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Research Article

Factors Affect the Prognosis in Women Undergone *In vitro* Fertilization

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Abstract

We conducted a systematic evaluation of the possible criteria that are frequently collected in routine practice as part of traditional patient care in order to identify which characteristics should be included in an IVF prediction model and which factors can be utilized to predict pregnancy after IVF. The PRISMA guideline was followed in the conduct of this investigation. Eligible articles evaluated the association between one or more of the predictive factors and pregnancy after IVF or ICSI treatment in an unselected patient group. From 2008 to 2024, literature searches were conducted in the electronic databases MEDLINE, Google Scholar, and EMBASE using both free-text keywords and database-specific index terms. We discovered that a successful birth following IVF in infertile women is significantly influenced by the number of embryos, number of injected oocytes, female age, cause for infertility, and PCOS.

Keywords: *In vitro* Fertilization; Intra-cytoplasmic Sperm Injection; Prediction; Success

Abbreviation

FSH: Follicle Stimulating Hormone; IVF: *In vitro* Fertilization; ICSI: Intracytoplasmic Sperm Injection; ART: Assisted Reproductive Technology; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PCOS: Polycystic Ovary Syndrome

Introduction

Doctors started giving women gonadotropin injections in the 1980s to encourage the production of oocytes from several ovarian follicles. The most healthy-looking embryos were then put in the woman's uterus after these oocytes were fertilized *in vitro*. With the introduction of controlled ovarian stimulation, average oocyte yields increased to 2.1 to 2.6 and average pregnancy rates increased to 23% and 30% each cycle in 1982 and 1983, respectively [1]. IVF was used to treat infertility in women with bilateral tubal obstruction [2]. IVF was initiated for couples with male infertility, endometriosis, cervical factor, failed ovulation induction, infertility that could not be diagnosed, or unilateral tubal disease [3]. These women have a possibility of conceiving naturally, but they are not totally infertile like women with bilateral tubal blockage. The likelihood of becoming pregnant following IVF should be weighed against the likelihood of getting pregnant naturally in order to avoid overtreating these ladies.

According to several cohort studies, a variety of variables, including the diagnosis following the fertility workup, the number of prior unsuccessful IVF efforts, and a prior pregnancy, both with and without IVF, may be predictive of success following IVF [4]. If they are reasonably priced, all pertinent predictive parameters should be included in a good prediction model for IVF success. Regretfully, the potential predictors of IVF success that these research found differed from one study to the next, and not all of them reached the same findings.

In order to determine which factors should be included in an IVF prediction model and which factors can be used to predict pregnancy after IVF, we conducted a systematic review of the following factors: female age, basal FSH, parity, duration of subfertility, number of oocytes retrieved, indication for subfertility, number of embryos transferred, embryo quality, and fertilization method. Since these potential criteria are often gathered in everyday practice as part of conventional patient care, they were selected.

Method

This study was conducted according to The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement [5]. Articles that assessed the relationship between pregnancy following IVF or ICSI therapy in an unselected patient population and one or more of the predictive criteria were eligible. Articles were chosen if the intended audience consisted of subfertile women undergoing IVF and ICSI techniques.

Literature searches were performed using both free-text keywords and database-specific index terms in the electronic databases MEDLINE, Google Scholar, and EMBASE from 2008 to 2024. There were no restrictions on language or anything else. As additional, pertinent citations were found, search phrases were added as part of an iterative process to improve the search approach.

Using the following methodology, we looked for all prognostic research on IVF or ICSI. Pregnancy or pregnancy result phrases were paired with a general search for ICSI/IVF. A broad search filter for prognostic methods and a filter for predicting variables were then added to this search. We do a separate search for three distinct parameters without the aforementioned restrictions to see if this search turned up all relevant articles.

An article was considered if it discussed relationships between predictive factors and post-IVF pregnancy, if the study group included infertile women undergoing a new autologous IVF cycle, and if a down-regulated stimulation protocol had been employed. Two researchers went through the abstracts of every article found by the search and chose all of the ones that could be relevant. Every chosen article's reference list was thoroughly examined to find more potentially relevant research.

Extracted data include; research characteristics (i.e., research design, prospective or retrospective, inclusion and exclusion criteria), predictors, outcome measures and their precise definitions, and whether missing data were reported or imputed.

Results

This systematic review included 5 articles (Figure 1), 4 retrospective and one prospective cohorts (Table 1). Ebbesen., *et al*. found that pregnant women reported less unpleasant life experiences before IVF that were not connected to fertility than non-fer-

tility-related events. After adjusting for age, the total number of life events, perceived stress during the previous month, depressive symptoms, and pertinent medical factors related to the patient or treatment procedure, such as the length of infertility, the number of oocytes retrieved, and the etiology of infertility, logistic regression analyses showed that the number of negative life events was still a significant predictor of pregnancy. According to mediation studies, the quantity of oocytes extracted during oocyte retrieval somewhat mediated the relationship between adverse life events and IVF pregnancy [6].

More than 80% of deliveries were successful in the Amini., *et al*. trial [7]. Random forest performed the best in terms of overall accuracy of findings. In terms of the significance of variables, the most significant predictors of a successful birth were the number of injected oocytes, the total number of embryos, the female age, polycystic ovarian syndrome (PCOS) and the reason of infertility.

Hierarchical, sequential logistic regression was used in the Gourounti., *et al*. [8] study to evaluate the relationship between infertility-related stress, anxiety, and depressive symptoms and the result of *in vitro* fertilization, while accounting for the influence of pertinent biological variables. Twenty-six percent of the ladies had a successful pregnancy after the embryo transplantation. After adjusting for biological variables such as age, the number of oocytes recovered, and the number of embryos transplanted, logistic regression studies showed that stress related to infertility and anxiety in general were adversely correlated with a successful IVF pregnancy result. After adjusting for biological factors, psychological stress was found to have a negative correlation with the result of *in vitro* fertilization.

An additional 10 years of age lowers the odds of a live birth, a 5 International unit per liter increase in FSH lowers the probability of a live birth, and women over or equal to 39 years old have a further lower chance of a live birth, according to a model used to predict the probability of a live birth by Sabatini., *et al*. [9].

Women between the ages of 22 and 36 had the highest success rate in Wang., *et al*. research [10], with an overall live delivery rate per begun cycle of 20%. The live birth rate was greater for male factor-only infertility than for female factor-only infertility (19%). A decrease in the success rate was linked to a woman's age. Each extra year of age was linked to an 11% decrease in the likelihood of becoming pregnant and a 13% decrease in the likelihood of a live birth for women above or equal to 30. Fifteen percent more live births would have been anticipated if women 35 years of age or older had received their first autologous fresh therapy a year sooner.

Table 1: Study design, aim, inclusion criteria and sample size of the included studies.

Citation	Study design	Study aim	Inclusion criteria	Sample size
Ebbesen., *et al*. [6]	Prospective cohort study	The purpose of the study was to investigate the relationship between IVF results and adverse, or stressful, life events that occurred within the preceding 12 months.	First IVF cycle; and no previous IVF attempts	837
Sabatini., *et al*. [9]	Retrospective cohort	The results of women's first IVF treatment cycle were examined in this study. To forecast, using age and baseline serum FSH levels, the chance of having a live birth.	Cycle in previous 6 months was regular	1589
Wang., *et al*. [10]	Retrospective cohort	This research provides the success rates in one-year increments for women receiving their first fresh ART treatment using their own oocytes.	Age more than 18 year and first ICSI or IVF cycle	36412
Amini., *et al*. [7]	Retrospective cohort	Study used a variety of categorization techniques to group successful IVF births based on the traits of the couples and the information that is currently available on oocytes, sperm, and embryos.	Only women whose clinical pregnancy was verified by intrauterine gestational sac observation were included by the authors.	6071
Gourounti., *et al*. [8]	Retrospective cohort	To investigate the relationship between stress, anxiety, and depression symptoms associated with infertility and the results of IVF, using multivariate statistical approaches to account for the influence of significant biological factors.	Women did not undergo third-party reproduction methods, and they did not have a history of mental illness or other underlying medical conditions.	160

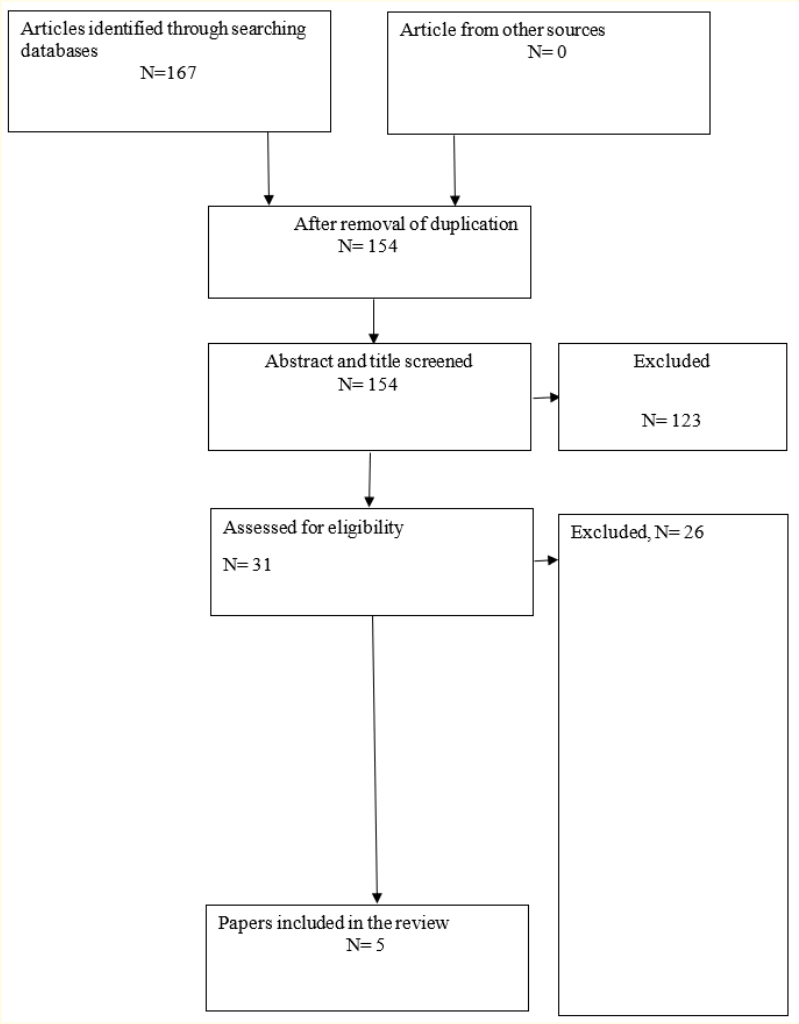

Figure 1: PRISMA consort chart of studies selection.

Discussion

Predicting the likelihood of pregnancy following IVF cycle can assist balance the likelihood of getting pregnant naturally vs the likelihood of getting pregnant after IVF, as well as prevent over-treatment. There is disagreement about which indicators are clinically most significant and on what criteria one should make the choice to begin treatment or not, despite the fact that several research have examined possible predictors of pregnancy chances following IVF. We assessed potential predictive parameters that may aid in forecasting the likelihood of pregnancy following IVF in this systematic review. Based on the information at hand, we deduce that the number of oocytes, baseline FSH, female age, and length of subfertility all predict the effectiveness of IVF.

According to the findings of the Amini., *et al*. (2021) study [7], a successful live delivery was correlated with the total number of embryos produced in each cycle. This result corroborated those published by Bartmann., *et al*. [11], who employed an artificial intelligence system to determine the likelihood of pregnancy by analyzing the clinical and laboratory data of the patients. They demonstrated that the best discriminant variable for predicting pregnancy was the number of embryos collected; the artificial intelligence system created in their study indicated that women who had more embryos were more likely to get pregnant. According to a publication, the total number of embryos may serve as a surrogate indicator for hormones that influence uterine receptivity [12].

According to Gourounti., *et al*. findings [8], younger women had a higher chance of becoming pregnant than older women, as did those whose oocytes were recovered in greater quantities. Large prospective studies have found these characteristics to be significant [4]. Pregnancy result was unrelated to any of the other biological variables examined, including the reason and duration of infertility and prior IVF efforts. While some earlier research [13,14] found that these biological characteristics were significant predictors of IVF outcome, several earlier investigations [13,15] revealed results that were comparable to those of Gourounti., *et al*. [8].

Reduced ovarian reserve, or the drop in both the amount and quality of oocytes, is the biological reason for the decreasing odds of conception with increasing female age. This is clinically significant in women starting in their mid-30s [16]. Reduced ovarian reserve reduces the likelihood of a successful pregnancy and typically results in a poor response to gonadotrophin treatment [17].

Age also affects the other variables that we discovered to be linked to the likelihood of getting pregnant: FSH, the length of infertility, and the quantity of oocytes. Because FSH increases with age [18] and the quantity of oocytes decreases with age [19], an older woman is likely to experience subfertility for a longer period of time.

Our study has limitations due to the retrospective nature to most of the included studies. Low and moderate risk of bias due to confounding was observed in two and 3 studies respectively. Bias in selection of participants was low in all of the included studies. Bias due to missing data was low in 4 of the studies and moderate in one study. Bias in measurement of the outcomes low in 3 studies and moderate in two studies, and bias in selection of the reported results was moderate in all of the included studies.

Conclusion

The number of embryos, number of injected oocytes, reason of infertility, female age, and PCOS all have a significant impact on a successful birth after IVF in infertile women. Counseling treatments should be included in fertility treatment regimens in order to potentially lessen the negative impacts of stress. Numerous life events that are thought to negatively affect quality of life may be signs of chronic stress, and stress may lower the likelihood of a successful outcome after IVF, potentially through psychobiological mechanisms that impact medical end-points like the outcome of oocyte retrieval.

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