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ORIGINAL RESEARCH

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Impact of male factor infertility on mental health and sexual function: a comparative study

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Abstract

Background: The psychological and sexual well-being of individuals experiencing infertility, especially when a male factor is involved, can be significantly affected. This research was conducted to assess the levels of anxiety, depression, and sexual functioning in male patients undergoing infertility treatment, taking into consideration the presence or absence of a male factor. **Methods**: From June 2022 to March 2024, 457 infertility clinic patients underwent assessments, including demographic data, physical exams, sperm analyses, hormone checks, and genetic screenings. The patients were classified based on whether a male factor was present or not. One month after being informed of their male factor status, patients completed the Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), International Index of Erectile Function (IIEF), and the Premature Ejaculation Diagnostic Tool (PEDT). **Results**: The distribution of patients was as follows: those with a male factor (n = 171, 37%) and those without (n = 286, 63%). The presence of a male factor was significantly associated with higher BDI and BAI scores ($p = 0.009$ for BDI and $p < 0.001$ for BAI). IIEF scores in the male factor group were significantly lower than those in the other group ($p = 0.013$), while no significant difference was found between the PEDT scores of the two groups ($p = 0.206$). A negative correlation was observed between age and BAI scores ($p = 0.027$, correlation coefficient = −0.104). No significant relationship was found between primary or secondary infertility, the number of failed ART cycles, and BDI or BAI scores. **Conclusions**: The recognition of male infertility as a contributing factor is linked to decreased psychological well-being and sexual performance, emphasizing the significance of providing mental health assistance to such individuals. Integrating mental health support within infertility treatment facilities could enhance the overall welfare and participation in treatment of patients.

Keywords

Male infertility; Mental health; Sexual function

1. Introduction

The definition of infertility is the inability to achieve pregnancy despite sexually active couples not using any contraceptive methods for 12 months. Infertility is believed to impact 8%–12% of couples, and around half of these cases are attributed to male-related issues [1]. Men experiencing infertility concerns often exhibit sperm irregularities, and in about 30%–40% of instances, the root cause remains unidentified, commonly known as idiopathic male infertility. While primary infertility is defined as the inability to achieve a first pregnancy despite attempts, secondary infertility refers to the inability to conceive following at least one previous pregnancy.

Infertility is a stressful process that can lead to negative psychological effects in patients, such as loss of self-confidence, low self-esteem, and even psychiatric disorders [2]. Infertility can lead to adverse psychosocial consequences such as anxiety, depression, fear, guilt, and frustration, with anxiety and depression being the predominant mental health issues often linked to infertility [3–5].

It is known that infertility negatively affects both men and women, and studies in the literature vary on whether men or women suffer more from this condition. In certain cultural settings, particularly those with a patriarchal structure, men might encounter heightened societal expectations, leading to increased psychological stress. Correspondingly, individuals undergoing infertility assessments may also grapple with feelings of anxiety and depression [6]. In societies with high reproductive rates, there's often a strong societal connection between fertility, masculinity, and power. It has been observed that anxiety rates are higher when there is male infertility in such societies [7]. The emotional stress may have a detrimental impact on infertility treatment outcomes, potentially resulting in premature discontinuation of the treatment process [8].

Moreover, infertility can negatively affect the sexual lives of patients [9]. Approximately one out of every six infertile men may experience erectile dysfunction (ED), while approximately one out of every ten may experience premature ejaculation (PE) [10]. The degree of deterioration in semen quality directly correlates with the severity of ED [11].

We hypothesized that men diagnosed with male factor infertility following evaluation at an infertility clinic would have worse mental and sexual health compared to those without male factor infertility. Consequently, we sought to investigate whether mental health and sexual function differ in this patient population based on whether infertility is due to a male factor.

2. Materials and methods

2.1 Study design and population

We prospectively collected data from patients who visited our hospital's assisted reproductive technology (ART) center for infertility treatment between June 2022 and March 2024. We recorded the patients' age, physical examinations, medical histories, comorbidities, surgical histories, medications, spermiograms, hormonal evaluations, genetic examinations, Beck Depression Inventory (BDI) scores [12], Beck Anxiety Inventory (BAI) scores [13], International Index of Erectile Function (IIEF) scores, and Premature Ejaculation Diagnostic Tool (PEDT) scores. All patients who completed the forms were informed about the purpose of the study, and only those who consented to participate were included. Patients who applied to our ART center due to infertility were included in the study if they met the following criteria: no prior diagnosis of psychiatric or neurological disorders or related treatments, mental capacity to complete the forms, and absence of endocrinological pathologies, alcohol or substance addiction, and renal, hepatic, or cardiovascular disease. Using data from previous studies [4], we calculated that to achieve 80% power with a 5% error and a standard effect size of 0.57, at least 49 patients should be included in each group. In our study, 457 male infertile patients who fully completed the forms were included, with each group having at least 49 patients to ensure a reliable sample size.

BDI is a self-reported scale consisting of 21 questions, each scored between 0 and 3, with a total score ranging from 0 to 63. The scores obtained were evaluated as follows: 0–9 indicated no depression, 10–18 indicated mild depression, 19–29 indicated moderate depression, and 30–63 indicated severe depression. Similarly, BAI consists of 21 questions, each scored from 0 to 3, with a total score ranging from 0 to 63. There is no specific cutoff point for the scale. However, according to the scores obtained, patients' anxiety levels are classified as follows: 0–7 points indicate minimal anxiety, 8–15 points indicate mild anxiety, 16–25 points indicate moderate anxiety, and 26–63 points indicate severe anxiety. The questionnaires were distributed after patients received information on the presence or absence of a male factor, with a minimum interval of one month given to avoid potential acute stress responses in the initial month.

In laboratory evaluations, the normal ranges are as follows: total testosterone 2.8–8 ng/mL, follicle-stimulating hormone (FSH) 1.5–12.4 mIU/mL, luteinizing hormone (LH) 1.7–8.6 mIU/mL, prolactin 4.04–15.2 ng/mL, and estradiol 11.3–43.2 pg/mL.

2.2 Statistical analysis

Statistical analysis was conducted using SPSS Statistics version 24 (IBM, Armonk, NY, USA). The results were expressed as median values with the corresponding range (minimum to maximum). The Kolmogorov-Smirnov test was conducted to assess the normality of the data distribution for variables. Categorical variables were compared using Pearson χ^2 test and Fisher's exact test, while differences in quantitative data were analyzed using the Mann-Whitney U test. Pearson's correlation test was used to analyze the correlation between the groups. A one-way analysis of variance (ANOVA) test was used to assess the effect of independent variables with more than one group on the dependent variable. If Levene's test indicated that the variances were not homogeneous, Welch's ANOVA test was used instead. A p-value of less than 0.05 was considered statistically significant.

3. Results

Based on physical examination, laboratory evaluation, and spermiogram results, the patients were divided into two groups: those with a male factor (n = 171, 37%) and those without a male factor (n = 286, 63%). The distribution of patients according to spermiogram results is as follows: normal 62.8%, azoospermia 14.2%, oligospermia 10.5%, asthenospermia 4.2%, teratospermia 1.3%, oligoasthenospermia 3.7%, oligoteratospermia 0.2%, oligoasthenoteratospermia 1.8% and asthenoteratospermia 1.3%. The distribution according to spermiogram results is shown in Fig. 1.

The median age was 33 (range 23–48) in the male factor group and 32 (range 21–59) in the other group (p = 0.212). Median levels of FSH, LH, total testosterone, prolactin, and estradiol in the male factor group were 5.11 (range 0.3–66.8), 6.25 (range 0.3–33.26), 3.97 (range 1.46–153), 9 (range 3.04–30.4) and 29.1 (range 2.15–50), respectively. In the other group, the median levels were 3.44 (range 0.7–56), 5.05 (range 1.4–26.6), 3.86 (range 2.86–7.77), 8.69 (range 3.1–24.1) and 26.55 (range 3.18–149), respectively. A statistically significant relationship was found between the presence or absence of a male factor and FSH ($p < 0.001$), LH ($p < 0.001$), and estradiol (p = 0.021) levels. The median BDI score was 7 (range 0–33) in the male factor group, compared to 5 (range 0–42) in the other group (p = 0.04). The median BAI score was 4 (range 0–32) in the male factor group, compared to 2 (range 0–26) in the other group ($p < 0.001$). Median IIEF scores were 26 (range 0–30) in the male factor group and 28 (range 0–30) in the other group (p = 0.013). Median PEDT scores were 8 (range 0–22) in the male factor group and 8 (range 0–19) in the other group (p = 0.206). Categorization based on BDI and BAI scores, as described earlier, revealed that both were significantly related to the presence of a male factor (p = 0.009 for BDI and $p < 0.001$ for BAI). The demographic, clinical and laboratory assessments, as well as BDI, BAI, IIEF, and PEDT

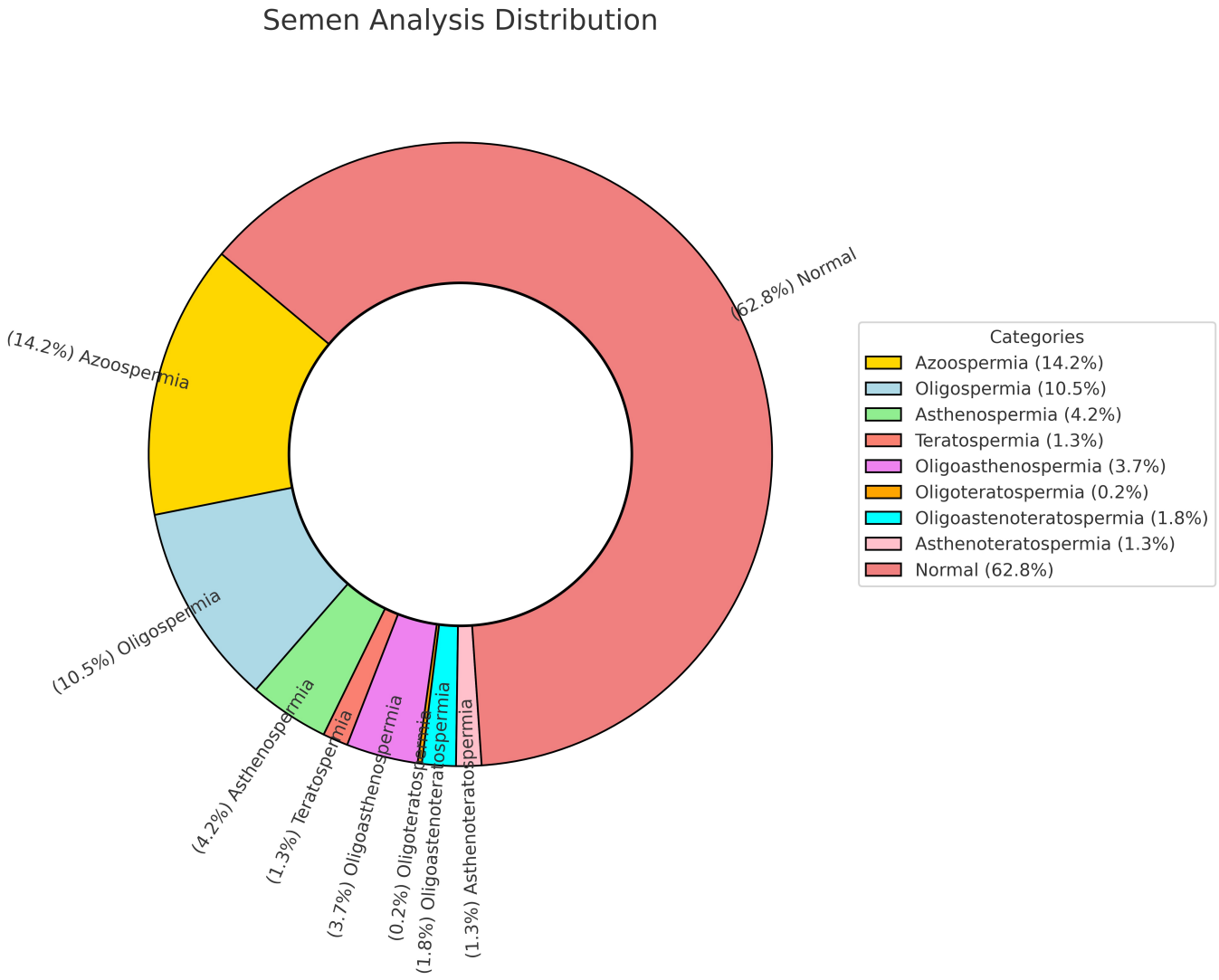

FIGURE 1. Distribution of spermiogram results.

scores of the patients, are shown in Table 1.

Out of the participants, 86 individuals (18.8%) were experiencing secondary infertility, whereas 371 individuals (82.2%) were dealing with primary infertility. There was no notable correlation detected between the nature of infertility (primary or secondary) and the BDI score, BAI score, BDI category or BAI category (Table 2).

An analysis of the correlation between age and BDI and BAI scores revealed a negative correlation between age and the BAI score (p = 0.027, correlation coefficient = −0.104). Additionally, no correlation was found between the number of failed ART cycles and the BAI and BDI scores (Table 3).

While 50 patients (6.1%) had a history of varicocele surgery, a newly diagnosed varicocele was detected in 28 patients (10.9%). Examining the relationship between varicocele status and BDI (p = 0.099) and BAI (p = 0.287) scores revealed no statistically significant relationship (Table 4).

4. Discussion

In our study, we investigated the frequency of anxiety and depression, the most common mental illnesses [14], among male patients who applied to our ART center due to infertility, comparing groups with and without male factor infertility. Furthermore, as the impact of infertility-related stress on couples' sexual well-being is widely recognized, we also examined the sexual health of the male participants [15].

While many studies in the literature primarily assess anxiety in infertile men, few have assessed depression in these men. In these studies, forms that do not exclusively assess depression, such as the Mini International Neuropsychiatric Interview (MINI), Hospital Anxiety and Depression Scale (HADS), and Depression Anxiety Stress Scales (DASS), were generally used. While we found many studies evaluating the depression status of infertile women, we realized that this issue has not been sufficiently examined in men.

It is clear that patients' expectations regarding the success of *in vitro* fertilization (IVF) and the information they receive about their prognosis will influence their levels of anxiety and depression. Most studies require all couples seeking treatment for infertility to complete forms. Nevertheless, the disclosure of success odds and identification of the specific factors contributing to infertility (be it male, female, or a combination of both) can have a profound impact on the psychological well-

TABLE 1. Demographic, clinical, laboratory assessment, beck depression score, beck anxiety score, IIEF score and PEDT score of the patients.

	Male Factor + N = 171	Male Factor − N = 286	*p* value
Age* (yr)	33 (23–48)	32 (21–59)	0.212
FSH* (mIU/mL)	5.11 (0.3–66.8)	3.44 (0.7–56.0)	<0.001
LH* (mIU/mL)	6.25 (0.3–33.26)	5.05 (1.4–26.60)	<0.001
Total testosterone* (ng/mL)	3.975 (1.46–153.00)	3.860 (2.86–7.77)	0.536
PRL* (ng/mL)	9.00 (3.04–30.4)	8.69 (3.10–24.1)	0.538
Estradiol* (pg/mL)	29.10 (2.15–50)	26.55 (3.18–149)	0.021
Beck Depression Score*	7 (0–33)	5 (0–42)	0.040
Beck Anxiety Score*	4 (0–32)	2 (0–26)	<0.001
IIEF*	26 (0–30)	28 (0–30)	0.013
PEDT*	8 (0–22)	8 (0–19)	0.206
Beck Depression Category			
No	110	223	0.009
Mild	38	41	
Moderate	21	18	
Severe	2	4	
Beck Anxiety Category			
Minimal	114	248	<0.001
Mild	39	29	
Moderate	14	7	
Severe	4	2	

**: Median (min–max). Abbreviations: FSH: Follicle Stimulating Hormone, LH: Luteinizing Hormone, PRL: Prolactine, IIEF: International Index of Erectile Function, PEDT: Pemature Ejeculation Diagnostic Tool. Pearson χ^2 test were used for Beck depression category and Beck anxiety category. Mann Whitney U test were used for age, FSH, LH, total testosterone, PRL, estradiol, Beck depression score, Beck anxiety score, IIEF and PEDT.*

being of patients. According to the findings by Devroe *et al*. [16], patients who were apprised of their self-assessed prognosis experienced a decline in their anticipated success rates across the board, with anxiety levels notably escalating among female participants.

It should also be noted that most other studies do not clearly specify when and under what conditions patients fill out these forms. One notable benefit of our research is that we ensured the patients completed the forms at least one month after receiving information about the male factor, thus considering the period of acute stress response.

In our study, 35.67% of patients with male factor infertility had depression, and 33.33% had anxiety. Anh *et al*. [17] found anxiety and depression rates of 33.5% and 10.6%, respectively, in their study using the DASS. The reason for the significant difference in depression rates between the two studies may be due to the different sociocultural backgrounds of the men and the lack of grouping by the cause of infertility. The theory is reinforced by the results of a study conducted by Li *et al*. [18], which demonstrated notable variations in anxiety levels across different ethnicities. Another research utilizing the MINI as an evaluation instrument revealed a 20.5% anxiety prevalence in males, with a corresponding depression rate of 17% [19]. The reason the rates in this study differ from ours may be that all couples seeking infertility treatment, regardless of the cause, filled out the form. However, the cause of infertility and whether it involves a male factor is important.

In our study, we did not find a significant relationship between primary or secondary infertility and depression or anxiety scores. However, when we reviewed similar studies in the literature, according to the study by Öztekin and colleagues, the primary infertility group showed notably elevated BAI and BDI scores [20]. Similarly, Klemetti *et al*. [21] observed that infertile men without children had poorer quality of life scores compared to men who did not face infertility issues. The association between primary or secondary infertility and the psychological symptoms of patients lacks clarity, as suggested by our findings and the limited existing research in the literature.

In the research examining the frequency of depression, anx-

TABLE 2. The relationship between the infertility status (primary or secondary) and Beck Depression Score/Category and Beck Anxiety Score/Category.

	Primary infertility N = 371	Secondary infertility N = 86	*p* value
Beck Depression Category			
No	269	63	0.524
Mild	64	16	
Moderate	34	5	
Severe	4	2	
Beck Anxiety Category			
Minimal	293	68	0.923
Mild	57	12	
Moderate	16	5	
Severe	5	1	
Beck Depression Score*	6 (0–42)	5 (0–35)	0.321
Beck Anxiety Score*	3 (0–32)	2 (0–27)	0.756

**: median (min–max). Pearson χ^2 test were used for Beck depression category and Beck anxiety category. Mann Whitney U test were used for Beck depression score and Beck anxiety score.*

TABLE 3. The relationship between failed ART cycle and Beck Depression Score and Beck Anxiety Score.

	Correlation Coefficient	*p* value	N
Failed ART cycle-Beck Depression Score	−0.014	0.771	457
Failed ART cycle-Beck Anxiety Score	−0.029	0.532	457
Age-Beck Depression Score	−0.070	0.137	457
Age-Beck Anxiety Score	−0.104	0.027	457

Abbreviations: ART: assisted reproductive technology.
Pearson Correlation test were used for Beck depression score and Beck anxiety score.

TABLE 4. Relationship between varicocele status and BDI and BAI scores.

	Beck Anxiety Score (Mean ± standard deviation (SD))	n	*p*
Varicocele status			
Yes	4.40 (±4.11)	50	0.287
No	4.58 (±5.71)	379	
Operated	6.29 (±6.97)	28	
	Beck Depression Score (Mean ± SD)	n	*p*
Varicocele status			
Yes	7.84 (±6.84)	50	0.099
No	7.04 (±6.61)	379	
Operated	10.79 (±9.19)	28	

One way ANOVA test were used for Beck Anxiety Score. Welch's ANOVA test were used for Beck Depression Score.

iety, and associated factors in infertile couples, Zhang *et al.* [22] discovered that the age of males did not show a substantial impact on their anxiety or depression levels. Similarly, another study found that age had no effect on psychological symptoms [23]. In our study, we did not find a correlation between age and depression scores, but we observed a weak negative correlation with anxiety scores. Based on our research results, which are in line with existing studies, we propose that there is no substantial association between age and psychological symptoms.

In the research conducted by Fernandes and colleagues, it was shown that the association between depression and sexual function exhibited greater significance among infertile males in comparison to their fertile counterparts [24]. A separate study indicated a notable rise in IIEF scores among infertile males following the successful achievement of pregnancy, as opposed to their pre-treatment scores [25]. Likewise, our own investigation revealed markedly elevated IIEF scores within the cohort lacking a male factor. Sexual dysfunction in infertile patients, often overlooked in clinical practice, should be evaluated in all patients with male factor infertility. If necessary, it should also be considered as part of their treatment plan.

Although our study offers valuable insights into the mental and sexual health of infertile men, it has some limitations. For instance, the levels of anxiety and depression in couples undergoing *in vitro* fertilization may vary during different phases of the process, including achieving pregnancy or live birth [26]. However, we did not perform reassessments during these specific stages. Despite the availability of various assessment tools for evaluating anxiety and depression, we opted for the BAI and BDI due to the lack of conclusive evidence supporting the superiority of one tool over the other. It is crucial to underscore that these instruments do not yield an official diagnosis of depressive or anxiety disorders, and even normal scores may not necessarily rule out the presence of these conditions. Patients displaying potential symptoms should be directed to a psychiatrist for further assessment. Another limitation is that it remains unclear how many patients with elevated scores were ultimately diagnosed with these conditions. Finally, because our study focused on the male factor, a limitation is that we did not collect data on the status of the female partner.

This study highlights the need for comprehensive mental health assessments in infertility clinics, especially for men diagnosed with a male factor. Subsequent research endeavors may delve into the effects of consistent psychological assistance for individuals undergoing infertility treatment, incorporating targeted approaches aimed at alleviating the heightened levels of anxiety and depression identified within this demographic. Furthermore, monitoring mental well-being indicators throughout different phases of treatment, such as pre- and post- ART procedures, embryo transfer stages, and post-pregnancy outcomes, whether successful or not, could offer additional perspectives on evolving psychological patterns and requisite support mechanisms. Comparative analyses of diverse screening tools for anxiety and depression within this framework in future studies could ascertain the sensitivity of specific assessment scales to the intricate emotional challenges associated with infertility-related anguish. Finally, including data on female partners and exploring the psychosocial dynamics within couples could offer a more comprehensive picture of the interplay between male and female factors in infertility-related mental health.

5. Conclusions

The research findings demonstrate that men who receive a diagnosis of male factor infertility tend to exhibit elevated levels of anxiety and depression, alongside a decrease in sexual function, in contrast to those not affected by male factor issues. These results highlight the significance of addressing the mental health and sexual welfare of male individuals undergoing infertility therapies, especially when male factor problems are detected. Acknowledging the emotional ramifications on patients can assist ART specialists in providing timely assistance, thereby enhancing patient fortitude and involvement during the course of treatment. Future studies could further explore interventions tailored to support mental health in men affected by infertility.

AVAILABILITY OF DATA AND MATERIALS

The data cannot be shared due to full compliance with the data protection law of the local administration.

AUTHOR CONTRIBUTIONS

MŞ—designed the research study, performed data analysis and wrote the manuscript. DŞE—performed data analysis and wrote the manuscript. MS—performed data analysis and wrote the manuscript. OC—performed data analysis, wrote the manuscript. HLC—developed the project and edited the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the local ethics committee at University of Health Sciences Basaksehir Cam and Sakura City Hospital (No: KAEK/2022.12.397). All procedures performed in our study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards and this study was designed according to the STROCSS 2021 criteria. The patients provided informed consent and agreed to publication of the details of this research.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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