

CLASSIFICATION OF P.I.H. BASED ON DOPPLER FLOW VELOCIMETRY STUDIES

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SUMMARY

Classification of (PIH) based on doppler flow velocimetry of the uterine and umbilical perfusion overcomes many of the limitations of other classifications currently in vogue. Hypertensive gravid subjects presenting with normal SD ratio in the uterine and umbilical arteries seem to have mild disease with no fetal or maternal affection. They do not need hypotensives or salt restrictions, and even fetal monitoring need not be very intensive. Those with high resistance uterine flow exhibit a greater tendency towards being significantly hypertensive quite often mandating hypotensive therapy and hence need hospitalization. Whereas, those with high resistant umbilical flow are not significantly hypertensive, but inflict fetal morbidity and hence mandate careful surveillance and timely intervention for fetal salvage.

The most morbid group is the one presenting with high resistance in both the uterine and umbilical arteries. Such patients have proteinuric severe hypertension and have significant fetal morbidity and mortality. Absent end diastolic flow in umbilical artery and diastolic notching in the uterine artery are very grave situations accounting for a significant fetal mortality.

Hypertensive disorders during pregnancy are the most common medical complications encountered, affecting approxi-

mately 7% of gravidas (Farmakides, et al., 1992). In our institutional study of more than 10,000 obstetric population pregnancy induced hypertension (PIH) was one of the most common pregnancy complications diagnosed in 8.6% of cases

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Accepted for Publication on 20.07.1994.

(Sudha and Rajan, 1993). Among the third trimester pregnancies referred for ultrasound evaluation, over the last 2 years, an incidence of 8.46% of hypertensive disorders has been documented (Rajan, 1994). PIH is also the most common cause of fetal growth retardation, prematurity and fetal loss. Perinatal mortality of 8.2% has been reported in PIH as against PNMR of 21.70/1000 reported for the general obstetric population (Sudha and Rajan, 1993). Early signs of PIH diagnosed by the physician and institution of optimal treatment should prevent most fetal deaths, and reduce many of the other complications (Farmakides et al., 1992).

Until recently, prediction of development of preeclampsia was based on analysis of various risk factors; and management was based on clinical symptoms and laboratory investigations. These conventional diagnostic measures often result in too late detection, suboptimal treatment and untimely interventions. Moreover, clinical diagnoses have many problems. Hypertension, proteinuria, and edema all correlate poorly with outcome (Ducey, 1989). Since doppler velocimetry could identify the abnormal hemodynamic changes of hypertensive pregnant women it has now become possible for early detection and classification of PIH, and formulation of management strategies (Farmakides et al., 1992). Modern fetal surveillance techniques including doppler flow velocimetry studies have made it possible to prevent most fetal deaths.

In this study an attempt has been made to classify PIH into four major groups based on the doppler flow velocity

pattern discerned in the uteroplacental circulation (uterine artery) and the fetoplacental circulation (umbilical artery). Identification of the four groups based on doppler velocimetry and evaluation of the incidence, fetomaternal risk, management strategy and the perinatal outcome for the four groups form the focus of this study.

MATERIAL AND METHODS

Obstetric subjects in the third trimester admitted to this institution with an elevated blood pressure of 140/90 or more, or with other clinical manifestations of PIH were recruited for this study. Such 79 consecutive subjects could be studied in detail employing abdominal doppler, and the blood flow velocity in the uterine, umbilical and fetal cerebral vessels have been monitored in these pregnancies. Continuous waveform doppler study was employed for evaluation of the uterine and umbilical flow velocities and pulse doppler was employed for studying the cerebral flow velocity pattern. In addition, routine B mode imaging of the pregnancy and biochemical scoring formed the integral part of pregnancy surveillance among these patients.

The cut-off values taken for normal S/D ratio in umbilical artery has been 2.8 (at 26 to 31 weeks), 2.4 (at 32 to 36 weeks), and 2.2 (at 37 to 40 weeks). The S/D ratio of upto 1.8 has been considered normal for the uterine artery (Rajan, 1994).

The Four Vascular Patterns

The pregnant women with hypertension could be divided into four categories depending on the flow velocimetry studied

in the uterine and the umbilical arteries.

1. Normal uterine and normal umbilical circulation.
2. Normal uterine and abnormal umbilical circulation.
3. Abnormal uterine and normal umbilical circulation.
4. Abnormal uterine and abnormal umbilical circulation.

RESULTS AND OBSERVATIONS

Among the 79 subjects with PIH who were classified based on the doppler velocimetry pattern in umbilical and uterine circulation, details on perinatal outcome was available for 67 subjects. More than on half had normal uterine and umbilical circulation (38 subjects), 12 had abnormal uterine flow pattern, 10 had abnormal umbilical circulation, and 7 had abnormalities in both uterine and umbilical circulation (Table I).

Uterine and umbilical normal

Among the 38 subjects with PIH in whom the uteroplacental and fetoplacental circulations were normal at doppler velocimetry studies, the hypertension was mild (around 140/90 mm), the patients were

not significantly edematous, and there was no proteinuria. Salt intake was not restricted (except additional salt at table) and they were not treated with hypotensives. The main accent was on rest, and hence quite often hospitalization for that purpose.

Analysis of perinatal outcome indicated normal near term delivery of healthy babies born with 1 minute Apgar of 8 or more in 31 subjects (81.58%). Growth retardation or prematurity was recorded only for 7 subjects (18.42%) (Table II). There was no perinatal loss among the 38 subjects studied. Of these 38 subjects 13 were delivered by LSCS, giving an incidence of 34.21% (Table III).

Abnormal uterine velocimetry

The second common group was those subjects with abnormality located in the uterine flow velocity pattern. The usual abnormality encountered in the doppler velocimetry was a high S/D ratio and/or diversity between the two uterine vessels; they seldom presented a diastolic notch. Since many of them proved to have higher range of blood pressure, they were treated with hypotensives. Among

Table I

Classification of hypertension in pregnancy based on doppler velocimetry

Vascular abnormality	No. of hypertensive subjects	Percent
Uterine & umbilical normal	38	56.72
Uterine abnormal	12	17.91
Umbilical abnormal	10	14.93
Uterine & umbilical abnormal	7	10.45

Table II

Doppler classification of hypertension in pregnancy perinatal outcome

Vascular abnormality	No. of patients	Perinatal outcome		
		Good	Premature	Mortality
Both vessels normal	38	31 (81.58%)	7(18.42%)	Nil
Uterine abnormal	12	8 (66.67%)	4(33.33%)	Nil
Umbilical abnormal	10	4 (40.00%)	6(60.00%)	Nil
Uterine and umbilical abnormal	7	Nil	3(42.86%)	4(57.14%)
Total	67	43 (64.18%)	20(29.85%)	4(5.90%)

these 12 subjects the perinatal outcome was good in 8(66.67%), and IUGR or prematurity was recorded in 4(33.33%). This group also did not record any perinatal mortality (Table II). Two third of these subjects (8) were delivered by LSCS (Table III).

Abnormal umbilical flow

This group of subjects had very mild hypertension, and hence did not need any maternal medication. The umbilical flow velocimetry essentially evidenced high resistance flow with high S/D ratio, and seldom evidenced absent end diastole.

However, among the 10 subjects 6 had fetal morbidity, either IUGR or prematurity (60%) (Table II), and had a higher incidence of LSCS (40%) (Table III). There was no perinatal mortality in this group. Because of the high perinatal morbidity they were considered at high risk for fetal well-being, and hence a more careful fetal surveillance was instituted with timely intervention.

Abnormal uterine and umbilical circulation

This group of 7 subjects had severe maternal and fetal risk factors. Many of

Table III

Incidence of L.S.C.S. in hypertensive gestations

Doppler velocimetry	Total patients	L.S.C.S.	Percentage
Uterine and umbilical normal	38	13	34.21%
Uterine abnormal	12	9	66.67%
Umbilical abnormal	10	4	40.00%
Uterine and umbilical abnormal	7	4	57.14%

them presented with diastolic notching in the uterine doppler, and absent end diastolic velocity (AEDV) in the umbilical circulation. These subjects were proteinuric hypertensives with high blood pressure and significant edema. Two of them were eclamptic, and 4 of the 7 subjects had a fetal loss. This was the only group recording perinatal mortality in PIH, and the other 3 fetuses were born with morbidity (either IUGR or prematurity).

The perinatal records of these patients were invariably poor as shown in Table II, and 5 of the 7 subjects were delivered by LSCS either for maternal or fetal indications (Table III).

Considering the maternal and fetal risks involved when both circulations were abnormal, these patients were treated with hypertensive therapy, and fetal surveillance studies were intensified. Timely delivery has been considered for the benefit of both the mother and her fetus.

All the hypertensive subjects

Among all the 67 hypertensive pregnant subjects the perinatal outcome was good in 43 subjects (64.18%); IUGR or prematurity was recorded in 20(29.85%) and perinatal mortality documented for 4 pregnancies (5.97%) (Table II).

Diastolic notch in uterine artery

There were 5 hypertensive subjects with uterine artery notching (7.46%), and of them 4 had in addition a high resistant umbilical circulation. In this group of 5 subjects the perinatal records were invariably poor, with 3 perinatal morbidities (IUGR) and 2 perinatal mortalities (Table IV).

AEDV (Table IV)

Absent diastolic flow in the umbilical artery waveform was documented in 3 of the 67 hypertensive subjects (4.48%), and all of them had perinatal complications. The perinatal complications included 2 fetal loss and 1 IUGR.

DISCUSSION

Hypertensive disorders of pregnancy are a heterogeneous group of disorders (Sibai, 1992). In many cases hypertension has little effect on the outcome of pregnancy (Farmakides et al, 1992). All the same a significant number of hypertensive pregnant women have perinatal mortality, prematurity and fetal growth retardation, the severity of which could correlate with the degree of reduction in flow velocity indicated by abnormal doppler velocimetry. On the contrary, hypertension, proteinuria, and edema all correlate poorly with perinatal outcome and mater-

Table IV

Diastolic notch in uterine artery in P.I.H.

Total	No. with Notch	Combined UMB resistance	IUGR	Mortality
67	5(7.46)	4(80%)	3(60%)	2(40%)

nal development of complications. Thus doppler velocimetry provides us with a tool that identifies women at significant risk for adverse outcome (Ducey, 1989).

Classification of hypertensive disorders in pregnancy based on the doppler blood flow studies in the uteroplacental circulation and fetoplacental circulation as proposed by Ducey et al., (1987) appears meaningful since velocity flow seems disturbed on both sides of the placenta in a significant portion of women with hypertension. In the clinical perspective best prognostication is possible by this classification, with the patient selection for hypotensive therapy and fetal surveillance rationalised with minimal perinatal and maternal complications.

Among the 38 subjects in whom the uterine and umbilical doppler velocimetry were normal the maternal and fetal behaviour were nothing different from that of any healthy gravid subjects, with a good perinatal outcome in 81.58% and no perinatal mortality. Moreover, majority of the hypertensive subjects belong to this group (56.72%), and safety managed by bed rest at home, with frequent blood pressure, urine output and fetal movement recordings. The patients must receive a regular diet with no salt restriction. Diuretics, sedatives and antihypertensive drugs are not to be prescribed.

The next common presentation of PIH is with high resistance flow in the uterine artery (17.91%). These subjects could be significantly hypertensive warranting hypotensive therapy, but do not have significant fetal morbidity. The perinatal outcome has been good in

two-thirds of the subjects, with no perinatal mortality. One has to be cautioned about those presenting with diastolic notching in the uterine artery, who quite often present with abnormal umbilical circulation as well and hence have perinatal complications.

The third common presentation is abnormal or high resistant umbilical velocimetry, seen in 14.93% of hypertensive pregnancies. While the mother does not need any medications, the fetal affection is significant with a perinatal morbidity of 60.00%. A careful fetal surveillance should be the corner stone in the management of such subjects and timely intervention should salvage more fetuses.

Combination of uterine and umbilical doppler abnormalities is the most ominous situation, which could affect maternal welfare and fetal salvage. Even though this complication is encountered only in around 10% of the hypertensive mothers, the associated problems are proteinuric hypertension, eclampsia, high incidences of LSCS and perinatal mortality. The problems are really acute in subjects who present with AEDV in the umbilical doppler and diastolic notching in the uterine vessels. Such subjects should be very carefully handled with hypotensives and urine output recording. Intense fetal surveillance and optimal intervention should help reduce the perinatal mortality.

CONCLUSION

Actual risk involved to the fetus or the mother in case of PIH could be sorted out based on the blood flow

velocity pattern and management and therapeutic schedules could be advocated depending on the nature and the extent of the risk involved.

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