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Antenatal testing to predict outcome in pregnancies with unexplained antepartum haemorrhage

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ABSTRACT

Objective To investigate whether Doppler studies of placental perfusion and antenatal tests for fetal hypoxia can identify reduced placental functional reserve in women with unexplained antepartum haemorrhage (APH).

Design A prospective, longitudinal study.

Setting Fetal Surveillance Unit, King's College Hospital, London.

Subjects 48 women with bleeding from the genital tract after 26 weeks gestation without a clinical diagnosis of abruption or ultrasound evidence of placenta praevia.

Interventions Fetal surveillance by Doppler measurements of the umbilical and uterine arteries, biophysical profile scoring and computerized measurement of the mean minute range of FHR variation.

Main outcome measures A poor outcome was defined by one or more of the following: (i) birthweight >2SD below the normal mean for gestational age and sex, (ii) abnormal FHR pattern in labour resulting in operative delivery, (iii) umbilical vein blood pH at delivery <7·15, (iv) a 5-min Apgar score <7.

Results Fifteen of the 48 pregnancies had a poor outcome; seven occurred in the 10 women delivered preterm (<37 weeks) and eight in the 36 women delivered between 37 and 42 weeks. Two women were delivered after 42 weeks and both infants had a good outcome. The results of Doppler studies of uterine and umbilical arteries, fetal biophysical profile or FHR variation were not significantly different between the two outcome groups. The 36 pregnancies delivered between 37 and 42 weeks were matched retrospectively for maternal age, parity and race with 36 pregnancies without APH; there was no significant difference in outcome between the women with unexplained APH and the matched comparison group.

Conclusion Morbidity related to unexplained APH is associated with preterm delivery rather than with damage to utero-placental function.

Unexplained antepartum haemorrhage (APH) occurs in about 5% of pregnancies and is associated with an increased perinatal morbidity and mortality rate (Chamberlain *et al.* 1978). It has been suggested that this perinatal damage results from either preterm labour (Willcocks 1971) or placental damage leading to reduced functional reserve (Scott 1981). The increased risk attached to these pregnancies has led many obstetricians to intervene by delivering such women when the fetus is mature (Scott 1981), adding to both fetus and mother the risks of induction of labour.

The aim of this study was to examine whether antenatal tests could help make obstetric intervention more selective. On the assumption that some cases of unexplained APH are due to small abruptions (Notelovitz *et al.* 1979) with consequent placental infarction, we hypothesized that Doppler studies of the utero-placental (uterine) or the feto-placental (umbilical) circulations would be abnormal (Morrow & Knox Ritchie 1988). Furthermore, fetal hypoxia resulting from placental damage could be detected by studies of fetal behaviour (biophysical profile) and fetal heart rate (FHR) pattern. To assess placental reserve we investigated fetal distress in labour and studied the birthweight of the infants as an indicator of long-term placental function.

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Subjects and methods

Between June 1990 and January 1991 women with vaginal bleeding after 26 weeks gestation were referred to a fetal surveillance unit (FSU) (Soothill *et al.* 1991) which had approval from the local ethics committee. In 51 women the APH was unexplained because a clinical diagnosis of abruption was not made, ultrasound scanning excluded placenta praevia and a speculum examination did not reveal any local cause for the bleeding. Three patients were excluded from the analysis, one had twins and two with preterm prelabour rupture of membranes.

After the initial episode of bleeding, patients were admitted to hospital for 24–48 h and when the bleeding stopped, they were subsequently managed as an outpatient with 1–2 weekly visits to the FSU.

Table 1. Criteria of poor outcome found in 15 patients with unexplained antepartum haemorrhage

	Criteria of poor outcome			
Subject no.*	Operative delivery†	SGA	UV pH <7·15	5-min Apgar score <7
1	–	–	+	+
2	+	–	NA	–
3	+	–	+	–
4	+	–	+	+
5	+	+	NA	–
6	–	+	–	–
7	+	–	NA	–
8	+	+	+	–
9	+	–	–	–
10	+	–	+	–
11	+	–	NA	–
12	–	+	+	–
13	–	+	–	–
14	–	+	+	–
15	–	–	NA	+
No. positive	9	6	7	3

Abbreviations: SGA = small-for-gestational age (>2SD below the normal mean); UV = umbilical vein; NA = not available.
* Subject nos. 1–7 were delivered preterm (<37 weeks gestation).
† Abnormal fetal heart rate pattern in labour leading to operative delivery.

The following investigations were made: (1) Continuous wave Doppler studies (Doptek, Chichester, UK) of the uterine arteries (Campbell *et al.* 1983); the results were considered abnormal if on either side the blood velocity waveform had characteristic notches (Schulman *et al.* 1986) or the resistance index (RI) was >97·5th centile for gestational age (Aristidou *et al.* 1990). (2) Continuous wave Doppler studies of the umbilical artery (Trudinger 1988); this was considered abnormal if the pulsatility index (PI) was >97·5th centile. (3) The biophysical profile (Manning 1990), the score was considered abnormal if <8 or ≤8 in the presence of oligohydramnios (single deepest pool <2cm); the FHR component was considered abnormal if there were fewer than two accelerations in 20 min of recording. (4) Computerized analysis of the FHR pattern (Oxford 8000, Sonicaid Ltd., Chichester, UK) was used which averages the one-minute ranges of pulse intervals about the base-line (Dawes *et al.* 1985); a mean minute range <20ms was considered abnormal (Ribbert *et al.* 1991).

The criteria for poor outcome were at least one of the following: (1) birthweight >2SD below the normal mean for gestational age and sex (SGA) (Yudkin *et al.* 1987); (2) abnormal FHR pattern in labour resulting in operative delivery; (3) umbilical vein blood pH at delivery <7·15; and (4) 5-min Apgar score <7. Values for umbilical vein blood pH at delivery were available for only 27 of the 48 patients (56%), but otherwise the outcome data were complete.

We compared the outcome of pregnancies with unexplained APH with a matched comparison group using the same criteria. Matching for confounding variables (such as management of preterm labour, and elective delivery decisions) was not possible for women delivered outside 37–42 weeks. Therefore, the comparison group had to be restricted to term pregnancies. Thus, for each of the 36 women with APH who were delivered between 37 and 42 weeks the records of the next woman delivered on our labour ward who did not have bleeding after 26 weeks but who matched the study patient for maternal age (within 3 years), parity and race were reviewed.

Statistical analysis

Since in normal pregnancy uterine artery RI and umbilical artery PI change with gestation, individual values in this study were expressed as multiples of SD from the normal mean for gestation (delta score). The data were normally distributed and Student's unpaired *t*-test was used to compare the data from the good and poor outcome groups. Since there were large differences among women in the number of visits (2–7) to the FSU, comparisons between the two groups were made with the results from the following visits: (1) the first visit; (2) the last visit before delivery; and (3) the worst result of any visit.

Results

The mean gestational age at referral to the FSU following

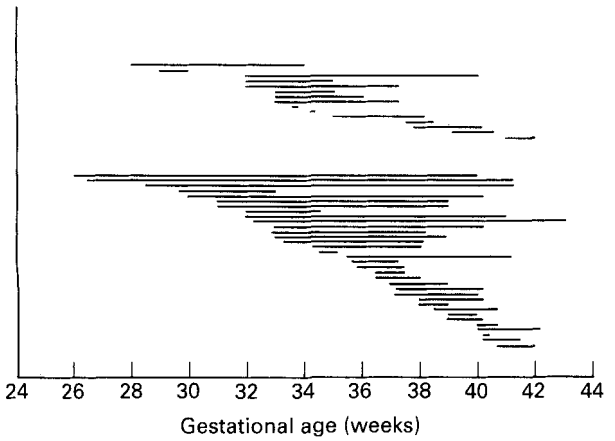

Fig. 1. The interval between presentation with unexplained antepartum haemorrhage and delivery. The 33 pregnancies with a good outcome are shown in the lower part of the figure and the 15 with a poor outcome are in the upper part.

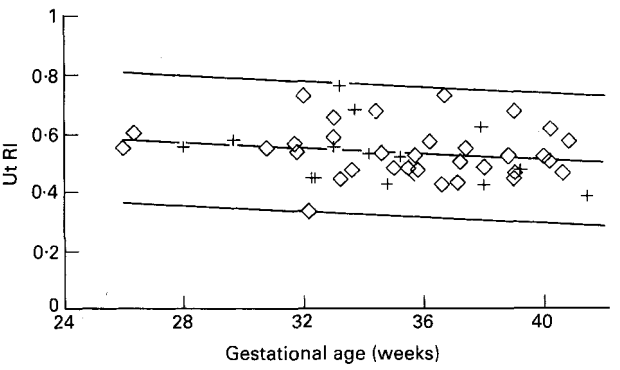

Fig. 2. The highest uterine artery resistance index (Ut RI) of any visit in 48 patients with unexplained antepartum haemorrhage compared to our normal range. + indicates a result from patients with a poor outcome and ◇ a result from patients with a good outcome.

Table 2. Results of tests for fetal well being at the first visit (1), last visit (2) and worst result of any visit (3) in 48 pregnancies with unexplained antepartum haemorrhage classified by outcome.*

Tests	Good outcome	Poor outcome	Significance		
			t	*P*	*n*
Uterine artery RI					
1	−0·09 (0·84)	−0·21 (1·0)	−0·45	0·66	48
2	−0·19 (0·67)	−0·30 (0·7)	−0·43	0·67	48
3	0·10 (0·81)	−0·10 (0·9)	−0·41	0·68	48
Umbilical artery PI					
1	−0·08 (0·87)	0·11 (1·3)	0·59	0·56	48
2	0·19 (0·99)	0·39 (0·9)	0·49	0·63	48
3	0·39 (0·93)	0·54 (0·8)	0·36	0·72	48
Fetal heart rate variation (ms)					
1	42·6 (11·3)	52·7 (17·3)	2·0	0·05	34
2	44·6 (9·6)	49·0 (15·4)	0·99	0·33	34
3	39·1 (10·1)	47·3 (16·8)	1·75	0·09	34

Results are mean (SD) values. The uterine artery RI (resistance index) and the umbilical artery PI (pulsatility index) are expressed as multiples of *SD from the* appropriate normal mean for gestation (delta score).
*All 48 pregnancies had a biophysical profile score of ≥8 at every investigation.

unexplained APH was 34·1 (range 26–40·6) weeks and the mean gestational age at delivery was 38·5 (range 30–43·1) weeks.

Review of the notes showed that none of the women was delivered because of the results of the tests carried out in the FSU and none of the babies died in the perinatal period.

A poor outcome occurred in 15 (31%) of the 48 pregnancies and some of the pregnancies fulfilled more than one of the criteria of poor outcome (Table 1). A retroplacental clot was observed at delivery on one occasion and this infant had a poor outcome. Although the mean gestational age at referral was not significantly different in the two outcome groups (poor, 34·15 weeks *vs* good, 34·13 weeks; $t = 0{\cdot}01, P = 0{\cdot}99$), the poor outcome group were born significantly earlier than the good outcome group (means: poor, 36·8 weeks *vs* good 39·3 weeks; $t = -3{\cdot}1, P = 0{\cdot}003$) (Fig. 1). Of the 10 women delivered <37 weeks (8 spontaneous and 2 elective for continuing haemorrhage) 7 had poor outcomes. In contrast only 8 of the 38 (22%) delivered >37 weeks had a poor outcome. The occurrence of poor outcome in the 36 women with unexplained APH who were delivered between 37 and 42 weeks was the same as that in the comparison group without APH (8 of 36).

There were no significant differences between the poor and the good outcome groups for the results of the first or last visits or the worst result of any visit (Table 2). The individual values of the highest uterine artery RI are shown in Fig. 2.

Discussion

The hypothesis that antenatal investigation of placental perfusion and fetal wellbeing would be able to identify those pregnancies in which unexplained APH is associated with placental damage and therefore fetal hypoxia was not substantiated. Indeed, the frequency of poor outcome in the pregnancies delivered at term was the same as that of controls, which suggests that unexplained APH does not reduce placental functional reserve. Since it appears that there was no placental damage in this group it is not surprising that the antenatal tests of placental function were normal.

The association between unexplained APH and perinatal morbidity could be explained if these haemorrhages are the result of small, clinically undetected, abruptions. Since abruptions can be predicted (Bewley *et al.* 1991) and detected (Morrow & Knox Ritchie 1988) by placental blood flow studies, the normal Doppler results in this study suggest that abruption was not the cause of the bleeding. Alternatively, the antenatal tests used may have been too insensitive to detect the changes we were looking for. Substantial changes in placental blood flow are probably required before they become detectable by continuous wave Doppler studies.

The greatest danger to these pregnancies was preterm delivery which occurred in 10 of the 48 women (21%) and seven of these fulfilled at least one of the criteria of poor outcome. However, even without APH, infants born after spontaneous preterm labour have a higher frequency of poor outcome, for example low Apgar scores (Goldenberg *et al.* 1984). Since we were unable to match these pregnancies with controls, we can not conclude that the high frequency of poor outcome in preterm pregnancies with unexplained APH was because of the APH alone. Indeed, the antenatal tests did not predict outcome even in this group so we have no evidence of placental damage. In a previous retrospective study of 307 women with unexplained APH, without the advantage of the antenatal tests of placental function, Willcocks (1971) concluded that 'the fetal risk in these cases is related to prematurity' and 'there is usually no need to terminate the pregnancy and spontaneous labour can be awaited'.

The results of the present study suggest that chronic fetal hypoxia is not a common feature in pregnancies complicated by unexplained APH and therefore there is a limited role for fetal surveillance or prophylactic elective delivery in the fetal interest.

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