Analysis on the Levels of Hope and Influencing Factors of Infertile Women with First-time and Repeated IVF-ET Cycle

Ying Ni

Department of Nursing, Ruijin Hospital, Shanghai Jiaotong University School of Medicine

Limin Huang

Reproductive Medical Center, Ruijin Hospital, Shanghai Jiaotong University School of Medicine

Chenye Tong

Reproductive Medical Center, Ruijin Hospital, Shanghai Jiaotong University School of Medicine

Wen Qian

Reproductive Medical Center, Ruijin Hospital, Shanghai Jiaotong University School of Medicine

Qiong Fang (✉ ny21085@outlook.com)

Shanghai Jiao Tong University School of Medicine <https://orcid.org/0000-0002-3821-9732>

Research

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Abstract

Purpose: To explore the hope level and influencing factors of infertile women with first-time and repeated in vitro fertilization-embryo transfer (IVF-ET).

Methods: Patients were divided into First (first-time) and Repeat (≥ 2 cycles) groups, then questionnaire survey was conducted. The questionnaire included demographic information, Herth hope index (HHI) scale, Locke-Wallace short marital-adjustment test scale and social support rating scale. Multiple linear regression was used to analyze the associated influencing factors with hope level.

Results: A total of 298 IVF-ET patients were recruited in the study, including 150 (50.3%) in the first cycle and 148(49.7%) in the repeated cycle. The HHI score of the repeated cycle was significantly lower than that of the first cycle (34.4 ± 3.5 vs. 37.5 ± 3.7 , $P < 0.001$). Multiple linear regression analysis indicated that repeated IVF-ET and age was independently negatively correlated with HHI, with a standardized coefficient β of -0.895 and -0.223, both $P < 0.001$. While high education level ($P = 0.002$), high monthly income ($P = 0.020$), high degree of short marital-adjustment test ($P < 0.001$) and social support rating ($P < 0.001$) were independently positively correlated with HHI.

Conclusion: The infertile women with repeated IVF-ET have a low hope level. Maintaining a good marriage adjustment, establishing a good social support and relationship network, may effectively improve their hope level.

Introduction

With changes in the living environment, the accelerating pace of life and delays in marriage and childbearing, the incidence of infertility is rising year by year. According to statistics from the World Health Organization (WHO), approximately 8-12% [1] of couples worldwide have experienced infertility. As consistently demonstrated, infertility has a strong and negative impact in several areas of the individual's life. For instance, impairments in marital relationship [2,3] sexual satisfaction [4,5], psychosocial well-being [6-8] and psychological correlates [9,10] are significantly associated with infertility.

Since the approaches of controlled ovarian stimulation (COS) and the conditions of the embryonic laboratory have improved, in vitro fertilization-embryo transfer (IVF-ET), as the main assisted reproductive therapy for infertile patients, brings hope to many infertile patients. However, due to the long treatment cycle, frequent visits, high costs, various traumatic operations and uncertain results, IVF-ET is a process with hope and disappointment, which brings both physical and psychological pressure to infertile women [11]

Some patients experienced repeated implantation failure, and about 25% had already undergone more than five IVF-ET cycles [12]. Repeated IVF-ET significantly increased the risk of ovarian hyperstimulation syndrome, premature delivery and estrogen dependent tumor. The study also found that anxiety and

stress are present in women throughout the treatment [13]. Meanwhile, the negative emotions caused by repeated IVF-ET failure may further reduce the success rate of pregnancy [14].

Hope is a valuable human response that has received more and more attention in recent years [15,16]. Hope is a kind of multidimensional positive life power, and provides an optimistic expectation of a wonderful outcome and an effective adjustment mechanism that enable individuals to overcome current difficulties [17]. Hope can change the experience of patients with chronic diseases and their lifestyle [18]. Hope has a beneficial effect on individuals' health because it enables people to cope with conflicts, achieve healthy objectives, maintain quality of life, and promote health [19,20]. Rahimipour et al (2015) conducted a clinical trial on the effect of hope therapy on anxiety, depression and stress among 50 patients undergoing HD [21]. They found a significant reduction in mean scores of anxiety, depression and stress in the hope therapy group before and after the intervention, and that changes in mean scores of depression, anxiety and stress were lower in the hope therapy group compared with the placebo group. Hope level is closely related to patients' mental health and emotional state. Therefore, to improve the hope level of infertile women with IVF-ET may contribute to relieve the psychological pressure of patients and improve the success rate of pregnancy. In current literature, exploration of hope and its role among infertile women with IVF-ET has not been yet been undertaken in this respect. This study aimed to use the Hertz hope index (HHI) [22] to evaluate the hope level of infertile women with different IVF-ET cycles and analyze its influencing factors, so as to provide guidance for clinical nurses to clarify the intervention objects, select reasonable intervention measures and improve the hope level of patients.

Methods

Ethics statement

The study protocol was in accordance with the ethical standards and was approved by the Ethics Committee of Shanghai Ruijin Hospital. Written informed consent was obtained from each participant. Information collected from all participants was kept confidential and anonymous.

Data and study design

This study was conducted among outpatient women diagnosed with infertility and treated with IVF-ET cycles from January to June 2019. All participants were recruited at the Center of Reproductive Clinic, Ruijin Hospital, Shanghai Jiaotong University School of Medicine in China. The inclusion criteria were as follows: ☐ women outpatients diagnosed with infertility, and ≥ 1 IVF-ET cycle; ☐ women who signed informed consent after completely comprehending the contents of the study; ☐ women who had basic ability to read, communicate, and complete the questionnaire independently. The exclusion criteria were as follows: ☐ women diagnosed with previous or current mental disorders, cognitive impairment, or inability to understand the content of the questionnaire; ☐ women diagnosed with severe chronic diseases; ☐ women who had the embryo of the previous cycle successfully implanted. The participants were divided

into two groups according to the number of IVF-ET cycles. In the First Group, participants were performed with the first time IVF-ET cycle. In the Repeat Group, each participant was treated 2 times or more IVF-ET cycles. The investigation was conducted at the last follow-up period before the next cycle. After written informed consent was obtained for this study, a self-reported questionnaire was distributed to each eligible participant, and clinical data were collected from their medical records. Questionnaires with any missing data were excluded from statistical analyses. All questionnaires were required to be completed independently by the patients. The questionnaires were collected, and their completeness was checked on the spot. The investigation process was conducted anonymously. The questionnaire elimination criteria were as follows: ① the same answer for each question or ② withdrawal from this research for various reasons. A total of 315 questionnaires were sent out and all of them were received, for a response rate of 100%. Seventeen questionnaires were excluded due to missing answers, the same answers for each question, or deviation from the inclusion criteria. In total, 298 complete responses were received in the present study. The effective rate of the questionnaires was 94.6%.

Measures

Demographic characteristics

The demographic characteristics were collected with a general information questionnaire designed by our panel, which included age, marriage age, residence, occupation, education level, monthly household income, and number of treatment cycles.

Measurement of hope level

This study used the Herth hope index (HHI) scale [22] to measure the hope level. The HHI scale consists of three dimensions: Positive attitude towards reality and future (including item 1, 2, 6 and 11), Take positive action (including item 4, 7, 10 and 12), and keep close relationship with others (including item 3, 5, 8 and 9). All items were scored by Likert 4-level scoring method with 1-4 points respectively represent very opposed, opposed, agreed and very agreed. The total score of the scale is 12-48 points, among which the low, medium and high hope levels are 12-23 points, 24-35 points and 36-48 points respectively. The higher the score, the higher the level of hope of the respondents. The cronbach's value of the reliability of the scale was 0.85 [23].

Measurement of marriage moderation

The Locke Wallace short marital adjustment test (MAT), jointly developed by Locke and Wallace, was used to assess marriage moderation. The MAT scale is designed to objectively and quantitatively assess the individual's adaptability and satisfaction with the relationship between husband and wife [24]. The

scale consists of 15 items, which reflect the adjustment of marriage from 15 aspects. The total score ranged from 2 to 158. The higher the score, the better the marriage adjustment and the higher the quality of marriage. If the score is less than 100, it means that the marriage is maladjusted. If the score is more than 100, it means that the marriage adapts well. The reliability coefficient of the questionnaire is 0.90, and the discriminant ratio is 17.5, which has good reliability and validity.

Measurement of social support

The Chinese version of the Social Support Rating Scale (SSRS), designed by Xiao Shuiyuan, was used to assess social support [25]. The scale has 10 items, including objective support (3 items), subjective support (4 items) and support utilization (3 items). The total score range was 12-66. The higher the score, the more support. The consistency of the total score was 0.92, and the consistency of each item was 0.89-0.94.

Statistical analysis

In this study, statistical analysis was performed with SPSS 23.0 software. The measurement data are presented as the mean $\pm$ standard deviation, and the enumeration data are expressed as the frequency and constituent ratio (%). Student t test was used to compare the two groups. Chi- x^2 test was used to test the rate inspection. Pearson correlation analysis (r) was used to analyse the correlation of continuous variables or rank data. Stepwise analysis was used for multivariate analysis. Retest reliability was tested by consistency κ Value representation. The validity was analysed by principal component analysis, factor analysis and principal component analysis. $P < 0.05$ was considered statistically significant.

Results

Description of the participants

There were 150 patients in First group out of totally 298 participants, while 148 in Repeat group with 53 of two IVF-ET cycles, 51 of three cycles, and 44 of four or more cycles. The age and marriage age of the patients in the Repeat group were 33.0 ± 3.9 years old and 6.7 ± 3.9 years, which were significantly higher than that of the First group with 31.9 ± 4.3 years old and 5.8 ± 3.9 years ($P \leq 0.001$). The results showed that the age of patients with repeated IVF-ET was higher and the marriage age was longer. On the other side, compared with the two groups, there was no significant difference in the education level, permanent residence, occupation and family monthly income between the two groups ($P > 0.05$), see Table 1.

Table 1

Demographic characteristics of infertile women undergoing IVF-ET with different cycles

Variables	Total (n=298)	First Group (n=150)	Repeat Group (n=148)	t/χ ²	P
Age (years)	31.9±4.3	31.0±4.4	33.0±3.9	-4.175	<0.001
Marriage Age (years)	5.8±3.9	4.8±3.7	6.7±3.9	-4.165	<0.001
Educational Level, n (%)					
Junior high school or below	56(18.8)	28(18.7)	28(18.9)	0.003	0.956
Senior high school or above	242(81.2)	122(81.3)	120(81.1)		
Residence, n (%)					
Rural	67(24.2)	36(24.2)	31(24.2)	0.118	0.731
City/town	210(75.8)	113(75.8)	97(75.8)		
Occupation, n (%)					
Physical	60(20.1)	28(18.7)	32(21.6)	0.405	0.525
Mental	238(79.9)	122(81.3)	116(78.4)		
Family monthly income (yuan), n (%)					
≤5000	112(37.6)	55(36.7)	57(38.5)	4.879	0.087
5000-10000	75(25.2)	31(20.7)	44(29.7)		
≥10000	111(37.2)	64(42.6)	47(31.8)		

Reliability and validity of HHI Scale

The reliability and validity of HHI Scale were analyzed before it was used in the participants of this study. Fifty patients were retested after 2 weeks, and the consistency test results indicated a good test-retest reliability with $k=0.805$ ($P<0.05$). The data of patients were analyzed by principal component analysis. The results of suitability test showed that the KMO statistical value was 0.765 ($P=0.01$), which indicated that factor analysis was suitable. The correlation coefficient matrix was rotated with maximum variance to extract the factors with eigenvalue > 1 . The eigenvalues of the three principal components were 2.365, 1.427 and 1.119, respectively. The cumulative variance contribution rate was 69.4%. The factor components produced by statistical analysis are consistent with the theoretical structure.

Hope level, marriage adjustment and social support

The scores of HHI, MAT and SSRS in the Repeat group were 34.4 ± 3.5 , 99.0 ± 24.9 and 35.4 ± 7.2 , which were significantly lower than 37.5 ± 3.7 , 116.3 ± 22.4 and 39.5 ± 5.2 in the First group ($P < 0.001$), see Figure 1. It is indicated that the hope level, marital adjustment and social support of patients with repeated IVF-ET are significantly decreased.

Comparing the scores of the three dimensions of HHI, it also showed that the scores of the Repeat group were significantly lower than those of the First group (see Table 2). According to the score, they were divided into low level, medium level and high level subgroups. Further analysis showed that 67.3% ($n = 101$) of the patients in the First group had high level. However, the high level was only 29.7% ($n = 44$) in the Repeat group ($P < 0.001$). It is indicated that more than half of the patients with first-time IVF-ET are at high hope level, while the proportion of patients with high hope level in the Repeat group is significantly decreased, as shown in Table 2.

Table 2

HHI score in dimension and subgroups of infertile women with IVF-ET

	Total n=298	First Group n=150	Repeat Group n=148	t/ χ^2	P
Herth hope index total score	35.9 $\pm$ 3.9	37.5 $\pm$ 3.7	34.4 $\pm$ 3.5	7.391	0.001
Positive attitude towards reality and future	11.9 $\pm$ 1.4	12.3 $\pm$ 1.4	11.5 $\pm$ 1.4	4.930	0.001
Positive actions taken	11.7 $\pm$ 1.6	12.1 $\pm$ 1.6	11.3 $\pm$ 1.4	4.373	0.001
Keep a close relationship with others	12.3 $\pm$ 1.9	13.1 $\pm$ 1.7	11.5 $\pm$ 1.7	7.761	0.001
Low level n(%)	1 (0.3%)	1 (0.7%)	0 (0.0%)	45.521	0.001*
Medium level n(%)	152 (51.0%)	48 (32.0%)	104 (70.3%)		
High level n(%)	145 (48.7%)	101 (67.3%)	44 (29.7%)		

Note: * P value is the result of likelihood ratio.

Correlation analysis of influencing factors of hope level

The correlation between HHI and demographic characteristics, MAT and SSRS was analyzed. The results showed that HHI was positively correlated with MAT ($r = 0.565$, $P < 0.01$) (see Fig. 2a), SSRs ($r = 0.498$, $P < 0.01$) (see Fig. 2b), monthly income ($r = 0.269$, $P < 0.01$), education level ($r = 0.292$, $P < 0.01$), permanent

residence ($r = 0.189$, $P < 0.01$) and mental work ($r = 0.179$, $P < 0.01$). On the other side, HHI was negatively correlated with age ($r = -0.204$, $P < 0.01$), marriage age ($r = -0.126$, $P = 0.029$) and repeated IVF-ET ($r = -0.480$, $P < 0.01$). It was indicated that the hope level of elderly pregnant women, patients with long marriage age and repeated IVF-ET treatment is low.

Multiple linear regression analysis on the influencing factors of hope level

HHI was used as the dependent variable, and the variables with statistical significance in univariate analysis were included in the multiple linear regression model (Stepwise regression). As shown in Table 3, the results showed that repeated IVF-ET ($\beta = -0.859$, $P < 0.001$) and age ($\beta = -0.223$, $P < 0.001$) were negatively correlated with hope level. However, education level, monthly income, marriage age, MAT and SSRS scores were positively correlated with HHI. It is indicated that repeated IVF-ET and age are independent factors of HHI down-regulation.

Table 3

Multivariate Linear Regression Analysis of Influencing Factors of HHI of infertile women with IVF-ET

Variables	Non standardized coefficient B	Standard error	Standardized coefficient β	t	P	95% confidence interval
constant	30.288	2.066	-	14.664	0.001	26.223~34.353
Repeated IVF-ET	-0.859	0.141	-0.291	-6.095	0.001	-1.136~ -0.581
MAT	0.045	0.009	0.288	5.266	0.001	0.028~ 0.062
SSRS	0.117	0.031	0.198	3.802	0.001	0.057~ 0.178
age	-0.223	0.059	-0.242	-3.779	0.001	-0.339~ -0.107
Marriage age	0.275	0.064	0.274	4.306	0.001	0.150~0.401
Monthly income	0.516	0.220	0.114	2.349	0.020	0.084~0.949
education level	1.474	0.478	0.147	3.081	0.002	0.532~2.416

Note: $R^2=0.487$ adjusted $R^2=0.475$ $P<0.05$ Note: $R^2=0.487$ adjusted $R^2=0.475$ $P<0.05$

Discussion

Hope is an individual's confidence and expectation to solve problems when facing difficulties. Patients with high hope level can actively seek help and solve problems. Hope is believed to be the psychological force to guide patients to deal with diseases more actively [26]. At present, the psychological research on infertile women with IVF-ET mainly focuses on anxiety, depression and stress. However, to the best of our knowledge, there is little research focused on their hope level. Therefore, this study conducted a cross-sectional study on the hope level and its influencing factors of infertile women undergoing IVF-ET. This study found that the HHI score of patients with repeated IVF-ET cycles was significantly lower than that of the ones with the first-time treatment (32.0 ± 3.3 vs 36.0 ± 3.1 , $P < 0.001$). The scores of positive attitudes towards reality and future, positive action taken and close relationship with others all decreased remarkably. In the Repeat Group, the proportion of high level subgroup was only 11%, which was significantly lower than 58.5% in the First Group. Multivariate analysis showed that Repeated IVF-ET cycles was the only independent negative correlation factor of hope level. High monthly income, living in the city, high marital adjustment and social support score were the independent positive correlation factors of hope level. The score of hope level by this research is lower than that obtained by TANG Nan et al. [26]. The reason may be that more infertile women with repeated IVF-ET cycles are included in this study. Among them, patients with more than 4 cycles accounted for 12.7%, and the score of these patients was significantly lower than that of the first-time group. We can find that the infertile women with repeated IVF-ET cycles are the main objects of nursing intervention. And maintaining good marital adjustment, establishing good social support and relationship network may be effective ways to improve the hope level of infertile women with IVF-ET.

In our previous study [27], we found that the psychological pressure of infertile women undergoing IVF-ET mainly comes from the worry about age and pregnancy success rate, family society and surrounding environment. Therefore, this time we not only evaluated the level of hope, but also conducted a targeted questionnaire survey on marriage adjustment and social support. Some studies have found that hope is positively correlated with happiness, persistence, health, social support, improvement of mental pressure and other factors [28]. Hope is an important factor in helping patients to cure when they feel stressed. This study also found that patients with first-time IVF-ET had a better level of hope. Because these patients had experienced a perfect early diagnosis and treatment, and had a clear treatment plan. They often had more confidence and had great expectations for the success rate. However, once the first cycle fails, the psychological pressure of patients will increase significantly, which leading to a significant decline in the level of hope.

The study from Israel found that although the overall success rate of IVF-ET reached 54%, about 25% of the patients went through more than five treatment cycles, and 12% of the patients went through more than seven cycles [12]. Most studies indicated that repeat of IVF-ET cycles for more than three times may lead to decreased ovarian reserve function and significantly increased risk of women reaching menopausal transition or menopause ahead of time. Repeated IVF-ET failure is easy to cause anxiety, depression and other adverse psychological problems [29]. This study also found that repeated IVF-ET

cycles was an independent negative correlation factor for the decline of hope level. Therefore, in nursing care, patients need to have an objective understanding of the outcome of repeated IVF-ET cycles. The nursing staff need to make appropriate guidance and suggestions, provide more disease-related knowledge, avoid patients with unrealistic expectations of treatment. Based on the three dimensions of hope level, there is one factor of "keeping close with others" besides other personal factors. It is easy to find the status of social and marital support of patients with the help of HHI scale. It is also recommended that reproductive clinics can guide patients to get more support from spouse, friends, family and so on.

This study also found that the age of patients in Repeat Group was significantly higher than that of the First Group. It showed that elderly patients may experience more IVF-ET cycles to obtain clinical pregnancy. The success rate of elderly pregnant women with the first-time IVF-ET is low due to the decrease of endometrial receptivity, immune dysfunction, embryo defects and other factors [30]. Clinical studies have found that with the decline of FSH level and the number of high-quality embryos, the age of more than 43 years is an important factor for the significant decline of clinical pregnancy rate and live birth rate of infertile women after IVF-ET treatment [31]. Long marriage age is also an obvious characteristic of the Repeat Group. Women with shorter marriage years have a closer relationship with their husbands and will get more support from their husbands. The long-term married couples will face more psychological pressure with repeated failure in the long-term treatment. Li et al. [32] found that in 260 pairs of infertile couples treated with IVF-ET, the incidence of psychological problems such as anxiety and depression was significantly higher than that of normal fertile couples. The infertile women with repeated IVF-ET cycles often bear the dual pressure of family and society, and have varying degrees of psychological problems. Also in our previous study, we found that the anxiety and depression of patients with repeated implantation failure significantly affected their fertility quality of life [33]. In the process of treatment, negative emotions often affect the outcome of pregnancy. Appropriate psychological caring can help to relieve anxiety, tension and other emotions, so as to improve the success rate of IVF-ET treatment [34]. Therefore, for the older and longer married couples, we need to inform them of the adverse side effects of repeated IVF-ET treatments and carry out more psychological nursing. Nursing staff can act as the mediator of patients' marriage, encourage husbands to listen more and care more about patients' state, relieve patients' anxiety and tension, so as to improve patients' hope level. Some studies have also found that shared decision-making intervention can improve the psychological state of patients undergoing IVF-ET, improve their hope level and treatment compliance, and significantly improve the pregnancy rate [35]. Helping patients to establish a sense of gratitude is helpful to alleviate the anxiety of patients in the process of IVF-ET [36]. This study is only a cross-sectional analysis, we need to try more intervention in the future.

Limitations

HHI scale has good reliability and validity [23]. In China, HHI is more commonly used to evaluate the hope level of cancer patients [37]. A systematic analysis of hope score found that in 68 studies, Snyder Hope Scale (46%) was the most commonly used, followed by HHI [38]. Further study using more scales, such

as Beck Scale [39], is helpful to evaluate the level of hope more richly. And Zhou FJ [40] measured salivary amylase level to reflect the stress state of patients. Through objective comparison, it is speculated that high pressure level is also related to IVF-ET failure. Therefore, it is deserved to add some objective indicators to verify in the future.

Conclusion

In a word, the infertile women with repeated IVF-ET have a low hope level. Maintaining a good marriage adjustment, establishing a good social support and relationship network, may effectively improve their hope level. As medical practitioners, we should take the initiative to take a variety of targeted nursing intervention to better enhance the hope level of infertile women with IVF-ET. Especially for those with repeated IVF-ET cycles or low HHI score, we can better improve their hope level and the success rate of assisted pregnancy by guiding them and their families, actively seeking more social support and getting more attention from their spouses.

Declarations

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contribution

NY made the contributions on study design, data collection, analysis, interpretation, and wrote the paper, and HLM contributed equally to this article as the co-author. FQ provided guidance in the study design, and is the corresponding author. TCY made contributions on investigation execution and data analysis. QW assisted with the data interpretation. All authors have read and approved the final version of the manuscript.

Ethics approval and consent to participate

All patients provided their informed written consent. The study was approved by the Ethics Committee of Shanghai Ruijin Hospital and was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Nursing Department of Ruijin Hospital Affiliated to Shanghai Jiaotong University School of Medicine, 197 Ruijin 2nd Road, Shanghai 200025, China. ²Reproductive Medical Center of Ruijin Hospital Affiliated to Shanghai Jiaotong University School of Medicine, 197 Ruijin 2nd Road, Shanghai 200025, China

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Figures

Figure 1

Frame chart of the difference between the two groups in Herth hope index (A), simple measurement of marriage adjustment (B), and social support assessment (C)

Figure 2

Correlation analysis between HHI and MAT & SSRS