THE OUTCOME OF PREGNANCY COMPLICATED BY THREATENED ABORTION

BY

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In a previous publication (Walker and Turnbull, 1953) we reported that in 14 pregnancies, in which there had been a history of threatened abortion, the haemoglobin and red cell levels in the baby's cord blood at birth were higher than normal. From other evidence in the same paper we concluded that this was an indication that the supply of oxygen to the foetus was defective.

If bleeding in the early months of pregnancy causes permanent impairment of placental function, we would expect the subsequent clinical course of such pregnancy to be abnormal. It is generally considered, however, that if bleeding ceases and the pregnancy continues, the end result is good (Mason, 1942; Carter, 1950; Stallworthy, 1951; Kaye, Rosner and Stein, 1953). Burge (1951), however, found that threatened abortion was associated with a slightly increased risk of foetal deformity, while Lilienfeld and Pasamanick (1955) reported an increased incidence of bleeding during pregnancy in mothers of children found to have cerebral palsy, epilepsy, mental deficiency and *behaviour disorders*.

The first part of this paper presents additional data on oxygen and haemoglobin levels and red cell counts in the cord blood of the foetus from pregnancies complicated by threatened abortion. The second part is a study of the outcome of pregnancy in cases of threatened abortion in Aberdeen Hospital cases. For the purpose of this investigation threatened abortion has been defined as uterine bleeding before the 28th week of pregnancy, usually painless, in which abortion did not follow within a week of the start of bleeding.

MATERIAL AND METHODS

Observations were made on cord blood obtained at hysterotomy, Caesarean section or vaginal delivery in cases which had previously threatened to abort. The technique of obtaining blood samples and of estimating haemoglobin and red cell levels have been described previously (Walker and Turnbull, 1953). The oxygen content of the blood was estimated by the method of Van Slyke and Neill (1924). In no case where oxygen readings were performed had the mother been given a gaseous anaesthetic or analgesic, or oxygen during labour or delivery; spinal anaesthesia was used for Caesarean section, with methedrine, if necessary, to keep the maternal systolic blood pressure above 110 mm. mercury.

HAEMOGLOBIN AND RED CELL LEVELS

Figure 1 shows the haemoglobin levels in cord blood in 46 cases where threatened abortion had occurred. In 8 of these, placenta praevia was proved to be present. The regression lines indicate the mean values, in clinically "normal" cases, of the haemoglobin level in cord blood (Walker and Turnbull, 1953). The haemoglobin levels in the cases of threatened abortion are mostly above average at all stages of pregnancy from 13 weeks onwards until term. After term there is no apparent difference.

FIG. 1

Haemoglobin levels in cord blood in cases in which abortion had threatened earlier in the pregnancy and in proved placenta praevia.

In the 8 cases of placenta praevia where bleeding had occurred earlier in the pregnancy approximately average haemoglobin levels were found. The aetiology of the bleeding in those is quite different and it comes from a localized area of placenta. There is little risk of damage to the placental site as a whole, and we would not expect any defect in oxygen supply. The average haemoglobin level in the remainder of the cases in the series is significantly raised $(P < \cdot001)$ above that of the "normal" cases represented by the regression lines, after allow-

ance has been made for the difference of average gestation period in the two series.

In 41 of these cases, red cell counts were performed and the values were also higher than those for "normal" cases (counts were not made in the remaining 5 cases).

OXYGEN LEVELS

Figure 2 shows the percentage saturation with oxygen of the blood in the umbilical vein in 12 cases where abortion had threatened earlier in pregnancy (there were no cases of placenta

PERCENTAGE SATURATION WITH OXYGEN OF BLOOD IN UMBILICAL VEIN
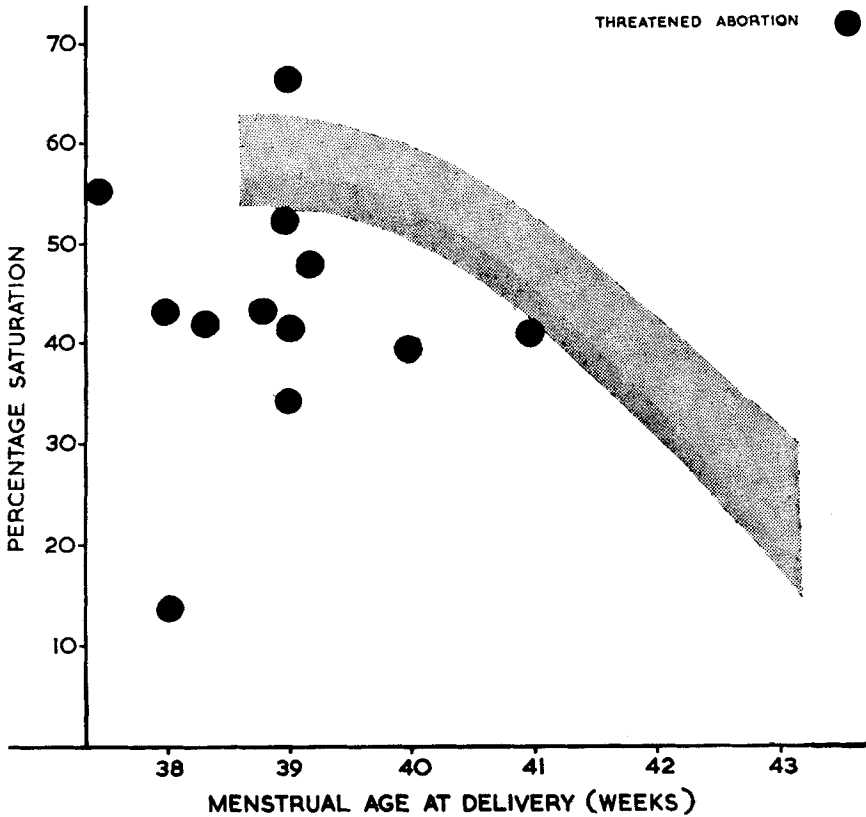
FIG. 2

Percentage saturation with oxygen of the blood in the umbilical vein in cases where abortion had threatened earlier in the pregnancy.

praevia). The range of values found in "normal" cases is also shown (Walker, 1954). It shows that, while the oxygen level in 1 case was above normal and in 3 at the lower limit of normal, in 8 cases the saturation is well below normal.

CLINICAL OBSERVATIONS

The observations on foetal blood suggest strongly that threatened abortion, not associated with placenta praevia, is associated with permanent deciduo-placental damage and impairment of the foetal oxygen supply; the latter, in turn, forces elevation of the haemoglobin and red blood cell levels. It is reasonable to expect that this will interfere with the normal course of

pregnancy. This assumption has been tested in two ways: (a) from records of cases admitted to hospital on account of threatened abortion, and (b) from records of pregnancies continuing beyond 28 weeks in Aberdeen Maternity Hospital booked cases.

Cases of Threatened Abortion Admitted to Hospital for Treatment

In the three years 1951–1953, 196 patients were admitted as cases of threatened abortion to the antenatal wards of the Aberdeen Maternity Hospital or to the gynaecological wards of the Aberdeen General Hospitals. Eight patients could not be traced after discharge

from hospital so that 188 were left for study.

In 33 (17·6 per cent) abortion took place before the patient was discharged from hospital. All the remaining 155 women left hospital with the pregnancy apparently progressing normally, but abortion occurred subsequently in 30 of these cases (19·4 per cent). The remaining 125 pregnancies continued past the 28th week and the outcome was similar in all respects to that in a larger group of Maternity Hospital booked cases described below.

Hospital Booked Cases where Pregnancy Continued Beyond the 28th Week Despite Threatened Abortion

During the years 1946–1953 inclusive, 19,593 women were admitted to the Aberdeen Maternity Hospital (this excludes multiple pregnancies). In 472 cases (2·4 per cent) there had been bleeding before the 28th week, which in most instances, but not all, had caused the patient to be admitted to hospital for treatment. The outcome of the pregnancy in these 472 cases has been compared with that in all booked cases.

PREMATURITY

The following Table gives the incidence of prematurity (birth weight 5½ pounds or less) and the obstetric death rate,* in the premature infants, in the "threatened abortion" series and in all booked cases, 1949–52.

TABLE I

	Threatened Abortion Series (Per cent)	All Booked Cases (Per cent)
Prematurity rate	20·9	6·5
Obstetric death rate in prematures	47·5	27·9

It shows that the prematurity rate is increased about three times in cases where there had been bleeding before the 28th week of pregnancy and the death rate among these prematures is nearly twice the average. These differences hold for both primiparae and multiparae.

The increased death rate among prematures

* Obstetric death rate=Stillbirths and first week deaths per 1,000 live and stillbirths.

appears to be due entirely to the fact that they are much lighter, for example, 47 per cent were under 4 pounds birth weight, compared with 24 per cent in all prematures. Weight for weight, death rates in each group were almost identical.

The high proportion of small babies is due mainly to the high incidence of premature onset of labour; 16·5 per cent of the babies were born before the end of the 37th week compared with 6·5 per cent of all booked cases. In addition, the possibility that foetal growth is depressed after threatened abortion is supported by the finding that, in the threatened abortion series, the average birth weight at any stage of gestation was usually slightly below that for all booked cases. This suggestion, however, is put forward with reserve, since more detailed analyses, e.g., within parity groups, did not yield entirely consistent results.

OBSTETRIC DEATHS

Table II shows that the obstetric death rate in 472 cases of threatened abortion was 121 per 1,000 live and stillbirths—about 3 times greater

TABLE II
Obstetric Death Rates per 1,000 Live and Stillbirths by Clinical Cause

Cause Group	Threatened Abortion Series	Aberdeen Maternity Hospital Booked Cases 1938–1952*
Premature—cause unknown	46·6 (22 deaths)	7·6
Ante-partum haemorrhage	23·3 (11)	4·2
Mature—cause unknown ..	14·8 (7)	5·3
Foetal deformity	10·6 (5)	6·0
Trauma	4·2 (2)	7·3
Toxaemia	6·3 (3)	3·8
Maternal disease	2·1 (1)	2·3
Other causes	12·7 (6)	2·0
All causes	120·8 (57)	38·6

* Baird, Walker and Thomson, 1954.

than the average for all hospital booked cases in the years 1938–52. More detailed analysis showed that a difference of this order existed in each age and parity group.

Analysis of the deaths into the clinical cause

groups described by Baird, Walker and Thomson (1954) shows that the greatest differences in mortality are in the groups "premature, cause unknown", "ante-partum haemorrhage" and "mature, cause unknown". In the remaining cause groups, numbers are too small to make comparisons possible.

The high death rate from prematurity, as already stated, is associated with a high incidence of premature onset of labour and, possibly, with a slight depression of foetal growth.

Of the 11 deaths due to ante-partum haemorrhage, 2 were from placenta praevia and 9 from accidental haemorrhage.

It is not surprising that there should be more deaths than usual in the category "cause unknown", even in mature babies. At autopsy, most of these babies show lesions characteristic of anoxia (Baird, Walker and Thomson, 1954) and we have just shown that bleeding in the early months of pregnancy seems to result in a diminished transfer of oxygen to the foetus.

Of the 6 deaths in the category "other causes", 5 were due to Rhesus factor incompatibility. This may be a chance phenomenon, but it is possible that serological incompatibility predisposes to abortion; there is some evidence for this, at least in respect of ABO incompatibilities (Sjöstedt, Grubb and Linell, 1951). It is also possible that disruption of the deciduo-placental site at the time of the bleeding may allow foetal cells to pass into the maternal blood stream and stimulate the antibody reaction.

ANTE-PARTUM HAEMORRHAGE

The increase of obstetric deaths due to ante-partum haemorrhage (Table II), suggests that following a threatened abortion the total incidence of ante-partum haemorrhage itself may be increased. There were 52 cases of bleeding after the 28th week (11 per cent) compared with 3 per cent in all booked cases, 1949–51. The figures in Table III do not indicate that the increase is mainly due to any one type of haemorrhage.

FOETAL DEFORMITY

Whether or not bleeding in the early months of pregnancy is a significant cause of foetal deformity remains unsettled. In this investiga-

TABLE III

	Threatened Abortion Series		All Booked Cases
	Per cent	Cases	Per cent
Placenta praevia	1·5	(7)	0·3
Accidental haemorrhage with toxaemia	1·1	(5)	0·5
Accidental haemorrhage without toxaemia ..	8·5	(40)	2·2
All ante-partum haemorrhage	11·0	(52)	3·1

tion, there were 17 cases (3·6 per cent) of congenital abnormality in the threatened abortion group, of which 2 were stillborn, 3 died in the first week of life, and 3 died after the first week (mortality 47 per cent). In all booked cases, 1949–53, the incidence of congenital abnormality was 1·5 per cent and the corresponding foetal mortality was 38 per cent.

Table IV gives details of the 17 abnormalities in the threatened abortion series, together with the stage of pregnancy at which bleeding occurred. It is noteworthy that the types of abnormality were extremely varied, and that in 7 cases bleeding was first reported after the 12th week, by which time organogenesis is probably complete. It does not appear possible to argue from these data that the type of abnormality can be closely correlated with the time at which bleeding started.

SUMMARY AND DISCUSSION

Our findings indicate that the danger to the foetus from threatened abortion is by no means over when the bleeding ceases. Of 155 women leaving hospital after apparently successful treatment of threatened abortion, 19 per cent subsequently aborted. Of those delivered after the 28th week, the prematurity, obstetric death and ante-partum haemorrhage rates were approximately three times as great as the average for all booked cases, and the incidence of foetal abnormality about twice as great. The excessive foetal death rate was associated especially with prematurity and ante-partum haemorrhage. The high proportion of very

TABLE IV
Type of Abnormality Associated with Threatened Abortion

Type of Abnormality	Time when Threatened Abortion Occurred
1. Atresia of trachea and ureters. Aplasia of lungs. Hydronephrosis. Hypertrophy of vagina and uterus	4 to 23 weeks
2. Bony deformities of fingers, spine, tibia and fibula	4 and 8 weeks
3. Anencephaly	6 weeks
4. Oesophago-laryngeal fistula	6 weeks
5. Talipes equinovarus	9 weeks
6. Hydrocephalus and spina bifida	10 weeks
7. Atresia of oesophagus	10 weeks
8. Spastic	10 weeks
9. Congenital cataract	11 weeks
10. Pilonidal cyst and umbilical hernia	12 weeks
11. Flexion deformities of limbs	14 weeks
12. Valvular obstruction of duodenum and urethra. Bilateral hydronephrosis	16 to 18 weeks
13. Multiple large haemangiomata	Before 20 weeks
14. Syndactyly and abnormality of facial bones	21 weeks
15. Imperforate anus	22 to 24 weeks
16. Spastic	24 weeks
17. Congenital heart disease. Low grade mental deficiency	About 6 months

small babies was explained largely by the high incidence of premature labour, but there is also a suggestion that foetal growth was slightly depressed following threatened abortion. Neither the raised incidence of foetal abnormalities nor the type was clearly related to the time of onset of bleeding.

It is difficult to say whether our findings can be explained by a persisting or recurrent maternal defect which caused firstly threatened abortion and later ante-partum haemorrhage and premature labour, or whether damage to the deciduo-placental site at the time of the initial bleeding was itself sufficient to cause permanent impairment of function. Possibly either or both mechanisms may be present in any given case.

Whatever the sequence of cause and effect, it seems clear that later in the pregnancy the foetus frequently suffers some degree of oxygen lack. Deciduo-placental damage, leading to impaired transfer of oxygen and to impaired foetal nutrition in general, or to relative lack of some essential nutrient, may account for defects in development and depression of foetal growth and vitality. It may also predispose to premature labour.

It is doubtful whether any form of treatment can repair damage to the deciduo-placental site occurring at the time of the threatened abortion,

although blood loss and the extent of initial damage may be limited by adequate bed rest. Our findings, however, suggest clinical methods which might improve the later outcome of such cases. Adequate attention to maternal health and diet throughout the pregnancy, with admission to hospital for bed rest for the period 30 to 34 weeks may prevent the onset of unduly premature labour. Such measures are specially indicated in poorly nourished women; where bleeding has occurred more than once; in multiple pregnancy; or where, as frequently, the mother gives a previous history of abortion, ante-partum haemorrhage or premature deliveries.

In fit women where earlier threatened abortion has been followed by an apparently uneventful pregnancy, the risk of anoxia to the foetus in the late weeks should be remembered. Such babies are, of course, especially vulnerable to the added anoxic effects of pre-eclampsia, postmaturity or prolonged and difficult labour.

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