"A prospective study to assess the role of endometrial volume in predicting the pregnancy rates in women undergoing intrauterine insemination at A.R.C at K.L.E.S Prabhakar Kore Hospital & MRC, Belgaum."

By

Dr. BLOSSOM

DISSERTATION

SUBMITTED TO
KLE UNIVERSITY, BELGAUM
KARNATAKA
IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SURGERY
IN
OBSTETRICS AND GYNAECOLOGY

Under the Guidance of
Dr. B. R. DESAI M.D.

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY,
JAWAHARLAL NEHRU MEDICAL COLLEGE,
BELGAUM – 10, KARNATAKA

MAY - 2009

KLE UNIVERSITY BELGAUM, KARNATAKA

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **"A PROSPECTIVE STUDY TO ASSESS THE ROLE OF ENDOMETRIAL VOLUME IN PREDICTING THE PREGNANCY RATES IN WOMEN UNDERGOING INTRAUTERINE INSEMINATION (IUI)"** *is a bonafide and genuine research work carried out by me under the Guidance of* **Dr. B. R. DESAI**$_{\text{M.D.}}$*. Professor and Head, Department of Obstetrics & Gynaecology, Jawaharlal Nehru Medical College, Nehru Nagar, Belgaum-590010.*

Date :

Place : Belgaum **Dr. Blossom**

KLE UNIVERSITY, BELGAUM, KARNATAKA

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled **"A PROSPECTIVE STUDY TO ASSESS THE ROLE OF ENDOMETRIAL VOLUME IN PREDICTING THE PREGNANCY RATES IN WOMEN UNDERGOING INTRAUTERINE INSEMINATION (IUI)"** *is a bonafide research work done by* **Dr. BLOSSOM** *in partial fulfillment of the requirement for* the award of the degree of **M.S. (Obstetrics and Gynaecology)**, *examination to be held in May 2009.*

Guide
Dr. B. R. Desai M. D.
Professor and Head,
Department of Obstetrics & Gynaecology
J. N. Medical College, Belgaum

Date :
Place : Belgaum

KLE UNIVERSITY, BELGAUM, KARNATAKA

ENDORSEMENT BY THE HOD, PRINCIPAL/HEAD OF THE INSTITUTION

This is to certify that the dissertation entitled **"A PROSPECTIVE STUDY TO ASSESS THE ROLE OF ENDOMETRIAL VOLUME IN PREDICTING THE PREGNANCY RATES IN WOMEN UNDERGOING INTRAUTERINE INSEMINATION (IUI)"** *is a bonafide research work done by* **Dr. BLOSSOM** *under the Guidance of* **Dr. B. R. DESAI.**$_{M.D.}$ *Professor and Head, Department of Obstetrics & Gynaecology, Jawaharlal Nehru Medical College, Nehru Nagar, Belgaum-590010.*

Seal & Signature of the HOD

Seal & Signature of the Principal

Dr. B. R. Desai $_{M.D.}$
Professor & Head,
Department of Obstetrics & Gynaecology
J. N. Medical College,
Nehru Nagar, Belgaum-590010.

Date :
Place : BELGAUM

Dr. V. D. Patil $_{M.D.\ D.C.H}$
Principal,
J. N. Medical College,
Nehru Nagar, Belgaum-590010.

Date :
Place : BELGAUM

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Date :
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Dr. Blossom

ACKNOWLEDGEMENTS

This dissertation work has been of great learning experience and encouragement in all walks of my postgraduate life, which by the grace of The Almighty was carried out with ease and enthusiasm, for which I am always indebted to him.

It has been a great pride, inspiration and privilege to work and carry out this study under guidance of **Dr. B. R. Desai**, M.D. Professor and Head, Department of Obstetrics and Gynecology, J. N. Medical College, Belgaum. I express my heartfelt gratitude and sincere thanks for his constant encouragement, motivation, supervision and support in carrying out my study and also in completing this dissertation with deliberation.

I am very grateful to The Principal **Dr. V. D. Patil,** J. N. Medical College, Belgaum, for his support and permission to undertake this study.

I sincerely thank **Dr. M. V. Jali**, The Medical Director, K.L.E.S Prabhakar Kore Hospital & MRC, Belgaum for his valuable support and help, in permitting me to include the patients from K.L.E.S Prabhakar Hospital required for my study.

I am thankful to **Dr. Shobhana S. Patted** and **Dr. Jayashree Ruge** for their support, understanding and concern throughout my study.

I genuinely thank all the staff in Assisted Reproduction centre for their persistent support during the period of the study.

I owe an immense debt of gratitude to Professor **Dr. B. R. Nilgar** $_{MD}$**,** Professor **Dr. M. K. Swamy** $_{MD}$**,** Professor, **Dr. (Mrs.) J. C. Shravage** $_{MD, DGO}$**,** Professor, **Dr.(Mrs.) S. M. Kodliwadmath** $_{MD}$**,** Professor, **Dr. M. B. Bellad**, $_{MD}$**,** Professor, **Dr.(Mrs) Kamal. P. Patil** $_{MD}$**,** Professor, **Dr. Yeshita Pujar** $_{MD}$, Associate Prof, **Dr. Hema A. Dhumale** $_{MD}$**,** Associate Professor, **Dr. (Mrs.) Anita Dalal** $_{MD}$**,** Associate Professor, **Dr. M. C. Metgud,** $_{MD}$**,** Associate Professor, **Dr. (Mrs.) Bhavana Sherigar** $_{MD}$**,** Associate Professor**, Dr. (Mrs.) Geeta Durdi,** $_{MD}$**,** Associate Professor, **Dr. Basavaraj Kolli** $_{MD}$**,** Assistant Professor and **Dr. Sasmita Das,** $_{MD}$, Assistant Prof, **Dr Mahesh K**. Assistant Prof, **Dr. Sheetal J** Lecturer, **Dr Pramila K.** Sr. Resident Department of Obstetrics and Gynecology for their invaluable suggestions and support throughout the study.

My deepest sense of gratitude to all my post graduate colleagues who helped me in collecting the data and to **Mrs. Jemima Yashpal** in ARC, who helped me in following the cases. I whole heartedly thank my friends without whose help it would not have been possible to complete this dissertation in time.

I am also thankful to Professor, **R. H. Dhareshwar** $_{MSc,MPhil}$ Statistician for statistical analysis.

I would like to acknowledge the tireless and timely work of **Mr. Mahesh** of **Malta Computers**, for his excellent data processing and completion of this manuscript.

I wish to offer my thanks to Department of Medical Education for their valuable information and support.

No amount of words can measure up to the deep sense of gratitude and thankfulness that I feel towards in father-in-law **Dr. Ajay Prakash,** mother-in-law **Dr.Divya Prakash**, sister-in-law **Dr.Swati Prakash** and my parents **Col. Joginder Singh, Mrs. Kiranjit** and my brother **S. Pushpinder Singh** whose cherished blessings and countless sacrifices are behind whatever success I have achieved in my life.

I am immensely thankful for continuous moral support extended with love and co-operation by my husband **Dr. Shwetank Prakash** and my daughter **Sara Prakash**.

I offer my sincere thanks to all my friends and post graduate colleagues for their companionship and support.

Last but not the least, this acknowledgement is incomplete if I fail in my duty to thank all the subjects who have whole heartedly participated in the study and have made the study complete.

I bow my head in respect before God Almighty.

Dr. Blossom

ABBREVIATIONS

ARC	Assisted Reproduction Centre
ART	Assisted Reproductive Technology
CC	Clomiphene Citrate
E_2	Estradiol
GIFT	Gamete intrafallopian transfer
hCG	Human chorionic Gonadotrophin
HMG	Human menopausal Gonadotrophin
HSG	Hystero salphingography
ICSI	Intracytoplasmic sperm injection
IUI	Intrauterine insemination
IVF	In-vitro fertilization
P	Progesterone
PRs	Pregnancy rates
rpm	Revolution per minute
TVS	Tranvaginal sonography
WHO	World health organization
ZIFT	Zygote intrafallopian transfer

ABSTRACT

Title: "A prospective study to assess the role of endometrial volume in predicting the pregnancy rates of women undergoing intrauterine insemination".

Objective:

To assess the role of endometrial volume in predicting the outcome of pregnancy in women undergoing intrauterine insemination.

Study Design:

A Prospective study.

Setting:

At A.R.C., K.L.E.S. Prabhakar Kore Hospital and Medical Research Centre, Belgaum

Sample Size:

207 women were included in the study, and they fulfilled the inclusion criteria for the study.

Method:

The ovulation induction was done as per the protocol, and using Trans vaginal sonography the endometrial parameters were noted on the day of IUI.

Outcome Measures:

Endometrial volume, thickness & pattern were noted.

Results:

Endometrial volume, analyzed isolated had no statistical significance. On the contrary endometrial thickness and pattern, when analyzed independently, had a statistical significance for endometrial thickness in range of 9-9.9 mm and trilaminar pattern (p value <0.05). On combining trilaminarity with endometrial thickness of 9-9.9 mm and volume of 2-2.9 ml, results were significant, p value <0.001 in both the cases. When endometrial volume was taken with endometrial thickness, the results were significant i.e. endometrial volume in the range of 2-2.9 ml with thickness of 8-9.9 mm and endometrial volume ≥ 3 ml with the thickness 9-9.9 mm had statistical significance with p value <0.05.

Conclusion:

Endometrial volume analyzed isolated had no statistical significance. Combination of endometrial thickness of 9 to 9.9 mm, trilaminar endometrial pattern and volume of 2 to 2.9 ml is a better predictor of pregnancy outcome than either of these factors alone.

Key Words:

Endometrial volume; Pregnancy Rates; Intra uterine insemination.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

INTRODUCTION

Infertility has a major impact on people's lives. Couples that have been trying to conceive for a long time without success will most likely, eventually turn for help for conception. Though quite a few women conceive with induction of ovulation and timed intercourse, some need higher assistance by way of ART (IVF & ICSI etc.). ART have provided the means to study reproductive processes in new and more revealing ways and have markedly improved the prognosis for a great number of infertile couples, particularly those whose infertility relates to severe tubal damage or male infertility. In between these two extremes there is quite a good chance of couples who can be helped with IUI.

The special programme of research Development and Research Training in Human Reproduction of the World health organization (WHO) has estimated that there are 60-80 million infertile couples world-wide.[1] It has also been estimated that in India between 10-15% of the couples are infertile.

IUI is most commonly used for infertility associated with endometriosis, anovulatory infertility, variable degrees of male factor infertility, cervical factor infertility and unexplained infertility. Despite the evident effectiveness of IUI for various causes of infertility there is no consensus on the parameters that determine pregnancy success. [2]

The overall success rate of IUI varies from institution to institution. The range is from mere 5 % to as high as 30% per patient; however a 10-20% clinical pregnancy per cycle is considered as an acceptable range.[3]

There have been many attempts to increase the outcome of intrauterine insemination, from the stimulation protocol to the best timing for IUI. Patients with a thin endometrium present with a clinical dilemma to the treating physician, whether to continue the cycle despite a possibly reduced chance of pregnancy.

The assessment of the endometrium with ultrasound has become a standard procedure during the evaluation of endometrial receptivity in assisted reproductive techniques. As it is both atraumatic and simple it has played a major role in monitoring ovulation induction and endometrial parameters, thus predicting the best timing for doing an IUI and prediction of outcome. Various endometrial parameters have been studied since a long time, which included the endometrial thickness and endometrial pattern. A wide range of conflicting data has been published regarding the role of above stated factors in prediction of pregnancy outcome. Almost a decade back a new parameter came into research and that was the role of endometrial volume. Though there are many studies on the endometrial volume and pregnancy rates following IVF or embryo transfer, very few studies are available to correlate the volume and pregnancy rates following IUI.

So the aim of the present prospective study was to assess the predictive value of endometrial volume for clinical pregnancy in women undergoing IUI.

OBJECTIVES

Primary objective : To assess the role of sonographically measured endometrial volume as a predictor of pregnancy rate in women undergoing IUI.

Secondary objective : To compare its efficacy in prediction of pregnancy with endometrial thickness and pattern.

REVIEW OF LITERATURE

During the menstrual cycle, the endometrium undergoes cyclic changes in preparation for implantation. In the follicular phase, the growing follicles produce increasing amounts of E_2 that induce proliferative endometrial changes. After ovulation, the corpus luteum produces progesterone (P), which leads to secretory changes. Since serum hormonal E_2 and P levels cannot always accurately predict the development of the endometrium and other methods such as histological studies are invasive, ultrasound has been used as a noninvasive technique to monitor infertile women for over two decades. The measurements are easy to perform, easily reproducible, and have been shown to have a good interobserver correlation. The advent of transvaginal ultrasound has greatly increased the visualization of the endometrium, providing more accurate and detailed evaluation.[4,5, 6]

Controversy existed in the past and is still there regarding the role of endometrial thickness and endometrial pattern associated with a successful pregnancy outcome. Various parameters of the endometrium were studied from time to time, and conflicting results have been published in the literature. Endometrial parameters studied included the pattern, thickness and recently endometrial volume.

A study conducted at Fatemeh Alzahra Infertility Center of the Babol University of Medical Sciences in which 249 candidates, who underwent IUI were included in the study. The overall pregnancy rate was 15%. Endometrial thickness on the day of hCG administration was significantly greater in cycles where pregnancy was achieved 10.1 ± 3.0 vs. 7.7 ± 3.5 (Mean ± standard deviation), latter being the endometrial thickness of

non pregnant cases on the day of hCG administration. It also stated that the woman's age was negatively associated with pregnancy outcome, unlike endometrial thickness and the total motile sperm count which were positively associated with pregnancy outcome. [7]

There are many reports on the impact of endometrial thickness, pattern and vascularization on the pregnancy rates after COH, IUI and IVF/ET. [8]

A prospective study was done and the data collected by authors suggested that endometrial sonographic pattern on the day of hCG administration was of predictive value regarding fecundity and continuing pregnancy in intrauterine insemination cycle.[9] As there was no agreement regarding the usefulness of monitoring the endometrial thickness in stimulated cycles, a study was conducted in Austria and they suggested that endometrial thickness was determined by the individual uterine architecture and therefore not predictive of likelihood of implantation. [10]

A prospective study was done to evaluate if preovulatory endometrial thickness or pattern were related to fecundity and to the use of clomiphene citrate (cc) or hMG in IUI. 271 patients were included in the study undergoing 474 cycles of IUI. The results shared no pregnancy when thickness was less than 6 mm. The pregnancy continuation rate was 12.6% when thickness was more than or equal to 9 mm ,compared to 6.9% when the thickness was 6mm to 8mm.It also stated that relation of Endometrial pattern whether homogenous or trilaminar with IUI had no effect on pregnancy outcome. [11]

The predictive power of trilaminarity was confirmed by a recent prospective trial done by a group of investigators, showing that endometrial pattern and not thickness, measured by a 2D ultrasound were positively correlated with the pregnancy rate after

intrauterine insemination. These authors were unable to show a statistically significant difference in the value of endometrial thickness to achieve pregnancy, but they concluded that significantly more women who had trilaminar endometrium while doing IUI achieved pregnancy, rather than those with homogenous pattern. The pregnancy rate was significantly higher in women with trilaminar endometrium on the day of IUI rather than in women with non trilaminar endometrium on the day of IUI. They had included 110 couples and there were 16 pregnancies. Trilaminar endometrium was present in 87.5% of the patient on the day of IUI who became pregnant and 57.4% had trilaminar pattern on the day of IUI who did not achieve pregnancy(p=.022) [12]

Some authors demonstrated that endometrial texture changed from homogenous at the start of the cycle to a triple line pattern on the day of hCG administration and then back to homogenous pattern 9 days after hCG. They also found a correlation between endometrial thickness and the presence of endometrial wave like activity before the start and in the luteal phase of the cycle.[13]

Some investigators have suggested that homogenous endometrial pattern is associated with poor pregnancy rates in intrauterine insemination[14] and this fact was supported by many others too.[15]

One earlier anecdotal study noted the importance of pathological changes in endometrium as a cause of infertility.[16]whereas many others described low PRs in patients who lacked the normal triple lined endometrium. [17,18,19,20]

Several authors, concluded that, endometrial volume of more than 2 ml on the day of ET was a positive predictor for ART outcome. [21]

A study concluded that the women undergoing IUI with an endometrial volume ≥ 2ml and trilaminar endometrium had significantly higher pregnancy rates (22%) than those women without these two criteria (PR = 6%, $p<0.05$). They had included 104 patients in the study group out of which 14 became pregnant. In this study a threshold value of 2ml for endometrial volume was predictive for the failure to establish a pregnancy with a negative predictive value of 96%. The positive predictive value, however, was only 16%.[22]

INTRA UTERINE INSEMINATION

Definition: Intra uterine insemination is the insertion of sperm, which have been carefully washed and prepared, directly into the uterine cavity.

INDICATIONS FOR IUI:

I. By husband's sperms

1. Male subfertility
    a) Oligozoospermia
    b) Asthenozoospermia
    c) Hypospermia
    d) Ejaculatory failure
        - Anatomical (e.g. Hypospadiasis)
        - Neurological (e.g. Spinal cord injury)
        - Retrograde Ejaculation
        - Psychological (e.g. Impotence)
2. Cervical factors
    a) Cervical Mucus hostility
    b) Poor cervical mucus
3. Immunological
    a) Male antisperm antibodies
    b) Female antisperm antibodies (cervical,serum)
4. Endometriosis- Mild and Moderate
5. Anovulatory factors : PCOS
6. Some cases with combine infertility factors
7. Unexplained infertility

II. ***Insemination by donor sperm***

Male factors

a. Azoospermia

b. Severe oligospermia

c. Severe astheno/necrospermia

d. Sterility due to disease or vasectomy, orchidectomy, chemical or radiation exposure

e. Sexual / ejaculatory dysfunction

f. Genetic consideration (e.g. haemophilia. Huntigton's chorea)

g. Rh incompatibility

CONTRAINDICATIONS TO IUI

I. Absolute Contraindications

1. Bilateral tubal block
2. Very severe oligoasthenoteratospermia
3. Genital tract infection
4. Pregnancy contra indicated in female partner
5. Unexplained genital tract bleeding

II. Relative Contraindications

1. Tubal pathology
2. Multiple failures at IUI (failure of >6 attempts of IUI)
3. Multiple infertility factors
4. Recent chemotherapy or radiotherapy

Counseling

Counseling is a very vital aspect in the treatment of infertility and should be provided at different stages of treatment. Everyone starting from clinician, embryologist and nursing staff have roles to perform in treating the patient, helping the patient to understand the implications of each treatment and possible outcomes, administering the necessary drugs and carrying out surgical procedures.

The counselor is an integral part of team approach and should be readily accessible. Confidentiality is a delicate area especially, in donor sperm insemination. The screening of donor sperm, selection of donor, and method of sperm preparation and anticipated success rate in the individual cases with possibilities of complications should be informed to the couple.

Nursing station

Staff requirements depend on the scope and volume of the clinical work load. At least one full time nurse should be employed. Designated Infertility Sister needs to be knowledgeable about gynecological and especially fertility disorders because it is likely that patients would discuss some aspects of management with her.

Out patient clinic facilities and insemination room

A room is made available within the complex for consultation between medical staff and patients. More appropriate to have separate insemination room.

Other staff and requirements

An assisted conception unit will normally have medical and scientific directors while a consultant gynecologist heads the general / teaching hospital IUI services. Supporting medical staff will assist them.

Steps involved in IUI

- ❖ Monitoring of a natural or stimulated cycle, so that the time of ovulation is apparent.
- ❖ Preparation of sperm wash: A sperm sample is obtained from either the male partner or donor. The sample has optically been through a process referred to as "sperm preparation".
- ❖ Procedure of insemination: Sperm sample is then inserted into woman's uterus via a catheter through the cervix.

The goal is to place as many active, well formed sperms as close to the ovulated egg as possible thereby increasing their chances of meeting.

IUI media :

- Bicarbonate buffer media, equilibrated with 5% carbon dioxide,5% oxygen and 90% nitrogen of 37°C with 95% humidity.
- 10% heat inactivated serum or Human Serum Albumin or Synthetic Serum can be added as protein supplement.
- Additions of methylxanthene derivatives like pentoxyphylline and caffeine can be done.

Medium should maintain sperm integrity, and promote acrosome reaction and capacitation.

Semen collection room :

This room should be provided for the production and collection of semen. Preferably located in a quite part of the unit, privacy is reinforced by hanging a 'DO NOT DISTURB' sign on the door when is in use. This should be left unmarked so as to avoid unnecessary attention. Room should be comfortable, large enough to accommodate two

people and furnished with materials that aid production of semen such as magazines and video films.

Sperm Preparation [23] :

There are a variety of methods that allow the separation of a more promising population of sperm. Sperm preparation technique is a very crucial step in the success of IUI. Semen processing in the laboratory not only separates highly motile function sperm with normal morphology in high percentage, but also removes seminal plasma, which contains prostaglandins and cytokines, as well as possible antigenic or infectious matter along with defective and non-vital sperm and debris.

Several methods of sperm preparation for IUI have been described. Swim-up, Density gradient are the common methods. All sperm separation methods produce specimens with better motility and more uniform morphology. This improvement may not necessarily translate into increased pregnancy rates.

- **Swim up method – (Sperm selection based on motility)**

The liquefied semen sample is diluted with sperm washing medium in the ratio 1:1 and centrifuged for 10 minute at 1000 rpm. Supernatant is carefully discarded and swim up medium is gently layered over the final sperm pellet. The specimen is then placed in an incubator for approximately one hour. During this time the sperms are allowed to swim up into the media, with the purpose of collecting the most motile, normal sperms which are free of debris. The supernatant is again centrifuged at 1000 rpm for another 5 minutes. The pellet is now mixed with 0.5 ml of media and mixed thoroughly. This sample is ready for IUI. Not recommended are sample of high viscosity, with high number of round cells or with a high content of debris.

❖ **Density gradient centrifugation**

The ejaculate is placed on top of the density medium with higher density and is then centrifuged for 10 minutes. During this procedure, all cells reach the semen sediment. However, highly motile spermatozoa, more active in the direction of the sedimentation gradient and can therefore penetrate the boundary quicker than poorly motile or immotile cells, thus, highly motile sperm cells are enriched in the soft pellet at the bottom.

Sperm capacitation *:* Readying the sperm

Freshly ejaculated sperms are unable or poorly able to fertilize. Capacitation is associated with removal of adherent seminal plasma proteins, re-organization of plasma membrane lipids and proteins. Sperms can be capacitated by incubation in certain fertilization media. Sperm that have undergone capacitation are said to become hyperactivated. Capacitation appears to destabilize the sperm's membrane to prepare it for the acrosome reaction

Sperms become "fertilization competent" after capacitation

❖ ***Ovulation induction***

There has been extensive progress in infertility management by IUI alone or in combination with controlled ovarian stimulation. Ovarian stimulation with clomiphene citrate (CC) alone has been used for induction of ovulation for more than three decades. However; various combinations with CC are also in practice in the recent years.

1. C.C (50/100/150 mg) daily from D5 to D9 and injection hCG (5000 IU) at the time of LH surge.

2. C.C. (50/100/150 mg) daily from D5 to D9 + Inj. HMG (75 IU) from D8 to D10, followed by Inj. hCG at the time of LH surge.
3. HMG / highly purified FSH/ rec. FSH + Inj. hCG.
4. Letrozole 2.5 mg once a day for five days + Inj. hCG

The rationale behind using clomiphene citrate is that it has a desirable central action of stimulating a transient increase in gonadotrophin secretion. Superovulation increases the number of oocytes available for insemination, thereby increasing the chances of fertilization. Super ovulation also increases the number of female gametes in the fallopian tube and IUI reduces obstacles to sperm migration by shortening the distance of male gametes to reach the site of fertilization. In addition to this, subtle ovulatory defects, disorders in endometrial development of borderline aberrations in corpus luteum function can be corrected by gonadotrophin therapy. Occult seminal defects are treated by various methods of sperm washing which also may be a major instrumental process to enhance fecundity.

In spite of the high ovulation rate with the use of clomiphene citrate, the pregnancy rate is much lower. It is believed that, due to, antiestrogenic effect of CC at the level of cervical mucus and endometrium, fertilization and embryo development, the pregnancy rates are low. Besides this, about 20-25 percent anovulatory women are resistant to CC and fail to ovulate at doses up to 150 mg daily. With gonadotropins, the risk of multiple pregnancies as well as hyperstimulation increases. Hence, recently aromatase inhibitors have been introduced in induction and augmentation of ovulation such as letrozole. If there is no pregnancy in 6 cycles, alternate therapy to be chosen.

IUI with Gonadotropins Treatment

Gonadotropins are a family of drugs which contain naturally occurring pituitary hormones (FSH & LH). Treatment involves injection of a gonadotrophin medication. This creates higher than normal levels of FSH, stimulating the ovaries to produce multiple follicles and eggs. Women should have regular blood testing and vaginal ultrasound to check the growing follicles. CC may also be used together with a gonadotropin medication during IUI treatment cycle. Many women take gonadotropin medications themselves by subcutaneous self injection into the thigh or abdomen.

Step up protocols

Ovulation in PCO patients remains a challenge. Ovarian hyperstimulation syndrome (OHSS), multiple pregnancy and Leutinized unruptured follicles are the problems. Step up allows right amount of FSH to correct the hormonal imbalance within the pituitary and ovary. It produces fewer follicles per cycle. It achieves safer, successful ovulation induction. Incidence of OHSS is reduced

Step down protocols

Principle : Activating pre-ovulatory follicles and limiting the number of growing follicles by hormonal therapy

Advantage : Reduced risk of OHSS and multiple pregnancy

Disadvantages

- Needs tight monitoring
- Increased cancellation of cycles

Prediction of ovulation

The measurements of number, growth and rupture of Graffian follicle, the measurement of endometrial pattern, thickness is usually done while monitoring the cycle. The endometrial proliferation and proper differentiation during follicular and subsequent luteal phase are directly influenced by the circulating estrogen and progesterone levels. Several guidelines have been suggested such as estradiol concentration of 200 µg / ml per mature follicle and the mean follicular diameter of at least 14 mm as determined by ultrasonography may predict the time of ovulation.[24] Ultrasonography monitoring and detection of the beginning of LH surge by hormonal assays of serum estradiol, LH, progesterone may be the most precise method , though it may not be cost effective.

Sperm Parameters for the outcome in IUI

It is almost impossible to predict the fertilizing potential of a semen sample in individual cases. Though, normal values of semen variables are given by WHO, numerous prospective studies have shown that routine semen analysis is only a weak predictor of male fertility. Men with relatively low count in the semen sample (oligospermia) [25] can show normal fertility potential and vice versa, when subjected to sperm function tests. Hence, sperm function tests (SFT) have come to stay for the diagnosis of male factor in normal as well as subnormal semen samples.

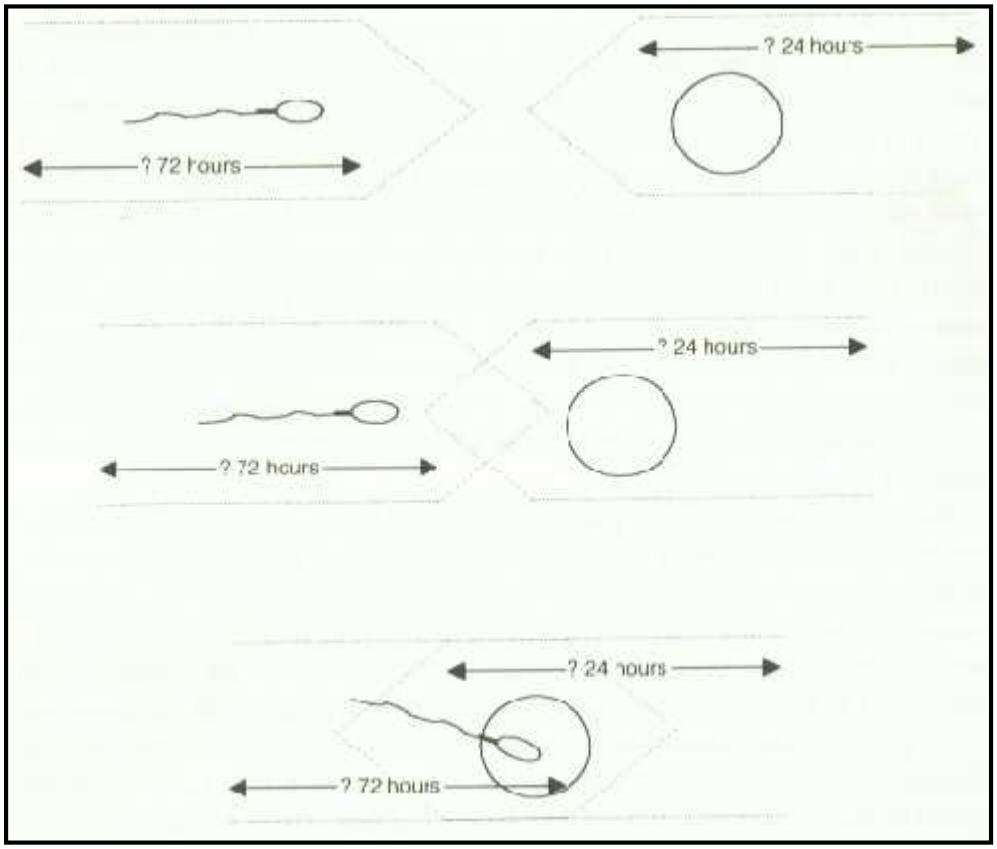
Because sperm is concentrated, introduced past the cervical mucus barrier, and have immotile and abnormal forms removed by processing. The initial quality necessary for achieving pregnancy may be lower for IUI than the WHO normal values. Many workers have evidenced in their studies that, best results are achieved when the total

number of motile sperm are greater than approximately 10 million [26,27,28] and 14 % or more sperms have normal morphology[29] (strict criteria; WHO III standard)

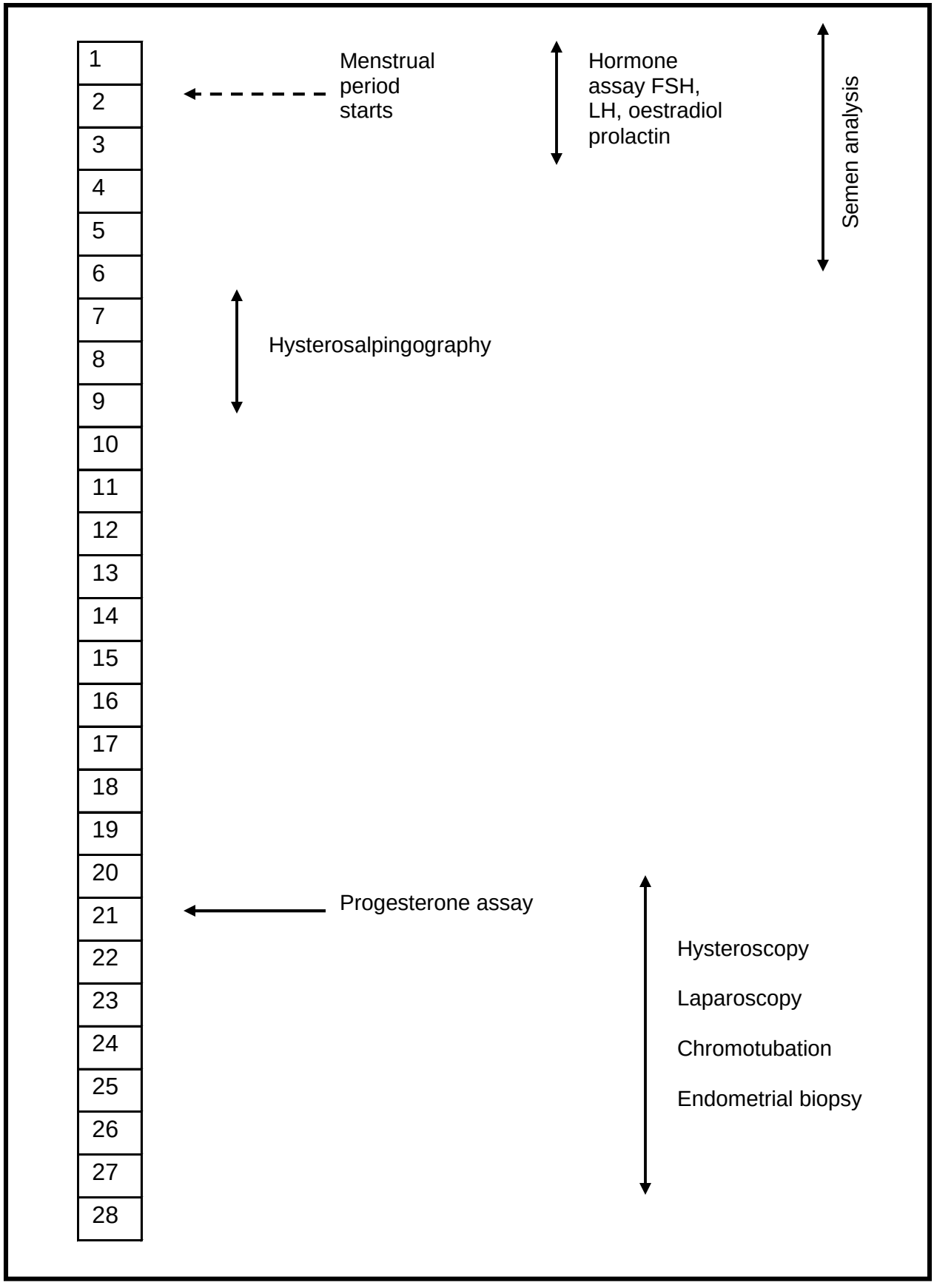
Monitoring cycles to time hCG administration

Monitoring will be performed by serial ultrasound scan and when the lead follicle reaches 18 to 20 mm in diameter, Inj. hCG is administered.

Monitoring of estradiol especially in PCOS, enables to avoid risk of ovarian hyperstimulation syndrome (OHSS). It also helps, when lead follicle displays an abnormal rate of growth, either too fast or too slow. When there are excessive number of small follicles associated with 3-4 leading follicles, a high E2 level (approx. 3000 pg/ml) indicated an increases risk of hyperstimulation, hence before the hCG administration, cycles are cancelled. Insemination will be performed 36 to 40 hours after hCG administration.



Coordination of insemination and ovulation: Pivotal role of V period of gamete viability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Menstrual period starts
Hormone assay FSH, LH, oestradiol prolactin
Semen analysis
Hysterosalpingography
Progesterone assay
Hysteroscopy
Laparoscopy
Chromotubation
Endometrial biopsy

Ultrasound scanning

Follicular development is monitored with serial ultrasound scans preformed with a transvaginal probe at a frequency of 7.5 MHz. Just before IUI, the endometrial volume, thickness & the pattern is to be noted.

IUI Technique

The patient is placed in lithotomy position so that the cervix is visualized with the help of a speculum. Cervix was cleaned with normal saline. Antiseptics are avoided. The catheter containing prepared sperm is manipulated through the cervix into the uterine cavity and then the sperm is released slowly. After the procedure the patient is advised to rest for 10 – 15 minutes and at discharge advised to keep progesterone pessary vaginally for luteal phase support.

Luteal Phase Defect (LPD)

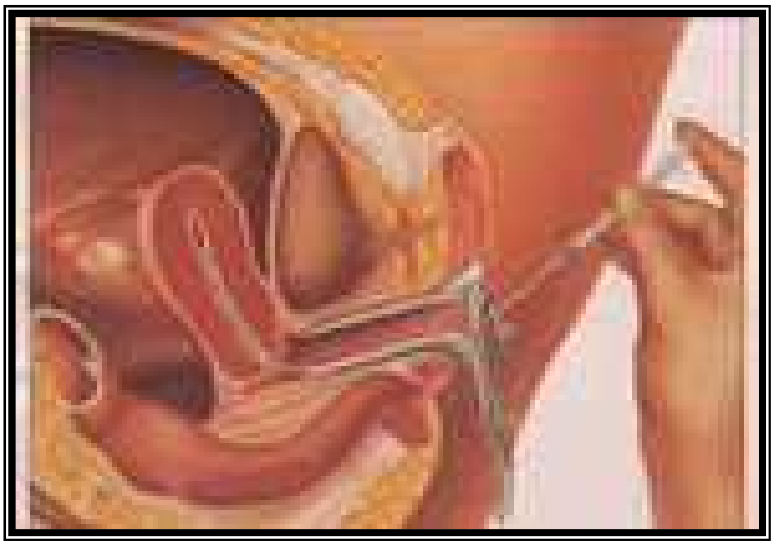
LPD is the failure of the uterine lining to be in right phase at the right time. May be due to inadequate progesterone production by corpus luteum or inadequate response of endometrium to the normal circulating level of progesterone

Luteal Phase Support

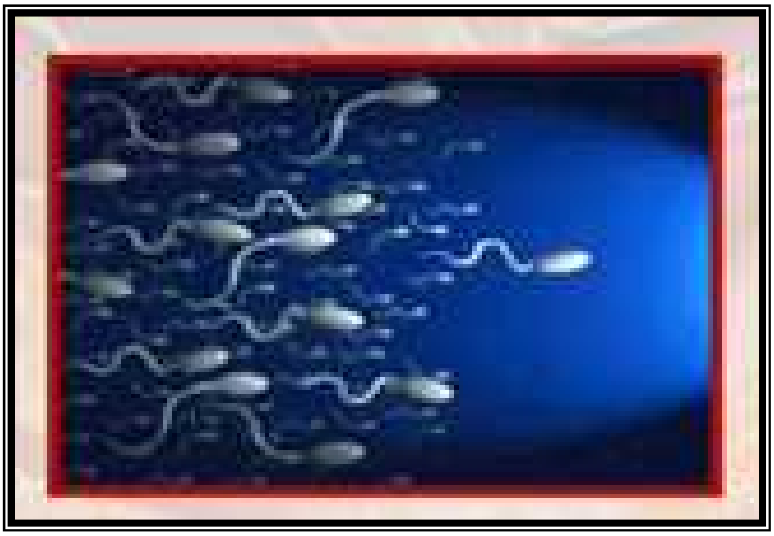
Progesterone containing suppositories or injection is used to give luteal phase support.

IUI Complications

Very few complications may occur after IUI. Uterine cramping may occur in 5% of patients, spotting in 1% and gastrointestinal upset in 0.5%. Although there is theoretical risk of transporting bacteria with insemination, pelvic infections reported are very rare - 0.2%. OHSS may occur after IUI with super stimulation in 1% of cases.



IUI TECHNIQUE



SPERMS

CAPACITATION

Chances of multiple gestations with superovulation is a known factor and are associated with maternal and fetal complications.

RESULTS AND LIMITATIONS OF IUI

Factors affecting success rate of IUI

- Female factors
  - Age – Pregnancy rate deteriorates very fast after 40 years
  - Cause of infertility – Best results are expected in cases of cervical factor
  - Ovarian stimulation – Stimulated cycles are superior to natural cycles
  - Endometrium – Thickness, pattern and volume are important
  - Insemination – Better pregnancy rates are observed if insemination procedure is easy
- Male factors
  - Semen parameters - Quality of motility and percentage of morphologically normal spermatozoa are most important, though most actively motile and morphologically normal forms are taken while doing an IUI.
- Common factors
  - Duration of infertility
  - Numbers of IUI cycles - Best results of IUI are observed in initial cycles. There is a steady decline in success rate after 4 – 6 unsuccessful IUI cycles.

When to stop treatment

One should consider statistical guidelines before exhausting all possibilities. Provide a “break” in between the treatment cycles. Never tell a couple that they cannot have a child. Counsel for further assisted reproductive techniques like – IVF, ICSI , ZIFT, GIFT etc.

METHODOLOGY

Source of data:

All patients coming to ARC at KLES Prabhakar Kore Hospital, Belgaum for a period of one year 1st Jan 2007 to 1st Jan 2008 were offered study entry.

Study design :

A prospective study over duration of one year

Setting :

ARC, KLES Prabhakar Kore Hospital and MRC, Belgaum

Sample size:

$$n = \frac{(Z_{\alpha} + Z_{\beta})^2 \cdot 2 \cdot S^2}{d^2}$$

$\alpha = 5\ \%$

Power = 80 %

Difference of mean is 0.06

Standard deviation is 1.5 & 1.9

The sample size is 112

Inclusion criteria:

All the couples enrolled in the study had a complete infertility work up that included the semen analysis, sperm preparation and documentation of tubal patency either by hysterosalpingography or chromotubation.

Exclusion criteria :

Women suffering from myomatas of the uterus, uterine anomalies e.g. Bicornuate uterus, septate uterus were excluded from the study.

Method:

All women gave a written & informed consent after counseling and the study was approved by the institutional ethical committee.

Ovulation induction was done as per the protocol, ovulation induction was done either using clomiphene citrate 50 to 150 mg/day from day 5 to day 9 and or with Human menopausal Gonadotrophin, and dose was adjusted as per the development of the follicle. Next 5,000 IU of hCG was given when the dominant follicle reached 18 mm in diameter. IUI was done 36 hrs after inj. hCG.

On the day of IUI semen sample was taken by masturbation after 2-4 days of sexual abstinence. After liquefaction and initial sperm analysis the standard swim-up technique was used for preparation.

In swim-up technique, the sperm sample was centrifuged at 1000 rpm for 10 minutes. The supernatant was discarded; the pellet was suspended in 2.5 ml of medium again centrifuged at 1000 rpm for 10 minutes. After discarding the supernatant, the pellet was gently over layered with medium and incubated for 45 min at 37°C. After incubation, the medium layer containing motile sperm was carefully collected and used for insemination.

All the semen sample was collected and analyzed according to WHO guidelines[30] and they were evaluated with respect to volume, total sperm count, concentration, leucocytes, motility, vitality and morphology. The ejaculate was processed and sperms were collected by swim up procedure.

Just before IUI , the endometrial volume , thickness & the pattern was noted. The assessment of endometrial thickness, pattern and volume were performed by trans vaginal ultrasonography using the SONACE - 8000 EX (PRIME – Model A4-MNT -15 TTK) systems with a 7.5 MHz vaginal transducer. Endometrial thickness was imaged in a longitudinal section and measured at the greatest anteroposterior diameter. Trilaminar & homogenous pattern was noted. Trilaminar pattern appeared as multilayered with hyperechogenic outer walls, a well defined central echogenic line and inner hypoechoeic region. Homogenous pattern was the one with single homogenous layer. For volume conventional method was used in which the anteroposterior diameter, the thickness and the length was measured and volume was calculated by the computer software.

The patient was placed in lithotomy position. The cervix was visualized with the help of a speculum. The vagina was cleaned with saline. The sperm sample loaded in the catheter plugged to the tuberculin syringe was manipulated through the cervix into the uterine cavity gently so as not to damage endometrium and then the sperm sample (About 0.4 to 0.5 ml of processed sperm) was released slowly with minimal compression into the uterine cavity in fundal region. We inseminated small volume of sperm sample to avoid reflux through the cervix into vagina, or efflux through the tubes into the peritoneal cavity. If any difficulty was encountered during entry to the cavity the tenaculum was used to hold the anterior lip of cervix. After the transfer, catheter was kept in its place for a while to avoid a suction effect and prevent reflux. After the procedure patient was advised to rest for 10-15 minutes.

A urine pregnancy test was performed 14 to 16 days after IUI if menses did not occur. Positive tests were confirmed by TVS.

EQUIPMENTS FOR IUI

ULTRASOUND MACHINE USED FOR IUI

MEASUREMENT OF ENDOMETRIAL VOLUME

TRILAMINAR ENDOMETRIAL PATTERN WITH ENDOMETRIAL THICKNESS OF 9.5 mm

Statistical Analysis:

For different quantitative variables mean and standard deviation were calculated. Means were compared using Student's paired 't' test, chi square test. The frequencies belonging to different categories of pregnant and non pregnant women were counted and percentages were calculated. The respective percentages (proportions) were compared using the test of proportion. For all the tests p value of <0.05 was taken as statistically significant.

RESULTS

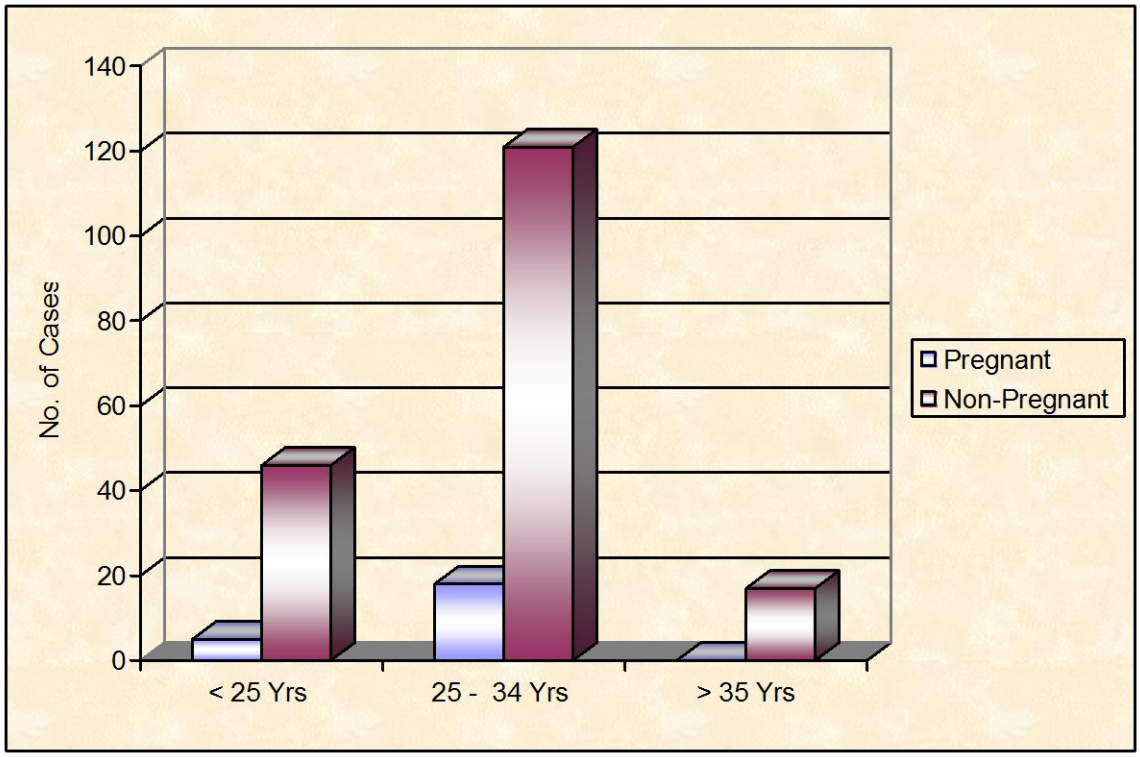
A total of 207 patients were included in the study out of which 23 became pregnant. The pregnancy rate of our study is 11.11 %.

Table 1 : Subject Demographic Data

	Pregnant	Non pregnant	P value	
Age	28.48 ± 3.3	27.63 ± 4.89	0.42	Ns
Duration of infertility	5.79 ± 3.94	6.14 ± 4.14	0.69	Ns
Day of IUI	14.57 ± 1.31	14.77 ± 1.76	0.59	Ns

Demographic data of both pregnant and non pregnant women is presented in table No. I. They are comparable between the two groups with neither of them having a statistical significance (p value > 0.05).

Graph 1 : Distribution of pregnant and non pregnant patients with respect to age



Graph 2 : Distribution of pregnant and non pregnant patients with respect to duration of infertility.

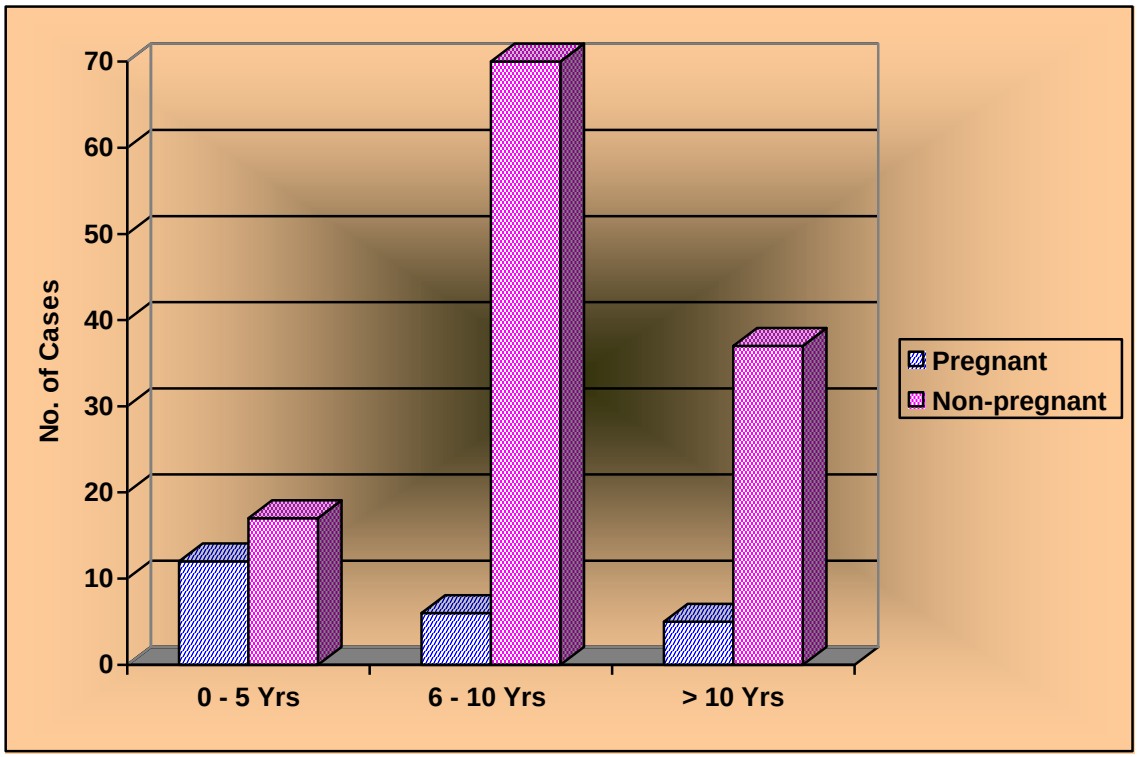


Table 2 : Sonographic data for pregnant versus non pregnant patients with respect to endometrial volume

Volume (ml)	Pregnancy	Cases	Percentage	P value	
< 1	2	25	8 %	0.511	Ns
1 - 1.9	7	91	7.69 %	0.085	Ns
2 - 2.9	11	68	16.18 %	0.312	Ns
≥ 3	3	23	13.04 %	0.941	Ns

The patients were alienated in subgroups on the basis of endometrial volume, the subgroups made were divided in volume < 1 ml, 1- 1.9 ml, 2-2.9 ml and ≥3 ml, p value was calculated , in all different subgroups there was no statistical significance. Also while analyzing the relation of pregnancy rate and endometrial volume on the day of IUI , it was observed that the pregnancy rate was double (percentage) when volume was more than 2 ml. To confirm the above finding we calculated the p value which came as non significant, but this volume of more than 2 ml had negative predictive value of 92.24 %. The positive predictive value, however, was 15.38 % when cut off was taken as 2 ml. The sensitivity was 60.87% and specificity was 58.15 %.

Graph 3 : Distribution of pregnant and non pregnant patients with respect to Endometrial volume.

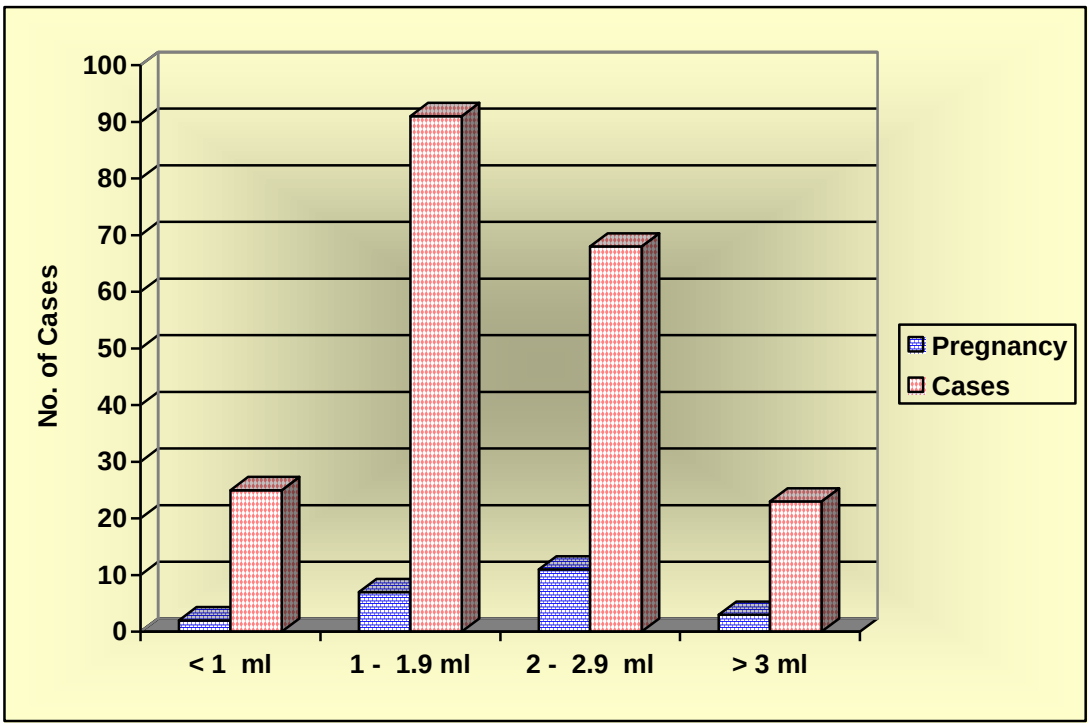
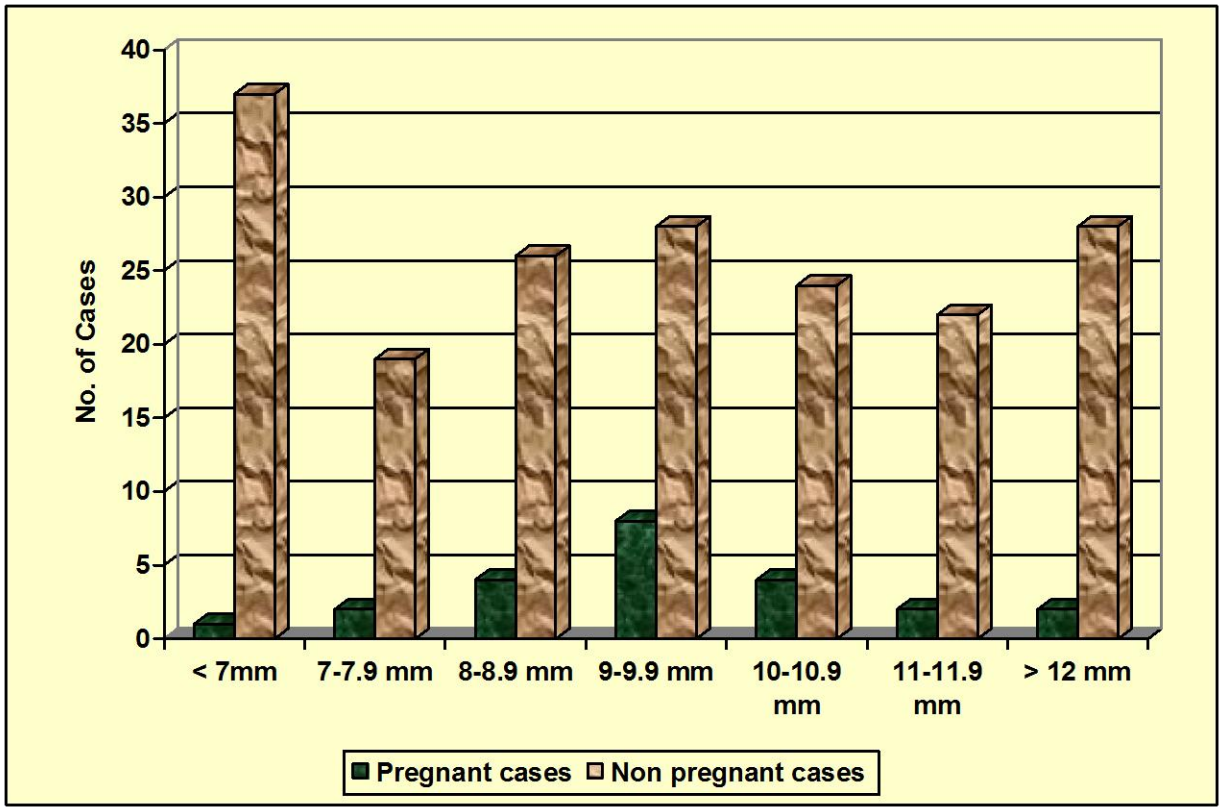


Table 3 : Sonographic data for pregnant versus non pregnant patients with respect to endometrial thickness

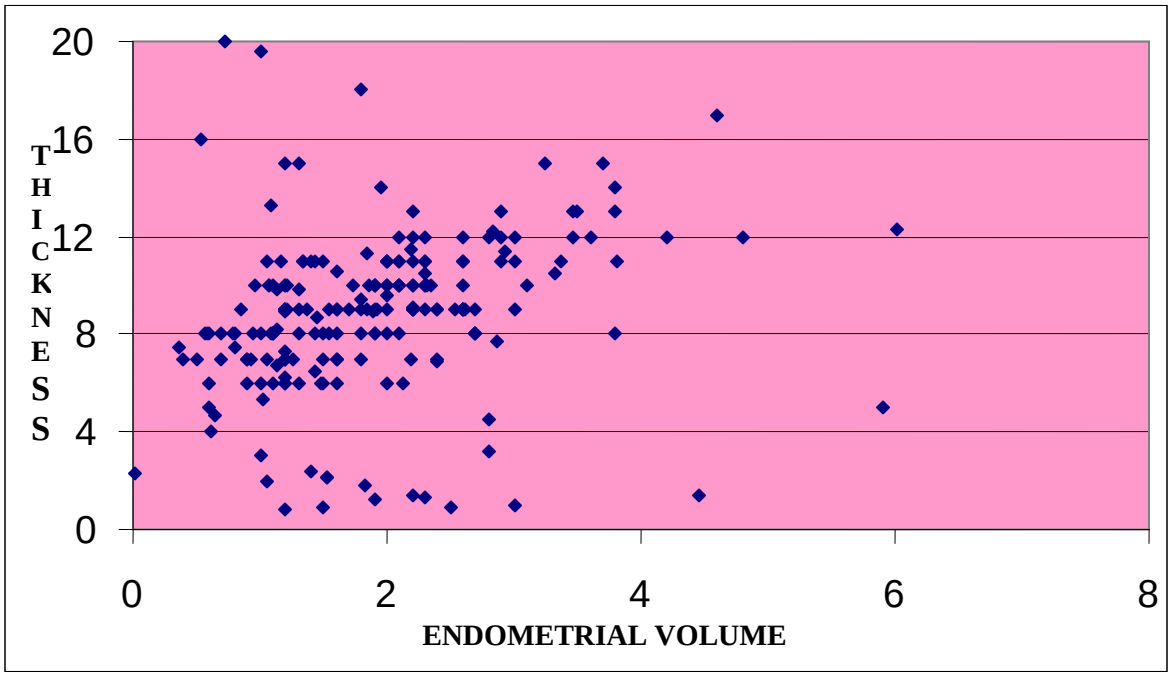
Endometrial thickness (mm)	Pregnant cases	Non pregnant cases	P value	
< 7	1	37	0.066	Ns
7-7.9	2	19	0.807	Ns
8-8.9	4	26	0.675	Ns
9-9.9	8	28	0.020	S
10-10.9	4	24	0.565	Ns
11-11.9	2	22	0.645	Ns
≥12	2	28	0.402	Ns

When testing endometrial thickness alone as a predictor of pregnancy, there was a statistical increase in pregnancy rates in the group with the endometrial thickness in the range of 9-9.9 mm (p value = 0.020). The minimal endometrial thickness associated with a pregnancy was 6 mm in the present study.

Graph 4 : Distribution of pregnant and non pregnant patients with respect to Endometrial thickness



Graph 5 : Scatter diagram to show relation of endometrial thickness with volume.



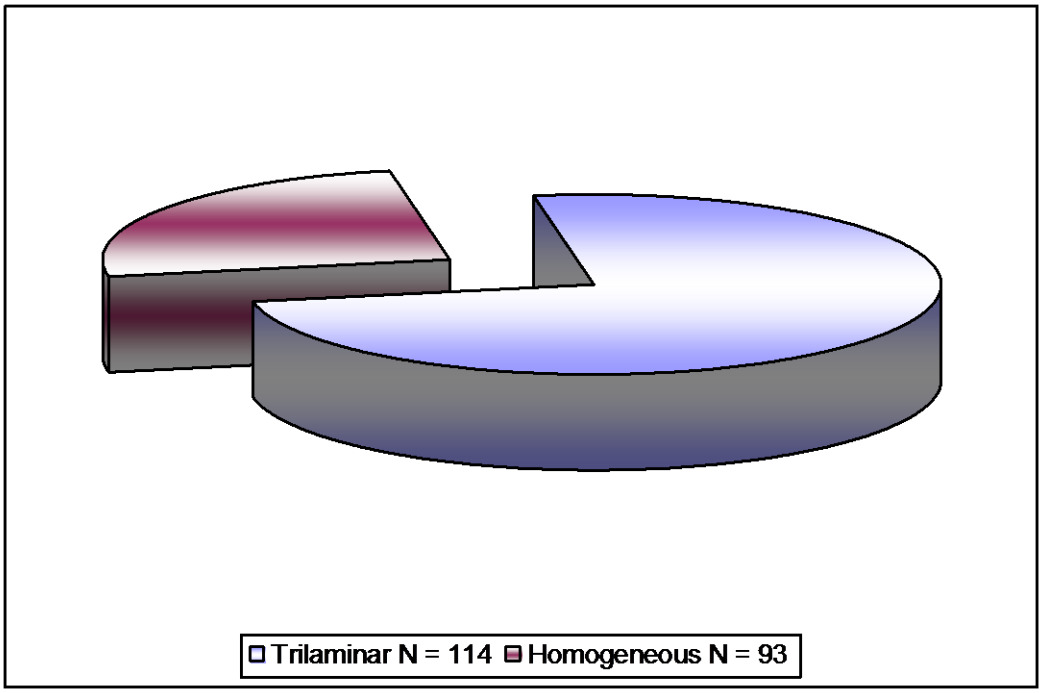
In our study we also observed that endometrial thickness has a statistical relation with the endometrial volume (p=0.0012). This can also be visualized by the scatter diagram. i.e. as there is increase in the endometrial thickness, the endometrial volume also increases.

Table 4 : Sonographic data of patients with trilaminar versus homogenous endometrium

	Trilaminar	Homogenous	P value	
Pregnancy rate (%)	15.79 %	5.37 %	0.0315	S

The above table suggests that a trilaminar pattern at the time of IUI is associated with a significantly higher pregnancy rates. In 114 (55.07%) patients trilaminar pattern was noted whereas 93 (44.92%) revealed homogenous pattern .The pregnancy rate was 15.79% in the trilaminar group compared with 5.37 % for the homogenous group ($P < 0.05$). For trilaminarity alone as a predictor of pregnancy the sensitivity is 78.26% and specificity is 47.83 %. Its positive predictive value came as 15.79 % and negative predictive value as high as 94.62%.

Graph 6 : Pie diagram to show distribution of pregnant and non pregnant patients with respect to Endometrial pattern.



After comparing all the factors separately we came to a conclusion that only endometrial pattern, and endometrial thickness in the range of 9-9.9 mm were statistically significant. Unlike endometrial volume which was statistically insignificant. To go into further detail we combined all the three factors- endometrial thickness, volume and pattern.

Table 5 : Sonographic data for pregnant versus non pregnant patients with respect to homogenous endometrial pattern and endometrial volume

Homogenous layer with volume of	Pregnant	Non pregnant	P value	
< 1 ml	2	20	0.750	Ns
1 – 1.9 ml	3	38	0.388	Ns
2 – 2.9 ml	0	25	0.059	Ns
≥3 ml	0	5	0.424	Ns

As seen from table 5 there is no statistical significance in homogenous endometrial pattern and endometrial volume

Table 6 : Sonographic data for pregnant versus non pregnant patients with respect to trilaminar endometrial pattern and endometrial volume.

Trilaminarity & volume	Pregnant	Non-pregnant	P value	
< 1 ml	0	3	0.537	Ns
1 – 1.9 ml	4	46	0.422	Ns
2 – 2.9 ml	11	32	<0.001	s
≥ 3 ml	3	15	0.433	Ns

From the above table it can be seen that there is significant impact on the pregnancy rates when trilaminarity and volume of 2-2.9 ml are taken together , with p value of <0.001.

Table 7 : Sonographic data for pregnant versus non pregnant patients with respect to endometrial volume of less than 1 ml and endometrial thickness.

Volume < 1 ml & thickness of	Pregnant	Non pregnant	P value	
< 7 mm	0	6	0.379	Ns
7- 7.9 mm	0	8	0.308	Ns
8- 8.9 mm	2	5	0.135	Ns
9- 9.9 mm	0	1	0.723	Ns
10- 10.9 mm	0	1	0.723	Ns
11- 11.9 mm	0	0	0	0
≥ 12 mm	0	2	0.615	Ns

Table 8 : Sonographic data for pregnant versus non pregnant patients with respect to endometrial volume of 1-1.9 ml and endometrial thickness.

Volume of 1- 1.9 ml & thickness of	Pregnant	Non pregnant	P value	
< 7 mm	1	20	0.329	Ns
7- 7.9 mm	1	9	0.909	Ns
8- 8.9 mm	0	17	0.128	Ns
9- 9.9 mm	2	15	0.929	Ns
10- 10.9 mm	3	9	0.115	Ns
11- 11.9 mm	0	8	0.308	Ns
≥ 12 mm	0	6	0.379	Ns

Table 9 : Sonographic data for pregnant versus non pregnant patients with respect to endometrial volume of 2-2.9ml and endometrial thickness.

Volume of 2- 2.9 ml & thickness of	Pregnant	Non pregnant	P value	
< 7 mm	0	8	0.308	Ns
7- 7.9 mm	1	2	0.217	Ns
8- 8.9 mm	2	3	0.037	S
9- 9.9 mm	5	12	0.012	S
10- 10.9 mm	1	12	0.685	Ns
11- 11.9 mm	1	12	0.685	Ns
≥ 12 mm	1	8	1.00	Ns

Table 10: Sonographic data for pregnant versus non pregnant patients with respect to endometrial volume of ≥ 3 ml and endometrial thickness.

Volume of ≥ 3 ml & thickness of	Pregnant	Non pregnant	P value	
< 7 mm	0	3	0.537	Ns
7- 7.9 mm	0	0	0	0
8- 8.9 mm	0	1	0.723	Ns
9- 9.9 mm	1	0	0.005	S
10- 10.9 mm	0	2	0.615	Ns
11- 11.9 mm	1	2	0.217	Ns
≥ 12 mm	1	12	0.685	Ns

On comparing the endometrial volume and thickness, when volume < 2 ml is taken irrespective of endometrial thickness there was no statistically significant correlation. But when volume of 2-2.9 ml is taken with endometrial thickness in the range of 8-8.9 mm and 9-9.9 mm the results are statistically significant with p value of 0.037 and 0.012 respectively. Also when volume of ≥ 3 ml is coupled with thickness of 9-9.9 mm results are significant with p value of 0.005.

Table 11: Sonographic data for pregnant versus non pregnant patients with respect to trilaminar endometrial pattern and endometrial thickness.

Trilaminarity and thickness of	Pregnant cases	Non pregnant cases	P value	
<7mm	0	18	0.116	Ns
7-7.9 mm	1	7	0.899	Ns
8-8.9 mm	2	12	0.695	Ns
9-9.9 mm	7	11	<0.001	S
10-10.9 mm	4	14	0.116	Ns
11-11.9 mm	2	16	1.000	Ns
≥ 12 mm	2	18	0.868	Ns

Table 12: Sonographic data for pregnant versus non pregnant patients with respect to homogenous endometrial pattern and endometrial thickness.

Homogenous pattern and thickness of	Pregnant cases	Non pregnant cases	P value	
<7mm	1	19	0.360	Ns
7-7.9 mm	1	12	0.685	Ns
8-8.9 mm	2	14	0.854	Ns
9-9.9 mm	1	17	0.433	Ns
10-10.9 mm	0	10	0.252	Ns
11-11.9 mm	0	6	0.379	Ns
≥ 12 mm	0	10	0.252	Ns

As seen from the above table 11 Trilaminarity and thickness of 9-9.9 mm have a statistical significance with a p value of <0.001, unlike, homogenous pattern which has no statistical significance with endometrial thickness

DISCUSSION

The success rate of IUI depends on a number of factors, starting from the ovulation induction protocol, to the day of administration of Inj. hCG and day of insemination. For the judgment of all above stated factors ultrasound helps in a very big way ,it has changed the scenario drastically and there is an evolution in the management of infertility after the use of ultrasonography.

A study was conducted to assess the impact of three-dimensionally measured endometrial volume on the pregnancy rates after intrauterine insemination. Those authors concluded that the endometrial volume on the day of IUI was not statistically significant in the women who became pregnant (4.0 ± 1.5ml) from non pregnant (3.4 ± 1.9ml). Similar results were demonstrated from our study, endometrial volume on the day of IUI ,in women who became pregnant (2.14 ± 0.83ml) versus non pregnant (1.88 ± 0.96 ml)had no statistical significance (p value=0.22). Those authors also concluded that there was no statistical significance in the thickness and pattern on the day of IUI. [22] On the contrary, we came to a conclusion that both endometrial pattern and thickness had a statistical significance. Trilaminar pattern had a p value of 0.0315 and endometrial thickness in the range of 9-9.9 mm had p value of 0.020. Lastly they concluded that the endometrial volume of ≥2 ml when taken along with trilaminar pattern had a statistical difference ($p<0.05$) when compared between pregnant and non pregnant patients. Similar results were also obtained from our study in which trilaminar pattern with endometrial volume of 2-2.9 ml, on the day of IUI, had statistical significance with p value of <0.05.

The endometrial pattern was so much under controversy ranging from no effect on pregnancy rates[11] to low PRs in patients who lacked the normal triple lined endometrium[19,20,21,22]. Our study concluded that trilaminarity alone had a statistical dominance ($p < 0.05$) on the pregnancy rates and also on combining endometrial volume and thickness. Trilaminarity with endometrial volume of 2-2.9 ml and endometrial thickness of 9-9.9 mm has p value of <0.001 in both the cases, making it statistically significant.

Many authors were unable to show a statistically significant difference in endometrial thickness in pregnant and non pregnant group.[13] While there were others who claim that the pregnancy continuation rate was 12.6% when thickness was more than or equal to 9 mm, compared to 6.9% when the thickness was 6mm to 8mm.[11] In our study we came to the conclusion that endometrial thickness has a important role to play in the prediction of pregnancy outcome when it is in range of 9-9.9 mm. We confirmed our findings by taking different cut off values of the endometrial thickness and there was statistical difference in the pregnancy outcome with p value of 0.020 which was statistically significant. Furthermore on combining endometrial thickness and endometrial volume it was seen that results were statistically significant. When endometrial thickness was in range of 8-9.9 mm with volume of 2-2.9 ml and also 9-9.9 mm with volume more than or equal to 3 ml , p value was <0.05 in both the cases.

CONCLUSION

Intrauterine insemination is used in the treatment of infertility due to various etiologies. There have always been many attempts to improve the outcome of IUI, and to increase pregnancy outcome, endometrial receptivity has always been investigated.

In the present study, we came to a conclusion that

1 Endometrial volume analyzed isolated had no statistical significance. Endometrial thickness in range of 9-9.9 mm and trilaminar pattern had a statistical significance when analyzed independently (p value <0.05).

2 When the above stated parameters were combined results came out to be significant on combining trilaminarity with endometrial thickness of 9-9.9 mm and volume of 2-2.9 ml with p value <0.001 in both the cases.

3 When endometrial volume and endometrial thickness were analyzed together results were statistically significant. Endometrial volume in the range of 2-2.9 ml with thickness of 8-9.9 mm and endometrial volume ≥ 3 ml with thickness 9-9.9 mm. had p value <0.05.

4 Thus, endometrial volume, thickness and pattern when combined together are better predictor of pregnancy outcome rather than either of them analyzed independently.

SUMMARY

A prospective study was conducted among 207 infertile couples attending ARC at KLES Prabhakar Kore Hospital and MRC, Belgaum over a period of one year from 1st January 2007 to 1st January 2008. Amongst those 207 couple enrolled 23 had become pregnant. Aim of the present study was to evaluate the role of endometrial parameters in terms of volume, thickness and pattern in the prediction of pregnancy outcome.

Demographic data including age, duration of infertility, IUI cycle and day of IUI were comparable in both pregnant and non pregnant groups.

It was observed that endometrial volume independently had no significant dominance on the pregnancy outcome, unlike trilaminar pattern and endometrial thickness of 9-9.9 mm which had statistical significance.

In addition, combination of endometrial volume with thickness and trilaminarity had a significant predictive value.

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PARTICPANTS INFORMATION AND CONSENT FORM

Sr. No. _____

Patients Name Mrs. _____

We hereby request you to participate in our study that is a "**A PROSPECTIVE STUDY TO ASSESS THE ROLE OF ENDOMETRIAL VOLUME IN PREDICTING THE PREGNANCY RATES IN WOMEN UNDERGOING INTRAUTERINE INSEMINATION (IUI) AT ARC, KLES PRABHAKAR KORE HOSPITAL AND MRC, BELGAUM**"

This study is designed to evaluate the role of endometrial volume as measured by trans vaginal ultrasonography in predicting the outcome of pregnancy after IUI.

This study is being done under direct supervision of Dr. B. R. Desai Program Director, ARC, If you agree to participate in this study, the protocol is to measure the endometrial volume just before intrauterine insemination. As such there are no risk involved. Your participation may benefit you and others undergoing same procedure. All information collected about you during the course of this study will be kept confidential.

There are no financial incentives promised to you for being a part of this study. You will not be charged any extra cost. Your participation in this study is entirely voluntary and you may withdraw from the study at any time and you will be treated according to the existing protocol.

If you have any questions about the study, you may please contact Dr. V. D. Patil, Principal, J. N. Medical College, Belgaum, Telephone no. 95831-2473777 in case of

emergency you may contact chief investigator Dr. B. R. Desai, Program Director, ARC, KLESH and MRC, Phone No. 98844054568, Dr. Blossom Prakash, P. G. Department of Obstetrics and Gynaecology, J. N. M. C., Belgaum, Contact No. 9343454222.

I have been explained in my vernacular language regarding the proposed procedure and the risk and benefits associated with it and I undersigned give my consent for the same.

Signature of participant or legally authorized representative

Participant's name _____

Signature _____

Address _____

_____

Telephone number _____

Experimenters / Witness Name _____

Signature _____

Date : _____

PROFORMA

"A PROSPECTIVE STUDY TO ASSESS THE ROLE OF ENDOMETRIAL VOLUME IN PREDICTING THE PREGNANCY RATES IN WOMEN UNDERGOING INTRAUTERINE INSEMINATION (IUI) AT ARC, KLES PRABHAKAR KORE HOSPITAL AND MRC, BELGAUM"

Sl. No. : _____ Place : _____

IUI : _____

BRD / ARC

Patients Name : _____ Age : _____

Husband's Name : _____ Age : _____

Address : _____

_____

Residence Phone No. : _____ Office Phone No. : _____

Duration of Infertility : _____ AIH/AID : _____

Semen analysis : _____

ML : _____ 1°/2° Infertility : _____

LMP : _____ Follicular study : _____

Day : _____

No. of previous IUI : _____ Endometrial volume : _____

No. of previous IUI : _____ Endometrial thickness : _____

Endometrial pattern : _____

Menstrual Cycle : _____

Treatment Given : _____

_____

_____

Scan done by

_____

_____

Date : _____

Outcome

UPT on : _____ / TVS on : _____

Conclusion : _____

_____

_____

_____

Dr. B. R. Desai
Professor and Head,
Department of Obstetrics and Gynecology,
J. N. Medical College, Belgaum

KEY TO MASTER CHART

AID : Assisted insemination – Donor sample

AIH : Assisted insemination – Husband sample

Day : Day of cycle

Endo. : Endometrial

Foll : Follicular

H : Homogenous pattern

Infer : Infertility

LT : Left

ML : Married life

Prev : Previous

RT : Right

T : Trilaminar pattern

Sr. No.	Name	Age (Yrs)	Duration of infertility	AIH/ AID	ML	Day	IUI Cycle	Prev. No. of IUI	1 / 2 infert	Foll. Study (mm)	Endo		Endo. Pattern	Pregnancy
											Volume (ml)	Thickness (mm)		
1	NNG	28	15	AID	15	16	2	1	1	Ruptured	0.01	2.28	H	No
2	ME	36	4	AIH	4	15	3	2	1	Rt. 17x16	0.4	7	H	No
3	HBD	25	8	AIH	8	14	1	-	1	Rt. 19×28	0.5	7	H	No
4	SBK	25	9	AIH	9	16	4	3	1	Lt. 16×19	0.54	16	H	No
5	MN	26	7	AIH	7	14	3	2	1	Ruptured	0.56	8	H	No
6	NN	28	14	AID	14	15	2	1	1	Ruptured	0.58	8	H	No
7	VP	25	5	AID	5	13	1	-	1	Lt 18 x 18	0.6	6	H	No
8	VB	28	8	AID	8	14	5	3	1	Rt 22 18	0.6	8	H	No
9	SB	21	2	AID	2	16	2	1	1	Ruptured	0.6	5	H	No
10	RB	32	3	AIH	5	15	3	3	2	Rt 19x17	0.62	4	H	No
11	RS	36	1	AIH	1	15	1	-	2	Ruptured	0.65	4.7	H	No
12	AM	36	13	AIH	13	19	2	1	1	Lt 19x21	0.7	7	H	No
13	AS	25	5	AIH	3	12	4	3	1	Rt 19x14	0.73	20	H	No
14	RG	23	4	AIH	4	16	2	1	1	R 19x21	0.78	8	H	No
15	MP	32	12	AIH	12	12	1	-	1	Lt 16×16	0.8	8	H	Yes
16	GV	26	3.5	AIH	3.5	14	1	-	1	Ruptured	0.8	7.5	H	No
17	SD	32	2	AIH	5	12	3	2	2	Ruptured	0.85	9	H	No
18	IAG	34	8	AIH	8	15	6	5	1	Ruptured	0.9	6	H	No
19	LB	25	5	AID	5	15	4	3	1	Ruptured	0.9	7	H	No
20	SSK	32	3	AIH	3	20	1	-	1	Rt. 14×15	0.9	7	H	No
21	GM	25	12	AID	12	14	2	1	1	Rt. 18×16	0.93	7	H	No
22	GG	24	6	AIH	6	17	1	-	1	Ruptured	0.95	8	H	No
23	SP	40	15	AID	15	13	1	-	1	Lt. 18x22	1	8	H	No
24	SMK	25	2	AIH	2	14	1	-	2	Ruptured	1	3	H	No
25	PBK	35	17	AID	17	18	2	1	1	Rt. 18×17	1.06	2	H	No
26	SS	38	9	AIH	9	12	2	3	1	Ruptured	1.07	10	H	No
27	G.C	35	13	AIH	13	13	4	3	1	Ruptured	1.08	13.3	H	No
28	UD	30	4	AID	4	16	1	-	1	Ruptured	1.1	8	H	No
29	AAF	32	1.5	AIH	1.5	13	1	-	1	Rt. 21×24	1.1	10	H	No
30	KUS	33	6	AIH	6	14	2	1	1	Ruptured	1.1	8	H	No
31	SB	31	8	AIH	12	15	1	-	2	Rt. 21×21	1.14	9.8	H	No
32	VJ	29	4	AID	4	16	3	2	2	Rt. 19x20	1.2	6	H	Yes
33	RA	28	2	AIH	2	13	1	-	1	Rt. 18x15	1.2	7	H	Yes
34	SH	25	3	AIH	8	17	2	1	2	Rt 11x12	1.2	10	H	No
35	ZS	28	2	AIH	2	15	2	1	1	Rt 15x17	1.2	6.2	H	No

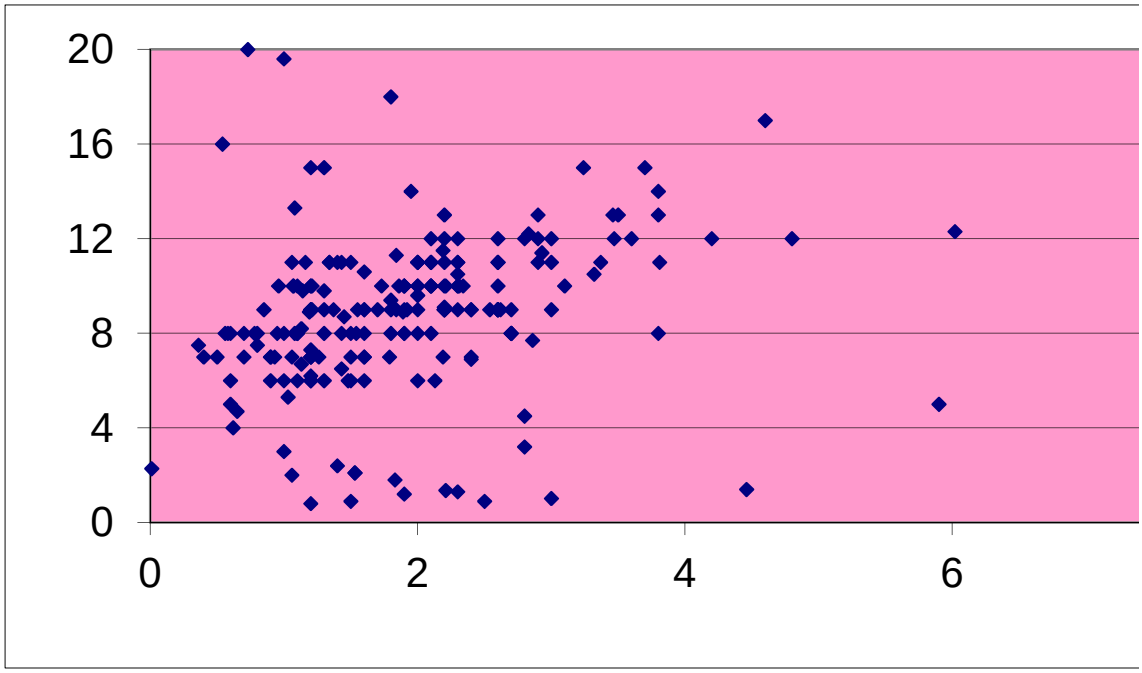
Sr. No.	Name	Age (Yrs)	Duration of infertility	AIH/ AID	ML	Day	IUI Cycle	Prev. No. of IUI	1 / 2 infert	Foll. Study (mm)	Endo		Endo. Pattern	Pregnancy
											Volume (ml)	Thickness (mm)		
36	ZS	28	2	AIH	2	15	3	2	1	Lt 22x22	1.2	7	H	No
37	RS	32	1	AIH	1	16	1	-	1	Lt 13x18	1.2	7.3	H	No
38	SB	21	2	AID	2	15	1	-	1	Rt 13 17	1.2	6	H	No
39	JLP	22	6	AIH	6	18	2	1	1	Ruptured	1.2	9	H	No
40	MP	24	5	AID	5	17	1	-	1	Ruptured	1.2	15	H	No
41	JK	21	5	AIH	5	14	1	-	1	RT 29×19	1.2	0.8	H	No
42	SK	25	9	AIH	9	14	3	2	1	Ruptured	1.21	9	H	No
43	MK	33	10	AIH	10	14	2	1	1	Rt 16x17	1.3	8	H	No
44	VK	30	6	AIH	6	14	2	1	1	Ruptured	1.3	6	H	No
45	SS	22	7	AIH	7	17	2	1	1	Rt 17x17	1.4	11	H	No
46	SS	32	14	AIH	14	15	2	1	1	Rt 18x18	1.43	6.5	H	No
47	VB	19	2	AID	2	14	2	1	1	Ruptured	1.43	8	H	No
48	RM	32	10	AIH	10	15	1	-	1	Rt 15x14	1.5	6	H	No
49	RK	20	3	AID	4	18	4	3	1	Ruptured	1.5	7	H	No
50	JG	27	8	AIH	8	19	1	-	1	Ruptured	1.54	8	H	No
51	RK	29	8	AIH	14	13	1	-	2	Ruptured	1.55	9	H	No
52	BK	25	2	AIH	2	18	1	-	1	Rt. 19x21	1.6	6	H	No
53	NA	28	15	AID	15	16	2	1	1	Ruptured	1.6	7	H	No
54	SH	26	6	AID	6	15	1	-	1	Rt. 15×15	1.6	9	H	No
55	ND	28	4	AID	4	13	5	4	1	Ruptured	1.8	9.4	H	Yes
56	SG	26	2	AID	3.5	14	1	-	2	Rt 18X16	1.8	9	H	No
57	LSB	25	5	AID	5	17	5	4	1	Ruptured	1.8	8	H	No
58	SA	21	6	AIH	6	14	1	-	1	Ruptured	1.84	11.3	H	No
59	ASF	31	3	AIH	3	12	7	6	2	Rt 14x10	1.86	10	H	No
60	SVH	24	3	AIH	3	16	1	-	1	Lt. 19x28	1.9	10	H	No
61	MS	35	17	AIH	17	14	1	-	1	Rt. 16x19	1.9	8	H	No
62	PA	33	6	AID	6	15	2	2	1	Lt. 19x18	1.9	1.2	H	No
63	RP	24	10	AID	10	15	2	1	1	Ruptured	1.92	9	H	No
64	YM	28	12	AID	12	15	2	1	1	Rt. 19×18	2	9	H	No
65	SS	23	5	AIH	5	15	1	-	1	Ruptured	2	11	H	No
66	DV	20	4	AID	4	14	2	-	1	Ruptured	2	11	H	No
67	SK	32	6	AIH	7	15	3	2	2	Ruptured	2.1	8	H	No
68	SC	38	7	AID	15	15	5	4	2	Rt. 19x19	2.13	6	H	No
69	DA	31	2	AIH	2	19	1	-	1	Ruptured	2.19	11.5	H	No
70	VK	32	7	AIH	7	13	1	-	1	Lt 19x20	2.2	9	H	No

Sr. No.	Name	Age (Yrs)	Duration of infertility	AIH/ AID	ML	Day	IUI Cycle	Prev. No. of IUI	1 / 2 infert	Foll. Study (mm)	Endo		Endo. Pattern	Pregnancy
											Volume (ml)	Thickness (mm)		
71	SK	32	3	AIH	3	15	2	1	1	Rt. 16×17	2.2	9	H	No
72	UA	30	4	AID	4	15	3	2	1	Ruptured	2.2	9.1	H	No
73	RP	24	2	AIH	2.5	16	2	1	2	Ruptured	2.2	9	H	No
74	SK	32	1	AIH	2	13	1	-	1	Ruptured	2.21	10	H	No
75	SK	31	12	AIH	12	13	1	-	1	Ruptured	2.3	10.5	H	No
76	SNB	29	6	AIH	6	15	3	2	1	Lt. 22×12	2.3	9	H	No
77	AP	30	4	AID	4	14	2	1	1	Ruptured	2.3	10	H	No
78	RP	25	9	AID	9	14	1	-	1	Ruptured	2.31	10	H	No
79	MG	24	9	AIH	9	15	1	-	1	Rt 14x15	2.4	6.9	H	No
80	LA	33	9	AIH	9	16	5	4	1	Rt 15x19	2.4	7	H	No
81	BS	30	10	AID	10	13	1	-	1	Rt 25x25	2.4	9	H	No
82	SS	27	5	AIH	5	14	1	-	1	Lt 16x15	2.6	12	H	No
83	KS	29	1	AIH	5	14	4	3	2	Rt 17×17	2.6	9	H	No
84	BV	20	4	AID	4	14	1	-	1	Lt 16×19	2.6	9	H	No
85	SH	33	10	AIH	10	14	2	1	1	Rt 19x19	2.7	8	H	No
86	RM	32	6	AIH	6	17	1	-	1	Ruptured	2.8	4.5	H	No
87	VB	18	1.5	AID	1.5	16	1	-	1	Ruptured	2.83	12.2	H	No
88	GH	24	5	AIH	5	15	1	-	1	Rt 18×18	2.9	12	H	No
89	NT	30	10	AID	10	13	7	6	1	Ruptured	3.32	10.5	H	No
90	GM	25	2	AID	12	14	1	-	1	Rt 17x18	3.37	11	H	No
91	IJ	27	8	AIH	8	15	3	2	1	Ruptured	3.6	12	H	No
92	SB	29	5	AIH	5	15	1	-	1	Rt 15x15	3.8	13	H	No
93	MB	20	5	AIH	5	14	1	-	1	Ruptured	6.02	12.3	H	No
94	RK	22	2.5	AID	2.5	17	4	3	1	Rt 19x19	0.36	7.5	T	No
95	JG	20	7	AID	7	17	1	-	2	Ruptured	0.7	8	T	Yes
96	ST	28	6	AIH	10	16	1	-	2	Lt. 18×22	0.96	10	T	No
97	AP	31	4	AID	4	15	1	-	1	Rt. 20x26	1	19.6	T	No
98	BT	25	9	AIH	9	16	1	-	1	Lt. 13x13	1	6	T	No
99	AK	27	6	AIH	6	15	4	3	1	Lt. 18×18	1.03	5.3	T	No
100	SK	21	8	AID	8	14	3	2	1	Ruptured	1.06	7	T	No
101	KS	21	3	AID	3	16	2	1	1	Rt 20×19	1.06	11	T	No
102	L	32	6	AIH	6	14	1	-	2	Rt 24x26	1.07	10	T	Yes
103	GS	22	1	AID	9	12	1	-	2	Rt 18×23	1.08	8	T	No
104	IN	26	2	AID	9	14	2	1	2	Rt. 18x20	1.1	6	T	No
105	AK	27	3	AIH	6	14	3	2	2	Rt 19x19	1.1	8	T	No

Sr. No.	Name	Age (Yrs)	Duration of infertility	AIH/ AID	ML	Day	IUI Cycle	Prev. No. of IUI	1 / 2 infert	Foll. Study (mm)	Endo		Endo. Pattern	Pregnancy
											Volume (ml)	Thickness (mm)		
106	VS	30	11	AIH	11	11	4	3	1	Ruptured	1.13	6.7	T	No
107	AA	25	0.67	AIH	3	14	3	2	1	Lt 17x15	1.13	8.2	T	No
108	SA	19	3	AIH	3	17	2	1	1	Ruptured	1.16	11	T	No
109	KB	25	10	AID	10	14	1	-	1	Ruptured	1.19	8.9	T	No
110	SG	30	13	AID	13	15	2	1	1	Lt 17x17	1.2	10	T	Yes
111	N	21	2	AIH	3	15	1	-	2	Ruptured	1.2	9	T	No
112	MP	20	12	AIH	12	12	1	-	1	Ruptured	1.2	7	T	No
113	FS	25	1	AIH	7	14	1	-	2	Lt 19x15	1.2	9	T	No
114	AH	27	6	AID	6	14	1	-		Rt 28x25	1.21	10	T	No
115	LN	31	3	AIH	3	14	1	-	1	Lt 25 24	1.26	7	T	No
116	GB	26	10	AIH	10	13	1	-	1	Rt 24x22	1.3	9.8	T	No
117	AG	29	6	AIH	9	16	3	2	2	Rt 14x19	1.3	9	T	No
118	JH	31	3	AIH	3	15	1	-	1	Ruptured	1.3	15	T	No
119	RS	29	5	AIH	9	16	1	-	1	Ruptured	1.34	11	T	No
120	KH	28	9	AID	9	14	2	1	1	Ruptured	1.34	11	T	No
121	NA	28	15	AID	15	15	2	1	1	Ruptured	1.37	9	T	No
122	CNH	25	9	AID	9	14	1	-	1	Rt 20×20	1.4	2.4	T	No
123	AR	25	3	AIH	3	16	4	3	1	Ruptured	1.43	11	T	No
124	PPJ	28	5	AIH	5	12	1	-	1	Ruptured	1.45	8.7	T	No
125	SB	25	1	AIH	8	16	1	-	2	Rt 16 18	1.48	6	T	No
126	NM	26	2.5	AIH	2.5	14	1	-	2	Lt 23x21	1.5	8	T	No
127	SF	37	3	AIH	5	13	1	-	2	Ruptured	1.5	0.9	T	No
128	SS	32	6	AIH	6	15	1	-	1	Ruptured	1.5	11	T	No
129	STN	29	4	AIH	11	14	2	1	2	Rt. 21×22	1.53	2.1	T	No
130	STM	29	4	AIH	11	14	2	1	2	Rt 21×22	1.53	2.1	T	No
131	SR	20	4	AIH	4	14	1	-	1	Rt 18x12	1.6	9	T	No
132	GC	21	12	AIH	12	14	5	4	1	Lt. 16x22	1.6	7	T	No
133	KS	21	3	AID	3	16	2	1	1	Rt 12×16	1.6	10.6	T	No
134	SB	21	1.5	AID	1.5	14	1	-	1	Ruptured	1.6	8	T	No
135	VR	24	8	AID	8	17	4	3	1	Rt 23x20	1.7	9	T	No
136	SK	31	12	AIH	12	14	2	1	1	Ruptured	1.73	10	T	Yes
137	SM	19	4	AIH	4	13	2	1	1	Ruptured	1.79	7	T	No
138	SDJ	32	5	AIH	8	14	1	-	2	Lt. 21×4	1.8	18	T	No
139	JNB	34	10	AID	10	15	5	4	1	Ruptured	1.83	1.8	T	No
140	SN	19	2	AIH	3	12	1	-	2	Ruptured	1.84	9	T	No

Sr. No.	Name	Age (Yrs)	Duration of infertility	AIH/ AID	ML	Day	IUI Cycle	Prev. No. of IUI	1 / 2 infert	Foll. Study (mm)	Endo		Endo. Pattern	Pregnancy
											Volume (ml)	Thickness (mm)		
141	KS	21	3	AID	3	14	1	-	1	Lt 20x18	1.89	8.9	T	No
142	SN	30	1	AID	10	16	4	3	2	Ruptured	1.9	9	T	Yes
143	SK	25	7	AID	7	14	2	1	1	Rt 22x15	1.9	10	T	No
144	AR	26	1.5	AIH	3	13	5	4	1	Rt. 18x18	1.9	8	T	No
145	GP	25	7	AIH	7	23	1	-	1	Ruptured	1.9	10	T	No
146	BB	35	12	AID	12	14	1	-	1	Ruptured	1.95	14	T	No
147	LB	30	10	AID	10	13	1	-	1	Rt 26x16	2	10	T	No
148	SP	28	4	AIH	9	14	3	2	2	Lt. 21x21	2	8	T	No
149	VB	18	1.5	AID	1.5	15	1	-	1	Rt. 25x13	2	11	T	No
150	BS	30	12	AID	12	17	3	2	1	Rt. 18×18	2	6	T	No
151	ACK	30	4	AIH	4	14	1	-	1	Ruptured	2	10	T	No
152	AG	24	2	AIH	2	17	1	-	1	Ruptured	2	9.6	T	Yes
153	JH	33	7	AIH	7	14	2	1	2	Ruptured	2.1	10	T	Yes
154	KK	28	10	AID	10	13	1	-	1	Ruptured	2.1	11	T	No
155	KS	28	1	AIH	5	14	3	2	2	Rt 17x22	2.1	11	T	No
156	PK	23	6	AID	6	16	3	1	1	Ruptured	2.1	12	T	No
157	UA	30	4	AID	4	14	2	1	1	Ruptured	2.1	10	T	No
158	VN	30	11	AIH	11	15	2	1	1	Lt. 24×27	2.1	10	T	No
159	NG	35	2	AIH	2	12	1	-	1	Ruptured	2.19	7	T	No
160	BM	30	6	AID	6	14	1	-	1	Ruptured	2.2	9	T	Yes
161	RA	28	2.5	AIH	2.5	14	1	-	2	Ruptured	2.2	10	T	No
162	YS	28	12	AID	12	16	1	-	1	Rt. 17×18	2.2	12	T	No
163	SK	26	8	AID	8	15	4	3	1	Lt 17x17	2.2	11	T	No
164	SS	32	14	AIH	14	13	3	2	1	Ruptured	2.2	13	T	No
165	IGJ	27	6	AIH	6	16	1	-	1	Ruptured	2.21	1.36	T	No
166	VH	23	2.5	AIH	2.5	12	1	-	1	Ruptured	2.3	12	T	No
167	SDM	30	5	AID	5	13	2	1	1	Rt. 19x18	2.3	1.3	T	No
168	NK	30	1	AIH	2	14	1	-	2	Rt. 19x20	2.3	11	T	No
169	AS	36	13	AIH	13	16	2	1	1	Lt 15x16	2.3	11	T	No
170	MS	26	6	AIH	6	14	1	-	1	Rt 27x28	2.3	10	T	No
171	RKY	22	3	AIH	3	15	1	-	1	Lt 16×13	2.34	10	T	No
172	SK	25	9	AIH	9	17	2	1	1	Lt 13x13	2.4	9	T	No
173	ACK	30	3.5	AIH	4	14	8	7	1	Ruptured	2.5	0.9	T	No
174	MVP	30	3	AIH	3	14	1	-	1	Rt. 18×20	2.54	9	T	No
175	Uma	26	1.5	AID	1.5	10	4	4	1	Ruptured	2.6	11	T	No

Sr. No.	Name	Age (Yrs)	Duration of infertility	AIH/ AID	ML	Day	IUI Cycle	Prev. No. of IUI	1 / 2 infert	Foll. Study (mm)	Endo		Endo. Pattern	Pregnancy
											Volume (ml)	Thickness (mm)		
176	SN	23	4	AIH	4	14	1	-	1	Lt 23x22	2.6	9	T	Yes
177	V	32	6	AIH	10	15	1	-	1	Ruptured	2.6	10	T	No
178	SC	25	3	AIH	3	16	1	-	1	Ruptured	2.6	11	T	Yes
179	CM	24	2	AIH	2	15	1	-	1	Ruptured	2.6	9	T	Yes
180	ASF	36	8	AID	8	11	1	-	2	Rt 27x28	2.62	9	T	No
181	JD	29	7	AIH	7	15	3	2	1	Ruptured	2.7	8	T	Yes
182	SC	31	10	AID	10	13	1	-	1	Ruptered	2.7	8	T	Yes
183	NK	26	4	AIH	4	15	2	1	1	Ruptured	2.7	9	T	Yes
184	FIS	25	2	AIH	7	16	2	1	2	Ruptured	2.8	3.2	T	No
185	JY	24	2	AIH	2	15	1	-	1	Ruptured	2.8	12	T	Yes
186	RK	34	6	AIH	7	13	1	-	2	Ruptured	2.86	7.7	T	Yes
187	RB	29	2.5	AID	2.5	15	2	1	2	Rt 21x25	2.9	13	T	No
188	SU	32	5	AIH	5	13	1	-	1	Rt. 18×18	2.9	11	T	No
189	RN	22	2	AIH	2	14	1	-	1	Ruptured	2.93	11.4	T	No
190	LM	28	3	AIH	5	15	1	-	2	Ruptured	3	11	T	Yes
191	PP	38	20	AIH	20	17	2	1	1	Rt 16x21	3	1.02	T	No
192	ND	21	8	AIH	3	15	2	7	2	Lt. 17x19	3	12	T	No
193	SH	24	2	AIH	2	17	1	-	1	Ruptured	3	9	T	Yes
194	KS	28	5	AIH	5	15	2	1	2	Ruptured	3.1	10	T	No
195	PP	38	20	AIH	20	17	3	2	1	Ruptured	3.24	15	T	No
196	MK	32	10	AIH	10	14	1	-	1	Rt 16x17	3.46	13	T	No
197	VK	26	5	AIH	5	15	3	4	1	Rt 14x16	3.47	12	T	No
198	RP	24	1.5	AIH	2	20	1	-	2	Rt 18×13	3.5	13	T	No
199	PS	30	7	AIH	7	15	1	-	1	Lt 13x18	3.7	15	T	No
200	RL	32	7	AIH	7	14	2	1	2	Lt 18×18	3.8	14	T	Yes
201	KM	32	6	AIH	6	17	1	-	1	Ruptured	3.8	8	T	No
202	RS	23	6	AIH	6	16	3	2	1	Ruptured	3.81	11	T	No
203	CA	23	3	AIH	3	14	1	-	2	Rt. 22x12 mm	4.2	12	T	No
204	JC	33	17	AIH	17	13	3	1	2	Rt 28×28	4.46	1.4	T	No
205	SB	29	1.5	AID	1.5	13	2	1	1	Lt. 22x18 mm	4.6	17	T	No
206	SN	27	6	AID	6	14	3	2	1	Lt. 26X22	4.8	12	T	No
207	SJ	42	15	AID	15	17	1	-	1	Ruptured	5.9	5	T	No


20
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12
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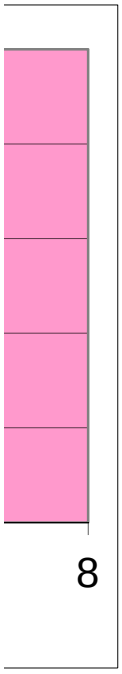

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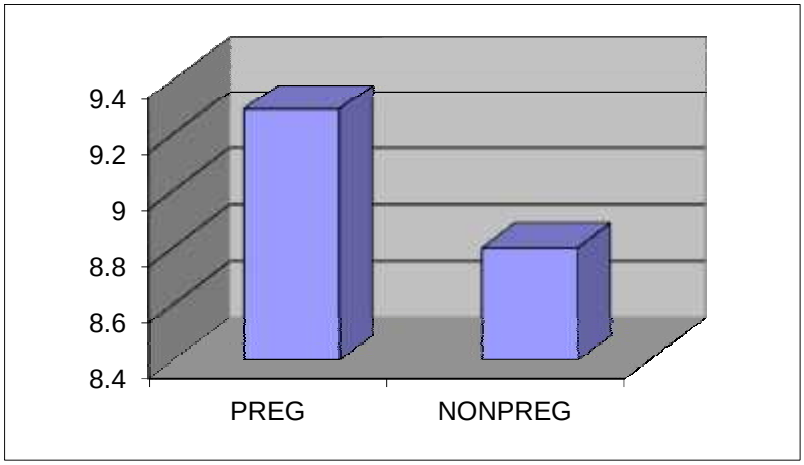
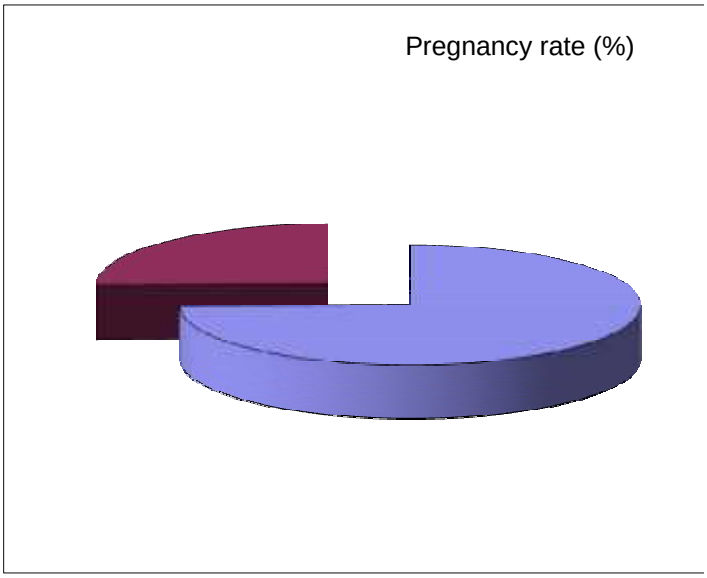
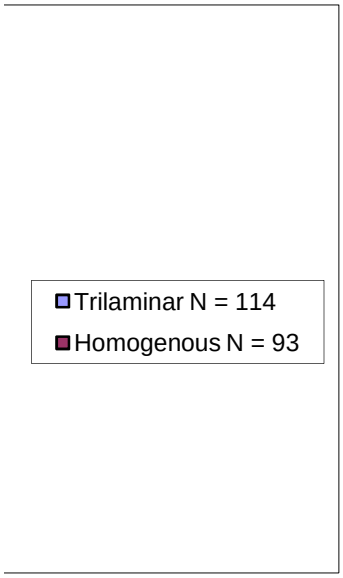


PREG	NONPREG
9.29	8.8

	Trilaminar	Homogenous
	N = 114	N = 93
Pregnancy rate (%)	15.79%	5.37%




Trilaminar N = 114
Homogenous N = 93