

**BLOOD PRESSURE MEASUREMENTS  
DURING THE THIRD TRIMESTER OF  
PREGNANCY**

**THESIS**

Submitted For Partial Fulfilment of  
Master Degree in Gynecology and Obstetrics

مناقشة

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1992

تمت المذاكرة العلمية للرسالة في فرع الامراض النسائية  
بجامعة عين شمس في ١٠/٥/١٩٩٢  
وقد اجازت ونجت ١٠٠٪  
م.م. حسن



سورة البقرة .. آية ٣٢



# Acknowledgement

*I would like to express my deepest gratitude to Professor Dr. Hassanein Makhlouf, Professor of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University, for his great help and supervision of this work.*

*Deep thanks are also offered to Dr. Alaa El-Ghannam, Lecturer in Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University for his kindness, continued interest and great assistance.*

*Great thanks are also extended to Dr. Mohy El-Din Waheed El-Din, Assistant Professor of Anaesthesia, Faculty of Medicine, Ain Shams University for his greatest effort and support during the practical part of this work.*

*Also I want to thank Dr. Sherif Akl, Lecturer in Obstetrics and Gynecology Faculty of Medicine, Ain Shams University, for his interest and choice of this subject.*

*Last but not least, I thank My Father for continuous encouragement and My Wife for sincere help and also every one involved in making contributions to this work.*

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# INTRODUCTION

## INTRODUCTION

On measuring blood pressure by non-invasive technique, Korotkoff divided the heard sounds into: First sound, which indicates the peak systolic pressure, second and third sounds are due to turbulent flow of blood, fourth occurs when the sounds become muffled, and fifth when they disappear. The fourth sound is 7-10mmHg above the diastolic blood pressure recorded directly by intra-arterial cannula, whereas the fifth corresponds more accurately to the real diastolic pressure. (*Swash and Mason, 1985*).

In the non pregnant state, the diastolic blood pressure is taken as the fourth sound in the United kingdom, while it is taken as the fifth sound in the United States of America (*Houston et al., 1985*).

Measurement of blood pressure is very important during antenatal care for detection and supervision of hypertensive disorders of pregnancy (*MacGillivray et al., 1969*).

Pregnancy is a state of hyperdynamic circulation, so the fifth Korotkoff sound is not reliable as it may reach zero mmHg in certain percentage of patients. Still the representation of diastolic blood pressure by fourth or fifth sound is controversial (*Villar et al., 1989*).

The only undoubted thing is the measurement of intra-arterial blood pressure by cannulation and pressure transducer, but this is an invasive technique and is not cost effective (*Swash, and Mason, 1985*).

# **AIM OF THE WORK**

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The aim of this work is to review literature of blood pressure measurements during pregnancy, and to investigate whether the fourth or fifth korotkoff sound is more representative of the real diastolic blood pressure, and if the fifth sound is more representative of diastolic pressure, is it recordable in a good percentage of cases?

# **REVIEW OF LITERATURE**

## THE PHYSIOLOGY OF CARDIOVASCULAR SYSTEM IN PREGNANCY

### Cardiac output:

The most obvious haemodynamic change in pregnancy is a rise in cardiac output of approximately 40 %, i.e. from about 3.5 l/min. to 6.0 l/min. when the patient is at rest. (*Gibbs, 1981.*).

The time of this rise in cardiac output can also be questioned. However, investigator who have measured cardiac output early in pregnancy found that it's already markedly elevated in the first trimester.

What is disputed is whether the cardiac output falls at the end of pregnancy, and if so by how much?. It was originally thought that this fall demonstrated in late pregnancy and associated with measurements made in the supine position. (*Lees et al., 1976*)

However the fall in cardiac output associated with lying in the supine position shows considerable intersubject variability and may be more than 3% on average (*Newman et al, 1983*).

Non invasive studies using electrical impedance cardiography (*Davis, et al. 1986*), and Doppler estimation of aortic velocity (*James et al., 1985*) have again suggested that cardiac output falls to non-pregnant level at term. Both of these techniques were subjected to criticism, the former because of changes that may occur in pregnancy in the pulmonary blood vessels (*de Swiet and Talbert, 1986*) that lead to under-estimation of cardiac output (*Milsom et al, 1983*), and the latter because of aortic dilatation in pregnancy (*Hart et al., 1986*).

Echocardiographic studies measuring volume changes in the heart during the cardiac cycle have also shown a 30% increase in the cardiac output in the 3rd trimester, declining rapidly after delivery. (*Mashini et al, 1987*).

This increase is caused partly by an increase in heart rate (*Clapp, 1985a*) and partly by an increase in stroke volume.

Since, blood pressure doesn't rise in pregnancy and usually falls, the increase in cardiac output is related to a marked fall in the peripheral vascular resistance which is one, if

not a major, factor that causes the rise in cardiac output.(*Phippard et al., 1986.; Schrier, 1988*).

### **Heart position and size:**

The heart is pushed upwards by the elevation of the diaphragm and rotated so that the apex in the 4th rather than the 5th space.

The lateral displacement of the heart may give an exaggerated clinical impression of cardiac enlargement. Radiological studies revealed that the volume increase by 12 % between early and late pregnancy, and the degree of cardiac enlargement has been confirmed by echocardiographic studies (*Rubler et al, 1977*).

### **Heart rate:**

It's the stimulus to increased cardiac output in pregnancy which is necessary to perfuse the uterus, (*the physiological shunt of pregnancy*), (*Burwell & Metcalfe 1958; Burwell, 1938.*)

The increased output of the heart is achieved both by an increase in the heart rate and increase in the stroke volume.

Heart rate is particularly sensitive to minor stimuli, (*Hytten and Leitch, 1971*).

The increase in heart rate averages about 15 beats / min, typically from 70 to 85 and is present as early in pregnancy as four weeks after the last menstrual period (*Clapp., 1985*).

### **Stroke volume:**

It has been estimated in studies where cardiac output and pulse rate were measured simultaneously and measured directly in studies using Doppler ultrasound (*Robson et al, 1987*.)

Since cardiac output increase about 1.5L/min from 4.5 to 6.0 L/min., and pulse rate from 70 to 85, the stroke volume must rise from about 64ml to about 71 ml/min *Shouse and Acker; 1964*).

### **Venous pressure:**

Compared to those in arterial blood, changes in venous pressure during pregnancy can be relatively dramatic. It's established that the pressure in the veins of the arm is not