POSTURAL HYPOTENSION IN LATE PREGNANCY

"THE SUPINE HYPOTENSIVE SYNDROME"

BY

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There have been several reports in recent years relating to the occurrence, incidence, and potential dangers of postural hypotension in the pregnant woman approaching term. In one of the earliest of these McRoberts (1951) summarized matters thus: "The dorsal recumbent posture may produce discomfort or circulatory collapse in late pregnancy. Turning to the side will relieve this condition, as will emptying the uterus."

Holmes (1960) reported a study of 500 women, all pregnant for 36 weeks or more. In 70% the systolic blood-pressure with the patient supine was 10% or more lower than with the patient in the left lateral position. Perhaps more significantly, 1 in 12 showed a fall in systolic pressure of more than 30%.

Experimental and clinical evidence available (Brigden, Howarth, and Sharpey-Schafer, 1950; Howard, Goodson, and Mengert, 1953) suggests strongly that the hypotension is secondary to impaired venous return caused by pressure on the inferior vena cava high in the abdominal cavity—thus explaining its relationship to both posture and uterine size. Holmes (1960) found that the tendency to hypotension decreased as the foetal head descended into the pelvis. This, too, is in keeping with a pressure effect of the uterus high in the abdomen.

In an earlier paper, Holmes (1957) had drawn attention to the probable relationship between this syndrome and the sudden circulatory collapse occasionally experienced after the administration of spinal anaesthesia for caesarean section. This would explain the apparent increased sensitivity of pregnant women at or near term to the hypotensive effect of spinal anaesthesia. (The existence of such a susceptibility was hotly contested in the literature of the '40's.) Cappe and Surks (1960) agreed with Holmes's conclusions. They estimated the incidence of severe cases of the syndrome as being less than 1% of 2,000 patients undergoing caesarean section at or near term. It is interesting in this context to note that Masters, who appears to have had no knowledge of the "supine hypotensive syndrome" as such, reported in 1948 that the hypotension complicating continual caudal analgesia in labour could be relieved almost invariably by placing the patient on her side. Many authors, too, had commented on the dramatic improvement in "post-spinal" hypotension when the uterus was emptied.

The possible relationship between the supine hypotensive syndrome and placental abruption has been investigated experimentally in animals by Howard and Goodson (1953) and by Nesbitt, Powers, Boba, and Stein (1958). They found that ligation of the inferior vena cava in pregnant bitches nearly always resulted in some degree of abruption. Smith and Fields (1958) presented a case of human placental abruption which followed immediately after an observed period of postural hypotension, and suggested that, as in the

experimental work, the ~~final~~ causative factor in the abruption was the increased venous pressure distal to the vena caval obstruction. However, Eastman (1959) comments that it does not seem that this can be a common or even a likely cause of abruption in humans, in view of the various clinical differences between the two groups of cases, especially the frequency of abruption before the period of gestation when supine hypotension becomes a major factor.

Reference to various obstetrical texts suggests that the occurrence of these alterations in blood-pressure is not widely recognized, and yet if they are as frequent and at times as severe as has been reported they are obviously of great practical importance. For this reason it is thought that a further study along the lines of that conducted by Holmes would be of value.

Material and Methods

One hundred patients were examined in the antenatal clinic. No selection was made other than that each was more than 36 weeks pregnant. The patient sat nearly upright on the examination couch and rested for a short while prior to the blood-pressure and pulse rate being recorded. She then lay supine and recordings were made at intervals over the next five minutes. Next she turned on to her left side and further recordings were taken.

During the period of this investigation four cases of severe postural hypotension, not included in the above 100, were encountered in the labour ward. They are described separately and in detail.

Results

Blood-pressure.—The alterations in blood-pressure with the change from a sitting to a supine position are shown in Table I. The falls in pressure have been calculated as percentages to allow comparison with Holmes's findings. In 47 cases the systolic pressure fell by 10% or more. A fall in diastolic pressure of similar magnitude was recorded in 41 cases. However, the two groups did not always coincide and require further detailing. The differences are most pronounced in those patients who had a comparatively small drop in systolic pressure. Thus of the 31 cases whose systolic pressure fell by 10 to 20% only 15 had a diastolic fall of more than 10%, and in three the diastolic pressure in the supine position was higher than when sitting. (In two, however, it fell more than 30%.) On the other hand, 10 patients whose systolic pressure dropped less than 10% had a diastolic fall of more than 10%. Where the systolic fall was more than 20% no case showed a rise in diastolic pressure. Of those in the 20–30% group, five had a diastolic fall of more than 20%. Of the six cases where the systolic pressure fell by more than 30% the diastolic fall was at least as great proportionately in four and was more than 20% in the other two. These cases are detailed in Table II. In only three cases did both systolic and diastolic pressure rise when the patient lay supine.

TABLE I.—Alterations in Blood-pressure with Change to Supine Position (100 Cases)

	Rise	No Change	Fall			
			<10%	10–20%	20–30%	>30%
Systolic	8	20	25	31	10	6
Diastolic	11	30	13	26	8	7

Pulse Rate.—A fall in blood-pressure was nearly always accompanied by a rise in pulse rate. A few cases, however, showed bradycardia, and two had transient bradycardia giving way to tachycardia.

Symptoms.—Ten patients became distressed—all six of those whose systolic pressure fell more than 30%, and two each from the 20% and 10% groups. In six, including four of the 30% group, the symptoms were severe, with breathlessness, pallor, sweating, and faintness. Some refused to stay supine and four would have undoubtedly fainted had they not been turned to a lateral position. It is of interest that nearly all of these 10 patients and several others with large pressure falls stated that they did not like lying supine. Some could give no reason, but most of the women whose symptoms were severe were aware that the supine position produced breathlessness and/or faintness.

Change to Left Lateral Position.—Usually, but not invariably, the pressure rose to the level that had previously been recorded in the sitting position when the patient assumed the left lateral position. Relief was immediate in all cases where symptoms of circulatory collapse had developed. A full lateral position was unnecessary and relief was gained with a tilt of as little as 20 to 30 degrees towards the side (see Case 3 below). In a few cases where the supine position had produced minimal depression of blood-pressure, turning to the side did not cause any rise.

Variations with Descent of Foetal Head.—These are set out in Table III. The numbers in each group are not large, but the incidence of severe hypotension is greater when the foetal head is above the pelvis. However, it is noteworthy that even with the head engaged the incidence is still appreciable.

TABLE II.—Cases with Systolic Fall of More than 30%

Sitting Blood-pressure	Supine Blood-pressure	Symptoms
120/85 mm. Hg	50/20 mm. Hg	Severe
115/75 "	40/0 "	"
130/75 "	50/20 "	"
140/80 "	85/60 "	Mild
120/70 "	80/50 "	Moderate
130/90 "	70/40 "	Severe

TABLE III.—Relationship Between Systolic Blood-pressure Alterations and Position of Foetal Head

Foetal head:	Above Pelvis	Entering	Engaged
Total No. of cases	23	48	29
Fall 10-20% ..	6	17	8
" 20-30% ..	3	5	2
" more than 30% ..	4	0	2

Atypical Results.—Two cases with minor pressure falls in the supine position developed a further but not severe fall when turned to the lateral position. One patient complained of discomfort when sitting upright and developed a typical severe hypotensive syndrome when she leaned forward.

Case 1

The patient, aged 25, was admitted at 24 weeks' gestation in her second pregnancy with concealed and revealed uterine haemorrhage. The first pregnancy had been entirely uneventful, as had the second until a few hours before her admission. There was no evidence of toxæmia. When first seen she was lying on her side. She was extremely pale, with intense peripheral vasoconstriction. The uterus was enlarged to a size in keeping with a pregnancy of 36 weeks' duration and was tense and tender. The blood-

pressure was 110/70 mm. Hg and the pulse rate 80 a minute. She was turned on to her back to facilitate examination and almost immediately developed signs and symptoms of circulatory collapse. The systolic blood-pressure was now found to be 60 mm. Hg, the diastolic unrecordable, and the pulse rate 56. When she was returned to the lateral position the blood-pressure rose to 110/60 and the pulse rate to 84. (She was subsequently transfused with 3 pints (1.7 litres) of blood and a marked hypofibrinogenaemia was corrected with 5.5 g. of fibrinogen.) Labour, which had already begun, proceeded to the spontaneous delivery of a stillborn foetus weighing 2 lb. (907 g.). The placenta appeared to have been completely separated.

Case 2

The patient, who was known to have a twin pregnancy, was admitted at 32 weeks' gestation, complaining of severe pain in the left lower abdomen. She stated that she had stumbled when boarding a bus and fallen heavily against the back of a seat. She was known to be highly emotional but appeared to be very distressed and exhibited pallor and air hunger. When she was supine her blood-pressure was 70/30 mm. Hg and her pulse rate 120 a minute. There was considerable tenderness, with some guarding over the lower part of the left rectus abdominis muscle, but the uterus elsewhere was soft and not tender. Any movement of the abdominal wall aggravated the pain. When she turned to the lateral position her blood-pressure rose immediately to 120/75 and her pulse rate fell to 88. A diagnosis of superficial muscle-bruising was made. Symptoms disappeared after 36 hours' bed rest.

The patient was re-examined on several occasions and the hypotension could always be reproduced when she lay supine. In a ward bed with a softer mattress it was less severe and did not occur if she had two pillows under her head and shoulders. (The patient was delivered six weeks later of live twins.)

Case 3

The patient was about to have a repeat elective caesarean section at 39 weeks' gestation. The foetus was presenting by the vertex with the foetal head above the pelvic brim. The pregnancy had been uneventful with blood-pressure readings averaging 105/65 mm. Hg. She was placed supine on the operating-table in the anaesthetic room prior to the induction of general anaesthesia. After several minutes she complained of faintness. The systolic blood-pressure was found to be less than 40 and the pulse rate 44. A pillow was placed under her right buttock, the pressure rose to 110/70 and the pulse rate to 80. She remained in this position throughout the induction and until delivery with no further hypotension.

Case 4

An 18-year-old primigravida, this patient had been in labour for 24 hours and was very distressed despite a large dosage of analgesic and sedative drugs. The foetal head was engaged in the pelvis in the occipito-posterior position and the cervix was approximately half-dilated. Her blood-pressure was 120/75 mm. Hg, her pulse rate 96 a minute, and the foetal heart rate 120. Caudal analgesia was initiated with 26 ml. of 1% lignocaine.

After 10 and 20 minutes there was no appreciable change in maternal or foetal heart rates. However, after a further 10 minutes the mother's blood-pressure and radial pulse could not be recorded and the foetal heart rate was 68 a minute. The patient was propped up and her blood-pressure rose almost immediately to 90/55. The foetal heart rate recovered to 120. (At no subsequent time was there evidence of foetal distress.) The level of sensory loss had not risen above that customary with caudal analgesia, and there was neither revealed haemorrhage nor signs of concealed haemorrhage.

For the next 90 minutes the patient remained more or less hypotensive. The blood-pressure varied between 70/50 and 90/55 and the pulse rate between 90 and 120. She complained at intervals of faintness and dizziness. She remained in a semi-recumbent position, as any attempt to lay her flat or to raise the foot of the bed caused further hypotension. Methylamphetamine hydrochloride injections had little effect.

Finally, it was realized that this might be, in part, a manifestation of postural hypotension and the patient was turned to the left lateral position. The response was immediate, with the blood-pressure rising to 115/70. Her symptoms were relieved completely.

The caudal analgesia was later "topped-up" with a further 17 ml. of 1% lignocaine, and so long as she remained on her side no ill effects ensued. When, however, she was turned again to a supine position the blood-pressure fell in 4 minutes from 120/70 to 70/40, the pulse rate rose from 84 to 120, and she declared that she felt "awful." When returned on to her side the response was again dramatic, blood-pressure and pulse regaining their former levels within two minutes, and symptoms disappearing completely.

Labour had meanwhile progressed, and rotation and delivery were effected with Kielland's forceps with the patient remaining in the left lateral position. The third stage was uneventful. The baby was lively at birth, established regular respirations within 90 seconds, and subsequently made normal progress. Fifteen minutes after delivery the blood-pressure was 115/70 and the pulse rate 70, neither being altered with changes of posture.

Discussion

The findings recorded in this paper confirm Holmes's contention that "supine hypotension" in late pregnancy is both real and frequent. Although the incidence in this series is not as high as he reported, it should be noted that the surveys were not conducted under identical conditions. Clearly there are a number of variable factors. Apart from posture these include particularly the size and height of the uterus and the lumbar lordosis of pregnancy. Probably the hardness or otherwise of the couch or bed plays a part, as doubtless does the ability of the individual to compensate for diminished venous return. One wonders if every patient may not be susceptible under certain conditions.

From a practical viewpoint the syndrome is probably of little import in the normal healthy woman. As described above, she will tend to assume a position which safeguards her. It is the patient who is made to assume a supine position who is at risk, especially if some other hypotensive factor is added—such as spinal or caudal anaesthesia (Case 4) or haemorrhage (Case 1). Fortunately, prevention and treatment are so simple that one needs only to recognize that the syndrome may exist. For this reason more emphasis should be given to McRoberts's (1951) contention that for the treatment of shock in pregnancy the patient should always be placed on her side, irrespective of the cause of shock.

The effect of posture itself deserves further consideration in relation to routine antenatal blood-pressure recordings. It appears that the ideal position is a semi-recumbent one. Although this has not been investigated fully, supine hypotension was not observed with the patient's head and shoulders raised 20 to 30 degrees.

The duration of pregnancy seems to be important only in so far as it affects uterine size. Cases 1 and 2

illustrate that a large uterus will produce hypotension irrespective of the state of pregnancy. Other similar instances were met with—notably a woman at 28 weeks' gestation with a twin pregnancy and hydramnios, and one at 32 weeks with hydramnios. This is, of course, to be expected if vena caval compression is the cause of hypotension.

Whether postural hypotension occurs at all with smaller uteri is still unknown. Although various authors infer that it does not, nobody appears to have published a full investigation. Certainly no instance was recorded in the 12 patients examined at 32 weeks' gestation during the present survey. However, until such an investigation is performed one cannot lightly dismiss the suggestion that this may on occasion be a cause of placental abruption.

Summary

The incidence of supine hypotension in a series of 100 women in late pregnancy is reported. Significant hypotension was observed in 47%, severe hypotension with unpleasant symptoms in 6%. The practical significance of this condition is discussed, and four cases are presented to illustrate this significance.

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"The old hospital was built to last. The new hospital must be built to change. That means it must be so designed as to give the utmost freedom to regroup and modify the layout around the central nervous system of the engineering services. These services are thus the key to the physical planning of the hospitals of the future. But they are the key to more than that. I said that in the past we tended to think of hospitals as boxes into which services and facilities were placed. We have also thought of them as boxes into which patients were put, along with the due proportion of doctors and nurses. This idea we must discard. Instead, we have to think of the hospital as a great piece of equipment placed at the disposal of a highly trained staff, to do specific jobs with, in the service of patients. The achievements of the modern world have been won by putting more and more mechanical power at the command of more and more refined and specialized skill. The development of medicine in our hospitals has not been outside this stream of modern life: it belongs to it and is borne forward on it. People ask: how are our new hospitals to be staffed? If they but realized it, the new hospitals will themselves be a great part of the answer to our present staffing problems. There is virtually no limit—certainly no limit is in sight yet—to the facilities which can be placed at the elbow of the doctor, the nurse and the technician in the hospitals of the future, and consequently no limit to the true economy that can be achieved in the effective use of human skill and devotion." (Mr. Enoch Powell, addressing Institution of Heating and Ventilating Engineers, February 7.)