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ORIGINAL RESEARCH

Endometrial Compaction Following Progesterone Supplementation in IVF Cycles: A comprehensive analysis

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ABSTRACT

Background: Embryo implantation is a complex and poorly understood process. The study was conducted to evaluate the effect of progesterone supplementation on endometrial compaction during an in vitro fertilization (IVF) cycle and its potential implications on embryo implantation and overall IVF outcomes. **Material & methods:** The present multi centric and retrospective study was carried out at Ashoka IVF care Bhopal and Raipur over a period of 5 year. All the patients coming for ivf who fulfilled inclusion criteria were included in the study. When the endometrial thickness reached ≥7 mm, usually around 10-12 days post estrogen the patient's commenced injections of progesterone.Embryos were thawed and transferred on day 6 of progesterone. Data was recorded.Statistical Analysis was performed using SPSS version 23. **Results:** The baseline characteristics were compared and there was no statistical significance.There was no statistically significant difference between the two groups with regard to the type of fertility (p value = 0.377). The comparison showed statistically significant association between endometrial compaction status and pregnancy results (p value >0.005) in all three groups i.e. Endometrial Compaction, EndometrialThickness increased, Endometrial thickness unchanged. The comparison showed no statistically significant association between endometrial compaction status and pregnancy results in compaction group. **Conclusion:** EC may hold promise for the future as a non-invasive predictor of positive pregnancy outcomes. A large and well-designed clinical trial to rigorously assess endometrial compaction as a non-invasive predictor of a successful pregnancy is warranted.

Keywords: Endometrial compaction, pregnancy, progesterone.

INTRODUCTION

Endometrial thickness and clinical pregnancy have been the subject of ongoing controversy for many years.[1,2]Embryo implantation is a complex and poorly understood process, in which critical cross-talk must be established between the developing embryo and the receptive endometrial surface.[3] Various hypotheses have been put forward about the conditions necessary for a receptive endometrium, among which is endometrial thickness. In that line, ultrasound monitoring of the endometrial cycle is currently the most widely used method to pinpoint the ideal moment for embryo transfer in the so-called "implantation window".[4] Since the advent of vitrification, frozen embryo transfer (FET) cycles have steadily increased worldwide.[5,6] With more frozen embryos available for future use, there has been a rise in the cumulative live birth rate per oocyte retrieval cycle.[5,7]Monitoring during FET cycles involves repeated ultrasound (US) examinations to assess the endometrium and the development of leading follicles and, if needed, blood tests for hormone levels. Combining this information during follow-up helps clinicians determine the timing of embryo transfer.[8] The endometrium is a complex tissue composed of multiple cell types that undergoes hormone-influenced dynamic remodeling to establish a microenvironment to support the implanting embryo.[9] It is known that the condition of endometrium is changeable in natural menstrual cycle, and also in IVF treatment. One of the typical change is that endometrial pattern will be changed from pattern A (triple-line pattern)/pattern B (intermediate isoechogenic pattern) to pattern C (homogenous, hyperechogenic pattern) after hCG or progesterone administration during IVF cycle,[10,11] but little is

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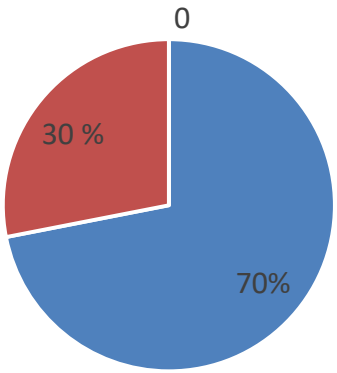
known about the endometrial thickness change after hCG or progesterone administration. In the morning of embryo transfer, endometrial pattern and thickness of all patients are routinely re-evaluated. The present study was conducted to evaluate the effect of progesterone supplementation on endometrial compaction during an in vitro fertilization (IVF) cycle and its potential implications on embryo implantation and overall IVF outcomes.

MATERIAL & METHODS

The present multi centric and retrospective study was carried out at Ashoka IVF care Bhopal and Raipur over a period of 5 year i.e. January 2020 – December 2024. Before the commencement of the study ethical clearance was taken from the institutional ethics committee.All the patients coming for ivf whofulfilled inclusion criteria were included in the study. Female patients aged 26–32 years, who underwent frozen embryo transfer (FET) cycles, received progesterone supplementation were included in the study. Female with h/o any medical disorder, factors affecting endometrial lining if present were excluded from the study.When the endometrial thickness reached ≥7 mm,usally around 10-12 days post estrogen the patients commenced injections of progesterone in (50 mg intramuscular daily).Embryos were thawed and transferred on day 6 of progesterone. On the day of embryo transfer under ultrasound guidance, routine measurementof the endometrial thickness and images of the endometrium were recorded.Parameters were reviewed:Detailed clinical patient profiles, Endometrial Imaging was obtained via transvaginal ultrasound (TVUS) and performed before and after progesterone administration, Endometrial thickness changes, Degree of compaction:No compaction, Mild compaction, Moderate compaction and Severe compaction.Primary Outcome was relationship between endometrial compaction and pregnancy outcomes.Statistical Analysis was performed using SPSS version 23. Chi-square test was used to assess categorical associations and p value for statistically significant correlation.

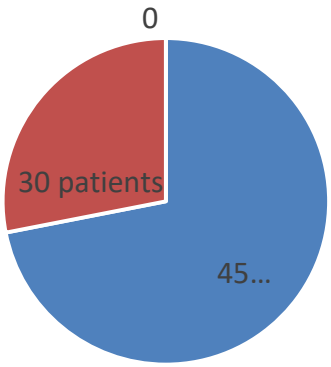
RESULTS

Pie chart 1: Total patients with and without compaction



Among the 250 women, endometrial compaction was noted in 175 (70%) women and the remaining 75(30%) exhibited either no change or increase in endometrial thickness.

Pie chart 2: Group with no compaction (n=75)



Among the 75 women, endometrial compaction was not noted in 45 women and the remaining 30 participants exhibited either no change or increase in endometrial thickness.

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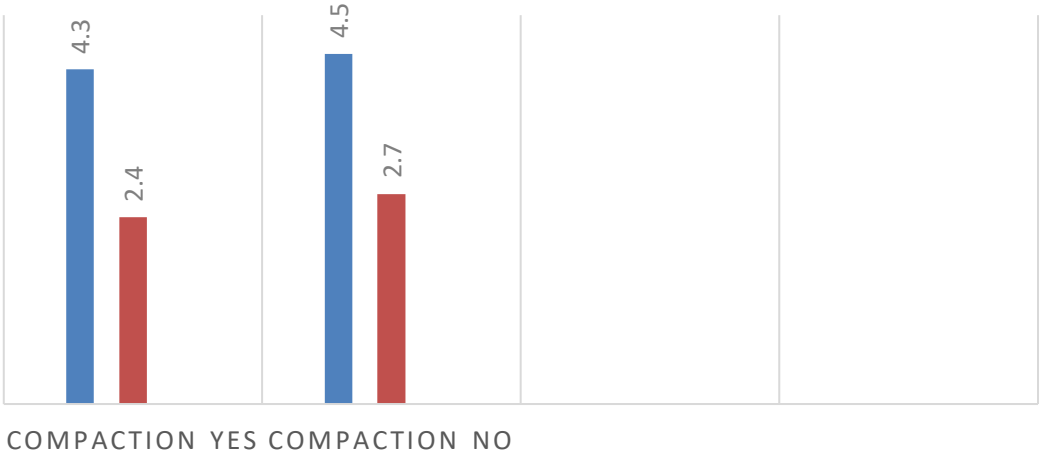
Table 1: Baseline characteristics and endometrial compaction (MEAN±SD)

PARAMETRS	YES(175)	NO(75)	PVALUE
Age	25±2.84	29±3	0.617
BMI	24.6±2.69	25.3±2.81	0.317
AMH	3.17±2.34	6.79±3.98	0.292
Duration of infertility	8.97±4.47	2.84±2.41	0.567

The baseline characteristics like age, BMI, duration of infertility, AMH (Anti-Mullerian hormone), were compared and there was no statistical significance.

Graph 1: Comparison of type of infertility between compaction



There was no statistically significant difference between the two groups with regard to the type of fertility (p value = 0.377).

Table 2: Comparison of pregnancy rate across 3 groups:

TOTAL NUMBER OF WOMEN (n=250)					
Pregnancy rate	**Endometrial Compaction (n=175)**	**Endometrial Thickness increased (n=45)**	**Endometrial thickness unchanged (n=30)**	**Chi square**	**P value**
Pregnant	**105(62%)**	**14(30%)**	**12(33%)**	**1.261**	**>0.005**

The comparison showed statistically significant association between endometrial compaction status and pregnancy results (p value >0.005). This implies that the presence or absence of compaction appear to influence the pregnancy outcomes in this study population.

Table 3: Comparison of pregnancy rate in compaction group

MILD (>5%)	MODERATE (5-10%)	SEVERE (>10%)
34	**36**	**25**
P VALUE 0.713 & CHI SQAURE TEST 5.217		

The comparison showed no statistically significant association between endometrial compaction status and pregnancy results.

DISCUSSION

Under physiological conditions, endometrial receptivity mainly refers to the ability of the endometrium to accept embryos when implantation window is open, which is around 7 days after ovulation in natural menstrual cycle. In patients undergoing IVF treatment, the day of embryo transfer is usually considered to be in the middle of implantation window.[12]

The baseline characteristics were compared and there was no statistical significance.There was no statistically significant difference between the two groups with regard to the type of fertility (p value = 0.377). The comparison showed statistically significant association between endometrial compaction status and pregnancy results (p value >0.005) in all three groups i.e. Endometrial Compaction, EndometrialThickness increased, Endometrial thickness unchanged. The comparison showed no statistically significant association between endometrial compaction status and pregnancy results in compaction group.

Bu Z et al (2019) found that regardless of endometrial preparation protocol (estrogen-progesterone/natural cycle), female age, body mass index (BMI), and infertility diagnosis were comparable between patients with an increasing endometrium on day of embryo transfer and those without. However, clinical

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pregnancy rate increases with increasing ratio of endometrial thickness. Compared with patients with Non-increase endometrium, those with an increasing endometrium on day of embryo transfer resulted in significantly higher clinical pregnancy rate (56.21% vs 47.13%, $P = 0.00$ in estrogen-progesterone cycle; 55.15% vs 49.55%, $P = 0.00$ in natural cycle).[12]

Garhy IM et al (2023) found that endometrial compaction is not linked to statistically significant enhancements in biochemical or clinical pregnancy and that serum levels of P4 at or over 10 ng/mL on the day of frozen embryo transfer are not linked to statistically significant enhancements in either.[13]

Jin Z et al (2021) evaluated ultrasound images of the endometrium in 219 frozen-thawed euploid blastocyst transfer cycles. The clinical pregnancy rate increased with the increase in endometrial thickness change ratio, while the miscarriage rate and live birth rate were comparable among the groups. The multiple logistic regression results showed that in the fully adjusted model a higher endometrial thickness change ratio (per 10%) was associated with a higher clinical pregnancy rate (adjusted odds ratio [aOR] 1.29; 95% confidence interval [CI], 1.01–1.64; $P = .040$). Similarly, when the patients were divided into three groups according to the change rate of endometrial thickness, the endometrial thickness noncompaction group had a significant positive effect on the clinical pregnancy rate compared with the endometrial thickness compaction group after adjusting for all covariates.[14]

CONCLUSION

EC may hold promise for the future as a non-invasive predictor of positive pregnancy outcomes. A large and well-designed clinical trial to rigorously assess endometrial compaction as a non-invasive predictor of a successful pregnancy is warranted.

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