# Role of Doppler Study in High Risk Pregnancy

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**Summary**

To study the role of Doppler in management of high risk pregnancies we conducted a study of 23 pregnant, having some or the other high risk factors. Most of these factors were suspected to cause placental insufficiency. The ratio of peak systolic to least diastolic velocity in umbilical artery was increased as an index of placental flow resistance. Patients were subjected to Doppler study of umbilical artery beyond 30 weeks of gestation S/D ratio of umbilical artery above 3 was considered abnormal.

13 cases showed normal Doppler study 9 cases showed elevated S/D ratio of umbilical artery and 1 case had absent flow during diastole in umbilical artery.

The perinatal outcome in patients with normal Doppler study was good. It was comparatively poor in patients with elevated S/D ratio of umbilical artery and it was worst in the case with absent flow during diastole.

In our study 90% patients with abnormal umbilical artery, Doppler study had adverse perinatal outcome.

## Introduction

Doppler velocimetry is a noninvasive technology using high frequency sound for investigation of blood flow. It has been extensively used for circulatory assessment in cardiology and angiology. The feasibility of its fetal application was first reported by Fitzerald & Drumm (1977).

The introduction of Doppler technology in obstetrics has made possible for first time, non invasive evaluation of feto placental circulation without any disturbance to human pregnancy. Accumulated data reveal that there is a strong association between abnormal Doppler studies and fetal disease. In uncomplicated pregnancies however the Doppler study shows expected progresive fall of peripheral resistance similar to that described previously in animal models.

The degree of increased vascular resistance and consequent reduction in flow velocity (elevated S/D or high P I) seems to correlate with adverse perinatal outcome.

## Aims & Objectives

1 To study Doppler velocimetry of fetal umbilical artery in high risk pregnancies and to correlate Doppler findings with perinatal outcome.
2 To study prognostic efficacy of colour Doppler in early detection of fetal compromise in high risk pregnancy.
3 To incorporate Doppler technique in obstetric management of high risk pregnancy.

## Material and Methods

23 pregnant patients with one or more of high risk factors shown in Fig 1, and table I were selected from antenatal clinic.

An Ultrasonography was done to confirm the gestational age and presence of IUGR. The Doppler study of umbilical artery was done anytime during the 3rd trimester of pregnancy usually after 30 weeks of gestation.

The nature of labour, mode of delivery and perinatal outcome were recorded.

**Observations**

**Normal Values of S/D Ratio of Umbilical Artery**

In our study the value of umbilical artery S/D ratio more than 3 was considered abnormal beyond 30 weeks. Several workers have identified normal S/D ratio values for different vessels at different gestational age.

| Year | Researcher | Upper normal limit of S/D ratio beyond 30 weeks |
|---|---|---|
| 1980 | Stuart et al (1980) | 2.5 |
| 1989 | Fleisher (1986) | 3 |
| 1992 | Rajan (1992) | 2.8 |

Rajan (1992) gave following value of S/D ratio of uterine and umbilical arteries at different gestational age.

| | Umbilical A S/D | Umbilical A S/D |
|---|---|---|
| 26-31 weeks | 2.8 | 1.8 |
| 32-36 weeks | 2.6 | 1.8 |
| 39-40 weeks | 2.7 | 1.8 |

This shows as pregnancy advances S/D ratio of umbilical artery progressively decline and that of uterine A remains 1.8.

Out of 23 high risk patients abnormal Doppler study was found in 10 patients. Abnormality of Doppler findings in our study were :-(Table II, Fig 2).

(1) Elevated S/D ratio in umbilical Artery (S/D >3)
(2) Absent end diastolic flow in umbilical artery.

None of the patients in study showed reversal of diastolic flow. And normal Doppler study seen in 13 patients, had S/D ratio < 3.

Perinatal outcome group of patients with normal umbilical artery S/D ratio was good. Only one patient had fetal distress & meconeum staining of liquor. One patient of this group was delivered by LSCS and preterm baby was born. Indication of C.S. being fetal distress.

**Distribution of Cases with High Risk Pregnncy According to Risk Factor**

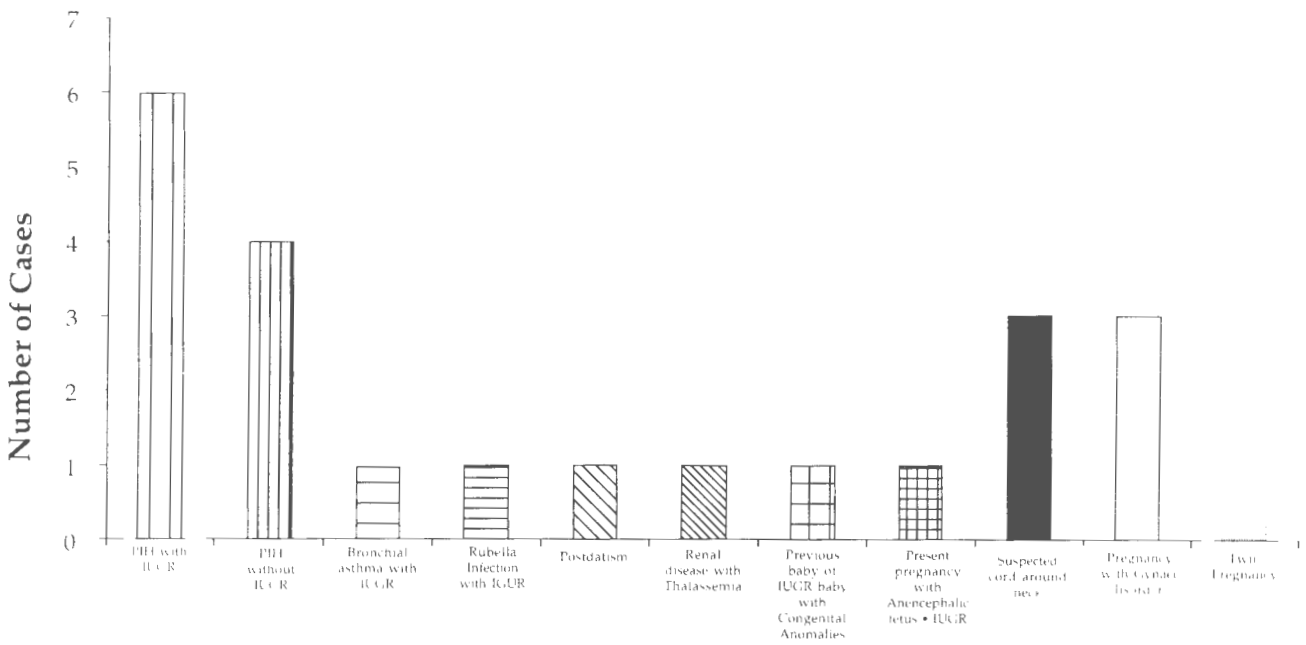


Fig 1

**Table – I**
**Distribution of cases with high risk Pregnancy according to risk factor**

| S. No. | Risk Factor | No. of Cases | Percentage |
|---|---|---|---|
| 1. | PIH with IUGR | 6 | 26.08 |
| 2. | PIH without IUGR | 4 | 17.39 |
| 3. | Bronchial asthma + IUGR | 1 | 4.35 |
| 4. | Rubella infection + IUGR | 1 | 4.35 |
| 5. | Postdatism | 1 | 4.35 |
| 6. | Renal desease + Thalassemia | 1 | 4.35 |
| 7. | Previous birth of IUGR baby + Congenital anomalies | 1 | 4.35 |
| 8. | Present pregnancy with Anencephalic Fetus + IUGR | 1 | 4.35 |
| 9. | Suspected cord around neck | 3 | 13.04 |
| 10. | Pregnancy with Gynaec disorder<br>- Fibroid (1)<br>- Ovarian cyst (2) | 3 | 13.04 |
| 11. | Twin Pregnancy | 1 | 4.35 |
| | Total | 23 | 100% |

**Table – II**
**Distribution of cases according to Umbilical A S/D ratio Findings**
**(In third trimester beyond 30 weeks)**

| S. No. | Risk Factor | S/D<3 | S/D>3 | AEDF | REDF |
|---|---|---|---|---|---|
| 1. | PIH with IUGR | Nil | 5 | 1 | - |
| 2. | PIH without IUGR | 4 | Nil | Nil | Nil |
| 3. | Renal desease + Thalessemia + IUGR | - | 1 | - | - |
| 4. | Bronchial asthma + IUGR | - | 1 | - | - |
| 5. | Rubella Infection + IGUR | - | 1 | - | - |
| 6. | Present Preg. With Anencephaly + IUGR | - | 1 | - | - |
| 7. | Previous baby with IUGR with congenital anomalies | 1 | - | - | - |
| 8. | Postdatism | 1 | - | - | - |
| 9. | Twin Pregnancy | 1 | - | - | |
| 10. | Cord around neck | 3 | - | - | - |
| 11. | Preg. With fibroid | 1 | - | - | - |
| 12. | Preg. With ovarian cyst. | 2 | - | - | |

REDF -Reverse end diastolic flow

AEDF - Absent end diastolic flow

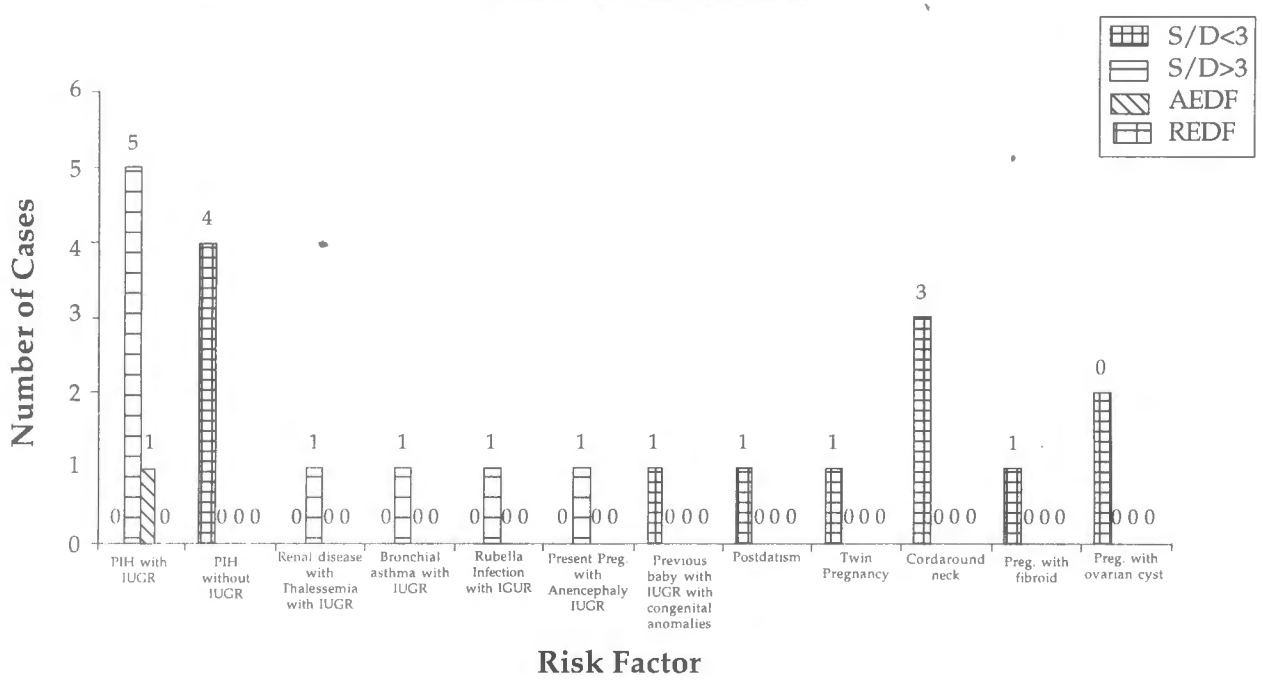
Distribution of High Risk Group Patients with Abnormal Umbilical Artery S/D Ratio According to Perinatal Outcome
S/D<3
S/D>3
AEDF
REDF
Number of Cases
Risk Factor
PIH with IUGR
PIH without IUGR
Renal disease with Thalessemia with IUGR
Bronchial asthma with IUGR
Rubella Infection with IGUR
Present Preg. with Anencephaly IUGR
Previous baby with IUGR with congenital anomalies
Postdatism
Twin Pregnancy
Cordaround neck
Preg. with fibroid
Preg. with ovarian cyst

Fig. 2

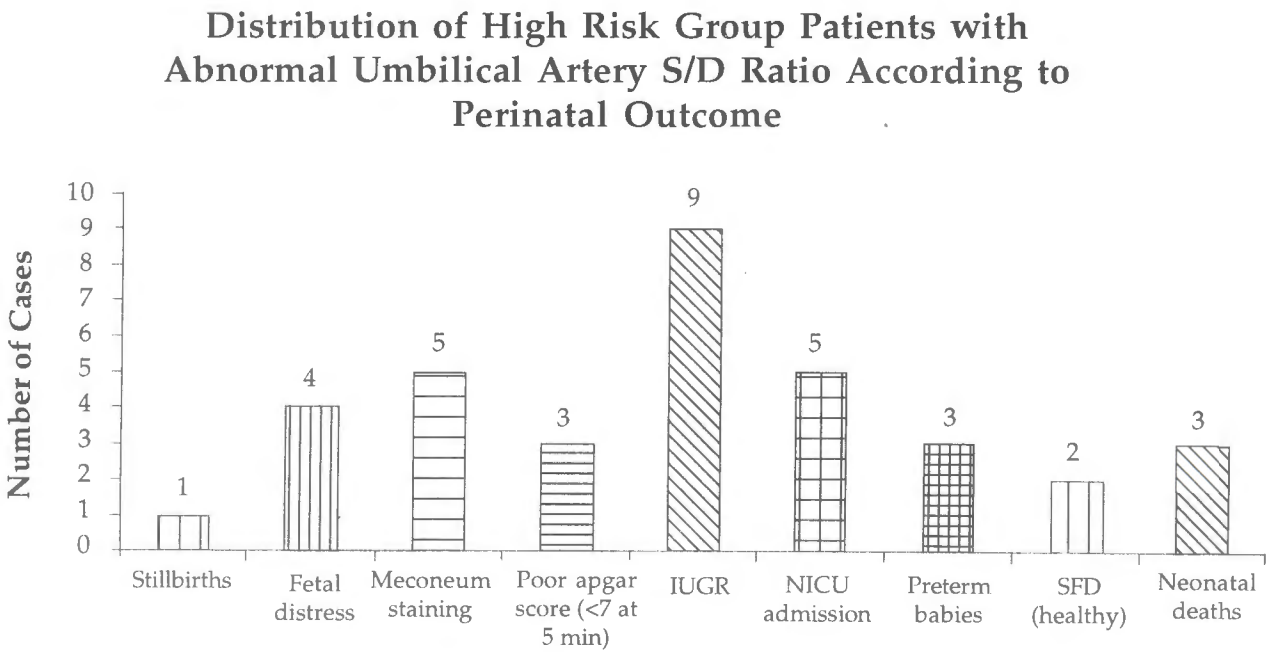
Distribution of High Risk Group Patients with Abnormal Umbilical Artery S/D Ratio According to Perinatal Outcome
Number of Cases
Perinatal Outcome
Stillbirths
Fetal distress
Meconeum staining
Poor apgar score (<7 at 5 min)
IUGR
NICU admission
Preterm babies
SFD (healthy)
Neonatal deaths

Fig. 3

**Table – III**
**Distribution of cases of high risk pregnancy having abnormal umbilical artery S/D Ratio according to perinatal outcome.**

| S.No. | Perinatal outcome | No. of cases | % |
|---|---|---|---|
| 1. | Stillbirths | 1 | 10 |
| 2. | Fetal distress | 4 | 40 |
| 3. | Meconeum staining | 5 | 50 |
| 4. | Poor apgar score (<7 at 5 min.) | 3 | 30 |
| 5. | IUGR | 9 | 90 |
| 6. | NICU admission | 5 | 50 |
| 7. | Preterm babies | 3 | 30 |
| 8. | SFD | 2 | 20 |
| 9. | Neonatal deaths | 3 | 30 |

Total No. of patients with elevated umbilical S/D ratio + AEDF = 10.
Total No. of patients with abnormal Doppler having adverse perintal outcome =9=90%

**Table – IV**
**Distribution of cases with adverse perinatal outcome in different groups of abnormality.**

| S.No. | Perinatal outcome | S/D<3 | S/D>3 | AEDF | REDF |
|---|---|---|---|---|---|
| 1. | Normal (SFD) | 2 | - | - | - |
| 2. | IUGR | - | 8 | 1 | - |
| 3. | Meconeum | 1 | 3 | 1 | - |
| 4. | Stillbirth | - | - | 1 | - |
| 5. | Apgar < 7 at 5 min. | - | 3 | - | - |
| 6. | NICU admission | - | 5 | - | - |
| 7. | Neonatal deaths | - | 3 | - | - |
| 8 | Preterm babies | 1 | 2 | - | - |
| 9. | Fetal distress | 1 | 3 | - | - |

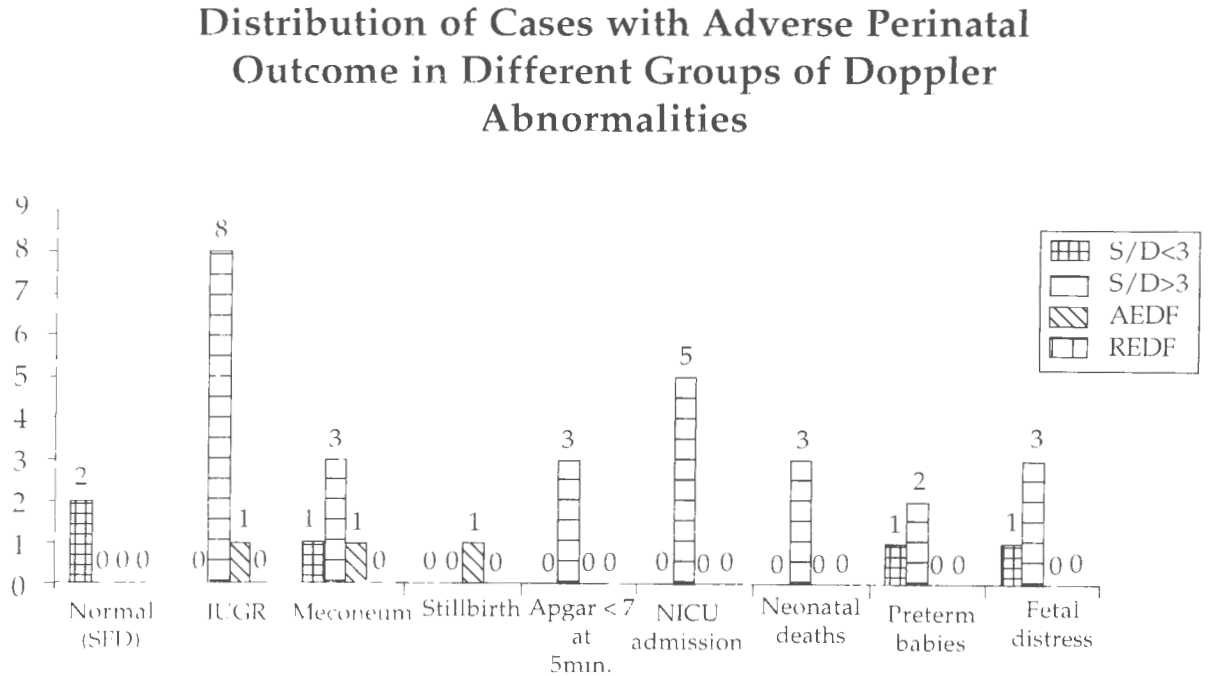


Fig. 4

Perinatal outcome in patients with S/D>3 in umbilical artery was comparatively poor. IUGR seen in 8 patients, 3 patients had meconeum in liquor, low apgar score (<7 at 5 min.) & fetal distress. Five newborns needed NICU admission and 2 patients delivered pretem babies. (Table III, Fig 3)

Patient with AEDF delivered a stillborn baby indicating worst outcome in this group None of the patients in study showed reversal of blood flow in umbilical arteries.

## Discussion

This study shows that umbilical blood flow studies by Doppler in 3rd trimester is very useful in predicting fetal outcome. In our study 90% patients with abnormal Doppler finding had adverse perinatal outcome. (Table IV, Fig 4)

### Pregnancy Induced Hypertension

4 cases with PIH had mild hypertension controlled by rest alone and no antihypertensives required. Normal S/D ratio of umbilical artery suggested fetal well being and ruled out placental insufficiency. All patients were managed on OPD basis with advise to have regular antenatal check-up. Perinatal outcome in this group was good & all pregnancies ended into spontaneous, normal vaginal delivery of healthy babies with Apgar score>8 at 5min. Only one case developed fetal distress during labour & had meconeum staining of liquor.

Normal S/D ratio of umbilical artery in all PIH cases suggests that Doppler is poor in predicting PIH. High uterine artery S/D ratio is said to have better specificity for PIH.

Flow studies are neither specific to disease nor sensitive to pick-up hypertensive subjects. This should be a surprise because there are 4 vascular patients described in Hypertensive subjects.

Rajan (1992) classified 74 patients of PIH according to finding of flow velocimetry in umbilical and uterine artery.

(1) Normal umbilical and uterine artery velocimetry in 56.72%
(2) Normal uterine and abnormal umbilical artery velocimetry in 17.19% patients.
(3) Abnormal uterine A and normal umbilical artery velocimetry in 14.93% patients.
(4) Abnormal uterine and abnormal umbilical artery velocimetry in 10.45% patients.

So maximum no. of patients of PIH have normal umbilical & uterine velocimetry and Doppler is poor in identifying PIH.

Doppler has its role in management of these cases to assess fetal wellbeing & detect fetal compromise.

### PIH with IUGR

All 6 patients were suffering from severe hypertension, proteinuria and significant edema. Umbilical A S/D ratio elevation indicated high resistance and reduced flow to foetus and placental insufficiency.

Since there was no evidence of reversal or absence of diastolic flow, patients were given expectant management because of being away from term.

Perinatal outcome was poor in this group. All 5 cases had intrapartum fetal distress with meconeum staining of liquor. All babies needed NICU admission for more than 48 hours. But neonatal deaths occurred in 3 out of 5 patients.

Thus, elevated umbilical artery finding in these patients correlated well with poor perinatal outcome in patients with PIH with IUGR. Thus Doppler allows early & accurate identification of foetuses who will become distressed. Brar et al 1989 noted that when umbilical artery S/D ratio > 3 than there is greater chance of SGA, Apgar score <7 at 5 min, LSCS for fetal distress, and thick meconeum in labour.

**Postdatism :** In the case with postdatism Doppler revealed umbilical artery S/D ratio less than 3. Since placental insufficiency was ruled out, active induction in presence of unfavourable cervix was avoided and patient was allowed to deliver past 41 weeks when spontaneous labour started and vaginal delivery of post dated pregnancy occurred.

Nimrood, et al (1990) randomized 243 postdated pregnancy cases into 2 groups and blinded one group with dopler results for management and for other group Doppler results were available. It was seen that caesarean section rate was higher in blinded group. (23.6% vs 17.2%). Greater proporation of patients were allowed to deliver past 42 weeks (P<0.04) in the group using Doppler results and their hospital stay was shorter.

**Twin Pregnancy :** In our study Doppler ruled out

discordance of growth of fetuses in a case with twin gestation because there was no significant difference in the S/D ratio value of 2 umbilical arteries.

Giles and Trudinger et al 1985 studied umbilical artery S/D ratio in 65 twin pregnancies and found SGA in 33 cases in one or both twins. In all these cases S/D ratio of umbilical artery was found elevated in at least one twin.

Elesher et al 1985, noted umbilical artery S/D difference of 0.4 or more between twins predicted a weight difference greater than 349 gm with sensitivity of 73% and specificity of 83%.

Detection of cord around neck by colour Doppler – In our study colour Doppler ruled out cord around neck in 2 cases out of 3 suspected cases and thus guided further management.

**Conclusion**

Colour Doppler helps in detection of compromised fetuses in high risk pregnancy like PIH, IUGR, twin pregnancy and other risk factors likely to cause placental insufficiency.

Since colour Doppler helps in obstetric management, it should be recommended for regular use in high risk pregnancy management.

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