Date: April 28, 1980

Title: IMPEDANCE CARDIOGRAPHY AND UTERINE DISPLACEMENT DEVICES

Authors: E. Abouleish, M.D., Y.G. Kang, M.D., M. Uram, M.D., R.McKenzie, M.D.

Affiliation: Departments of Obstetrics and Anesthesiology, Magee-Womens Hospital
University of Pittsburgh School of Medicine, Pittsburgh, Pa. 15213

Introduction. The supine position in the parturient, especially during the last trimester, is inadvisable because it can cause aortocaval compression.[1] Aortic compression can decrease the uterine blood flow leading to fetal asphyxia despite the maintenance of an apparent normal arterial blood pressure as measured in the upper limbs. Vena caval compression can decrease the venous return to the heart leading to decreased cardiac output, maternal hypotension, and fetal asphyxia. Therefore, every effort, especially during cesarean section, should be made to displace the uterus off the aorta and inferior vena cava. This can be achieved by several means including a wedge under the right hip, a left uterine displacement device (LUDD), or tilting the operating table to the left. Which method of these is the best? To answer this question, the physiological changes in the cardiovascular system produced by each method should be determined. However, commonly used techniques for measuring the cardiac output and left ventricular stroke volume, being invasive, are not easily justified in the healthy parturient. Impedance cardiography, being non-invasive and correlating well with invasive techniques[2-5] is ideal for use in obstetrics. The aim of our study was to compare the effects of a wedge (30° angle) under the right hip versus a LUDD (C-M Uterine Displacer®) on the cardiovascular system of healthy full-term parturients using impedance cardiography.

Methods. The protocol has been evaluated and accepted by the Research Committee of our hospital and the patient's consent was obtained. The study consisted of 18 parturients who were scheduled for elective repeat cesarean section. Prior to anesthesia, cardiac output, left ventricular stroke volume, and maternal heart rate were recorded using IFM Impedance Cardiograph model 400. The maternal arterial blood pressure was monitored using infrasound. The maternal cardiovascular functions were measured after placing a wedge under the right hip or after using the LUDD. These two positions were used in the same patient, their sequence was selected randomly, and the measurements were repeated every two minutes for ten minutes in each position. The results were expressed as mean ± SE and were analysed by paired t-test with $p < 0.01$ considered significant.

Results. The maternal arterial systolic blood pressure, diastolic pressure, heart rate, stroke volume, and cardiac output were slightly higher with the LUDD than with the wedge (see table). However, the differences were not statistically significant.

Discussion. Controlled data while the patient was in supine position without uterine displacement may theoretically be required, but practically, were inadvisable because of the possibility of causing aortocaval compression. Our results showed that when the uterus is properly displaced to the left, the effects on the cardiovascular system are the same irrespective of the means used. For example, the wedge should be placed under the right hip rather than under the lumbar region. The LUDD should displace the uterus anteriorly and to the left. The position of either the wedge or the LUDD should be modified to obtain satisfactory displacement of the uterus as viewed by the anesthesiologist at the head or foot of the table rather than at the side. In conclusion, there is no preference in using either a wedge or a LUDD (C-M Uterine Displacer) for uterine displacement, regarding the cardiovascular effects.

Table

Cardiovascular Parameters with Left Uterine Displacement at Full-term Pregnancy Using Non-invasive Techniques

	Wedge		LUDD	
	Mean	± SE	Mean	± SE
Systolic BP (torr)	124	1.6	125	1.8
Diastolic BP (torr)	63	2.6	65	2.3
Maternal heart rate (beats/min)	83	2	89	3
Stroke volume (ml)	69.0	4.8	71	5.8
Cardiac output (L/min)	5.842	0.484	6.477	0.599

References.

1. Eckstein KL., Marx GF.: Aortocaval compression and uterine displacement. Anesthesiology 40: 92-96, 1974.
2. Kubicek WG., Karnegis JN., Patterson RP. et al: Development and evaluation of an impedance cardiac output system. Aerospace Medicine 37: 1208-1212, 1966.
3. Hill DW., Lowe HJ.: The use of electrical impedance technique for the monitoring of cardiac output and limb blood flow during anesthesia. Medical and Biological Engineering 11: 534-545, 1973.
4. Rasmussen JP., Sorensen B., Kann T.: Evaluation of impedance cardiography as a non-invasive means of measuring systolic time intervals and cardiac output. Acta Anaesth Scand 19: 210-218, 1975.
5. Naggar CZ., Dobkin DB., Flessas AP., et al: Accuracy of the stroke index as determined by the transthoracic electrical impedance method. Anesthesiology 42: 201-205, 1975.