

VALUE OF FETAL FEMUR LENGTH IN ESTIMATION  
OF FETAL WEIGHT

Thesis

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of the Master Degree in  
Obstetrics and Gynaecology

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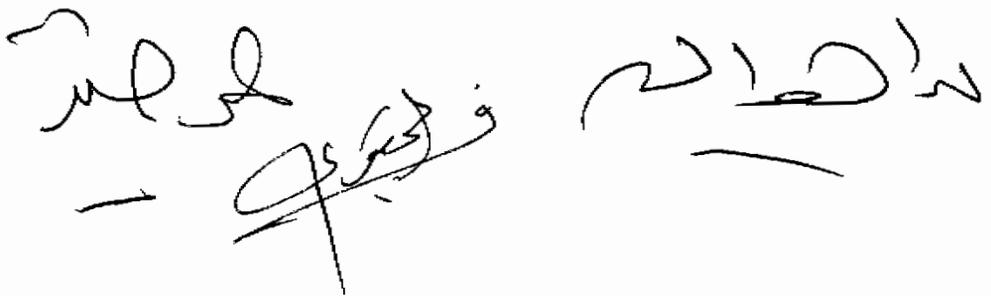
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The image shows two handwritten signatures in black ink. The signature on the left is more complex and appears to be 'Ibrahim Yassin Abou Senna'. The signature on the right is simpler and appears to be 'Aly Abdel Halim Shahwan'. There are some additional scribbles and lines below the signatures.



CONTENTS

	<u>Page</u>
1. Introduction.....	1
2. Aim of the work.....	4
3. Review of Literature.....	5
a- Historical Review of Ultrasound.....	5
b- Introduction to Basic Physics of Ultra- sound.....	7
c- Indications and clinical value of predic- tion of fetal weight.....	26
d- Methods of fetal weight estimation.....	40
4. Material and Methods.....	103
5. Results.....	107
6. Discussion.....	116
7. Summary and Conclusion .....	125
8. References.....	130
9. Arabic Summary	

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31

# Introduction

10

### INTRODUCTION

A simple and accurate method of estimating fetal weight which could be applied to all pregnancies would be an important means of reducing perinatal mortality and morbidity. Perinatal morbidity and mortality can be related to both fetal age and fetal weight. For example, Yerushalmy (1970), reported an eight fold increase in perinatal mortality of small for gestational age (SGA) neonates.

Usher and McLean (1974), in a series of 44256 consecutive births from 1958 to 1971 they found that there was a tenfold increase in perinatal mortality in babies born more than two standard deviations under weight when compared with those whose birth weight was within two standard deviations of the mean, and that 22% of perinatal deaths were in the small-for-dates group. They calculated that 2.7 perinatal deaths per 1000 birth were due to chronic fetal deprivation and that 70% of these babies could be salvaged if the diagnosis was made by 34 weeks menstrual age.

14

Goldstein and Peckham (1975), have shown that birth weight is the principle variable affecting late fetal and neonatal mortality and that low birth weight babies both pre-term and small-for-dates are at greatest risk.

Similarly, there are data that clearly show an increase in perinatal morbidity and mortality of the large-for-dates neonates.

Gellis et al (1973) has reported an increase in mortality of large-for-dates infants born to mothers with diabetes mellitus.

Chase et al (1974) has shown that, when birth weight is 5001 gm perinatal mortality is increased approximately three times over that of infants weighing 4501 to 5000 gm. Therefore, it is of particular importance to predict fetal weight with adequate accuracy in the high and low weight ranges. Clinical examination, X-ray, and ultrasound have all been applied for fetal weight estimation. Clinical examination has proved inadequate for this purpose (Loeffler, 1967). Because of the dangers of irradiation, X-ray can not be recommended for repeated examinations of pregnant women (Ringertz, et al 1971).

Diagnostic ultrasound being a painless, non-invasive, inexpensive and apparently harmless technique, has the potential to be used to screen all patients. Numerous fetal body dimensions that can be measured by ultrasonography have been evaluated in an attempt to estimate fetal weight more reliably. For example Suzuki et al (1974) used fetal heart volume and Thompson et al (1965) used the diameter of the thorax to estimate fetal weight. Campbell and Wilkin (1975) estimated fetal weight from the circumference of the fetal abdomen and claimed that 95% of birth weights fell within 106 gm of the estimate.

Use of various body diameters in conjunction with the biparietal diameter has been found to increase the accuracy of the ultrasonographic prediction of fetal weight. One of the more commonly used formulas incorporates ultrasonographic measurements of abdominal circumference and biparietal diameter (Shepard et al, 1982).

Since femur length closely correlates with crown-heel length (Fazekas and Kosa, 1978), it has recently been proposed as an adjunctive measurement in the estimation of fetal weight. (Hadlock, 1984).

## **AIM OF WORK**

17

AIM OF THE WORK

Early attempts to estimate fetal weight with ultrasound were based on measurements of individual parameters such as the biparietal diameter (BPD). Subsequent reports have demonstrated that such estimates can be improved when measurement of the BPD is used in conjunction with a body measurement such as the abdominal circumference (AC). The purpose of this work is to determine whether the addition of femur length (FL) could improve the accuracy of in utero fetal weight estimates. To the best of our knowledge, this is the first trial to clarify this problem among the Egyptian population.

11

# Review of Literature

REVIEW OF LITERATURE

(A) Historical Review of Ultrasound:

Man communicates by sound in the audible frequency range. Ultrasound has a much higher frequency and is used by bats for navigation, that it is also of use to man has been discovered in the last 100 years.

In 1880 the Curie brothers discovered a mean to produce and detect these high-frequency sound waves. Forty years later, the combined effects of the Titanic disaster in 1912 and the threat to the Allied powers by submarines during the First World War made it essential to find a mean for detecting unseen underwater obstructions.

But if ultrasound could detect submarines under water, could it be used to look into human tissues? The Dussik brothers, in Austria in 1937, were the first to describe the use of ultrasound for imaging. They used a transmission technique, akin to x-radiography, to produce "hyperphonograms" of the head.

19

By this time, work in ultrasonics was proceeding in Europe and Japan, using an industrial flow detector, Turner, at the Royal Marsden Hospital in London, was able, by 1952, to recognize echoes from the head and heart.

In 1953, Leksell, a Swedish neurosurgeon, demonstrated by ultrasound a midline shift in the brain of a 16-month boy, he went on to remove the blood clot responsible, thus saving the child's life.

Echo-encephalography became established as a useful technique after the publication of Leksell's work in 1956, and was further improved by automation in the 1960s.

In Scotland, in the mid-1950s, Ian Donald, Regius Professor of Midwifery at Glasgow University, became interested in the use of ultrasonic techniques to distinguish between cystic and solid gynaecological lesions. Close co-operation between Donald's team and an engineer, Tom Brown, then lead to the production of the first two-dimensional contact Scanner in 1958.

By the late 1950s, therefore, diagnostic ultrasound was of proven clinical value in the investigation of the eye, the brain, the heart, the abdomen and the pelvis.

In the early 1970s, a great deal of work was being done on finding solutions to the problems posed by moving structures in scans, since it takes five to ten seconds to build up a conventional ultrasound image, movement during the scan is a nuisance, and patterns of movement can not be studied. If the scan were to be completed faster, it could provide dynamic information. Real-time systems were designed to produce instantaneous moving images of moving structures. The pioneers in the field were Somer and Bom in the Netherlands. So, after a long gestation and childhood, diagnostic ultrasound is now reaching adolescence with a potential for considerable further growth. (Hassani et al, 1976).

(B) Introduction to Basic Physics of Ultrasound:

Ultrasound is sound with a frequency above the audible range. This normally lying between 18,000 and 20,000 hertz (20 KHz) - one hertz representing

one cycle or wave per second. While strictly speaking any sound over 20 KHz may be regarded as ultrasound, for diagnostic purposes considerably higher frequencies are required. Thus for obstetric work, frequencies of between 3 and 5 MHz (Megahertz) are usually used. (Hassani et al., 1976).

To understand the way in which ultrasound can be used to identify structures within the body the following points should be considered:

- (1) The means whereby ultrasound is generated.
- (2) The propagation of ultrasound into the tissues under examination.
- (3) The reflection of ultrasound from the tissues under examination.
- (4) The registration of the reflected ultrasonic echoes.

**The Generation of Ultrasound: The Piezo-electric crystals and effect:**

Certain naturally occurring crystalline substances such as Quartz, Rochelle salt, Lithium sulphate, and Lead zirconate, when subjected to forcible alterations in shape, generate small voltages between their surfaces.