



## Colour Doppler study of foetal middle cerebral artery in early diagnosis of foetal hypoxia in a case of cholestasis of pregnancy

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### Abstract:

Intrahepatic cholestasis during pregnancy is associated with several adverse foetal outcomes including meconium staining of the amniotic fluid (16-58%)<sup>1</sup>, CTG abnormalities, RDS, preterm labour (36%)<sup>2</sup> and sudden intrauterine death(15%)<sup>3</sup>. The risk of adverse foetal outcome is thought to be related with the maternal serum bile acid level and a recent study has shown that there is a 1%-2% increased risk for every  $\mu\text{mol/l}$  bile acid above  $40 \mu\text{mol/l}$ <sup>4</sup>. Non invasive monitoring of foetus is a challenge in such cases. In our case biophysical profile, CTG and umbilical artery flow were normal. Foetal MCA show low impedance flow (increased diastolic flow and reduced RI and PI index suggestive of foetal hypoxia. Large number of case studies needed in such cases to establish association of meconium staining of amniotic fluid and foetal hypoxia with MCA low impedance flow and MCA Doppler study as non invasive diagnostic tool in monitoring of complicated pregnancy with intrahepatic cholestatic pregnancy and reducing the perinatal mortality and sudden intrauterine death.

**Key words:** Doppler, cholestasis, pregnancy, hypoxia, cerebral artery

### Case Report:

A 27 years old female with 32 week pregnancy presented with pruritus of hand and feet. Clinically patient is diagnosed as intrahepatic cholestatic jaundice. Patient is investigated by ultrasound abdomen, total serum bile acids, liver function test, Hb% and viral markers. The test show SGPT-599 unit, SGOT-659 units, serum total bile acids-  $110 \mu\text{mol}$ , serum bilirubin -  $0.64 \text{ mg/dl}$ , serum alkaline phosphate-  $167 \text{ iu}$ , GGT-  $20 \text{ u/l}$ , total serum protein-  $6.9 \text{ gm/dl}$ , serum albumin-  $3.7 \text{ gm/dl}$ , globulin-  $3.2 \text{ gm/dl}$ , plasma glucose random-  $73 \text{ mg/dl}$ , Hb-  $13.5 \text{ gm\%}$ , viral markers are non reactive. Ultrasound abdomen show normal hepatobiliary system and normal growth parameters of foetus. Foetal biophysical profile is normal. After 32 weeks of gestation, weekly monitoring of foetus by liver function test and ultrasound done. Oral drugs (ursodeoxycholic acid) given to patient for cholestatic jaundice. In view of high intranatal mortality, prophylactic betamethasone and vitamin k injection were given at 34.5 weeks of gestation. On ultrasound study at 35 weeks biophysical profile of foetus was normal. On colour Doppler study, flow in umbilical

arteries was normal (fig.1) with PSV- $43.9 \text{ cm/sec}$ , EDV - $18 \text{ cm/sec}$ , mean velocity- $31.1 \text{ cm/sec}$ , PI- $0.833$ , RI- $0.590$ , S/D - $2.44$ . Flow in MCA show low impedance flow(fig. 3) with PSV- $76.7 \text{ cm/sec}$ , EDV- $35.7 \text{ cm/sec}$ , mean velocity  $50.6$ , PI- $0.812$ , RI- $0.535$ , S/D  $2.15 \text{ cm/sec}$ . Based on low impedance flow in MCA foetal hypoxia was diagnosed. Based on MCA Doppler study, obstetrician colleague decided for preterm caesarean delivery within 6 hours of Doppler study. On operation they found meconium staining of liquor along with a loop of cord around the neck of foetus. A male child of  $2.5 \text{ kg}$  weight delivered, cried immediately after birth, no evidence of respiratory distress or meconium aspiration noted.

### Discussion

Intrahepatic cholestasis of pregnancy (ICP) is associated with foetal risk including meconium staining of the amniotic fluid, CTG abnormalities, decrease foetal heart rate variability, RDS, preterm labour and sudden IUD.

There is increased risk of spontaneous preterm labour in as many as 36% of delivery. Older studies using biochemical abnormalities to diagnose

ICP have reported a perinatal mortality rate of 10-15 %. This has been reduced to 3.5% [5-10] or less in more recent studies employing policies of active management. Active management includes ursodeoxycholic acid administration and delivery at 37-38 weeks of gestation because study show that stillbirth tends to occurs around 37-39 weeks, however there have been reports of still births even at 31 weeks.

The risk of adverse foetal outcome is thought to be related with maternal serum bile acid level and a recent study has shown that there is a 1-2% increased risk for each  $\mu\text{mol/l}$  bile acid above  $40\mu\text{mol/l}$ . It is therefore likely that the risk of IUD is higher in ICP pregnancies with more severe hypercholeolemia, however foetal death reported at bile acid level  $<40\mu\text{mol/l}$ . Maternal serum bile acid level is high in majority of IUD reported in the literature but these observation illustrate the difficulty encountered by the clinicians in using biochemical measurements to dictate delivery strategies for ICP cases.

Doppler study of foetal umbilical arteries, MCA and ductus venosus is helpful in diagnosis of foeto-placental circulation abnormalities. Doppler indices commonly used in obstetrics imaging are RI , PI , and S/D .

$RI = S-D/S$

$PI = S-D/M$

$S/D = \text{systolic/diastolic}$ .

Umbilical arterial circulation is low impedance circulation (fig. 1) with an increase in amount of end diastolic flow with advancing gestation. Umbilical arterial waveform reflect the status of placental circulation , and increase in end diastolic flow that is seen with advancing gestation is a direct result of an increase in the number of tertiary stem villi that takes place with placental maturation. Diseases that obliterate small muscular arteries in the placental tertiary stem villi result in progressive decrease in end diastolic flow in the umbilical arterial Doppler waveform until absent and then reversal flow during the diastole is noted [11]. Reversed diastolic flow in the umbilical arterial circulation represent an advanced stage of placental compromise and is associated with more than 70 % of placental arterial obliteration [12] .

Uterine artery vasculature show progressive decrease in impedance with advancing gestation . This maternal adaptation to pregnancy is thought to result from the trophoblastic invasion of the maternal spiral arteriole in the first half of pregnancy . The presence of notch in the waveform and an increase in the impedance index after 22 weeks of gestation characterizes an abnormal uterine circulation .

MCA circulation is high impedance circulation (fig. 2) with continuous forward flow throughout the cardiac cycle . This is the reverse of the flow within the umbilical cord toward the placenta .In the presence of foetal hypoxemia there is redistribution of blood flow mainly towards brain, heart ,adrenals and reduction in flow to the peripheral and placental circulations. This blood flow redistribution is known as the brain sparing reflex and plays a major role in foetal adaptation to oxygen deprivation.

Although middle cerebral artery Doppler evaluation is often used to asses foetal IUGR, more recently MCA velocity has also been used in assessing the degree of anaemia in foetus with haemolytic disease due to Rh isoimmunisation and parvovirus B19 infection.

In intrahepatic cholestasis of pregnancy it is difficult to predict the foetal outcome and majority of IUD occur at 37-39 weeks gestation. So delivery is usually planned at 37 weeks of gestational age. Amnioscopy is an invasive procedure and not routinely recommended for meconium staining of amniotic fluid confirmation.

In our case Doppler study of MCA shows low impedance flow (fig 3) with PSV-76.7 cm/sec, EDV-35.7 cm/sec, mean velocity 50.6 cm/sec, PI-0.812, RI-0.535, S/D 2.15cm/sec suggestive of foetal hypoxia. Foetal umbilical arteries flow was normal.

On the basis of MCA Doppler study our obstetrician colleague planned for elective caesarean section in spite of prematurity and risk of foetal complications. Operative findings include meconium staining of liquor and single loop of umbilical cord around the foetal neck .CTG study and biophysical profile prior to delivery is normal.

### Summary and Conclusion:

In conclusion MCA Doppler study is helpful in early detection of foetal hypoxia associated with intrahepatic cholestatic pregnancy, which leads to reduction of perinatal mortality. Large case series study needed for further study and stabilization of intrhepatic cholestatic pregnancy associated Doppler changes of foetal MCA ,umbilical artery and foetal veins .

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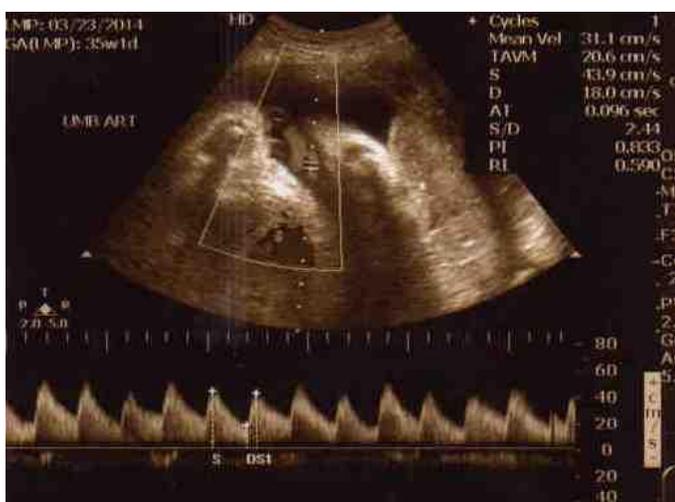


Figure-1 ,showing normal (low impedance)flow of foetal umbilical artery.



Figure 2-Normal high impedance flow of foetal middle cerebral artery.

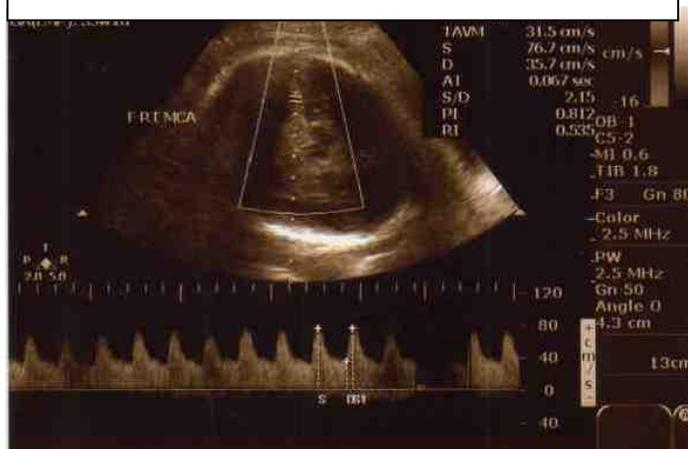


Figure 3-Abnormal low impedance flow of foetal middle cerebral artery in foetal hypoxia .

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