categories were positive (high-risk group), otherwise it was considered as being at low-
risk (low-risk group) (Netzer et al., 1999; Thurtell et al., 2011).

2.2. Statistical analysis

Data were analyzed using IBM SPSS Statistics, Version 22.0. (IBM Corp., Armonk, New York, USA). Qualitative data were described using numbers and percentages, while quantitative data were described using median and range. The result’s significance was judged at the 0.05 level. After using the Kolmogorov–Smirnov test for normality testing, Student’s t test (for parametric variables) and χ² test (for nonparametric variables) were used to compare between the patient and the control group, and between the two patients’ groups.

3. Results

The patient and control cohorts were sex and age-matched; all of the enrolled participants were females. The age of the IIH patients group ranged between 21 and 49 with a median age of 31 years, whereas the median age of the control group was 30 (18–50) (P = 0.41) (Table 1).

The BMI was significantly higher in the IIH group (median 36, range 24–42) than in the control group (median 28, range 20–41) (P = 0.005).

Snoring (category 1), daytime somnolence (category 2), and hypertension and BMI (category 3) were higher in the IIH group compared with the patient group; however, only category 1 and category 3 showed statistical significance (P = 0.038 and 0.02, respectively). Most of the positive category 3 results was due to BMI more than 30 kg/m². As regards the overall BQ score and the estimated OSA risk, nine (45%) of the IIH patient group patients had a high-risk BQ score, while only three (15%) of the healthy control group had a high-risk score (P = 0.038) (Table 1).

4. Discussion

Polysomnography is the gold standard test for establishing the diagnosis of OSA, but it is expensive, time-consuming, and inconvenient for many patients. Based on these, several simple and sensitive screening tests have been proposed as the BQ. The BQ can be carried out within minutes and was validated in different languages including Arabic as a useful screening tool for patients with a high risk of OSA (Netzer et al., 1999; Saleh et al., 2011).

IIH patients are typically young females, in contrast to OSA, which is more common among older males, thus, it is debatable whether the BQ would serve as a reliable tool to identify IIH female patients with OSA (Netzer et al., 1999; Wall and Purvin, 2009).

The aforementioned interplay between obesity, OSA, and IIH summarized in Fig. 1 triggered the necessity of evaluation of IIH patients for OSA using the BQ.

Most of the previous reports that studied the coexistence of IIH and OSA were based on polysomnography (Marcus et al., 2001; Lee et al., 2002; Yiangou et al., 2022; Wall and Purvin, 2009). To our knowledge, only one study used the BQ in the screening of OSA in IIH (Thurtell et al., 2011).

Our results were comparable to their findings; however, the percentages of the positive results of the three categories and the overall risk were lower in our study participants. This can be related to the relatively higher BMI among the patients reported by Thurtell and colleagues, knowing that obesity is

### Table 1. Comparative statistical analysis between the idiopathic intracranial hypertension and the control group.

<table>
<thead>
<tr>
<th></th>
<th>Idiopathic intracranial hypertension (N = 20 patients)</th>
<th>Control (N = 20 patients)</th>
<th>Significance</th>
<th>Thurtell et al. (Netzer et al., 1999)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>31 (21–49)</td>
<td>30 (18–50)</td>
<td>P = 0.41</td>
<td>31 (16–54)</td>
<td>NA</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Females</td>
<td>20 (100)</td>
<td>20 (100)</td>
<td></td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>0</td>
<td>0</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>36</td>
<td>28</td>
<td>P = 0.005</td>
<td>39.8</td>
<td>NA</td>
</tr>
<tr>
<td>BMI</td>
<td>24–42</td>
<td>20–41</td>
<td></td>
<td>27.3–51.7</td>
<td></td>
</tr>
<tr>
<td>Berlin questionnaire (BQ)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>Significance</td>
<td>n (%)</td>
<td>Significance</td>
</tr>
<tr>
<td>Category 1</td>
<td>9 (45)</td>
<td>3 (15)</td>
<td>P = 0.038</td>
<td>17 (56.7)</td>
<td>P = 0.41</td>
</tr>
<tr>
<td>Category 2</td>
<td>6 (30)</td>
<td>3 (15)</td>
<td>P = 0.25</td>
<td>17 (56.7)</td>
<td>P = 0.73</td>
</tr>
<tr>
<td>Category 3</td>
<td>15 (75)</td>
<td>8 (40)</td>
<td>P = 0.02</td>
<td>28 (93.3)</td>
<td>P = 0.06</td>
</tr>
<tr>
<td>BQ overall estimated risk</td>
<td></td>
<td></td>
<td>P = 0.038</td>
<td></td>
<td>P = 0.12</td>
</tr>
<tr>
<td>Low risk</td>
<td>11 (55)</td>
<td>17 (85)</td>
<td></td>
<td>10 (33.3)</td>
<td></td>
</tr>
<tr>
<td>High risk</td>
<td>9 (45)</td>
<td>3 (15)</td>
<td></td>
<td>20 (66.7)</td>
<td></td>
</tr>
</tbody>
</table>
associated with a higher risk of both IIH and OSA, and the severity of OSA increases in association with weight increase (Thurtell et al., 2011; Nousseir, 2019). Weight loss is reported to help both conditions (Yiangou et al., 2022; Sarkhosh et al., 2013; Sinclair et al., 2010; Mollan et al., 2021). This highlights the necessity of screening for OSA in IIH females to improve their quality of life and to reduce the comorbid risks from type 2 diabetes mellitus, ischemic heart disease, and hypertension (Adderley et al., 2020).

4.1. Limitations and recommendations

Our study had several limitations. The number of our study participants is relatively small. The evaluation of the other OSA screening tools is warranted; also evaluation of the BQ in male IIH patients should be considered. Further, large-sized multicentered polysomnography-based studies are warranted.

4.2. Conclusion

Stratifying the risk of OSA in IIH may be feasible using the BQ. A high likelihood for OSA in BQ is more common in patients of IIH. Polysomnography may be warranted in IIH patients with high-risk BQ scores to reduce the morbidities associated with OSA, especially in obese patients.

Conflict of interest

The authors declare that they have no conflict of interest.

References
