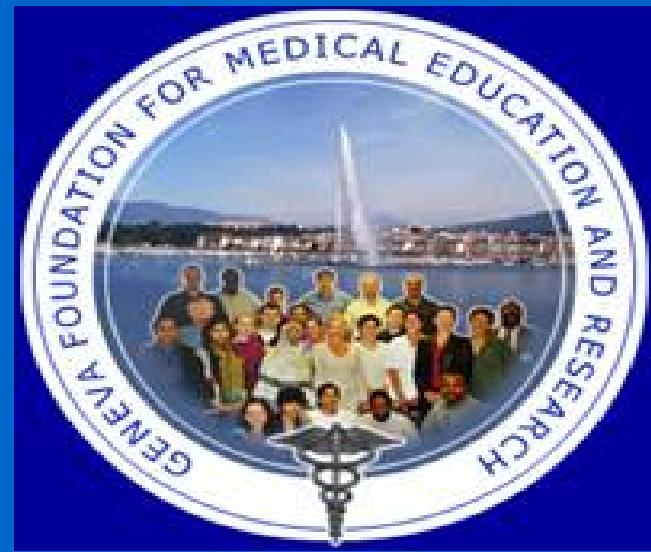


DOPPLER ULTRASOUND IN HIGH RISK PREGNANCIES

COCHRANE REVIEW



WHO/GFMER/IAMANEH
Postgraduate Training Course in
Reproductive Health
Geneva 2004

DOPPLER ULTRASOUND IN HIGH RISK PREGNANCIES COCHRANE REVIEW

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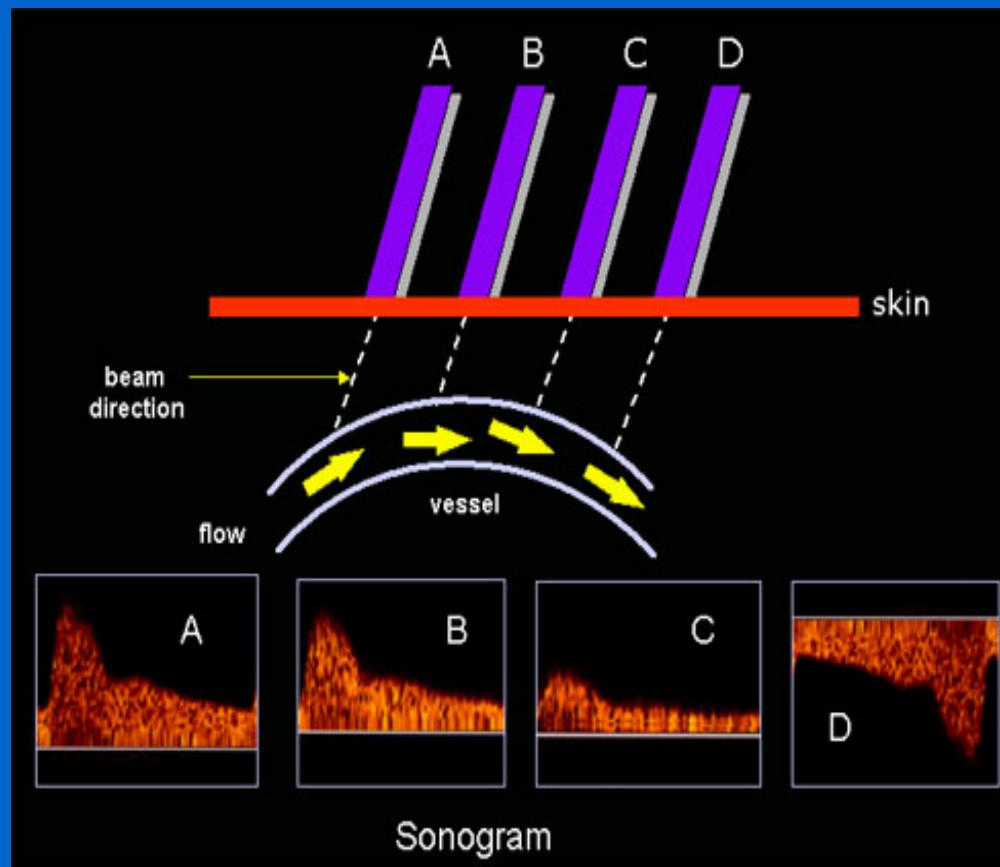
Geneva Foundation for Medical Education and Research
Iamaneh

PROTOCOL

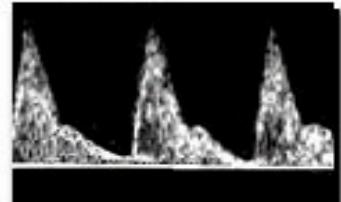
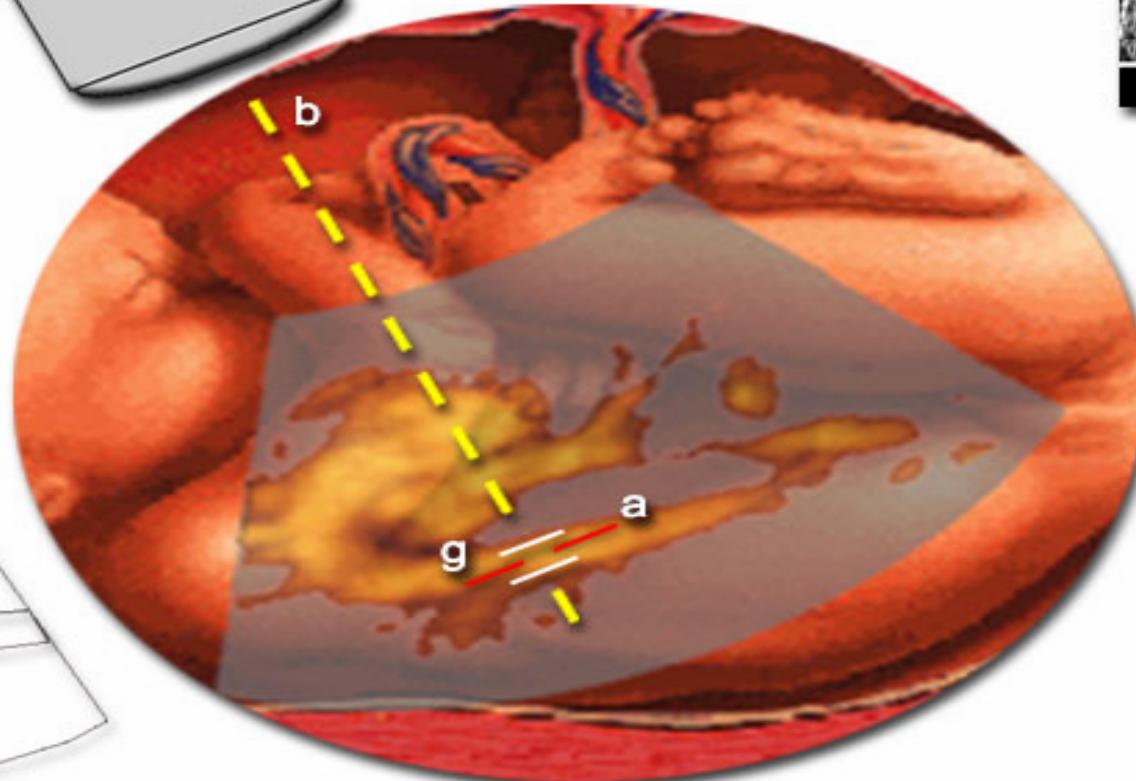
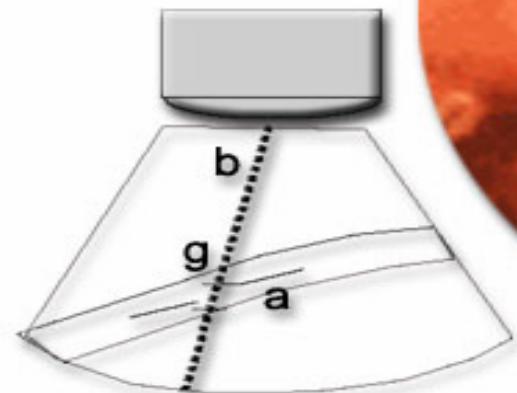
BACKGROUND

Doppler ultrasound: basic principles

Effect of the Doppler angle in the sonogram. **(A)** higher-frequency Doppler signal is obtained if the beam is aligned more to the direction of flow. In the diagram, beam **(A)** is more aligned than **(B)** and produces higher-frequency Doppler signals. The beam/flow angle at **(C)** is almost 90° and there is a very poor Doppler signal. The flow at **(D)** is away from the beam and there is a negative signal.



transducer

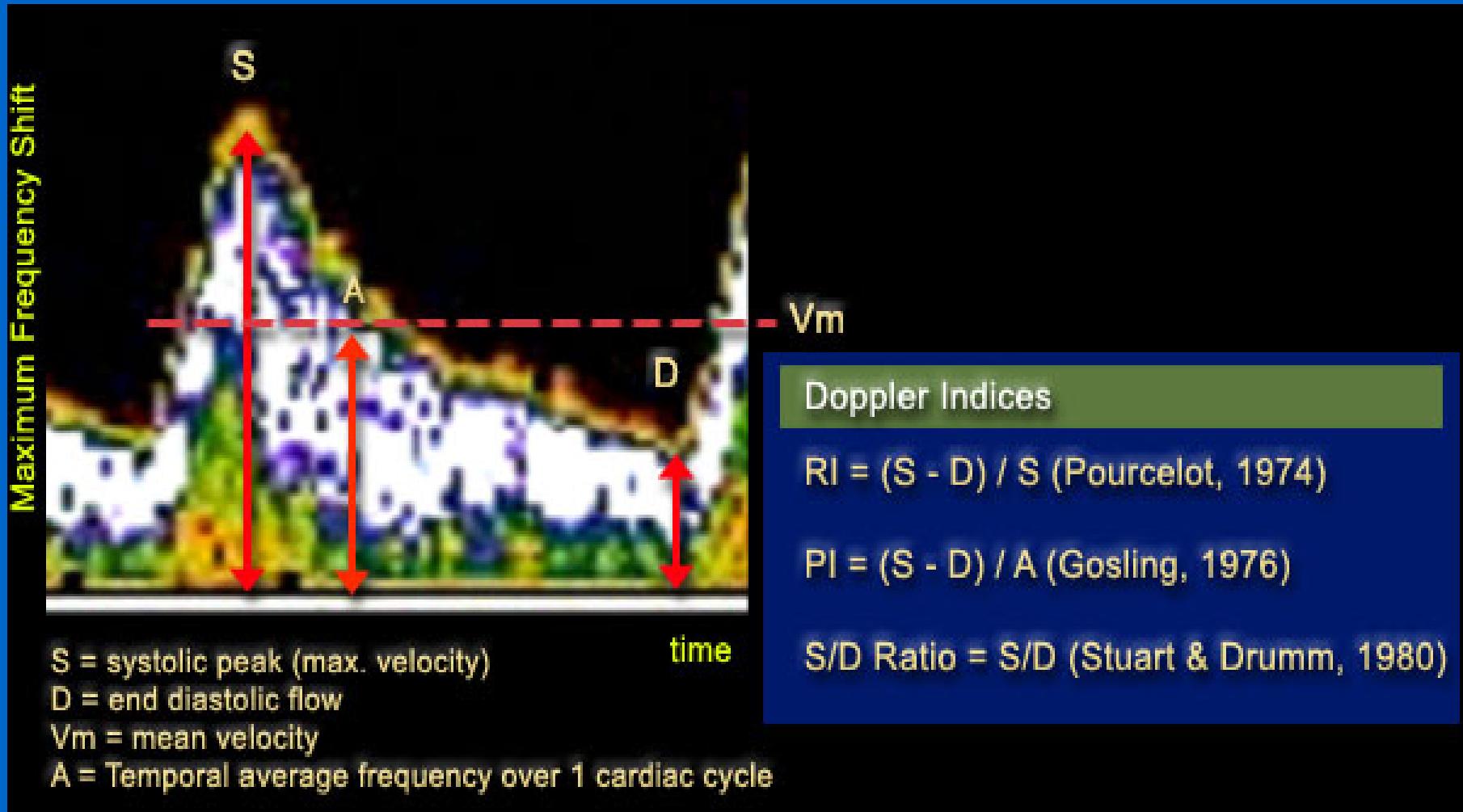


descending
aorta

- (b) - direction of the Doppler beam
- (g) - gate or sample volume
- (a) - angle correction

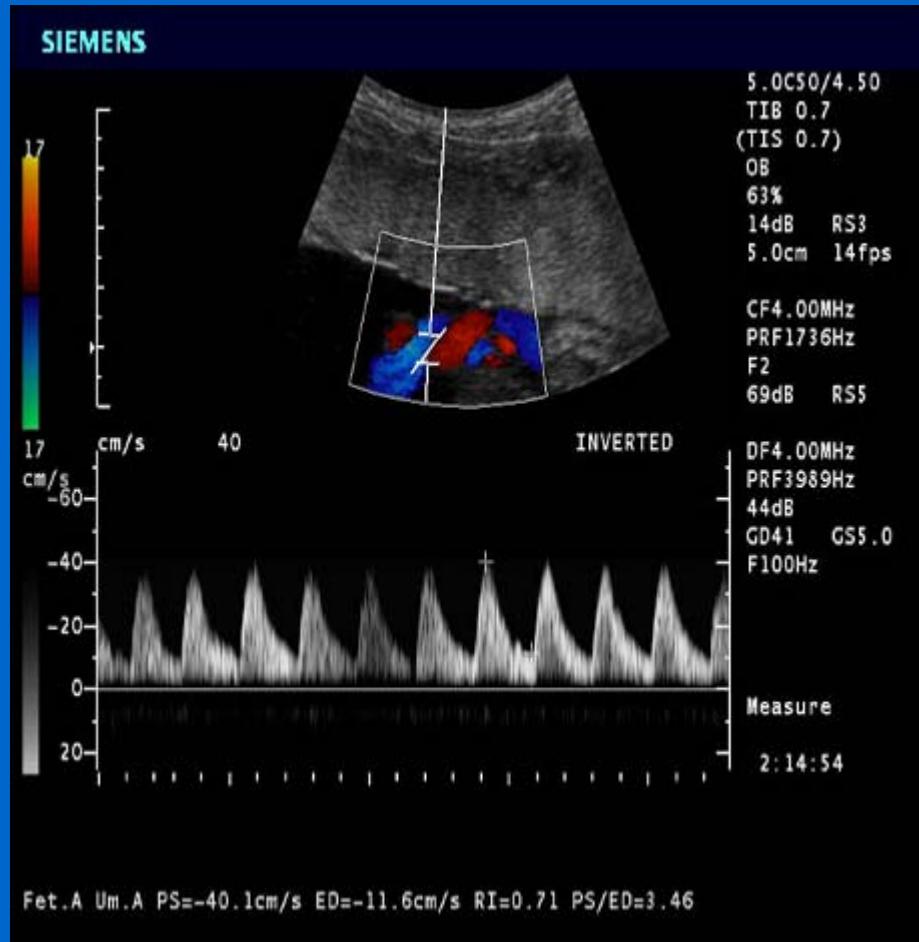
Sonogram of the descending aorta. With the angle correction the peak velocities

Doppler Ultrasound: basic principles

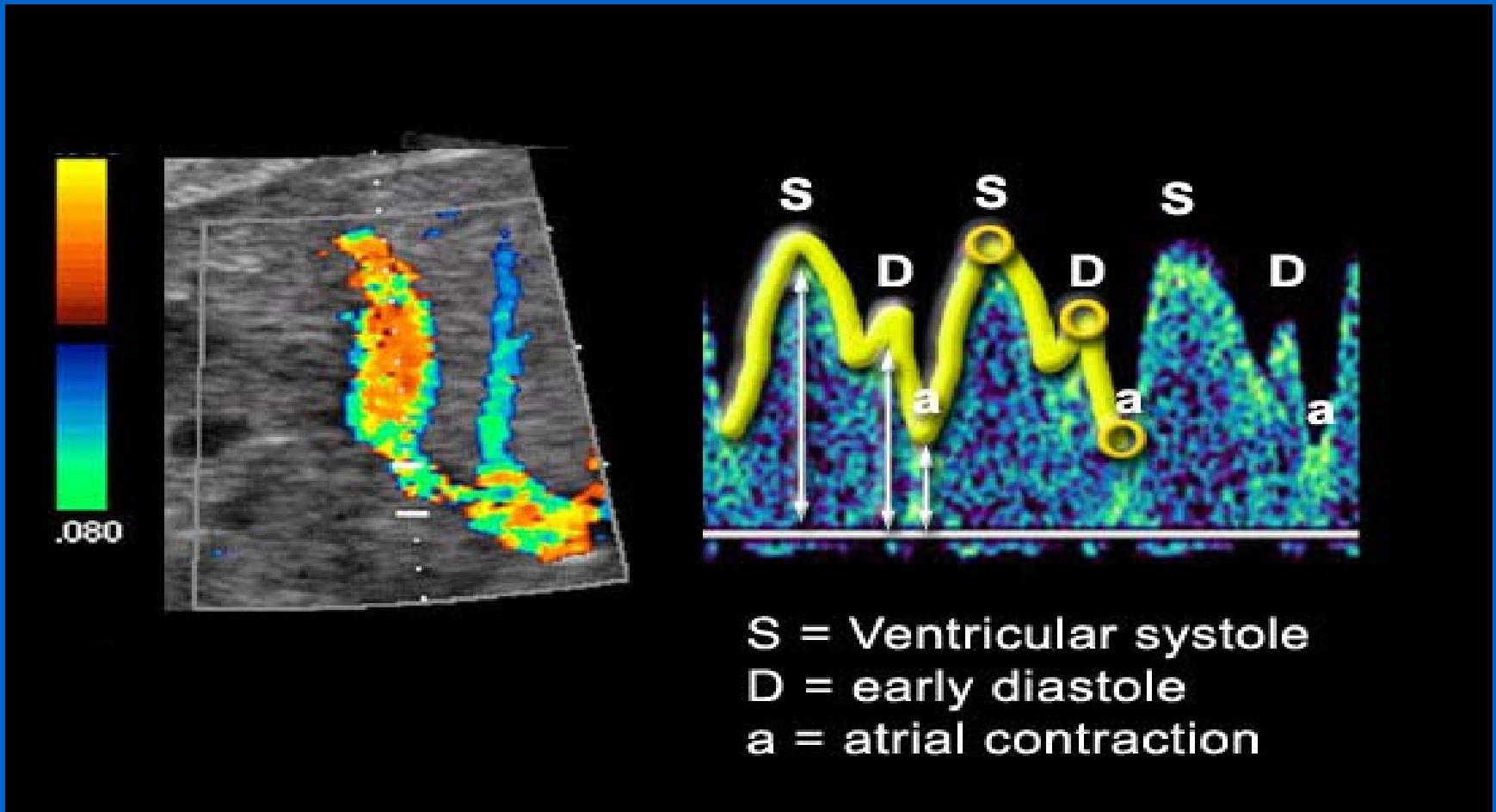


Doppler Ultrasound: basic principles

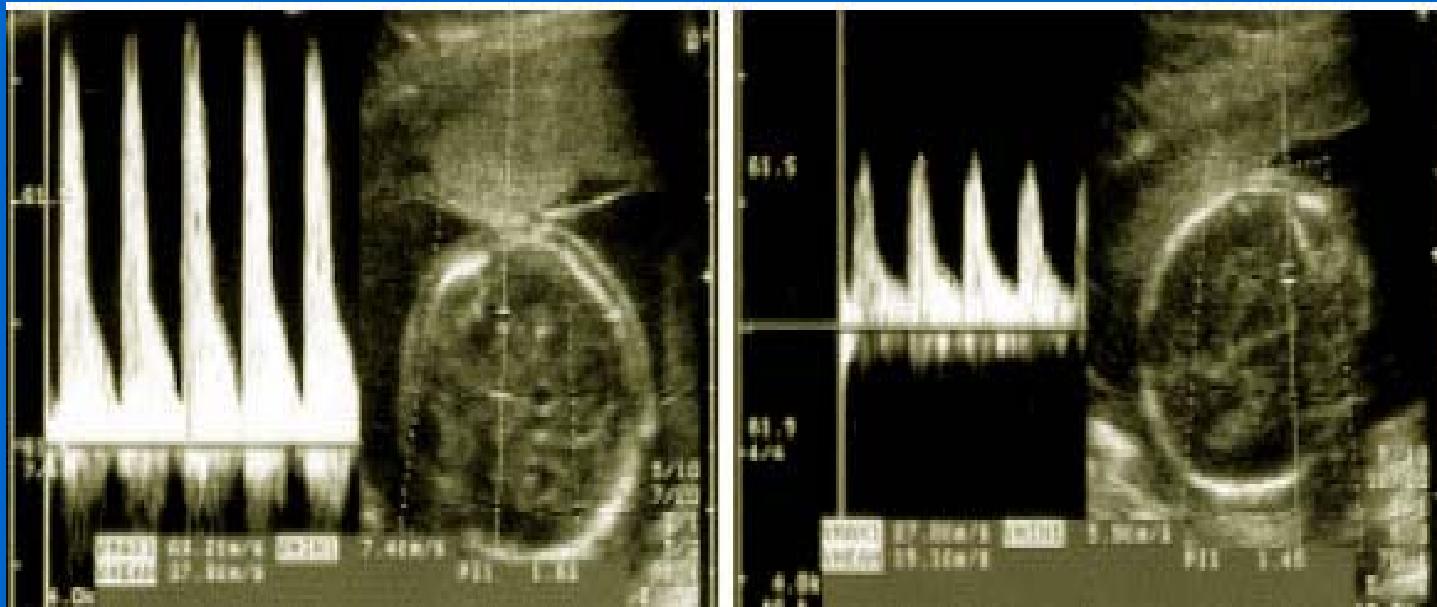
The 40% of the combined fetal ventricular output is directed to the placenta by two umbilical arteries. The assessment of umbilical blood flow provides information on blood perfusion of the feto-placental unit.



Ductus Venosus (leads directly into the vena cava)



Middle Cerebral Artery



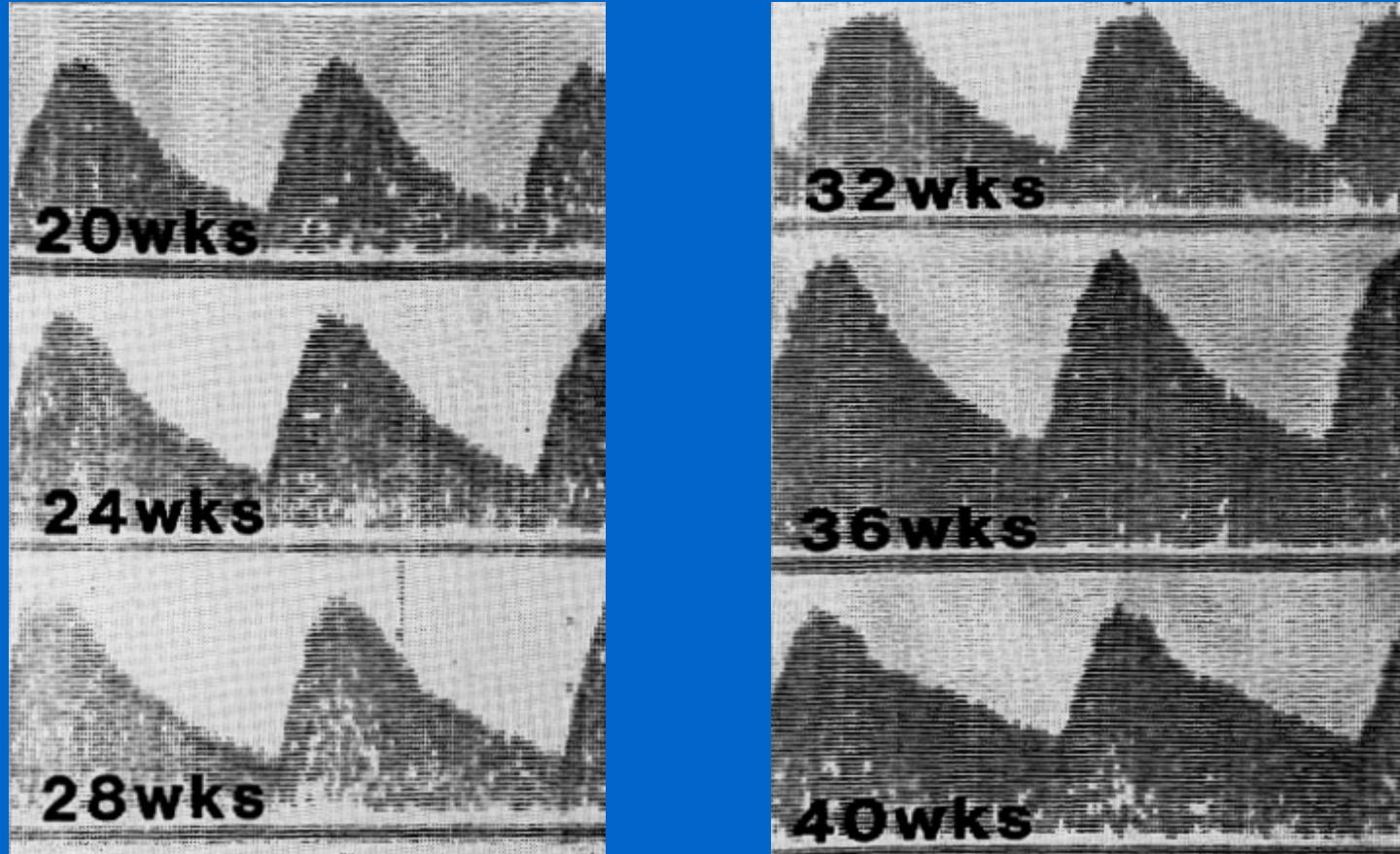
Flow velocity waveform in the fetal middle cerebral artery in a severely anemic fetus at 22 weeks (left) and in a normal fetus (right). In fetal anemia, blood velocity is increased

Why use Doppler ultrasound in high risk pregnancies?

First use of Doppler ultrasonography to study flow velocity in the fetal umbilical artery was reported in 1977

Fitzgerald and Drumm. Non-invasive measurement of human circulation using ultrasound: a new method.
BMJ 1977, 2:1450-1.

Doppler History



The volume flow in the UAs increases with advancing gestation. The high vascular impedance detected in the first trimester gradually decreases. It is attributed to growth of placental unit and increase in the number of the functioning vascular channels.

Doppler History

Fitzgerald & Drumm. Umbilical artery studies 1977
BMJ

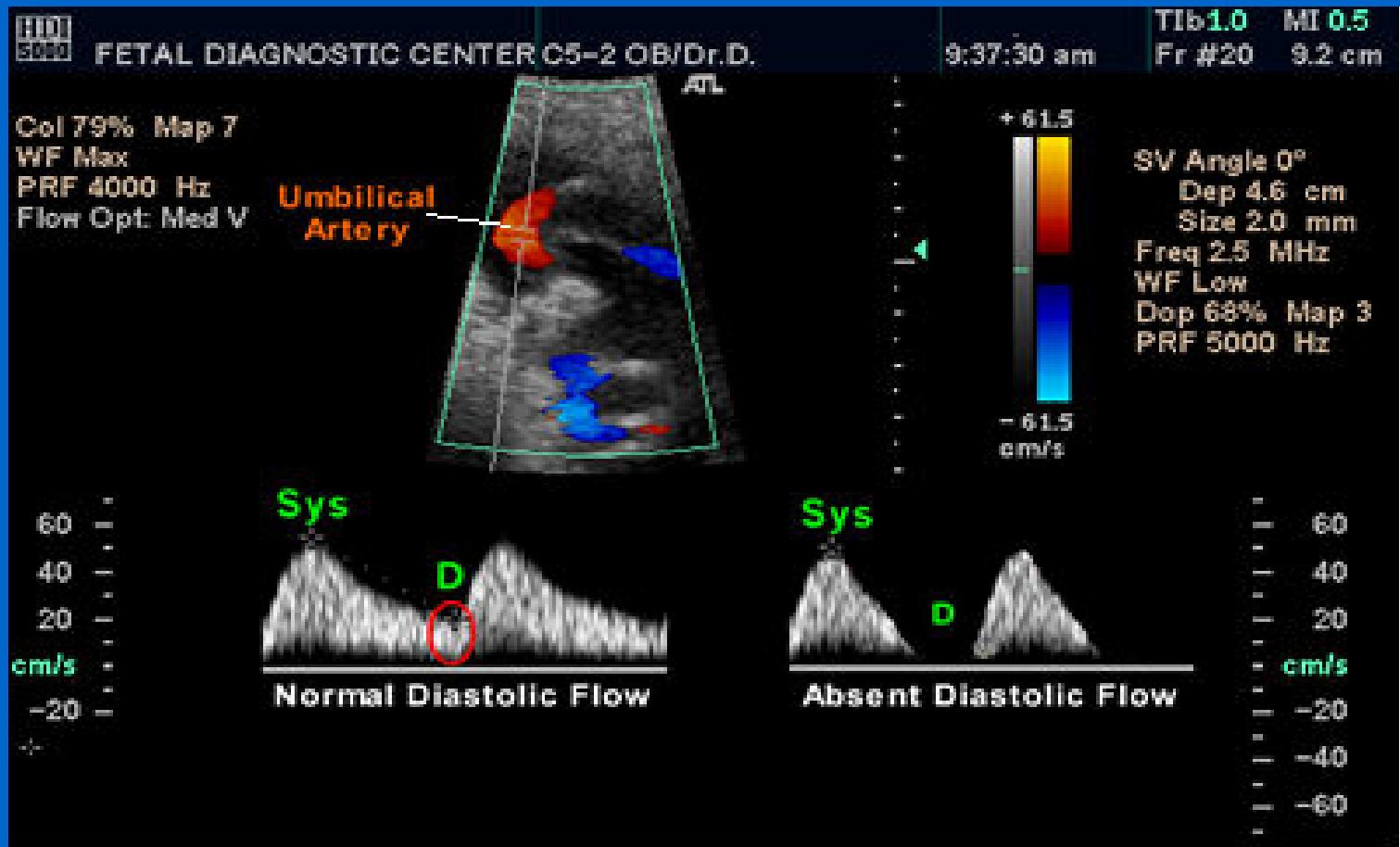
Eik-Nes et al. Fetal aortic velocimetry : Dupplex scanner 1980 *Lancet*

Campbell et al. Utero-placental circulation: Dupplex scanner 1983 *Lancet*

Wladimiroff et al. MCA / UA PI ratio 1987 *OG*

Kiserud et al. Ductus venosus velocimetry 1991
Lancet

Doppler velocimetry sites



Doppler X pre-eclampsia X IUGR

- Maternal hypertensive disorders are associated with inadequate blood supply through the placenta.
- When the fetus is hypoxic, the cerebral arteries tend to become dilated in order to preserve the blood flow to the brain
- The systolic to diastolic (A/B) ratio will decrease (due to an increase in diastolic flow)

Biophysical profile for fetal assessment in high risk pregnancies

- When compared with conventional fetal monitoring (usually cardiotocography) biophysical profile testing showed no obvious effect (either beneficial or deleterious) on pregnancy outcome. There was an increase in the number of inductions of labour following biophysical profile in the trial.
- Alfirevic Z, Neilson JP. Biophysical profile for fetal assessment in high risk pregnancies (Cochrane Review). In: *The Cochrane Library*, 1995.

Doppler Ultrasound for Fetal Assessment in High-Risk Pregnancies

Neilson JP and Alfirevic Z

Doppler ultrasound for the fetal assessment in high-risk pregnancies (Cochrane Review). In: *The Cochrane Library*, 1999.

11 Studies Included In Analysis

**Trudinger et al 1987
McParland et al 1988
Tyrrell et al 1990
Hofmeyr et al 1991
Newham et al 1991
Burke et al 1992**

**Almstrom et al 1992
Biljan et al 1992
Johnstone et al 1993
Pattison et al 1994
Nienhuis et al 1997**

Main Results

- Nearly 7000 patients were included
- The trials compared no Doppler ultrasound to Doppler ultrasound in high-risk pregnancy (hypertension or presumed impaired fetal growth)

Main results

- A reduction in perinatal deaths (odds ratio 0.71, 95% confidence interval 0.50 to 1.01)
- Fewer inductions of labour (odds ratio 0.83, 95% confidence interval 0.74 to 0.93)
- Fewer admissions to hospital (odds ratio 0.56, 95% confidence interval 0.43 to 0.72)
- no report of adverse effects

Main Results

- No difference was found for fetal distress in labour (odds ratio 0.81, 95% confidence interval 0.59 to 1.13)
- No difference in caesarean delivery (odds ratio 0.94, 95% confidence interval 0.82 to 1.06)

Perinatal Mortality

The use of Doppler ultrasound in high risk pregnancies to assess umbilical artery waveforms with or without uteroplacental studies was associated with a 29% reduction in overall perinatal mortality; the 95% confidence intervals were compatible with a reduction of as much as 50% and with no effect. Examination of individual indices of perinatal mortality show no result of statistical significance but in each case the trend is towards a reduction in deaths.

Objectives

- To evaluate the benefits and possible harms of the use of Doppler ultrasound screening in high risk pregnancies

Types of studies

- Randomised controlled trials of Doppler ultrasound as a clinical technique to improve pregnancy outcome in high risk pregnancies

Types of Participants

Women with pregnancies deemed by investigators to be ‘at risk’
(hypertensive disorders of pregnancy,
including pre-eclampsia and
intrauterine growth restriction)

Types of interventions

- All routine Doppler ultrasound versus no Doppler
- Umbilical artery Doppler X no Doppler
- Uterine artery Doppler X no Doppler
- Umbilical and uterine Doppler X no Doppler
- Umbilical artery Doppler and Ductus venosus X no Doppler
- Umbilical artery Doppler and Middle cerebral artery X no Doppler
- Doppler ultrasound and other monitoring methods X other method only

Types of outcome measures

- Perinatal outcome: preterm delivery
- Obstetrics interventions: elective cesarean section or emergency cesarean section
- Neonatal outcome: acute neonatal problems, neonatal morbidity (Apgar score and admission to neonatal intensive care unit)

Conclusions

Screening is only worthwhile if an effective preventive treatment is available.

If we could identify the ‘at risk’ fetus using Doppler ultrasound in order to apply clinical interventions, it could result in reduced perinatal deaths and unnecessary obstetric interventions.



THANKS