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AORTOCAVAL COMPRESSION:
INCIDENCE AND PREVENTION*

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THE position of a pregnant woman at term affects both the venous and arterial sides of her circulation and has the potential of impairing the well-being of the fetus through a decrease in uteroplacental blood flow. Compression of the inferior vena cava has been well recognized as the cause of the so-called supine hypotensive syndrome since 1953, when Howard, Goodson, and Mengert¹ presented their classical observations of near-shock in 18 of 160 consecutive women at term who had maintained the supine position for several minutes. Radiographic studies made by an Edinburgh group² confirmed the entity of inferior caval compression. After contrast medium (Urografin) was injected into the femoral veins of 12 healthy women in the last trimester, it was found that in 10 the inferior vena cava was occluded almost completely in the supine position, the venous return being directed via the azygos and vertebral systems, whereas in the lateral position the

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dye moved up the inferior vena cava, although some degree of compression was still evident. Subsequent hemodynamic studies³ demonstrated that most women compensated for the reduction in venous return and the resultant decrease in cardiac stroke volume by increases either in heart rate or in systemic vascular resistance or both, so that the brachial blood pressure remained unchanged in the supine position.

In 1968, or 15 years after the recognition of inferior caval compression, members of Caldeyro-Barcía's department in Montevideo, Uruguay,⁴ discovered that involvement of the lower aorta occurred in the supine position as well. Serial abdominopelvic arteriograms, made after injection of a contrast medium (Hypaque) in women in late pregnancy and labor, showed that the subrenal part of the aorta was displaced laterally—most often to the left—and was less densely opacified at the region of the lumbar lordosis (L₄ - L₅). Pressure recordings in the same patients showed that, during the course of a contraction, the uterus almost divided the maternal circulation into two zones: distal to the obstruction, arterial pressure was decreased, venous pressure was elevated, and blood flow was reduced; proximal to the obstruction, aortic pressure was increased.

Thus, when a woman in the latter part of pregnancy lies supine, the uterus not only compresses the inferior vena cava but also partly obstructs the lower aorta, making the designation "aortocaval compression" more appropriate. While the mother is affected primarily by compression of the inferior vena cava, the fetus is affected predominantly by the obstruction of the lower aorta, which may lead to inadequate uteroplacental perfusion. However, generalized hypotension in the mother as the result of inferior caval compression or other causes will increase the collapsibility of the aorta and thus enhance the sequelae of aortic compression. Since the legs are also perfused by end branches of the lower aorta, aortic obstruction can be detected clinically by measurements of pressure in the femoral or popliteal arteries.

We have compared arm and leg pressures in 72 unselected parturient women in the left lateral and supine positions, alternating the order of positional changes.⁵ Right-sided brachial and femoral arterial pressures were taken with cuffs of proper size in the interval between uterine contractions, after the positions had been assumed for at least five minutes. Forty-five of the patients were in the latent phase of labor and 27 in the active phase; of the latter, 12 were in the early

stage of active labor (cervix dilated 4 to 6 cm.) and 15 had almost completed the stage of dilation (cervix dilated 8 to 9 cm.). Both brachial and femoral pressures were lower in the supine than in the lateral position in most of the patients. The decrease in mean brachial pressure exceeded 10 torr in 12 women in the latent phase (27%), in one woman in early active labor (8%), and in none of the patients in advanced labor. In contrast, the decline in mean femoral pressure exceeded 10 torr in 29 women in the latent phase (64%), in six patients in early active labor (50%), and in six in advanced labor (40%). These data demonstrate: 1) that the clinical effects of lower aortic obstruction become manifest significantly more often than those of inferior caval compression and 2) that the magnitude of both decreases with the progress of labor, most probably because of descent of the presenting fetal part.

Evidence of lower aortic obstruction obtained by measurements of femoral pressure is not synonymous with uterine hypoperfusion, since ovarian-uterine anastomoses around the site of obstruction may provide adequate blood flow to the uterus and fetus. However, as the presence and competence of ovarian-uterine anastomoses cannot be predicted, the development of aortacaval compression must be prevented in all cases. The lateral position should be recommended for the management of labor. If the supine position must be assumed for any procedure, including cesarean section, the uterus should be shifted away from the great pelvic vessels with dispatch. Alleviation of fetal arrhythmia following uterine displacement has been reported by various authors, notably Hon⁶ and Goodlin.⁷ For short periods of time, uterine displacement may be accomplished manually. Otherwise, the uterus can be displaced by elevation of the right hip⁸ (often combined with a left-down tilt of the table^{9, 10}) or by the self-supporting devices designed for this purpose by Colon-Morales¹¹ and by Kennedy.¹²

We have evaluated the efficacy of elevation of the hip and of mechanical uterine displacement by simultaneous monitoring of brachial and femoral arterial pressures in the aforementioned 45 women in the latent phase of labor.⁵ We found that elevation of the hip by means of a foam-rubber wedge resulted in higher brachial pressures than were observed in the flat supine position in all women, but control levels were reached in only 33 (73%). The displacers, in contrast, brought brachial pressure to at least normal values in 38 patients (84%), and in

16 of these (36%) the pressures were above normal. Femoral pressures also increased with both methods of uterine displacement. Elevation of the hip resulted in a return to control levels in 27 women (60%), whereas the mechanical displacers accomplished this in only nine (20%). It may be concluded that elevation of the hip is more effective in mitigating inferior caval compression.

Our studies were undertaken in healthy parturients with uncompromised fetuses. However, the implications are even more important for the fetus at risk, since it is especially vulnerable to the effects of uteroplacental hypoperfusion and maternal hypotension.

In conclusion, the presence of normal brachial arterial pressure in the mother does not rule out aortic compression by the uterus and its contents with the resultant hazard of uteroplacental hypoperfusion and fetal impairment.

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