ORIGINAL RESEARCH

Psychological Status and Influencing Factors Among Pregnant Women Undergoing *In Vitro* Fertilization

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ABSTRACT

Objective • This retrospective study aimed to observe the psychological status and analyze the influencing factors among pregnant women undergoing *in vitro* fertilization (IVF).

Methods • A total of 456 pregnant women who underwent IVF and were admitted to the Second Hospital of Hebei Medical University from June 2021 to January 2022 were included as research subjects. General data of all subjects, including previous miscarriage history, infertility duration, number of IVF treatments, factors contributing to infertility, endometrial thickness, and embryo quality, were collected. Univariate/multivariate logistic regression analysis was performed to identify the risk factors associated with the psychological status of pregnant women undergoing IVF.

Results • In this study, 191 (41.89%) patients were diagnosed with anxiety disorder, and 131 (28.73%) patients were diagnosed with depression. Significant differences were observed between the anxiety group and the non-anxiety group in terms of previous miscarriage history, infertility duration, number of IVF treatments, ovarian factors of infertility, oviduct factors of infertility, uterus factors of infertility, endometrial thickness, and embryo quality (all $P < .05$). Similarly, significant differences were found between the depression group and the non-depression group in terms of previous miscarriage history, infertility duration, number of IVF treatments, ovarian factors of infertility, oviduct factors of infertility, uterus factors of infertility, endometrial thickness, and embryo quality (all $P < .05$). Multivariate logistic regression analysis indicated that the number of IVF treatments was an independent risk factor for both anxiety and depression status (all $P < .05$).

Conclusions • Among pregnant women undergoing IVF, psychological states such as anxiety and depression may be associated with the number of IVF treatments, endometrial thickness, and embryo quality. (*Altern Ther Health Med.* 2023;29(6):393-399).

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INTRODUCTION

Infertility is the inability to conceive for at least one year without contraception and with a normal sexual life.[1] In recent years, there has been a significant increase in the number of infertile patients due to factors such as rapid economic development, changes in lifestyle, environmental pollution, and work and life pressures .[1,2] The prevalence of infertility in developed countries ranges from 3.5% to 16.7%, while in developing countries, it ranges from 6.9% to 9.3%.[2] Infertility is not only a personal issue but also affects family harmony and social stability. In the clinical treatment of infertility, *in vitro* fertilization (IVF) technology is commonly used, which has shown promising results and provided hope to families worldwide.[2,3]

However, during the actual clinical consultation process, it has been observed that pregnant women experience significant psychological pressure due to various factors, including pregnancy-related symptoms such as nausea and

vomiting, their age, physical condition, family background, economic status, and the hospitalization period before childbirth. These factors often contribute to the development of different psychological states, which can profoundly impact both the birthing process and the successful development of the fetus.[3]

Pregnant women, particularly those undergoing IVF-assisted pregnancies, are highly vulnerable to psychological problems such as worry and anxiety. Unfortunately, the psychological issues faced by IVF-assisted pregnant women are often overlooked by their families and are not promptly or appropriately managed. This neglect can lead to a range of adverse perinatal outcomes for both the pregnant women and their offspring. Such outcomes may include poor pregnancy and delivery outcomes and compromised physical, psychological, and cognitive development from infancy to adulthood.[4]

Therefore, early identification and analysis of the factors contributing to psychological disorders in elderly pregnant women, along with targeted interventions, are crucial areas of clinical concern. In line with this objective, this study aims to investigate the psychological status and its influencing factors among pregnant women undergoing IVF through the evaluation conducted by two psychologists.

MATERIALS AND METHODS

Study Design

A retrospective study was conducted at the Reproductive Medicine Center of The Second Hospital of Hebei Medical University from June 2021 to January 2022. The study included a total of 456 pregnant women who underwent IVF. The gestational age of the subjects ranged from 18.39 to 28.83 weeks, with a mean age of 24.38 ± 2.12 weeks.

Study Protocol

During the IVF procedure, the human chorionic gonadotropin (HCG) injection dosage was adjusted based on the patient's follicular condition. When the dominant follicle reached a size of 18-22 mm and had been present for at least 3 months, an intramuscular injection of 4000-10000 U of HCG was administered. Eggs were retrieved 34-36 hours later, and progesterone was administered orally on the same day for luteal support until 10-12 weeks of pregnancy. Additionally, the husband's semen was collected on the day of egg retrieval for *in vitro* fertilization, and embryo transfer was performed after 3 days.[5]

This study protocol adheres to the ethical principles outlined in the World Medical Association Declaration of Helsinki and has received approval from the ethics committee of The Second Hospital of Hebei Medical University. Informed consent was obtained from all participating patients.

Inclusion and Exclusion Criteria

Inclusion criteria. (1) pregnant women who have undergone IVF; (2) individuals who can communicate normally and are mentally sound; (3) couples who have cohabited for more than 1 year, with the male partner having normal semen and other relevant test results, and engaging in regular sexual activity; (4) participants who voluntarily agree to take part in this study and are capable of independently completing the questionnaire.

Exclusion criteria. (1) women with diagnosed mental disorders; (2) individuals with underlying conditions that may interfere with the efficacy of assisted pregnancy techniques; (3) participants with endocrine dysfunction or genital tumors; (4) individuals with confirmed obstructive azoospermia or asthenozoospermia; (5) subjects who withdraw from the study during the course of the research; (6) participants with a history of alcohol or drug abuse.

Data Collection

The following data were collected from all subjects: age, gestational age, body mass index (BMI), history of previous miscarriage, duration of infertility in years, monthly family income, number of IVF treatments, causes and factors contributing to infertility, education levels, endometrial patterns on the day of HCG injection (classified as A, B, or C), endometrial thickness (categorized as < 7 mm, 7-12 mm, or ≥12 mm), number of embryo transfers, embryo quality, and occurrence of gestational complications such as hypertension and diabetes.

Assessment of Endometrial Thickness and Patterns

Endometrial thickness was assessed using a Voluson E8 (GE Healthcare). On the day of HCG injection, endometrial patterns were evaluated based on the methodology described in a previous study.[6] The following patterns were identified: (1) Pattern A: This pattern exhibited a trilinear structure characterized by a central hyperechoic line surrounded by two hypoechoic layers; (2) Pattern B: An intermediate pattern was observed, which displayed the same reflectivity as the surrounding myometrium and a poorly defined central echogenic line; (3) Pattern C: This pattern represented a homogeneous and hyperechoic endometrium.

Morphological Grading of Embryos

The morphological grading of embryos followed the criteria outlined in the previous study.[6] The grading system is as follows: (1) Grade I: Blastomeres were equal in size, exhibited homogenous permeability, and had less than 10% debris; (2) Grade II: Blastomeres varied in size, with 10% fragmented blastomeres. Blastomeres were equally large, with 10%-20% fragments; (3) Grade III: The blastomeres displayed uneven sizes, with 20%-50% fragmentation; (4) Grade IV: Numerous non-nuclear debris was observed, with the debris comprising more than 50% of the embryo. High-quality embryos were defined as Grade I embryos, characterized by blastomeres that were equal in size, homogeneous and transparent, with either no debris or less than 10% debris. Additionally, these embryos had more than 6 cells. Grades I and II were classified as high-quality, while Grades III and IV were considered poor quality.

Assessment of Psychological Status

The assessment of psychological status among the enrolled women took place on the first day after their inclusion in this study. The Edinburgh Postnatal Depression Scale (EPDS),[7] developed by COX, was employed to evaluate depression. This scale is not only suitable for screening postpartum depression but also demonstrates good reliability and validity in screening depression among pregnant women, with an internal consistency of 0.91. The EPDS consists of a total of 10 items, with each item scored on a scale of 0-3 points. The total score ranges from 0 to 30 points. This study utilized a cutoff score of 12/13 points to assess depression in pregnant women.

The Self-Rating Anxiety Scale[8] was employed to assess the subjects' anxiety status. This scale comprises a total of 20 items, with each item rated on a 4-grade scale. The raw score is obtained by summing the scores of the 20 items, and the raw score is then multiplied by 1.25 to obtain the standard score. A standard score of ≥50 has been recommended to identify subjects with anxiety.

Statistical Analysis

The data were analyzed using SPSS 21.0 software (SPSS Inc., Armonk, NY, USA). Measurement data that followed a normal distribution were presented as mean ± standard deviation. The overall data comparison among different groups was performed using the *t* test, while pairwise comparisons between groups and within the group were conducted using the LSD method. Count data were presented as n (%) and analyzed using the χ^2 test. Univariate and multivariate logistic regression analyses were employed to investigate the factors influencing the psychological status of pregnant women undergoing IVF. The results, including odds ratio (OR) and the corresponding 95% confidence interval (CI), were reported. A significance level of $P < .05$ was considered statistically significant.

RESULTS

Baseline Characteristics of Pregnant Women With IVF

The study included 191 (41.89%) patients with anxiety disorder and 131 (28.73%) patients with depression. When patients were divided by anxiety and depression status, there were no significant differences observed in age, gestational age, BMI, monthly family income, causes of infertility, education levels, endometrial patterns on the day of HCG, number of embryo transfers, and gestational complications between the two groups when patients were divided by anxiety and depression status (all $P > .05$), see Table 1.

Table 1. Baseline Characteristics of Pregnant Women with IVF

	Anxiety Status				Depression Status			
Variables	**Presence (n = 191)**	**Absence (n=265)**	**χ^2/t**	***P* value**	**Presence (n = 131)**	**Absence (n = 325)**	**χ^2/t**	***P* value**
Age			3.728	.155			4.085	.129
≤ 35	91 (43.33%)	119 (56.67%)			81 (38.57%)	129 (61.43%)		
36-39	73 (44.79%)	90 (55.21%)			31 (19.01%)	132 (80.98%)		
≥ 40	27 (32.53%)	56 (67.47%)			19 (22.89%)	64 (77.11%)		
Gestational Age (week)	24.21±2.09	24.18±2.03	0.174	.862	24.22±2.13	24.13±2.09	0.511	.609
BMI (kg/m^2)	27.82±4.39	27.79±4.32	0.083	.934	27.76±4.28	27.89±4.32	-0.362	.717
Previous Miscarriage History	147 (57.20%)	44 (17.12%)	117.34	<.001	113 (43.97%)	144 (56.03%)	66.809	<.001
Infertility Duration (Year)			14.7	<.001			103.78	<.001
≤ 3	82 (33.61%)	162 (66.39%)			21 (8.61%)	223 (91.39%)		
> 3	109 (51.42%)	103 (48.58%)			110 (51.89%)	102 (48.11%)		
Monthly Family Income (RMB)			6.415	.107			5.279	.259
< 2000	9 (40.91%)	13 (59.09%)			10 (45.45%)	12 (54.54%)		
(2000, 4000)	52 (48.60%)	55 (51.40%)			41 (38.32%)	65 (60.75%)		
(4000, 6000)	62 (40.52%)	91 (59.48%)			42 (27.45%)	111 (72.55%)		
(6000, 8000)	52 (44.07%)	66 (55.93%)			38 (32.20%)	80 (67.80%)		
≥ 8000	16 (28.57%)	40 (71.43%)			19 (33.93%)	37 (66.07%)		
Times of IVF Treatments			64.398	<.001			7.176	.028
1	114 (32.48%)	237 (67.52%)			97 (27.64%)	254 (72.36%)		
2	35 (60.34%)	23 (39.66%)			13 (22.41%)	45 (77.59%)		
≥ 3	42 (89.36%)	5 (10.64%)			21 (44.68%)	26 (55.32%)		
Causes of Infertility			1.118	.298			1.302	.254
Primary	104 (44.26%)	131 (55.74%)			62 (26.38)	173 (73.62)		
Secondary	84 (309.37%)	134 (60.63%)			69 (31.22)	152 (68.77)		
Factors of Infertility								
Ovary	51 (34.00%)	99 (66.00%)	5.711	.017	30 (20.00%)	120 (80.00%)	8.317	.004
Oviduct	67 (45.27%)	124 (83.78%)	6.257	.012	28 (18.92%)	120 (81.08%)	19.297	.001
Uterus	39 (70.91%)	16 (29.09%)	5.524	.019	41 (74.55%)	14 (25.45%)	22.906	<.001
Unknown Factors	32 (16.75%)	44 (21.8%)	0.002	.966	15 (16.74%)	61 (80.26%)	3.554	.059
Educational Levels			4.338	.227			3.084	.379
Junior High School	21 (32.81%)	43 (67.19%)			18 (28.13%)	46 (71.88%)		
Senior High School	49 (48.51%)	52 (51.49%)			30 (29.70%)	71 (70.30%)		
College	111 (41.11%)	159 (58.89%)			75 (27.78%)	195 (72.22%)		
Undergraduate & Above	10 (47.62%)	11 (52.38%)			8 (38.10%)	13 (61.90%)		

Table 1. (continued)

Variables	Anxiety Status		χ^2/t	*P* value	Depression Status		χ^2/t	*P* value
	Presence (n = 191)	Absence (n=265)			Presence (n = 131)	Absence (n = 325)		
Endometrial Patterns On The Day Of HCG Injection			0.073	.787			0.803	.370
A	156 (42.51%)	221 (57.49%)			102 (27.79%)	265 (72.21%)		
B or C	35 (39.33%)	54 (60.67%)			29 (32.58%)	60 (67.42%)		
Endometrial Thickness (mm)			11.323	.003			17.308	<.001
< 7	34 (32.88%)	71 (67.62%)			41 (39.05%)	64 (60.95%)		
[7, 12)	116 (49.36%)	119 (50.64%)			73 (31.06%)	162 (68.94%)		
≥12	41 (35.34%)	75 (64.66%)			17 (14.66%)	99 (85.34%)		
Number of Embryo Transfers			5.189	.074			5.287	.071
1	10 (37.04%)	17 (48.14%)			13 (48.15%)	14 (51.85%)		
2	144 (45.57%)	172 (54.43%)			87 (27.53%)	229 (72.47%)		
3	38 (33.63%)	75 (66.37%)			13 (11.50%)	14 (12.39		
Embryo Quality (High)	86 (32.09%)	182 (67.91%)	25.629	<.001	64 (23.88%)	204 (76.12%)	7.459	<.001
Gestational Complications			2.686	.101			1.116	.291
Gestational Hypertension	20 (64.52%)	11 (35.48%)			21 (67.74%)	10 (32.26%)		
Gestational Diabetes	17 (44.74%)	21 (55.26%)			21 (55.26%)	17 (44.74%)		

Note: values presented as mean ± standard deviation, or n (%); BMI, body mass index; HCG, human chorionic gonadotropin; IVF, *in vitro* fertilization; χ^2, chi-square test; t: the independent samples *t* test. *P* values less than .05 are considered statistically significant.

Table 2. Univariate Logistic Regression Analysis of Factors Influencing the Anxiety Status of Pregnant Women With IVF

Variables	β	SE	Wdlod χ^2	OR (95% CI)	*P* value
Previous Miscarriage History	1.163	0.409	8.309	2.876 (1.098-4.981)	.003
Infertility Duration	1.387	0.478	7.193	3.091 (1.291-6.561)	.007
Times Of IVF Treatments	1.039	0.429	4.871	2.381 (1.209-3.491)	.018
Ovary Factors of Infertility	0.353	0.239	2.007	1.321 (0.856-2.098)	.163
Oviduct Factors of Infertility	0.832	0.189	1.121	1.238 (0.962-1.932)	.505
Uterus Factors of Infertility	0.462	0.361	1.709	1.608 (0.893-3.009)	.209
Unknown Factors of Infertility	0.693	0.163	18.932	1.673 (1.291-2.453)	<.001
Endometrial Thickness	2.398	1.059	5.421	10.287 (1.372-16.982)	.014
Embryo Quality	1.987	0.593	9.032	7.981 (1.762-13.298)	.004

Note: IVF stands for *in vitro* fertilization; β, regression coefficient; SE, standard error; χ^2, chi-square statistic; OR, odds ratio, and CI represents the confidence interval. *P* values less than .05 are considered statistically significant.

Table 3. Univariate Logistic Regression Analysis of Factors Influencing the Depression Status of Pregnant Women With IVF.

Variables	β	SE	Wdlod χ^2	OR (95% CI)	*P* value
Previous Miscarriage History	1.537	0.491	1.579	4.321 (1.838-10.231)	.001
Infertility Duration	1.428	0.462	1.271	4.081 (1.563-7.321)	<.001
Times Of IVF Treatments	2.046	0.793	6.931	7.008 (1.981-12.298)	.007
Ovary Factors of Infertility	0.193	0.173	1.093	1.303 (0.94-1.384)	.539
Oviduct Factors of Infertility	0.143	1.049	0.021	1.154 (0.142-3.763)	.836
Uterus Factors of Infertility	0.248	0.198	1.931	1.368 (0.939-1.863)	.376
Unknown Factors of Infertility	0.721	0.283	7.592	2.098 (1.232-3.262)	.004
Endometrial Thickness	0.412	0.191	4.683	1.462 (1.033-2.087)	.024
Embryo Quality	0.127	0.043	6.683	1.128 (1.021-1.252)	.013

Note: IVF stands for *in vitro* fertilization; β represents the regression coefficient; SE represents the standard error; χ^2 represents the chi-square statistic; OR represents the odds ratio; and CI represents the confidence interval. *P* values less than 0.05 are considered statistically significant.

However, significant differences were found in previous miscarriage history, infertility duration, times of IVF treatments, ovarian factors of infertility, oviduct factors of infertility, uterus factors of infertility, endometrial thickness, and embryo quality between the anxiety group and the non-anxiety group. Similarly, between the depression group and the non-depression group, significant differences were observed in terms of previous miscarriage history, infertility duration, times of IVF treatments, ovarian factors of infertility, oviduct factors of infertility, uterus factors of infertility, endometrial thickness, and embryo quality (all $P < .05$).

Logistic Regression Analysis of Factors Influencing the Psychological Status of Pregnant Women with *In Vitro* FertilizationTop of Form

In the univariate logistic regression analysis (Table 2 and 3), several risk factors were found to influence the anxiety and depression status of pregnant women undergoing IVF. For the anxiety status, the significant risk factors included previous miscarriage history, infertility duration, times of IVF treatments, unknown factors of infertility, endometrial thickness, and embryo quality (all $P < .05$). Similarly, for the depression status, the significant risk factors were previous miscarriage history, infertility duration, times of IVF treatments, unknown factors of infertility, endometrial thickness, and embryo quality in univariate logistic regression analysis (all $P < .05$).

The multivariate logistic regression analysis included the factors that showed statistical significance in the univariate analysis (Tables 4 and 5). The results revealed that the times of IVF treatments (OR: 4.381, 95% CI: 2.197-8.761, $P < .001$), endometrial thickness (OR: 2.084, 95% CI: 1.209-6.009, $P = .011$), and embryo quality (OR: 2.381, 95% CI: 1.732-3.298, $P < .001$) were independent risk factors influencing the anxiety status of pregnant women undergoing IVF. Furthermore, the times of IVF treatments (OR: 2.108, 95% CI: 1.052-3.981, $P = .029$), endometrial thickness (OR: 2.187, 95% CI: 1.371-4.876, $P = .017$), and embryo quality (OR: 3.198, 95% CI: 1.276-7.098, $P < .001$) were identified as independent risk factors for the depression status of pregnant women undergoing IVF.

Table 4. Multivariate Logistic Regression Analysis of Factors Influencing the Anxiety Status of Pregnant Women With IVF.

Variables	β	SE	Wdlodχ^2	OR (95% CI)	*P* value
Previous Miscarriage History	0.387	1.067	1.069	1.372 (0.706-3.009)	.309
Times Of IVF Treatments	1.519	0.348	17.831	4.381 (2.197-8.761)	<.001
Unknown Factors of Infertility	0.387	0.367	1.073	1.481 (0.681-2.871)	.309
Endometrial Thickness	1.041	0.419	6.087	2.084 (1.209-6.009)	.011
Embryo Quality	0.889	0.179	23.098	2.381 (1.732-3.298)	<.001

Note: OR, odds ratio; CI, confidence interval; IVF, *in vitro* fertilization.

Table 5. Multivariate Logistic Regression Analysis of Factors Influencing the Depression Status of Pregnant Women With IVF

Variables	β	SE	Wdlod χ^2	OR (95% CI)	*P* value
Previous Miscarriage History	0.353	0.109	1.671	1.198 (0.838-1.672)	.208
Times Of IVF Treatments	0.778	0.367	4.423	2.108 (1.052-3.981)	.029
Unknown Factors of Infertility	0.019	1.053	0.000	1.009 (0.121-7.651)	.987
Endometrial Thickness	0.978	0.389	6.876	2.187 (1.371-4.876)	.007
Embryo Quality	1.290	0.376	11.871	3.198 (1.276-7.098)	<.001

Note: OR, odds ratio; CI, confidence interval; IVF, *in vitro* fertilization.

DISCUSSION

A recent survey reported that the prevalence of infertility-related psychological stress exceeded 90%.[15] Furthermore, in the third trimester of pregnancy, women undergoing IVF exhibited higher levels of anxiety symptoms and stress biomarkers compared to women who conceived naturally.[16] Additionally, women undergoing repeated IVF treatments experienced higher levels of emotional distress.[17] A study conducted by Shengjing Hospital of China Medical University indicated that 14.2% of pregnant women undergoing IVF exhibited anxiety symptoms, while 30.8% showed symptoms of depression.[18]

In this study, among the 456 cases, 131 (28.73%) patients were diagnosed with depression, and 191 (41.89%) patients experienced anxiety. The prevalence of depression was higher than that reported in previous studies, which could be attributed to variations in research subjects. Significant differences were observed between the anxiety group and the non-anxiety group, as well as between the depression group and the non-depression group, in terms of previous miscarriage history, infertility duration, times of IVF treatments, ovarian factors of infertility, oviduct factors of infertility, uterus factors of infertility, unknown factors of infertility, endometrial thickness, and embryo quality. These findings suggest a potential relationship between anxiety, depression, and factors such as previous miscarriage history, infertility duration, times of IVF treatments, ovarian factors of infertility, oviduct factors of infertility, uterus factors of infertility, unknown factors of infertility, endometrial thickness, and embryo quality.

There are several reasons for these associations. Firstly, pregnant women with a history of previous miscarriages tend to experience higher levels of depression and anxiety than those without a miscarriage history. The experience of miscarriage can lead to increased stress, anxiety and make women more prone to accidents during subsequent pregnancies. Secondly, women who undergo multiple IVF treatments are more likely to experience higher levels of depression, anxiety, and psychological stress.[19] Thirdly, ovarian factors play a significant role in pregnancy outcomes, including ovarian damage, congenital abnormalities, and premature ovarian failure. The impact of ovarian factors on pregnancy is primarily attributed to the quantity and quality of follicles remaining in the ovary. A reduction in ovarian reserve function is characterized by a decrease in the number and quality of eggs produced by the ovaries. This reduction also affects the endocrine function, which in turn influences the internal environment of pregnancy.[20]

Furthermore, when the ovarian reserve function decreases, obtaining eggs for IVF becomes more challenging, leading to a higher likelihood of depression and anxiety among pregnant women undergoing IVF. Additionally, oviduct abnormalities are a common cause of infertility. Among oviduct-related infertility cases, hydrosalpinx accounts for approximately 10-30% of all oviduct diseases.[21] Hydrosalpinx contains toxic substances, including lymph and microorganisms, which can be detrimental to sperm. The accumulation of fluid in the oviduct can flow into the uterine cavity during embryo transfer, affecting embryo implantation through its mechanical scouring effect.

In addition, oviducts may be characterized by poor openness, blockage, or absence. These factors can impact the pregnancy rate of IVF and contribute to an increased risk of early miscarriage, which, in turn, affects the psychological well-being of women undergoing IVF and may result in anxiety and depression. Additionally, the thickness of the endometrium serves as an indicator of the functional status

of the endometrium. An optimal thickness promotes successful embryo implantation, while a thinner endometrium can reduce the likelihood of pregnancy. Therefore, women undergoing IVF may experience negative psychological effects. Furthermore, it has been observed that there is a correlation between embryo quality and pregnancy outcomes. Kong et al.[22] highlighted the impact of embryo quality on the psychological well-being of women undergoing IVF, potentially leading to anxiety, depression, and other adverse psychological states.

Therefore, embryo quality impacts the psychological well-being of women undergoing IVF. In this study, multivariate logistic regression analysis further revealed that the number of IVF treatments, endometrial thickness, and embryo quality were risk factors influencing depression and anxiety in IVF pregnant women. Considering the negative effects of depression and anxiety on IVF outcomes, a systematic review has shown that cognitive behavioral therapy and related interventions have a significant impact on the pregnancy outcomes of women undergoing IVF treatment.[23] Hence, it is important to pay attention to the psychological status of pregnant women undergoing IVF, analyze the influencing factors, and provide timely and effective intervention measures to improve the pregnancy rate.

Some studies have indicated that the E2/P ratio is more significant than the absolute values of P and E2 in determining the appropriate proportion of endometrial epithelial glycosyl conjugates. Psychological tension or anxiety can activate the hypothalamic-pituitary-adrenal axis (HPA), leading to the release of large amounts of corticotropin-releasing hormone (CRH) from the hypothalamus.[22,23] Additionally, research has shown that hypothalamic CRH secretion promotes the release of hypothalamic opioid peptides, including β-endorphins, which inhibits the pulsatile release rhythm of gonadotropin-releasing hormone (GnRH) and reduces gonadotropin levels, thus disrupting the E2/P ratio. It is speculated that psychological stress may alter the endometrium's internal environment, potentially reducing its receptivity and leading to an incompatible environment for embryo implantation, consequently reducing the embryo's implantation rate. Endometrial thickness serves as an indicator of the functional state of the endometrium, with an appropriate thickness being favorable for successful embryo implantation. Conversely, a thinner endometrium can decrease the pregnancy rate, resulting in negative psychological experiences for pregnant women undergoing IVF.[20-23]

Based on the findings of the present study, several measures should be considered to address the psychological well-being of IVF pregnant women. Firstly, medical staff should initiate timely communication with the family members of IVF pregnant women, particularly their spouses, to emphasize the significance of family support in alleviating the psychological pressure experienced by IVF pregnant women. Encouraging family members to provide normal care and support while fostering an atmosphere of tolerance and understanding can contribute to reducing psychological stress during pregnancy. Furthermore, guiding IVF pregnant women in regulating their emotions and maintaining harmonious family relationships can be beneficial.

Medical staff should also consider the specific circumstances of IVF treatment, including the frequency of treatments, endometrial thickness, and embryo quality, to provide personalized psychological counseling. Informing pregnant women about the importance of adhering to medical advice for regular prenatal examinations, adopting a healthy and balanced lifestyle, and minimizing the risks of pregnancy complications can help alleviate anxiety and stress. Additionally, medical staff should provide meticulous, scientific, and tailored care based on the psychological state of pregnant women undergoing IVF. This includes patiently addressing patients' inquiries, enhancing their understanding of pregnancy and childbirth, and minimizing the overall pressure experienced by pregnant women. By offering support and guidance throughout the pregnancy and childbirth process, medical professionals can assist IVF pregnant women in navigating these stages more effectively. By implementing these measures, healthcare providers can contribute to improving the psychological well-being of IVF pregnant women, thereby enhancing their overall experience and outcomes.

Study Limitations

It is important to acknowledge the limitations of this study. Firstly, the study only included pregnant women undergoing IVF from a single center, which may limit the generalizability of the findings. Future research should consider conducting multicenter studies to include a larger and more diverse sample size, ensuring a broader representation of the population. Secondly, the research duration in this study was relatively short, and the analysis did not include an examination of pregnancy outcomes. It is crucial to analyze and report on pregnancy outcomes in subsequent studies to provide a more comprehensive understanding of the impact of IVF on psychological status. Lastly, it is worth noting that this study employed a retrospective analysis design, which has inherent limitations, such as recall bias and limited control over confounding variables. To strengthen the evidence base, future studies should incorporate prospective designs, allowing for data collection in a systematic and controlled manner. Prospective studies can provide more robust evidence and help to validate the results obtained in this study.

CONCLUSION

In conclusion, this study highlights the association between the psychological state, including anxiety and depression, of pregnant women undergoing IVF and several key factors. The findings indicate that the number of IVF treatments, endometrial thickness, and embryo quality play significant roles in influencing the psychological well-being of these women. The results emphasize the importance of considering the psychological aspects alongside the medical and physiological factors in IVF pregnancies. It is crucial for healthcare professionals to recognize

and address the psychological needs of pregnant women undergoing IVF to ensure comprehensive care and support throughout their journey. Further research is warranted to explore additional factors and mechanisms that contribute to the psychological status of IVF pregnant women. Additionally, interventions and support programs should be developed and implemented to alleviate anxiety and depression and improve the overall well-being of these individuals.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHORS' CONTRIBUTIONS

All authors contributed equally; they read and approved the final manuscript. Fangfang Wan and Aimin Li contributed equally to this paper.

FUNDING

This study was funded by the Hebei Provincial Natural Science Foundation of the Beijing-Tianjin-Hebei Cooperation Project (No. H2019206707).

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