

# Transvaginal Sonography in Unexplained Infertility: A Study

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## Research Article

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## Abstract

**Introduction:** Infertility is a devastating disease. Its victims are affected at a very basic level, the ability to reproduce, to leave a legacy. This can be divisive to the couple involved, their relatives and friends. The sphere of influence this disease has can be immense.

Attendant to the medical consequences of infertility are the psychological sequelae. Afflicted patients and their families can suffer loss of esteem, disappointment and depression.

**Aim of the Study:** To determine the applicability of uterine biophysical profile (UBP) scoring by transvaginal sonography with chances of pregnancy in a cohort of females with unexplained infertility. Also to determine the applicability of individual parameters in predicting a positive pregnancy outcome.

**Materials and Methods:** This prospective observational study was conducted at department of radiodiagnosis, g r medical college and J A group of hospitals during the period of 2015 to 2016. The study subjects included 50 infertile females (primary /secondary infertility) in the age group of 20-40 years.

**Results and conclusion:** By predicting the positive pregnancy outcome, the possible advantages are medical, psychological, economical and emotional. With available previous studies, we also analysed the uterine biophysical profile by transvaginal Sonography in the patients, to predict the outcome.

**Keywords:** Transvaginal Sonography; Ultrasound Technique; Transabdominal; Coronally and Sagittally; Ultrasound Equipments; Endometrial; Myometrial

## Introduction

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families can suffer loss of esteem, disappointment and depression.

## Aim of the Study

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of individual parameters in predicting a positive pregnancy outcome.

## Materials and Methods

This prospective observational study was conducted at department of radio diagnosis; g r medical college and J A group of hospitals during the period of 2015 to 2016. The study subjects included 50 infertile females (primary /secondary infertility) in the age group of 20-40 years, primarily referred for follicle maturation monitoring by transvaginal ultrasound (with color and pulsed Doppler) with patent tubes and normal utero-ovarian morphology. Male factor infertility was also excluded. The UBP was determined by applying the uterine scoring system for reproduction (USSR). A score of 16 or above, out of a perfect score of 20, was hypothesized to be favorable for pregnancy. Frequency of pregnancy was correlated with the cumulative score as well as individual variable. Significance of correlation was taken as  $p < 0.05$ .

### ➤ Exclusion Criteria:

- Congenital anomalies of Uterus
- Uterine masses
- Abnormal ovarian cycles.

### ➤ Inclusion Criteria:

- Primary and secondary infertility

### ➤ Ultrasound Equipments:

- ALOKA prosound SSD-4000 SV.
- Toshiba colour Doppler usg SSA 350 A/31 nemio 30. with 6-
- 12 MHz TVS probe and 3-5 MHz curvilinear probe
- No. of cases 50

## Ultrasound Technique Unique to the Uterine Biophysical Profile

To perform the UBP special care should be taken. The following guidelines are recommended:

- To determine the presence of a 5-line appearance, information from both the transabdominal and transvaginal studies may be useful. In this case, a 5-line appearance is considered to be present and endometrial vascular penetration may be estimated when performing the endovaginal study.
- Perform the Doppler study slowly. The flow of blood in the endometrium is of low velocity. It may take time for the ultrasound machine to register the presence of

blood flow and create the image. If one sweeps through the endometrium too quickly, flow may not be seen.

- Endeavor to make the endometrium as specular a reflector as possible. Use the techniques of manual manipulation of the anatomy and probe pressure to achieve this.
- Scan endovaginally both coronally and sagittally. There may be a difference in how well the blood flow is imaged.
- When measuring the endometrium in the A-P dimension, try to obtain the value when no contraction affecting it is present. Contractions may alter this value. Also, when possible, obtain the measurement in a standard plane such as when both the endometrial and cervical canals appear continuous.

The Uterine Scoring System for Reproduction ("USSR") comprises evaluation of the following parameters [1-5]:

- Endometrial thickness (full-thickness measured from the myometrial-endometrial junction to the endometrial-myometrial junction)
- Endometrial layering (i.e., a 5-line appearance)
- Myometrial contractions (seen as endometrial motion)
- Myometrial echogenicity
- Uterine artery Doppler flow evaluation
- Endometrial blood flow
- gray-scale myometrial blood flow

Each parameter is scored as follows:

### ➤ Endometrial Thickness

- Endometrial thickness is the maximum distance between the echogenic myoendometrial interfaces measured in long axis
- To avoid the variability in measurements by 1-2 mm due to uterine contractions which peaks during the periovulatory phase, it is advised to perform several measurements
- When present endometrial fluid should be excluded from the endometrial measurement.
- Obtain the measurement in a std. plane when both the endometrial and cervical canals appear continuous

A. < 7 mm = 0

B. 7 - 9 mm = 2

C. 10 - 14 mm = 3

D. > 14 mm = 1

### ➤ Endometrial Layering

- A. no layering = 0
- B. hazy 5-line appearance = 1
- C. distinct 5-line appearance = 3

#### ➤ Myometrial Contractions (Seen as Wave-Like Endometrial Motion)

The inner third of myometrium demonstrates a subtle contractile pattern best appreciated in a magnified mid sagittal view. The contractions propagate from the internal cervical os towards the uterine fundus.

- A. < 3 contractions in 2 minutes (real-time) = 0
- B. > 3 contractions in 2 minutes (real-time) = 3

#### ➤ Myometrial Echogenicity

- A. coarse/inhomogeneous echogenicity = 1
- B. relatively homogeneous echogenicity = 2

#### ➤ Uterine artery Doppler Flow Evaluation

Uterine artery is demonstrated laterally to the cervix at the level of cervico corporeal junction. An elevated PI > 2.5, an absent end diastolic flow is considered as an abnormal waveform.

- A. PI > 3.0 = 0
- B. PI < 2.5 - 2.99 = 0
- C. PI < 2.2 - 2.49 = 1
- D. PI < 2.19 = 2

#### ➤ Endometrial Blood Flow within Zone 3

Zones of Vascular Penetration

- Zone 1 - A 2 mm thick area surrounding the hyperechoic outer layer of the endometrium
- Zone 2 - The hyperechoic outer layer of the endometrium
- Zone 3 - The hypoechoic inner layer of the endometrium
- Zone 4 - The endometrial cavity

Power Doppler is preferable for 2 reasons

- To detect signal from vessels with low velocity blood flow
- To avoid signal loss due to 90 degree angle incidence of the ultrasound beam, that occurs with conventional colour Doppler.

- A. absent = 0
- B. present, but sparse = 2
- C. present multifocally = 5

#### ➤ Myometrial Blood Flow Internal to the Arcuate Vessels Seen on Gray-Scale Examination

- A. absent = 0
- B. present = 2

#### Statistical Tools

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using *Epidemiological Information Package (EPI 2002)*.

Using this software, range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. *Kruskal Wallis chi-square test* was used to test the significance of difference between quantitative variables and Yate's test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

#### Results and Analysis

Age in Years	Cases	
	No.	%
Up to 25 yrs	9	18
26-30	10	20
31-35	20	40
36-40	9	18
>40	2	4
Range	23-42 yrs	
Mean	32 yrs	
S.D.	5.07 yrs	

Table 1: Age distribution.

The study includes women with age group ranging from 23-42 years, maximum number of patients between 31-35 years (20 patients)(40%). Out of 20, 7 patients (35%) were pregnancy positive and 13 patients (65%) were pregnancy negative.

Patients with > 40 years (2 patients) were pregnancy negative.

P value- 0.9115

Variables	Range	Mean	SD
Endometrial Thickness (in mm)	5-18	8.63	2.65
Uterine artery PI	1.5-3.6	2.61	0.39
UBP Score	5-18	12.64	3.34

Table 2: Quantitative Variables.

Variables	Cases	
	No	%
<b>Endometrial Layering</b>		
Hazy 5 line	13	26
Distinct 5 line	36	72
No layering	1	2
<b>Endometrial Contractions</b>		
<3 in 2 minutes	17	34
>3 in 2 minutes	33	66
<b>Myometrial Echoes</b>		
Coarse	27	54
Heterogeneous	4	8
Homogenous	19	38
<b>Zone 3 Sub endometrial</b>		
Absent	6	12
Sparse	30	60
Multi focal	14	28
<b>Myometrial flow</b>		
Present	41	82
Absent	9	18
<b>Pregnancy</b>		
Positive	14	28
Negative	36	72

Table 3: Qualitative Variables.

#### Relationship between Pregnancy Outcome and Various Parameters

Age group	Pregnancy Outcome			
	Positive		Negative	
	No.	%	No.	%
Upto 25 yrs (9)	3	33.3	6	66.7
26-30 (10)	1	10	9	90
31-35 (20)	7	35	14	64.3
36-40 (9)	3	33.3	6	66.7
>40 (2)	-	-	2	100
Mean	31.7 yrs		31.53 yrs	
SD	5.2 yrs		5.1 yrs	
'p'	0.9115 (Not significant)			

Table 4: Age and pregnancy outcome.

Pregnancy Outcome	Endometrial Thickness (mm)	
	Mean	SD
Positive	8.78	2.19
Negative	8.58	2.83
'p'	0.81 (Not significant)	

Table 5: Endometrial Thickness and pregnancy outcome.

Positive group have endometrial thickness measuring from 6 - 12 mm with mean value of 8.78mm. Among negative group, mean endometrial thickness is 8.58 mm. There is no significant relationship between endometrial thickness and outcome, as P value is 0.81.

Pregnancy Outcome	Uterine artery	
	Pulsatility index (PI)	
	Mean	SD
Positive	2.73	0.43
Negative	2.56	0.36
'p'	0.1622 (Not significant)	

Table 6: Uterine artery PI and pregnancy outcome.

PI ranges from 1.5 - 3.6 with mean value of 2.61 +/- 0.39. Mean PI in pregnancy positive patients is 2.73 +/- 0.43 and in pregnancy negative patient is 2.56 +/- 0.36.

Endometrial Layering	Pregnancy Outcome			
	Positive		Negative	
	No.	%	No.	%
Hazy 5 line (13)	3	23	10	77
Distinct 5 line (36)	11	30.5	25	69.4
No layering (1)	-	-	1	100

Table 7: Endometrial Layering and pregnancy outcome.

Out of 50 patients, 36 patients (72%) have distinct 5 line endometrial layering. 13 patients (26%) have hazy endometrium. No layering could be seen in one patient. Only 11 patients with distinct endometrial layering found to be pregnancy positive, with rest of 25 patients were pregnancy negative.

Endometrial Contractions	Pregnancy Outcome			
	Positive		Negative	
	No	%	No	%
<3 in 2 minutes (17)	3	17.65	14	82.35
>3 in 2 minutes (33)	11	33	22	67

Table 8: Endometrial contractions and pregnancy outcome.

In pregnancy positive group, 11 patients (33%) had more than 3 endometrial contractions in 2 minutes and 3 had less than 3. But in non pregnant group 22, (67%) patients had > 3 contractions in 2 minutes and 14 patients had < 3 contractions in 2 minutes.

Myometrial Echoes	Pregnancy Outcome			
	Positive		Negative	
	No	%	No	%
Coarse (27)	4	14.8	23	85.2
Heterogeneous (4)	1	25	3	75
Homogenous (19)	9	47	10	53

Table 9: Myometrial echoes and pregnancy outcome.

About 47% patients in pregnancy group had homogenous myometrial echo texture and 14.8% patients had coarse echoes. But in non pregnant group, about 85.2% patients had coarse echo texture.

Zone 3 Sub Endometrial Flow	Pregnancy Outcome			
	Positive		Negative	
	No	%	No	%
Absent (6)	-	-	6	100
Sparse (30)	2	6.6	28	93.3
Multifocal (14)	13	92.9	1	7.1

Table 10: Zone 3 Sub endometrial flow and pregnancy outcome.

Out of 50 patients, 14 patients had multi focal subendometrial flow (zone 3) of which 13 patients (93%) was pregnancy positive. One patient was negative. 30 patients had very sparse subendometrial flow. 28 patients (93.3%) were pregnancy negative. But 2 patients turned out to be pregnancy positive (6.6%).

Myometrial Flow	Pregnancy Outcome			
	Positive		Negative	
	No	%	No	%
Present (42)	14	33.33	28	66.67
Absent (8)	-	-	8	100

Table 11: Myometrial flow and pregnancy outcome.

Out of 50 patients, 42 patients found to have adequate myometrial flow and 8 patients show absent flow. But only 14 patients with myometrial flow were pregnancy positive (33.33%). Rest was pregnancy negative.

Pregnancy Outcome	Uterine Biophysical Profile Score	
	Mean	SD
Positive	16.93	0.82
Negative	10.97	2.24
'p'	0.000017 (Significant)	

Table 12: Uterine Biophysical Profile Score and Pregnancy outcome

Out of 50 patients, scores range from 5 to 18. In positive cases, the score was mean of 16.93. In negative cases, the mean score is 10.97 since P value is 0.000017, Score and outcome is significant.

Uterine Biophysical Feature	Total cases	Incidence among Positive Pregnancy Outcome Cases	
		Cases	%
Endometrial Layering (Distinct 5 line)	36	11	30.55
Endometrial Contractions (>3 in 2 minutes)	33	11	33.33
Myometrial Echoes (Homogenous)	19	9	47.4
Myometrial flow (Positive)	41	14	34.1
Zone 3 Subendometrial (Multi focal)	14	13	93

Table 13: Incidence among positive pregnancy outcome cases

## Discussion

Our study group comprises of 50 patients (n: 50) All of them were being investigated for either primary / secondary infertility. All of them were subjected to transvaginal Sonography to assess the uterine biophysical profile; including myometrial and endometrial characterization (endometrial receptivity).

Various studies are available in which various individual parameters (myometrial and endometrial characteristics) are analyzed in the prediction of pregnancy outcome in terms of positive pregnancy rates. We also tried to analyse the uterine biophysical profile in predicting positive pregnancy outcome. In our study, out of 50 patients, 14 patients (28%) were pregnancy positive and 36 patients (72%) were pregnancy negative. There is significant decline in human fecundity with advancing age noted.

### Summary and Conclusion

By predicting the positive pregnancy outcome, the possible advantages are medical, psychological, economical and emotional. With available previous studies, we also analysed the uterine biophysical profile by transvaginal Sonography in the patients, to predict the outcome. We analyzed various parameters. viz. Endometrial thickness, endometrial layering, endometrial contractions, uterine myometrial echoes, uterine artery PI, subendometrial flow, and myometrial flow and scores given for each parameter.

In our study, we concluded that endometrial thickness between 6 to 11mm and distinct 5 line endometrial layering improves the pregnancy rates. Patients with Endometrial thickness < 6 mm are less likely to become pregnant. 33 % of patients in pregnant group had endometrial contractions > 3 in 2 minutes. But Rest of the patients with contractions > 3 in 2mnts was pregnancy negative. Hence we conclude that endometrial contractions (> 3 in 2mnts) towards fundus improve the implantation rate.

We also conclude that myometrial echoes and uterine artery PI has no significant correlation in predicting the outcome. More importantly, we found that those patients who have multi focal subendometrial flow (up to zone 3) (93% of patients) have conceived. Those patients with absent subendometrial flow and very sparse subendometrial flow (not up to zone III) didn't conceive, indicating that subendometrial blood flow has significant role in predicting outcome. This well correlates with other studies. Finally we conclude, that patients with uterine biophysical score more than or equal to 16, are more likely to become pregnancy positive. (P value-0.000017) Those patients with score <16, are less likely to be pregnancy positive.

We conclude that by relying on the above mentioned significant parameters, it is possible to predict the positive pregnancy outcome.

- Multifocal subendometrial flow has got a significant role in implantation.
- Distinct triple layered appearance is associated with good outcome.
- If subendometrial blood flow is detected, the endometrial morphology becomes less important.
- Absent blood flow was associated with failure of conception (P <0.05)
- A high negative predictive value in cases, when there is minimal et.
- Myometrial Echoes and uterine artery PI has got a less significance in predicting the outcome.
- Endometrial Contractions (> 3 In 2 Mins) towards fundus improve the implantation rate. finally we conclude that patients with uterine biophysical score more than or equal to 16, are more likely to become pregnant ( P < 0.000017)
- The success rate of various assisted reproduction technologies which are presently low, can go high if the same idea is applied by relying on these parameters
- Further, if the likelihood of an unsuccessful cycle existed, the patient could be informed prior to the time of aspiration or transfer and the embryos could be returned to a frozen cycle in various assisted reproduction technologies.

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