Faculty of Medicine
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PREDICTION OF PREGNANCY OUTCOME IN THREATENED ABORTION USING TRANSVAGINAL ULTRASONOGRAPHY

Thesis
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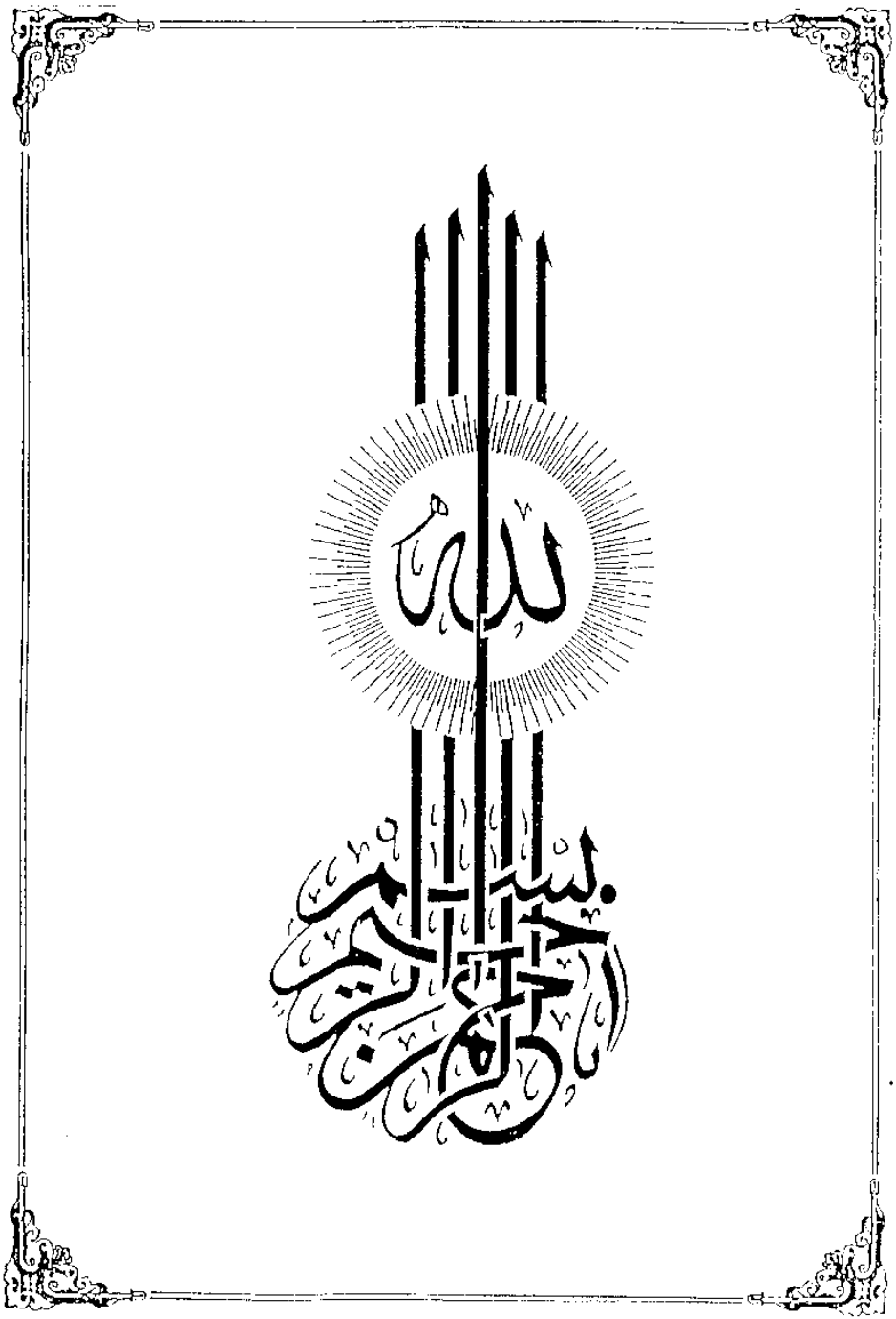
DEDICATION

To My Family



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CONTENTS

INTRODUCTION AND AIM OF THE WORK

Tongsong *et al.* (1994) stated that a single transvaginal ultrasound examination is useful in differentiating viable from non viable gestational sac.

Transvaginal ultrasonography is superior to transabdominal ultrasonography (TAS) in evaluating complicated pregnancy status because imaging resolution is better and morphologic details are clearly seen as the transducer is in close contact with pelvic viscera **(Volpi, 1989)**

With the application of high resolution vaginal ultrasound, problems such as obesity, bowel gas, retroverted uterus and inability to permit full bladder no longer preclude accurate diagnosis **(Freimanis *et al.*, 1992).**

With vaginal ultrasonography diagnostic advantage and clinical decision making become earlier and easier and the clear recognition of normal state from abnormal is of psychological benefit to the anxious patient **(Mendelson *et al.*, 1990).**

Aim of the Work

Evaluation of transvaginal ultrasonography as an investigation in first trimester threatened abortion to improve the prediction of pregnancy outcome.

REVIEW OF LITERATURE

PHYSIOLOGY OF EARLY PREGNANCY

During the early months of pregnancy, there is a space between the decidua capsularis and the decidua vera, as the gestational sac does not fill the uterine cavity. By the end of 1st trimester, the growing gestational sac fuses the decidua capsularis with vera, thus filling and obliterating the uterine cavity **(Cunningham *et al.*, 1994)**.

By 6 weeks, the gestational sac measures approximately 2 cm in diameter **(Hellman *et al.*, 1969)**. It's wall is actually composed of chorion, which consists of a layer of mesoderm, a layer of cytotrophoblast and a thick layer of the syncytial trophoblast. This should provide a strong echogenic interface with the homogenous fluid present within the sac itself.

By the third month of pregnancy, the chorionic sac is expanded, to fill-up the uterine-cavity completely. After the obliteration of the extra-embryonic coelom at approximately two months and the obliteration of the uterine cavity at three months, the amniotic cavity is the only space delineated in the uterus by the ultrasonographic techniques for the remainder of pregnancy **(Percival, 1980)**.

Normally, the amniotic fluid is the clear fluid that increase in the quantity as the pregnancy advances. At the

12th week of gestation, the fluid is about 50 ml. At the mid-pregnancy, it is about 400 ml. The source of the amniotic fluid is definitely unknown. It may be secreted by the amnion, diffused through the umbilical cord, or directly came from the maternal circulation, or from the foetal lungs and kidneys **(Cunningham *et al.*, 1994)**.

VAGINAL SONOGRAPHY

History of Endosonographic Development

"Endosonography" is the name given to the non-invasive imaging system for examining the body cavities and their organs in the neighbour hood. Endoscopy and sonography were the ideological parents of the technique **(Lindemann, 1988).**

The intention to use endosonography goes back as far as 1967, where a rod-shaped transducer was inserted into the vagina to record the foetal cardiac action, as early as, possible. The same technique was used for the differential diagnosis of the adnexal masses. A transducer, in the form of a thimble, was allowed to combine the gynaecological and ultrasonic examination. A further improvement was made in 1969, by the two-dimensional representation of the examination results. Probes of different forms and dimensions allowed transvaginal, transurethral and transrectal examinations. The technique was applied in 1970, to measure the female pelvis in obstetrics, in the observation of the physiological changes of the ovary, in detection of the recurrence after radical surgery for genital carcinomas, and the inspection of the prostatic gland among the males **(Kratochwil, 1988).**

Only, the introduction of the Gray-scale imaging, the real-time scanning, and the construction of smaller

transvaginal transducers have resulted in a break-through of endosonography which is regarded today as a routine method in different medical fields **(Sabbagha, 1987)**.

With the improvement in technology in the last few years, a transvaginal transducer was introduced. The first generation of these transducers was a 5 MHz. Despite the fact that these transducers produced the expected clarity and resolution, there was a reluctance for its usage due to their size and their limited angles of 60° **(Timor-Tritsch, 1988a).**

The 7.5 MHz transducers, via the transvaginal route, brought about an improvement in imaging **(Timor-Tritsch, 1988a)**.

"Vaginosonography", as one of the applications of endosonography, can allow imaging the surface of hollow organs, as well as the adjacent structures. In addition, the image is enhanced because the "blind areas" possibly caused by bony structures within the sound-path, or air-containing organs, can be avoided. This is particularly important in patients having extensive adhesions after previous pelvic operations, radiotherapy, endometriosis or pelvic infammatory disease.

Vaginosonography, can be performed by means of the linear array probes, as well as, the frontally radiating sector probes" or "panoramic sector probes". The later pobes, with scan angle of 240°, proved to have superior ori-

entation and assessment **(Osman, 1990)**. A wide diagnostic and therapeutic areas have been opened-up **(Lindemann, 1988)**. Latest development in endosonography was the use of "Duplex scanners" to detect the flow of blood in the uterine arteries, both in cases of placental insufficiency as well as, in the fertilization and implantation problems **(Kratochwil, 1988)**. If we look further, we may see, in the near future, that most of ultrasonic images produced in a three dimension, instead of a two dimension only **(Lindemann, 1988)**.

Transvaginal Sonographic Transducers

The number and the types of the transducers vary widely. Linear transducers exist for the abdominal sonography. For the transvaginal sonography, all probes produce sector images. Since female vagina is a potentially closed space, the vaginal transducers are characterized by the appropriate size and shape for insertion into the vagina. The higher the frequency (5-7 MHz), the shorter is the focal length, and the sharper focus **(Kremkau, 1990)**.

The sector probes are either a mechanical, phased array or a curvilinear. The mechanical sector transducer consists of rotating or oscillating crystals in an oil bath. This method is the simplest way of scanning, and allows the widest view-field. One disadvantage of the mechanical sector probe is its inherent noises in the nearby field. For transvaginal sonography, since pelvic structures may often

lie within 1 cm of the transducer, the slight withdrawal of the probe from the vagina moves the structures away from the field. Another disadvantage, is the fact that it must be bathed in oil, and air bubbles will severely distort the image **(Peisner, 1991)**.

The phased array sector transducer, consists of a fixed array of crystals that are sequentially triggered to aim the ultrasound beams in a sector. this methodology requires no moving parts. It is electronically more difficult to be processed. On the other hand, the curvilinear sector transducer consists of an array of various crystals, that are arranged along the tightly curved end of the probe. Since the beam from each crystal exists perpendicular from the transducer surface, the curvature of the probe-end yields a sector image from this array. This arrangement is simpler than a phased array but has a similar image **(Peisner, 1991)**.

Some transvaginal transducers have bent "broken" handles while others have straight handles. The probes with bent handles may be easier to be manipulated if the patient is not on the gynaecological table. However, a transverse view of the lateral portion of the adnexa is difficult to examine with this type of probe, unless the probe is rotated 180° degrees for the opposite sides of the pelvis. In addition, the operator must invert the images on the screen, to maintain a proper orientation when the probe is rotated. Those with

straight handless, are easier to be aimed, and do not have to be rotated when the adnexa are examined.

Most probes have biopsy or needle-guides that attach to allow the ultrasound guided puncture procedures in the pelvis. These include; follicle retrievals, drainage of cyst and termination of early pregnancy **(Abdel-Hady, 1992)**. **Goldstein (1990)**, suggested that, the use of the higher frequency probes results in excellent resolution, despite the high degrees of magnification which actually becomes a form of a "sonomicroscopy".

Disinfection of TVS Transducers

The possibility of the cross infection with microorganisms causing sexually transmitted disease should be a major concern with the usage of the transvaginal transducers. The probes should be disinfected after each examination. some disinfectant solutions have the ability within 10 min., thus enabling more frequent uses. These disinfectants may have a bactericidal, and/or a virucidal effects.

The transducer should be used with an extreme care so as not to damage the acoustic window. The imaging window and the casing, should be regularly cleaned with a towelette or soft cloth dampened with mild soaps and water solutions. For the cable to be cleaned, we must use soaps and water solution or a cloth dampened with an alcohol. The transducer should not be autoclaved, or otherwise subjected