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CASE REPORT

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Successful application of middle cerebral artery peak systolic velocity to time intrauterine tranfusions in Rh isoimmunised fetus

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Introduction

Intrauterine fetal blood transfusion (IUT) is the only fetal therapy for anemic Rh isoimmunized fetuses less than 32-34 weeks of gestation. The goal of IUT is to achieve a post-transfusion hematocrit of 50-60%. The first IUT is done when spectrophotometry of amniotic fluid shows high bilirubin level, cordocentesis shows severe anemia (hemoglobin < 10 g/dL, hematocrit < 30%) or there is ultrasound evidence of hydrops fetalis. However, serial aminocentesis and cordocentesis are invasive technics with risk to the mother and the fetus such as preterm labor, premature rupture of membranes, chorioamnionitis, fetal bleeding, fetal bradycardia, and fetal death. Both procedures lead to fetomaternal hemorrhage which may increase maternal alloimmunization and worsen the outcome. After one IUT, the timing of the next IUT is usually planned arbitrarily after 2-3 weeks depending on previous posttransfusion hematocrit, considering a fall in hematocrit of 1% per day [1].

The middle cerebral artery peak systolic velocity (MCA-PSV) has recently been found to be an accurate and noninvasive means of diagnosing fetal anemia in patients with Rh isoimmunization [2]. At cut off point of 1.5 times the median, MCA-PSV is found to corelate with moderate to severe anemia, with a sensitivity of 100% and a false positive rate of 12% [3]. We successfully applied MCA-PSV measurements to time the first and subsequent transfusions in a case of severe Rh isoimmunization.

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Case report

A 35 year old 6th gravida was referred to us at 21 weeks of gestation for severe Rh isoimmunization. Her first pregnancy was a preterm home vaginal delivery at 8 months. The baby died on the third day. Her Rh status was not known, and she did not receive injection anti-D. Second pregnancy was a full term vaginal delivery at home but baby died after 12 hours due to aspiration. She was diagnosed to be Rh negative in this pregnancy, received antepartum injection of anti-D at 28 weeks, but did not receive postpartum injection of anti-D. In her third pregnancy, fetal hydrops was detected by ultrasound at 7th month and intrauterine death occurred. Fourth pregnancy was a spontaneous abortion at 4 months and she was given injection anti-D by her local doctor. In her 5th pregnancy hydrops fetalis was detected on ultrasound at 7 months gestation and intrauterine death occurred subsequently.

In the present pregnancy, indirect Coombs test was positive with a titer of 1:256. Fetal monitoring for anemia was done every 3-4 days by ultrasound for hepatomegaly, cardiomegaly, placentomegaly, and hydrops. Doppler velocimetry was used to measure MCA-PSV every 3-4 days. An axial section of the brain, including the thalami and the cavita septi pellucida was obtained. The circle of Willis was identified and middle cerebral artery nearest to the probe was targeted (Figure 1). The highest point of the wave form was measured in cm/second. It was expressed as multiple of mediun (MoM), as established for various gestational ages [3].

MCA-PSV measurements performed biweekly from 21 weeks onwards showed readings less than 1.5 MoM. At 23 weeks, MCA-PSV was 43.25 cm/second (> 1.5 MoM).

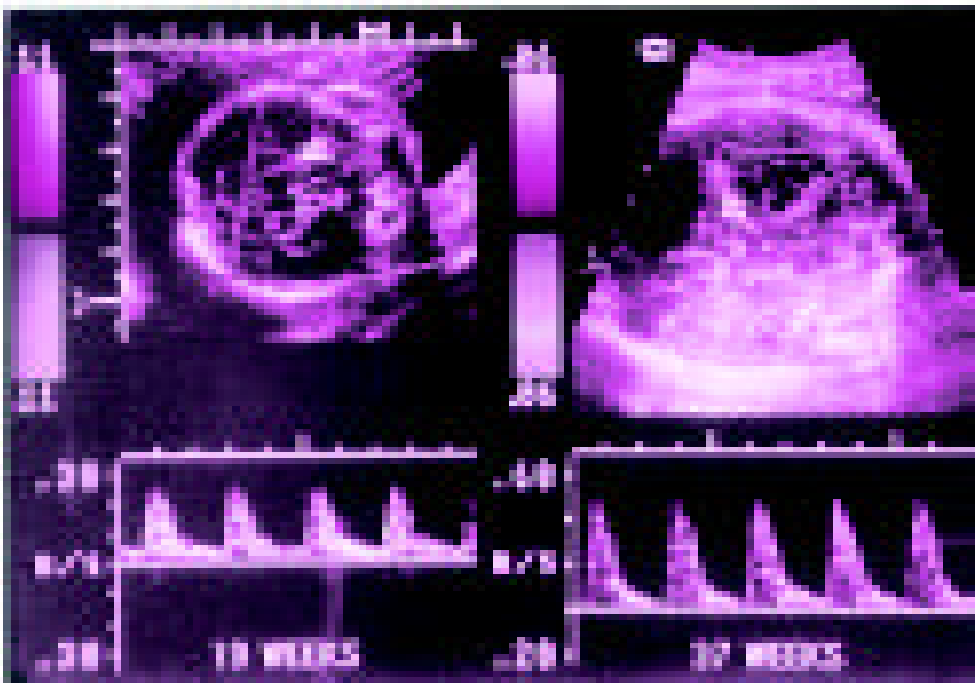

Figure 1. Showing measurement of MCA-PSV

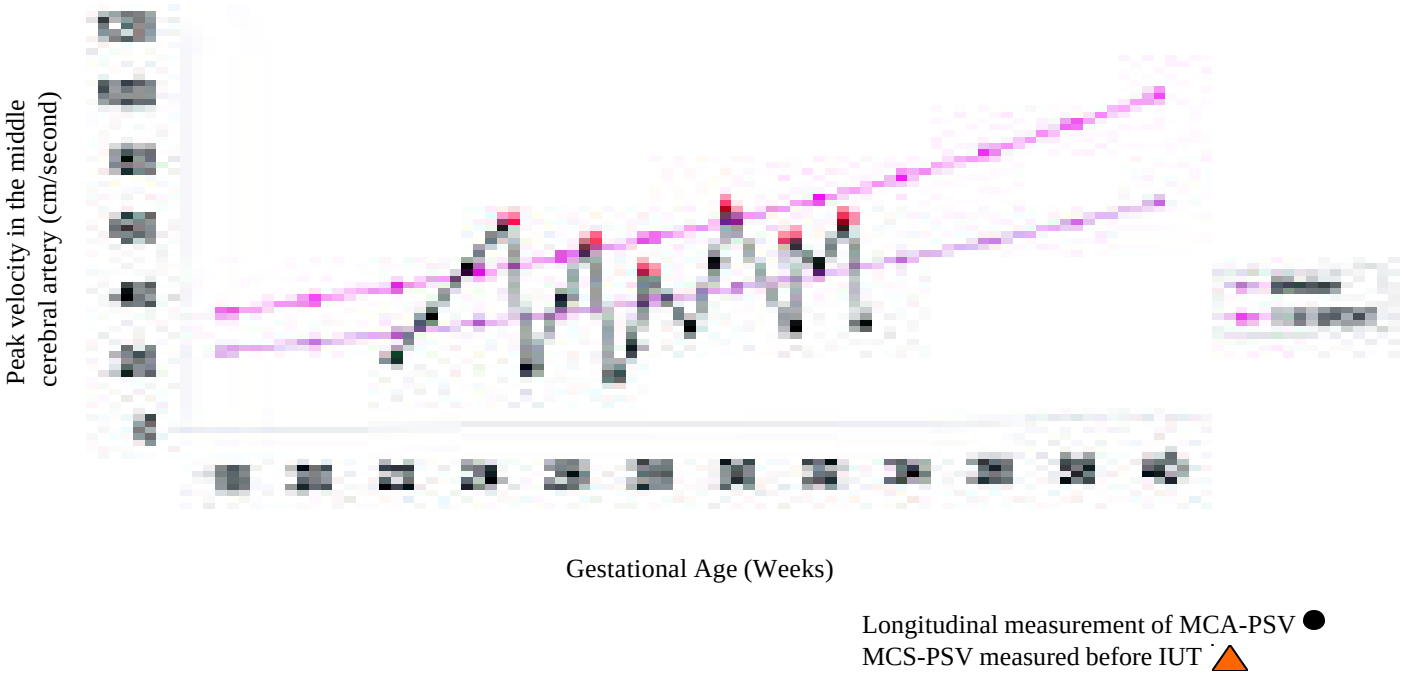

Figure 2. Showing relation of MCA-PSV using Mari's [3] chart and fetal blood transfusion.

Hence amniocentesis was done for spectrophotometry and fetal ABO and Rh grouping. Fetal blood group was O+ve, and amniotic fluid bilirubin spectrophotometry was in Liley's upper zone 2. Cordocentesis was planned and performed at 24 weeks. The MCA-PSV was 61 cm/second and cord blood hematocrit was 10%. So ultrasound guided intrauterine transfusion was performed and 50 mL of O negative packed cells was tranfused into the fetal umbilical vein at the rate of 15 mL/minute. Posttransfusion hematocrit was 40%. Ultrasound assessment for fetal well being and MCA-PSV were performed 2 days after transfusion. MCA-PSV value was found to have fallen to 20 cm/second .On follow up, MCA-PSV measurements showed a gradual rising trend and at 25 weeks and 4 days when MCA-PSV was raised to 58.1 cm/second (>1.5 MoM) repeat IUT was done.

The MCA-PSV and fetal hemoglobin at subsequent cordocentesis and at the six intrauterine transfusions are shown in Figure 2 and Table 1. She went into spontaneous labor at 32 weeks of gestation and delivered a baby weighing 1620 g with apgar score of 7. Cord blood hemoglobin was 10.4 g/dL, hematocrit 25%, and bilirubin 1.5 mg/dL. The baby needed one exchange transfusion and phototherapy. At the last follow up the baby was alive and healthy at one year of age.

Table 1 : Corelation of pre- and posttransfusion hematocrit with MCA-PSV measurements.

		Pretransfusion		Posttransfusion	
IUT	Gestation (weeks ± days)	MCA-PSV cm/second	Hematocrit percent	MCA-PSV cm/second	Hematocrit percent
1st	24	61	10	20	40
2nd	25 +4d	58.1	35	14.68	50
3rd	27 +5d	43.75	11	28	17
4th	29 +3d	64	20	20	40
5th	30 +3d	50	18	30	25
6th	31 +3d	50	27	24	45
	32	30	Neonatal cord blood hematocrit 25%		

Discussion

We used doppler MCA-PSV measurements along with 2D ultrasound to time intrauterine transfusion whenever MCA-PSV was more than 1.5 MoM and when it was rising. High MCA-PSV corelated with amniotic fluid spectrophotometry value and cord blood hematocrit value on six occasions of cordocentesis (Table 1). We did not need any additional diagnostic amniocentesis or cordocentesis to time next IUT. There was a reciprocal relation between MCA-PSV and cord blood hematocrit values. Thus, MCA-PSV was very useful in diagnosing severe fetal anemia and to accurately schedule the next IUT.

In anemic fetuses, the hematocrit levels fall leading to decrease in blood viscosity and increase in MCA-PSV [4]. Low hemoglobin concentration is also associated with tissue hypoxia and lactate production which result in vasodilatation of cerebral blood vessels and thus increased blood flow [5].

Stefos et al [6], found that correction of fetal anemia decreases and normalizes the MCA-PSV values in fetuses thus reducing the number of unnecessary amniocentesis and cordocentesis for diagnosing fetal anemia . Delle Chiaie et al [7] measured MCA-PSV before and after 39 IUTs .They found a significant reduction in posttransfusion MCA-PSV value.

MCA-PSV is a sensitive, noninvasive means to determine the degree of fetal anemia in cases of Rh isoimmunization . It can be used successfully and accurately to time the first and subsequent intrauterine transfusions.

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