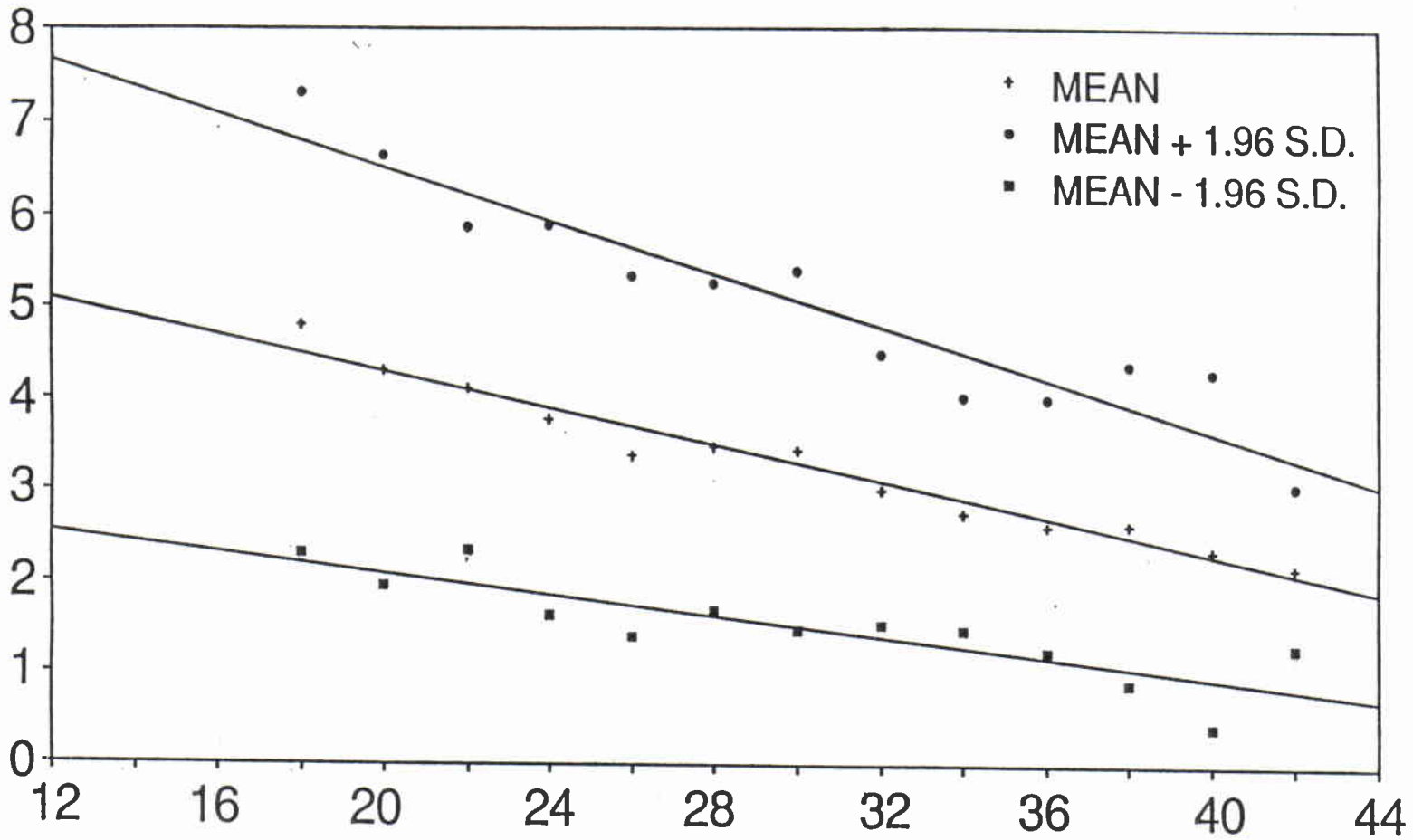
Umbilical Artery $\frac{A}{B}$

FIGURE 4 - A/B RATIO



If > 24 wks + see little diastolic flow (high S/D) then raise concern of placental or cord abnl

$$\frac{\text{Cerebral (MCA) Perfusion}}{\text{Placental (UA) Perfusion}} = \frac{\text{A/B cereb}}{\text{A/B UA}}$$

A/B cereb: usually high

A/B UA: varies ↑ EGA

(Normal is > 1.0)

B. Packwood

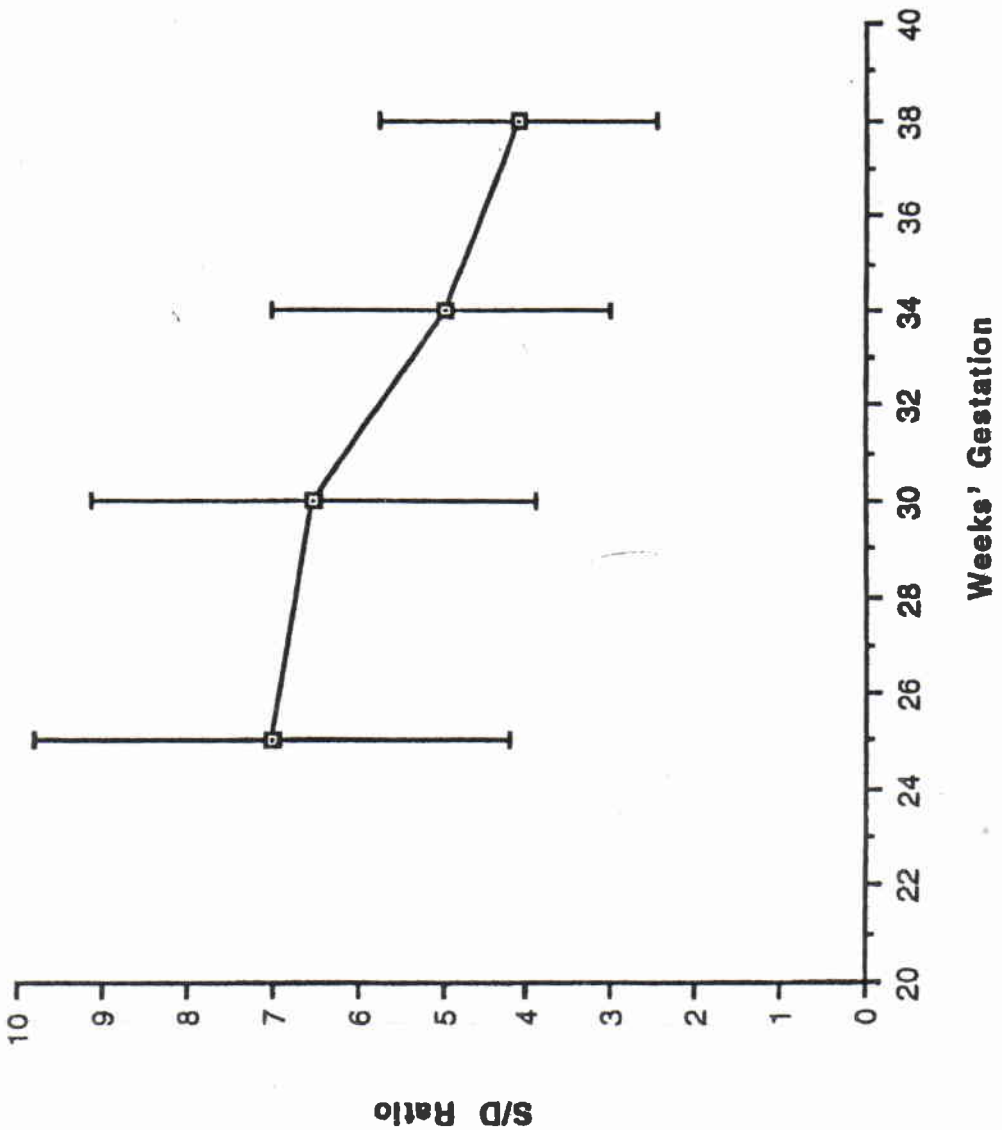


FIGURE C–2. Middle cerebral artery Doppler systolic/diastolic ratios. (Modified from Woo JSK, Liang ST, et al: Middle cerebral artery Doppler flow velocity. Reprinted with permission from the American College of Obstetricians and Gynecologists [Obstetrics and Gynecology, 1987, 70:613].)

Table 1. *Umbilical Artery Flow A/B Ratio*

WEEKS	MEAN	UPPER LIMIT
24	3.5	4.25
25	3.4	4.1
26	3.3	3.9
27	3.2	3.75
28	3.1	3.7
29	3.0	3.6
30	2.9	3.5
31	2.85	3.45
32	2.8	3.4
33	2.7	3.3
34	2.6	3.15
35	2.55	3.1
36	2.45	3.0
37	2.4	2.9
38	2.35	2.8
39	2.3	2.65
40	2.2	2.5

Courtesy of JD Bowie, MD, Duke University. This table is a composite of tables found in the following references: Stuart B, Drumm J, Fitzgerald DE, Dugan NM: Fetal blood velocity waveforms in normal pregnancy. Br J Obstet Gynaecol 87:780–785, 1980; Erskine RLA, Ritchie JWK: Umbilical artery blood flow characteristics in normal and growth-retarded fetuses. Br J Obstet Gynaecol 92:605–610, 1985; and Trudinger BJ, Giles WB, Cook CM, et al: Fetal umbilical artery flow velocity waveforms and placental resistance: Clinical significance. Br J Obstet Gynaecol 92:23–30, 1985.

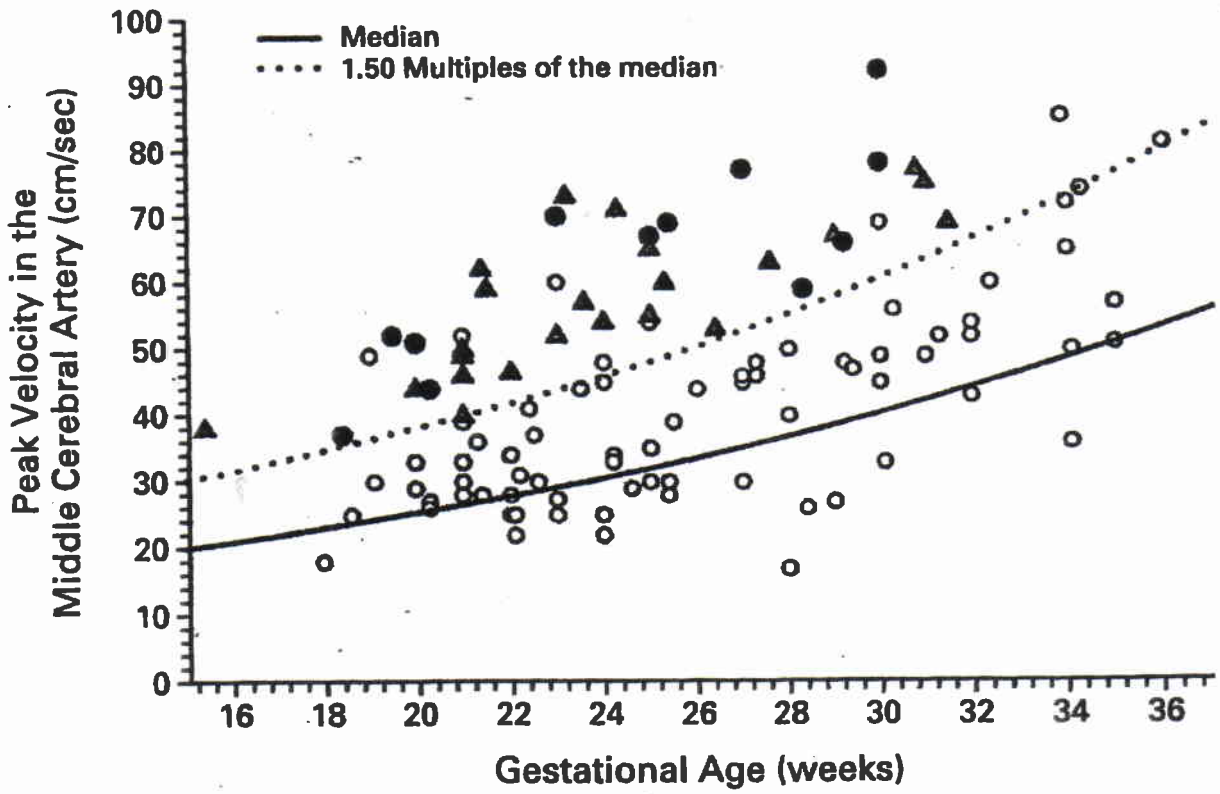


Figure 3. Peak Velocity of Systolic Blood Flow in the Middle Cerebral Artery in 111 Fetuses at Risk fo Anemia Due to Maternal Red-Cell Alloimmunization.

Open circles indicate fetuses with either no anemia or mild anemia (≥0.65 multiples of the media hemoglobin concentration). Triangles indicate fetuses with moderate or severe anemia (<0.65 mult ples of the median hemoglobin concentration). The solid circles indicate the fetuses with hydrops. Th solid curve indicates the median peak systolic velocity in the middle cerebral artery, and the dotte curve indicates 1.5 multiples of the median.

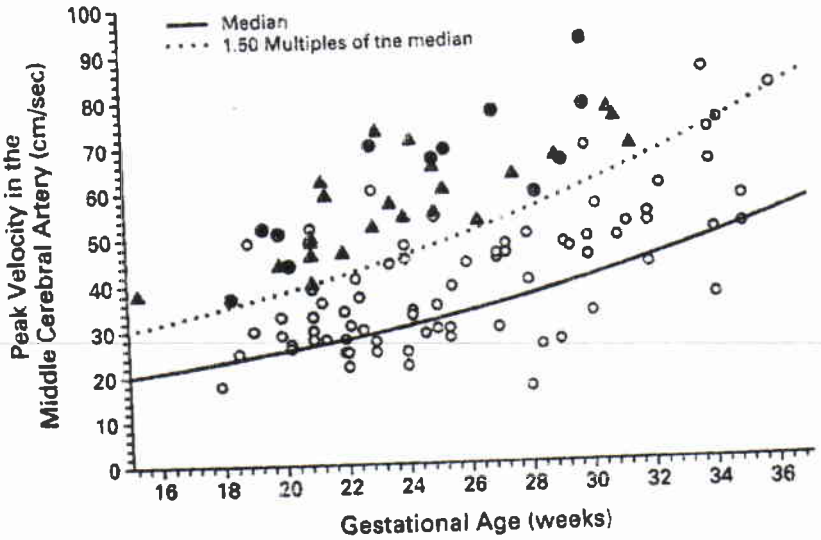


Figure 3. Peak Velocity of Systolic Blood Flow in the Middle Cerebral Artery in 111 Fetuses at Risk for Anemia Due to Maternal Red-Cell Alloimmunization.

Open circles indicate fetuses with either no anemia or mild anemia (≥0.65 multiples of the median hemoglobin concentration). Triangles indicate fetuses with moderate or severe anemia (<0.65 multiples of the median hemoglobin concentration). The solid circles indicate the fetuses with hydrops. The solid curve indicates the median peak systolic velocity in the middle cerebral artery, and the dotted curve indicates 1.5 multiples of the median.

tuses with a peak systolic velocity of 1.50 times the median or higher. Fetuses with values below 1.50 either did not have anemia or had only mild anemia. The fact that this test does not predict mild anemia well is not clinically important, because no intervention is indicated in fetuses with mild anemia, as defined in our study, whereas those with moderate or severe anemia should undergo cordocentesis and may need transfusion.[2]

In the United States, on the assumption that 4 million infants are born each year, approximately 4000 pregnancies are complicated by Rh alloimmunization, but only 10 percent of those require intrauterine transfusion before 34 weeks of gestation. More than 10,000 pregnancies are complicated by alloimmunization against other blood-group antigens, and less than 10 percent of those require intrauterine transfusion. Therefore, approximately 1400 fetuses each year require intrauterine transfusion. To detect the fetuses at risk for hydrops before 34 weeks of gestation (10 percent of the entire population at risk), either serial cordocentesis or serial amniocentesis is currently performed. Although cordocentesis allows direct measurement of fetal hemoglobin, it is associated with infection, bleeding, fetal bradycardia, premature rupture of the membranes,[4,20] and a procedure-related pregnancy loss of 1 percent.[4] If each fetus at risk for anemia were to undergo one cordocentesis procedure, we estimate that there would be at least 140 fetal losses every year.

Amniocentesis is less invasive than cordocentesis, but the reliability of measurements of bilirubin in amniotic fluid before 27 weeks of gestation is questionable.[21,22] For both amniocentesis and cordocentesis, there are no data concerning the optimal frequency of repeated sampling. Furthermore, these procedures may be associated with a worsening of maternal alloimmunization.[23-25] Finally, the results of the analysis of amniotic fluid in cases in which there is sensitization to Kell antigens correlate poorly with the severity of fetal anemia.[26] The use of measurements of peak systolic velocity as described here would decrease the number of fetuses subjected to amniocentesis and cordocentesis.

In conclusion, measurements of the peak velocity of blood flow in the middle cerebral artery in fetuses at risk for anemia due to maternal red-cell alloimmunization provide an accurate and noninvasive means of determining the degree of anemia.

We are indebted to Dr. Jeremiah Mahoney for his thoughtful review of the manuscript.

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