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## Umbelical Waveforms in Twin Pregnancy

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**Abstract.** Continuous wave Doppler ultrasound was used to study the twin fetus in 76 multiple pregnancies. The technique is not difficult and allowed the identification of the small for gestational age twin in both intrauterine growth failure and twin to twin transfusion syndrome.

**Key words:** Twin pregnancy, Umbilical artery waveforms, Twin to twin transfusion

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Twin pregnancy has confronted the obstetrician with the problems of increased fetal loss and increased perinatal morbidity and mortality. The previous problems associated with late clinical diagnosis have to a large degree been overcome by the increased use of ultrasound in the early diagnosis of twin pregnancy [5]. However, the problem of monitoring the progress of fetal growth and fetal welfare once the twin pregnancy has been diagnosed is well known to the obstetrician [4]. For, despite the fact that both twin share a common maternal utero-placental circulation, and also, in the case of monozygotic twins, a common genetic potential, it is not uncommon for one twin to be delivered small for gestational age with all the sequelae of intrauterine growth failure and yet its intrauterine partner is appropriate for gestational age.

We studied the umbilical artery velocity-time waveforms of 76 twin pregnancies to compare the umbilical placental circulations in the presence of a common maternal uteroplacental bed [3].

The ratio of peak systolic (point A) to least diastolic velocity (point B), the A/B ratio, provides an angle independent measure of fetal placental blood flow resistance. This also gives an index of blood flow as  $\text{flow} = \text{pressure}/\text{resistance}$ . In the singleton fetus a low or negligible diastolic flow velocity in the umbilical artery is indicative of high fetal umbilical placental blood flow resistance and is seen in association with fetal growth failure [2,6].

The 76 patients were studied on 260 occasions; in 71 patients the last study to delivery interval was within 14 days. These 71 patients were studied on 254 occasions. The patients were a consecutive series of twin pregnancies seen at two weekly intervals

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from 28 weeks gestation until delivery.

The position of each fetus was determined by a B-mode linear array ultrasound scanner and the umbilical cords were identified. The umbilical artery velocity-time waveform was recorded using a 4mHz sonicaid Vasoflow continuous wave directional Doppler blood velocimeter with real-time spectral analysis on a Angioscan real-time spectral analyser. To identify the twin under study the fetal heart motion was observed on the B-mode scanner and simultaneously matched with the audible umbilical artery velocity-time waveform. The cord bloods and placentae were collected after identification of the respective twin. In most cases of same sex twins with fused placentae, the placenta was injected to detect the presence of feto-fetal anastomoses [1].

There were eight stillborn fetuses, including one set of twins where both twins died in utero at 35 weeks as the result of a twin-twin transfusion syndrome, and one twin of an otherwise uncomplicated twin pregnancy who died following cord prolapse before arrival at hospital. There were five neonatal deaths, one anencephalic, one with a non-correctable congenital heart malformation, one with Down's syndrome that died following acute septicaemia, and two premature twins that died of severe hyaline membrane disease.

Of the twins delivered within 14 days of the last Doppler study, 32 had both infants appropriate for gestational age with respect to singleton birth weight tables. Their umbilical artery A/B ratios showed close agreement with the normal singleton pregnancy limits for A/B ratios that we have previously reported [2,6].

There were 33 pregnancies in which one (26 cases) or both (7 cases) infants were small for gestational age; 70% of these cases had one or both fetuses with abnormal A/B ratios. One such case is shown here which demonstrates the differences in the two A/B ratios (Fig. 1).

We also calculated the A/B ratio difference and compared this with the percentage weight difference between the two twins. The results were ranked and we delineated the 75th centile for each parameter. An interesting trend emerged. As was expected, all the patients delivering two appropriate for gestational age infants had an A/B ratio difference within the 75th centile. The same was not true for those patients delivering one or both infants small for gestational age. There was a significant group above the 75th centile for A/B ratio difference, but there was also a large group with no demonstrable A/B ratio difference.

The explanation for this is illustrated in Fig. 2. We feel we are observing the effects of a pathological twin-twin vascular anastomosis or twin-twin transfusion syndrome. This would have the effect of causing the resistances of both twins umbilical placental circulations to approach each other by virtue of the degree of vascular shunting. This explains the eight patients from whom a small for gestational age infant was delivered and yet there was a large percentage weight difference without any A/B ratio difference. The eight pregnancies included two cases of proven twin-twin transfusion (with haemoglobin differences of over 5g/dl) and three with demonstrable twin-twin vascular anastomoses (the other three placentae were not injected). There was also another case of proven twin-twin transfusion syndrome where the percentage weight difference was just within the 75th centile. This case also showed no A/B ratio difference as did the other two cases of proven twin-twin transfusion.

Therefore, in conclusion:

- 1) The study of the umbilical artery velocity-time waveforms in twin pregnancies is an easily performed procedure;

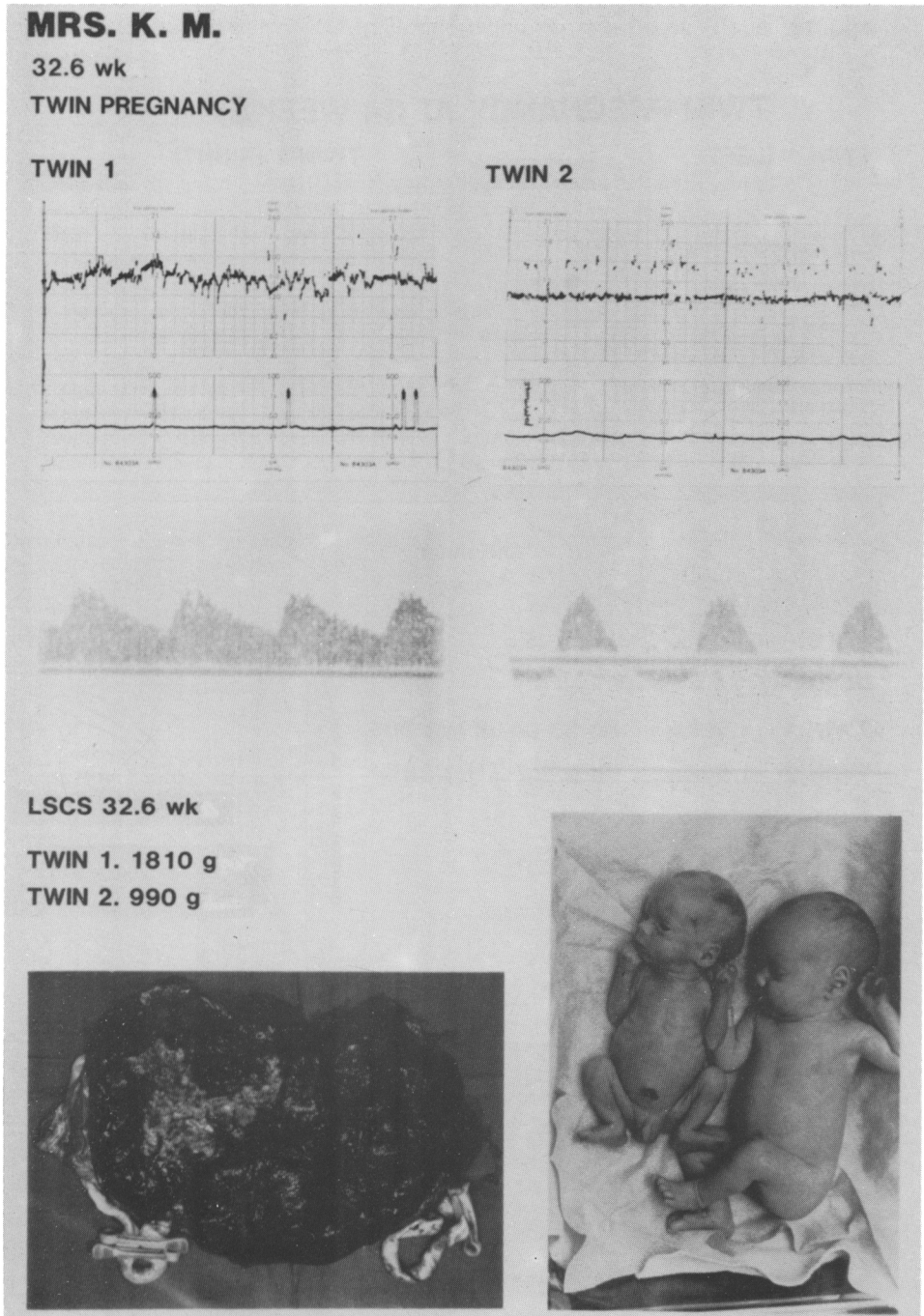
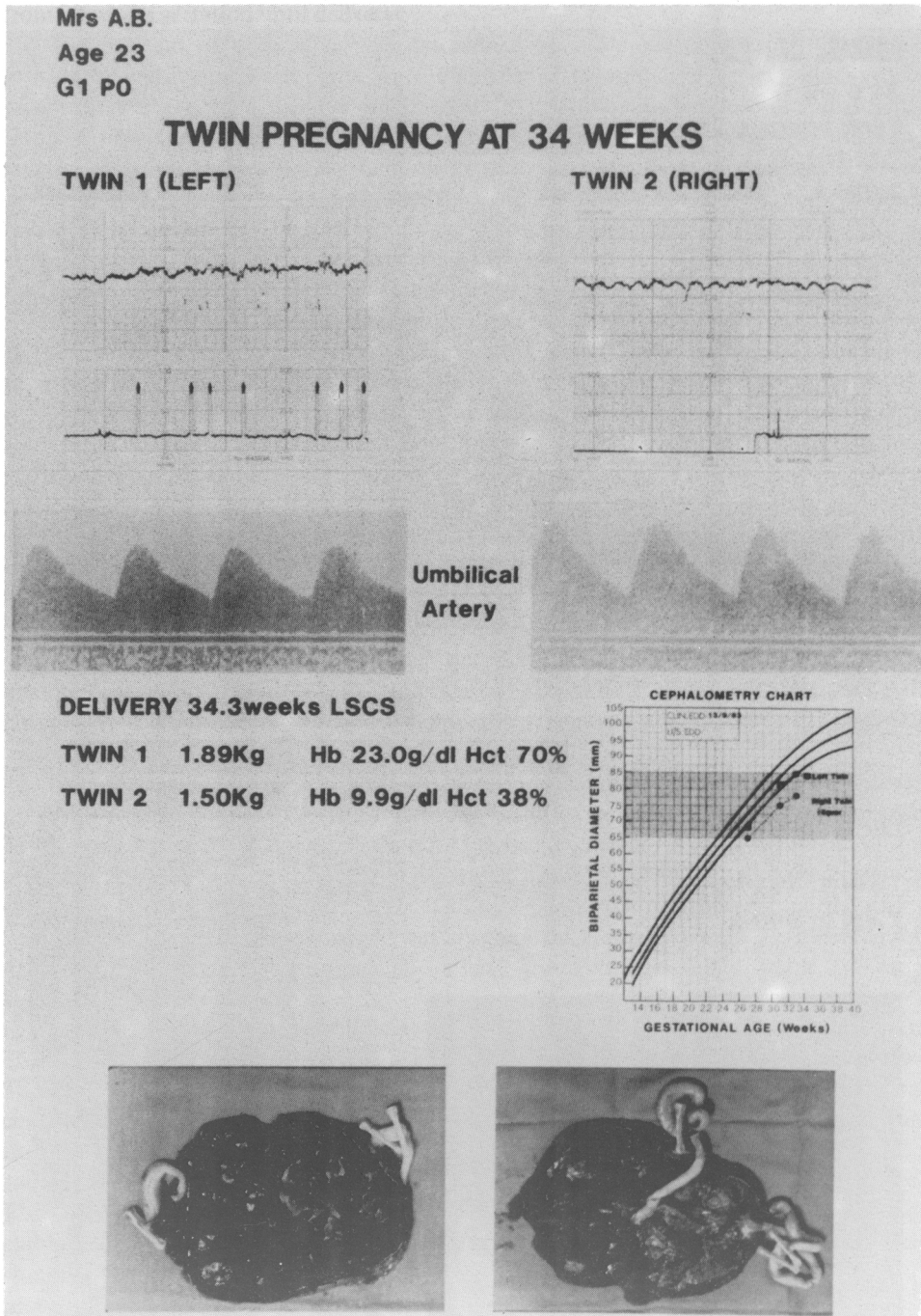


Fig. 1 - This twin pair demonstrates the following: Twin 1 (female) has a normal cardiotocograph (CTG), umbilical artery waveform and birthweight. Twin 2 (male) is small for gestational age and has a markedly abnormal CTG and umbilical artery waveform (the reversal of flow in diastole indicating raised umbilical placental blood flow resistance). There is a large area of infarction in Twin 2's placenta.





**Fig. 2** - This twin pair demonstrates the following: Twin 1 has a normal CTG, Twin 2 has a sinusoidal CTG. Both twins have similar umbilical artery waveforms. There is discordance of fetal ultrasound growth and liquor volume, and marked haematological discordance (indicative of twin to twin transfusion). The placenta of twin 1 (the polycythaemic recipient) is engorged with blood, that of twin 2 (the anaemic donor) is pale and smaller.

- 2) The twin fetus with intrauterine growth failure can be identified;
- 3) The antenatal diagnosis of intrauterine twin-twin transfusion is possible using this method.

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