

# Biophysical Scoring of the Endometrium and Intrauterine Insemination Outcome in the Patient with Infertility

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## Abstract

**Introduction:** Infertility is a condition affecting the couple at its ground level – ability to reproduce. Apart from medical and social consequences, it is also having psychological consequences having spectrum of manifestation from loss of self-confidence to depression. There are many transvaginal sonographic (TVS) indicators that can predict the successful implantation by the Doppler study of the endometrial growth pattern and its perfusion.

**Objectives:** To find out the efficacy and usefulness of the TVS color Doppler, especially power Doppler for the assessment of endometrial biophysical scoring and its receptivity for assisted reproductive technique such as intrauterine insemination (IUI) outcome in patients with infertility.

**Materials and Methods:** A total of 90 patients were included in this study undergoing IUI procedures and were evaluated for the endometrial thickness and its morphological appearance, myometrial contractions, and endometrial and subendometrial perfusion.

**Results:** 34 cases had biophysical scoring  $\geq 17$  in which 17 (50%) females conceived. Among 82 females with endometrial thickness 7-14 mm 26.82% females conceived. 32.07% (17/53), 19.23% (5/26), and 18.18% (2/11) females showed positive outcome in distinct trilaminar, indistinct trilaminar, and homogeneous hyperechoic pattern, respectively. 31.25% (15/48) females conceived with pulsatility index (PI) value 2.1-2.49; followed by 26.09% (6/23).

**Conclusion:** Endometrial morphology, endometrial and subendometrial blood flow, and uterine artery PI is reliable indicator of IUI outcome. More perfusion indicates more chances of likelihood of intrauterine implantation. Color Doppler evaluation of uterine artery at the time of ovulation also showing low resistive index and high flow index or PI signifies favorable outcome. Endometrial thickness has not been significantly associated with pregnancy outcome.

**Key words:** Endometrial and subendometrial perfusion, Endometrial receptivity, Intrauterine insemination, Pregnancy rate, Transvaginal sonography

## INTRODUCTION

There are numerous causes of infertility including structural distortion of fallopian tube and endometrial

cavity, gamete quality, and congenital anatomical abnormality of uterus (bicornuate, separte uterus, etc.) and post-surgical complications. So many studies showed that poor uterine blood flow is associated with poor pregnancy outcome.<sup>1</sup> Evaluation of the uterus including endometrium has been mainly done by ultrasonography. Transvaginal sonography (TVS) is a simple, non-invasive, reproducible quick, and safe method for the assessment of pelvic organs in females.<sup>2</sup> Endometrial blood supply plays an important role in implantation of blastocyst, which is an early endometrial response of pregnancy.<sup>3,4</sup> Further transvaginal Doppler is an useful

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tool for assessment of uterine artery blood flow which is an indicator of uterine (endometrial) receptivity.<sup>5,6</sup> Several authors proposed different scoring systems for the evaluation of uterine receptibility using various parameters at different phases of induced cycle. We used Applebaum proposed Doppler ultrasonographic studies of uterus in midleutal phase to evaluate endometrial thickness, endometrial layering, myometrial contractions, myometrial echogenicity, and uterine artery blood flow (pulsatility index). According to this, a perfect score of 20 was associated with very favorable outcome in almost all the cases.<sup>7</sup>

## MATERIALS AND METHODS

A total of 90 patients were enrolled for this study coming to the Indira Gandhi Institute of Medical Sciences by Mutual Collaboration of Department of Radiodiagnosis and Reproductive Biology for both primary and secondary infertility.

The study has been approved by the Ethical Committee of this Institute. Informed written consent was obtained from these patients. One patient was included in this study for a maximum of 6 cycles of therapy.

### Inclusion Criteria

1. Age between 20 and 40 years,
2. Absence of uterine abnormalities (e.g., fibroid distorting the endometrial cavity, tubal stricture, etc.).

### Exclusion Criteria

1. Age <20 and > 40 years and
2. Presence of uterine anomalies and tubal block.

Ovarian stimulation was done with clomiphene citrate in appropriate dosage. Follicular growth was monitored by serial TVS scan from day 9 to day 14 or till ovulation. Dosages of gonadotropins were adjusted according to the follicular responses. After reaching the average size of 18 mm or more beta-human chorionic gonadotropin (beta-HCG) was administered as a single injection to induce ovulation. On day 14 or at the expected time of ovulation or 36 h after beta-HCG injection, biophysical scoring of uterus, were done using TVS that includes endometrial thickness, endometrial layering, endometrial blood flow (in zone 3), myometrial echogenicity and its contractions, myometrial blood flow internal to arcuate vessel, and uterine artery Doppler.

Success of the study has been assessed after diagnosis of pregnancy. It is defined by presence of gestational sac by ultrasonography with appropriate elevation of beta-HCG level.

## RESULTS

A total of 90 female patients were included in this study for both primary and secondary infertility excluding uterine abnormalities causing distortion of endometrial cavity or tubal block. The mean age of all cases was 28.12 years (range = 19-45 years).

Figure 1 shows that among 90 females, 24 (26.67%) conceived and was confirmed by rising beta-HCG level and/or presence of gestational sac by ultrasonography. Two patients had abortion at 5-7 weeks of pregnancy with unexplained etiology.

Figure 2 shows that 34 cases had biophysical scoring  $\geq 17$  in which 17 (50%) females conceived. 43 patients had biophysical scoring 14-16 and 13 patients had BPs  $\leq 13$  in which 13.95% (6/43) and 7.69% (1/13) conceived, respectively.

Table 1 depicts that endometrial thickness was found to be 7-14 mm in 91.11% (82/90) patients indicating good endometrial reservoir in these females. Among these 82 females, only 26.82% (22/82) females conceived. 25%

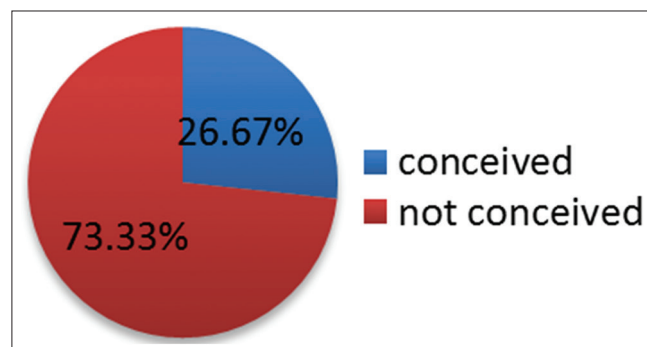


Figure 1: Success rate of intrauterine insemination

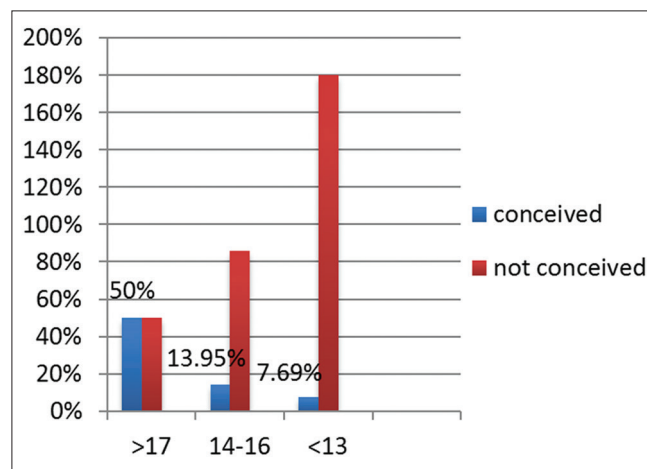


Figure 2: Correlation of pregnancy rate with different biophysical scoring

(2/8) of females conceived when the endometrial thickness was 7 mm or less.

Figure 3 depicts that endometrial pattern was found to be distinct triple line in 58.89% (53/90), indistinct hyperechoic in 28.89% (26/90), and homogeneous hyperechoic in 12.22% (11/90) of patients.

Figure 4 shows that 32.07% (17/53), 19.23% (5/26), and 18.18% (2/11) females showed positive outcome in distinct trilaminar, indistinct trilaminar, and homogeneous hyperechoic pattern, respectively.

36.21% (21/58) females showed positive outcome with abundant flow in zone 3 and 9.37% (3/32) female only if zone 3 showed sparse flow.

Table 2 shows that 31.25% (15/48) females conceived with pulsatility index (PI) value 2.1-2.49; followed by 26.09% (6/23) and 22.22% (2/9) females with PI value 2.5-2.95 and <2, respectively. Only 10% (1/10) females conceived having PI value higher than 3 (Figures 5-7).

## DISCUSSION

Endometrial receptivity plays an important role in the favorable outcome of intrauterine insemination (IUI). There are a lot of data regarding well-established *in vitro* fertilization (IVF)-programs, but very few data regarding the IUI are present. In this study, we investigated that measurement of endometrial thickness and endometrial morphology along with measurement of subendometrial blood flow by TVS with Doppler supplementation can improve the predictability of endometrial receptivity.

The mean age of female was 28.12 years (range = 19-45 years) in our study. The mean age of women was

31 ± 5.4 years (range = 18-45 years) in a study conducted by Aghahoseini *et al.*<sup>8</sup>

In this study, 26.67% (24/90) female conceived. Miscarriages were found in 2 patients at 5-6 weeks of pregnancy due to unexplained etiology. Triplet pregnancy was detected in one

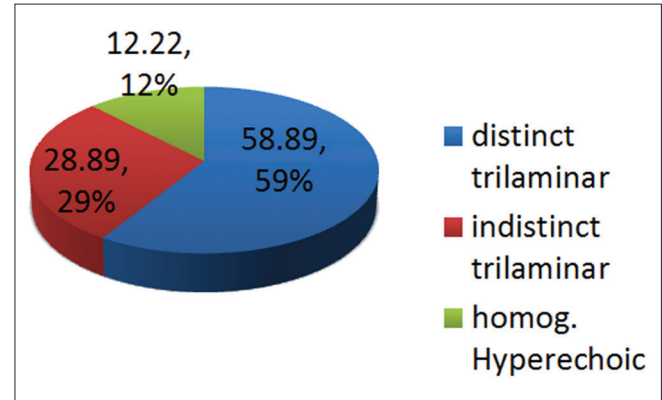


Figure 3: Endometrial pattern/morphology

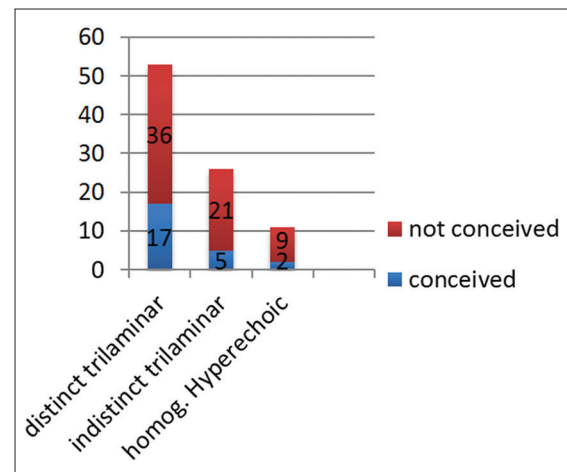


Figure 4: Correlation of pregnancy rate with endometrial morphology

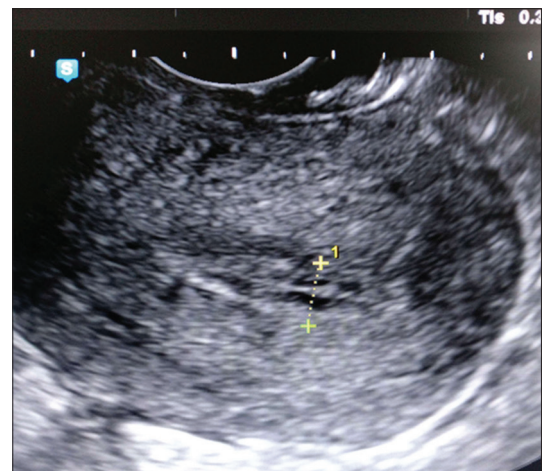


Figure 5: Distinct trilaminar endometrium

**Table 1: Correlation of pregnancy rate with endometrial thickness**

ET (mm)	Conceived (%)	Not conceived	Total patients
<7	2 (25)	6	8
7-14	22 (26.82)	60	82

**Table 2: Correlation of pregnancy rate with PI value**

PI value	Total patients	Conceived	Not conceived
>3	10	1	9
2.5-2.95	23	6	17
2.1-2.49	48	15	33
<2	9	2	7

PI: Pulsatility index



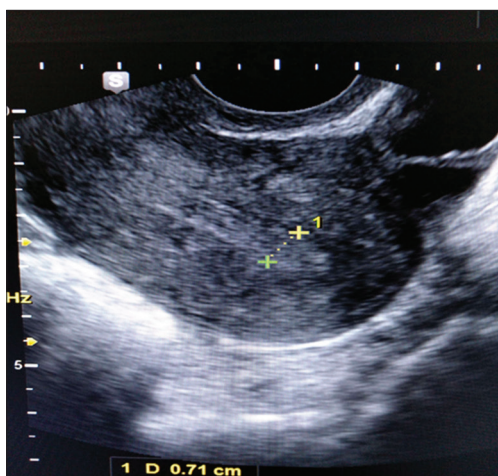


Figure 6: Indistinct trilaminar endometrium

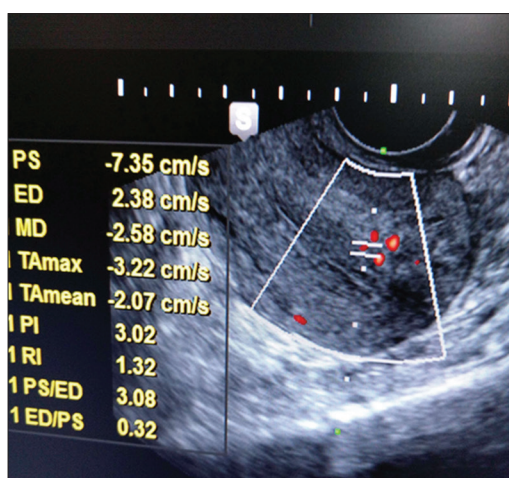


Figure 7: Endometrial blood flow pattern

female and twin pregnancy was detected in one female. No ectopic pregnancy was found in our study group. According to Aghahoseini *et al.*, pregnancy rate occurred in 32.2% of female.<sup>8</sup> Kupesic *et al.* found that fertility occurred in 31.5% women.<sup>9</sup>

In our study, biophysical score between 17 and 20 was associated with 50% pregnancy rate. Score between 14 and 16 and 13 or less was associated with 13.95% and 7.69% pregnancy rate, respectively. In some study, it has been found that score between 17 and 19 was associated with 77% pregnancy rate and between 14 and 16 associated with 60% pregnancy rate and below score 13 or <13 were associated with poor pregnancy outcome.<sup>7</sup>

In our study, 91.11% of patients had endometrial thickness between 7 and 14 mm and among them, only 26.67% of females conceived. 25% (2/8) females were conceived when the endometrial thickness is <7 mm. Hence, there was no significant association found between implantation rates and endometrial thickness. Endometrial thickness as a

single parameter has been investigated by numerous studies giving variable results. Glissant *et al.* found that endometrial thickness was significantly greater in cycles resulting in pregnancy than those, which did not.<sup>10</sup> Some showed significant correlation between the endometrial thickness and pregnancy rate and others yielded no such relationship. Welker *et al.* were unable to relate endometrial thickness to outcome.<sup>11</sup> These confusing results may be due to: (1) Different sonographic techniques such as transabdominal and TVS, (2) different ovarian stimulation protocols.

In this study, endometrial pattern was found to be triple line in 58.89%. 32.07% of females were conceived with distinct trilaminar pattern of endometrium and it drops down suddenly to 19.23% (5/26) and 18.18% (2/11) with indistinct trilaminar and homogeneous hyperechoic pattern. Kupesic *et al.* also found that endometrial pattern was triple line in 58.9%, indistinct in 3.4% and homogeneous in 29.1%. Success rate of implantation were significantly more in endometrium with triple-line pattern.<sup>9</sup> Welker *et al.* found that triple-line appearance of endometrium was more likely to be associated with implantation.<sup>11</sup> Multiple studies showed lower implantation rate in female exhibiting homogeneous endometrium pattern. However, another study by Kupesic *et al.* showed that the homogeneous hyperechoic endometrial texture is favorable for implantation.<sup>9</sup>

In this study, 36.21% (21/58) females showed positive outcome with abundant flow in zone 3 and 9.37% (3/32) female only if zone 3 showed sparse flow. Absent endometrial blood flow has been associated with no conception in spite of good scoring for other parameters. According to Zaidi *et al.*, absence of endometrial blood flow was associated with failure of implantation in IVF-cycles.<sup>12</sup>

In our study, 31.25% (15/48) females conceived with PI value 2.1-2.49; followed by 26.09% (6/23) and 22.22% (2/9) females with PI value 2.5-2.95 and <2, respectively. Steer *et al.* demonstrated that patients with low PI at the expected time of ovulation were more likely to conceive than those with high PI.<sup>6</sup> Battaglia *et al.* also showed that gradual and progressive decline in PI at mid-cycle have been associated with better outcome of assisted reproductive techniques.<sup>13</sup> Cacciatore *et al.* also found that implantation became very unlikely when PI was >3.3.<sup>14</sup>

## CONCLUSION

According to our study, transvaginal color Doppler with power Doppler supplementation for the evaluation of endometrium and subendometrial blood flow is a simple, quick, effective, and reproducible method for

the assessment of endometrial receptivity. Endometrial thickness has not been significantly associated with pregnancy outcome. Endometrial morphology, endometrial and subendometrial blood flow, and uterine artery PI is reliable indicator of IUI outcome. Further studies are required on large population to evaluate whether such assessment will cause higher pregnancy rate.

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