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EVALUATION OF ANXIETY AND DEPRESSION LEVELS IN PATIENTS FOLLOWING ENDOVASCULAR TREATMENT OF UNRUPTURED INTRACRANIAL ANEURYSMS WITH FLOW DIVERTER

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ABSTRACT

Object: The diagnosis of unruptured intracranial aneurysm and the anxiety caused by the knowledge of potential complications of endovascular treatments may negatively affect the mental health of the patients. We sought to investigate the prevalence of symptoms of anxiety and depression in a cohort of consecutive patients six months after flow diversion treatment for an unruptured intracranial aneurysms. **Methods:** This study included consecutive patients treated with flow diverter for an unruptured intracranial aneurysm and for whom a six-month angiographic and clinical follow-up was available, as well as a control group of healthy subjects. The participants were assessed for symptoms of anxiety and depression using a patient-filled questionnaire based on the Greek version of the Hospital Anxiety and Depression Scale (HADS). **Results:** A total of 61 consecutive patients managed with flow diversion for unruptured intracranial aneurysms and 63 healthy subjects serving as the control group were included in the study. Higher mean anxiety and mean depression score in the patient group were observed compared to the control group (p=0.039 and p=0.049 respectively). Higher anxiety scales were positively correlated with female gender (p=0.003) and employment status (p=0.005). Increasing age (p=0.05), female gender (p=0.05) and employment status (p=0.04) were statistically significant risk factors for the emergence of symptoms of depression and higher education level was negatively correlated with higher depression scales (p=0.002). **Conclusion:** The diagnosis of unruptured intracranial aneurysms and knowledge of the complications of endovascular management with flow diverters may be associated with increased prevalence of symptoms of anxiety and depression. Further, well designed studies are necessary to evaluate the prevalence of mental disorders in patients undergoing endovascular treatment for unruptured intracranial aneurysms.

KEYWORDS: anxiety, depression, unruptured intracranial aneurysms, endovascular treatment, flow diverter.

INTRODUCTION

Flow diversion has been established as a safe and effective treatment option for unruptured intracranial aneurysms.[1,2] However, the time-course of aneurysmal occlusion is unclear, usually occurring within six months following flow diversion.[3-5] Moreover, flow diversion is not without complications with post-procedural acute cerebral ischemia representing the most common one.[1] Though the complications associated with intracranial aneurysms and their treatment have been well described, the mental health impact of knowledge of the potential complications of an intracranial aneurysm and/or its treatment have been rarely reported.[6]

We sought to investigate the prevalence of anxiety and depression symptoms in a cohort of consecutive patients six month after flow diversion treatment of unruptured intracranial aneurysms.

METHODS

This study involved 61 consecutive patients that were treated for unruptured, incidental intracranial aneurysms with flow diversion from September 2019 to November 2020 in a single center and for which six-month clinical and angiographic follow-up was available. The control group consisted of 63 randomly selected healthy subjects. The study was approved by the Institutional Scientific Board and the Institutional Board of Directors.

Informed consent was obtained from all individuals participating in the study.

HADS is a self-report scale consisting of 14 questions on a 4-point Likert scale. The questions are subdivided in two subgroups of seven questions, measuring anxiety and depression levels respectively. By calculating the total points scored for each subgroup (range 0-21), the patient's anxiety and depression levels can be categorized as normal (range 0-7), borderline abnormal (range 8-10) and abnormal (11-21).[7]

The Greek version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the levels of anxiety and depression of the participating patients at the six-month follow-up visit. HADS was used to access for symptoms of anxiety and depression. The scale's reliability has been validated on hospitalised patients of Greek hospitals.[7] All participants received a questionnaire composed of two parts, with the first part pertaining to demographic factors (age, gender, education level, employment and marital status) and the second part consisting of the HADS.

STATISTICAL ANALYSIS

In order to select the appropriate correlation criterion between the variables, the Kolmogorov-Smirnov test was performed. Correlations were made using the Mann-Whitney test, t-test, Spearman correlation coefficient, one-way ANOVA and Kruskal-Wallis test. Statistical significance was defined as $p<0,05$. SPSS 25 was used to perform the statistical analysis.

RESULTS

Over the study period, 61 patients were treated with flow diversion for unruptured intracranial aneurysms and were evaluated on their six-month follow-up appointment using the HADS. A total of 63 people were randomly selected to participate in the study as the control group and were also required to provide demographic data and complete a HADS questionnaire.

Table 1: Demographic data for patient and control group.

	Patient group	**Control group**
	Value (range or %)	**Value (range or %)**
Group number	61	63
Age	55.26 ± 11.53	51.64±9.41
Male to female ratio	1:3.2	1:1.6
Education levels		
Primary	16 (26.2)	3 (4.8)
Secondary	23 (37.7)	12 (19)
Post-secondary non-tertiary	9 (14.8)	4 (6.3)
Tertiary	11 (18)	20 (31.7)
MSc equivalent	2 (3.3)	15 (23.8)
PhD equivalent	0 (0)	9 (14.3)
Employment status		
Civil servant	5 (8.2%)	28 (44.4%)
Private sector employee	21 (34.4%)	14 (22.2%)
Freelancer	4 (6.6%)	8 (12.7%)
Retired	16 (26.2%)	8 (12.7%)
Unemployed	15 (24.6%)	5 (7.9%)
Marital status		
Single	17 (27.9)	8(12.7)
Married	33 (54.1)	49 (77.8)
Divorced	6 (9.8)	6 (9.5)
Widowed	5 (8.2)	0 (0)
Number of children		
0	14 (23)	12 (19)
1	20 (32.8)	14 (22.2)
2	21 (34.4)	29 (46)
3	5 (8.2)	6 (9.5)
4	1 (1.6)	2 (3.2)

Table 1 presents the sociodemographic data of the patient and the control groups.

Table 2: Anxiety and depression HADS scores for patient and control group.

	Patient group	Control group
	Value (range or %)	Value (range or %)
Anxiety levels		
Mean anxiety score	7.51 ± 4.46 (0 - 20)	6.14 ± 4.44 (0 - 19)
Normal	34 (54.97)	43 (68.2)
Borderline abnormal	19 (30.16)	9 (14.3)
Abnormal	10 (14.87)	11 (17.5)
Depression levels		
Mean depression score	7 ± 4.93 (0 - 19)	5.17 ± 3.97 (0 - 20)
Normal	38 (60.32)	47 (74.6)
Borderline abnormal	13 (20.63)	10 (15.9)
Abnormal	12 (19.05)	6 (9.5)

Table 2 presents the anxiety and depression HADS scores for the patient and control groups. The mean anxiety score (Mann – Whitney test, p=0.039, Z= -2.06) and mean depression score (Mann – Whitney test, p=0.049, *Z*= -1.933) were found to be statistically significantly higher in the patient group compared to the control group.

Higher mean anxiety and mean depression score in the patient group were observed compared to the control group (p=0.039 and p=0.049 respectively).

We also sought to investigate additional factors (age, gender, marital status, number of children, education level and employment status) that might contribute to the increased anxiety and depression levels observed in the patient compared to the control group.

Female gender (p=0.003, Mann-Whitney test, Z= -2.997) and employment (p=0.005, one-way ANOVA test, *F*=4,224) as civil servant or unemployment noted to be associated with higher levels of anxiety compared to other professionals.

The evaluation of the same sociodemographic variables and depression levels revealed that increasing age (p=0.015, Spearmann correlation coefficient=0.309), female gender (p=0.048, t-test, t=-2,016) and the employment status of the patients (p=0.043, one-way ANOVA test) correlated with higher levels of depression and a higher education level (p=0.002, Spearmann correlation index= -0.386) was associated with lower level of depression.

DISCUSSION

The association between intracranial aneurysms and reduction in quality of life has been reported.[8] Diagnosis of intracranial aneurysms is a significant risk factor for the emergence of anxiety and depression symptoms, regardless of a history of subarachnoid hemorrhage, the presence of neurologic deficits or the successful treatment of the aneurysm.[9] Moreover, sociodemographic factors, such as gender and employment status, have been proven to have a significant role in the occurrence of anxiety and depression respectively.

Flow diversion has been proven to be a safe and effective treatment option, for intracranial aneurysms.[1,2,10] However, aneurysmal occlusion after flow diversion is not immediate and usually occurs within six months of treatment.[3-5] Additionally, recent studies evaluating the effectiveness of newer generation of flow diverters, suggest that total occlusion is achieved in up to 85.3% of the patients in the first twelve months, while a small number of patients requires retreatment either endovascularly or microsurgically.[11] Thus, the uncertainty of treatment outcomes may be associated with increased symptoms of anxiety and depression. In a study by Joseph T. King Jr. et al[9], untreated intracranial aneurysms constituted a risk factor for anxiety.

In a large national study by Skapinakis et al, the prevalence of mental disorders was estimated to be 14% in the general population.[12] In our study, significantly higher mean anxiety and depression scores in the patient group as compared to the control can be attributed to: a) patient knowledge of possible aneurysm persistence despite endovascular treatment with flow diversion, b) the need for long-term treatment with antiplatelet drugs after flow diversion and the increased risk for complications or drug adverse effects, c) the need for long-term follow-up post flow-diversion treatment, that involves invasive medical procedures, such as cerebral digital subtraction angiography, which carry a substantial risk of complications.

Additional factors related with high anxiety and depression levels in patients harboring intracranial aneurysms in our study included female gender and unemployment. This is in accordance with the study by Pala et al, that established a clear connection between female gender, employment status, and mental disorders.[10] Additionally, increasing age was correlated with a higher chance for depression in our study, a finding that has been reported by other researchers as well and is mainly attributed to the increased prevalence of risk factors that are connected with increasing age, such as disability, cognitive impairment, perception of health status and chronic diseases.[13] Finally, higher education level was negatively correlated with depression in our study. Low educational level has been proved to be a well-established factor predictive of

higher depression rates and has been attributed to a number of reasons, including a positive correlation between income and education level, health system access inequalities, and higher embeddedness of highly qualified people in cohesive social structures.[14]

STUDY LIMITATIONS

The limitations of this study include: a) The small sample size limits the power of the study and prevented the identification of factors associated with an increased risk of anxiety and depression, b) The inherent weaknesses of the HADS (factor structure, item construction, and the response scales used in its administration, self-assessment nature)[15], c) The absence of a long follow-up period of the patients that underwent endovascular repair of intracranial aneurysms, might have led to an overestimation of the prevalence of anxiety and depression in the population, d) The patients were not assessed prior to endovascular treatment thus the levels of anxiety and depression before and after treatment could not be analysed.

CONCLUSION

Patients with unruptured intracranial aneurysms treated with flow diversion may exhibit higher anxiety and depression levels on average compared to the general population. Several sociodemographic factors seem to contribute in the emergence of these mental disorders. Well-designed studies are necessary to evaluate our results and to identify patients with intracranial aneurysms exhibiting mental disorders that are in need for further psychological and pharmacological support.

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