

# **PREGNANCY AND DIABETES— THE IMPROVING PROGNOSIS**

by

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THE continuing fall in perinatal mortality for the general population highlights those conditions such as diabetes which are still associated with an unacceptably high incidence of intrauterine and perinatal deaths (Fig. 1). The management in Belfast of patients with pregnancy complicated by diabetes was originally reviewed in 1956<sup>1</sup> at which time the perinatal mortality was approximately 20 per cent, i.e. 1 in 5 pregnancies which progressed beyond 28 weeks gestation, resulted in a dead baby, a stillbirth or neonatal death within seven days of birth. Subsequently, a combined metabolic/antenatal clinic was established in the Royal Maternity Hospital, Belfast, in 1959, and over the following 8 years the perinatal mortality was reduced to 12 per cent.<sup>2</sup>

The purpose of this paper is to present the most recent results from the combined clinic over 10 years (1.1.72—31.12.81) and to discuss changes in the management of the pregnant diabetic which may further reduce the perinatal mortality and morbidity and, perhaps more importantly, reduce the incidence of fetal malformations.

## **PATIENTS AND MANAGEMENT**

The patients under review were insulin-dependent diabetics diagnosed before pregnancy, apart from seven who were diagnosed during pregnancy and confirmed after delivery: their management followed clearly set out guidelines. At the booking visit to the clinic, all patients who required stabilization of their diabetes were admitted to hospital and discharged only when control was satisfactory. The importance of control was emphasized and those not admitted were given instruction in self-monitoring of capillary blood glucose. In the past this was carried out using visual assessment of a glucose-oxidase impregnated strip (Dextrostix, Ames). More recently, patients have been taught to use a portable reflectance meter (Glucometer, Ames) to read the strips and to check preprandial capillary blood glucose four times daily. Patients attended every two weeks unless more frequent visits were necessary; the results of venous plasma glucose levels (and latterly glycosylated haemoglobin) measured 48 hours previously by arrangement with their local hospital or health centre were available, as were the records of the patients' home monitoring. All patients were instructed to make minor adjustments in insulin dosage dependent on the preprandial plasma glucose result, and the overall trend was monitored at each

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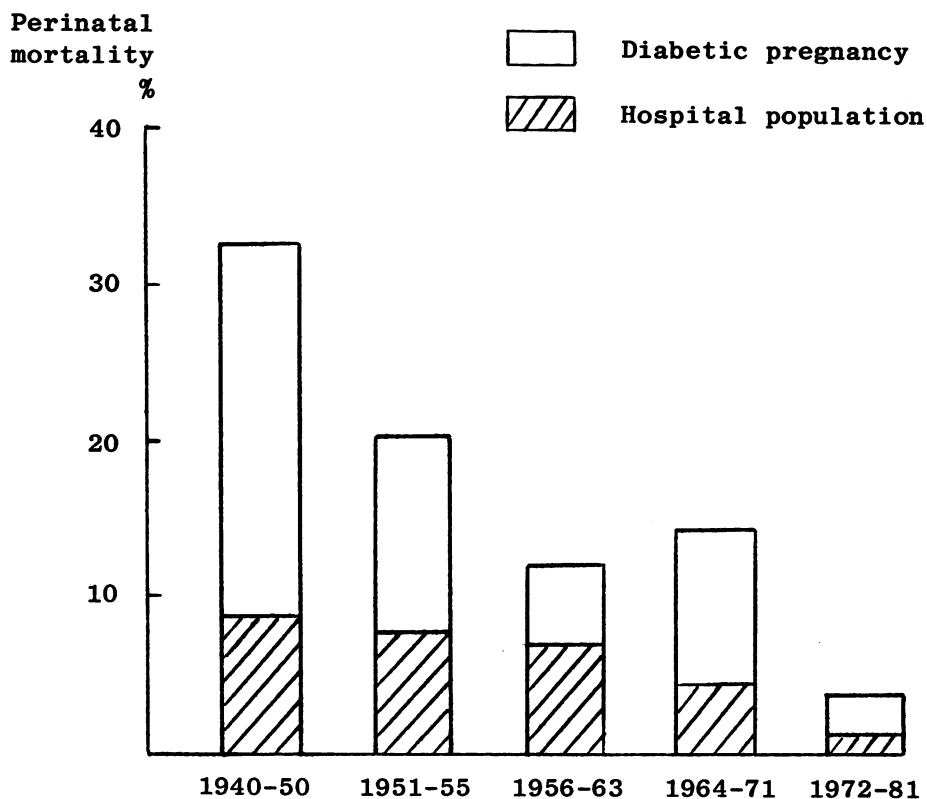


FIG. 1

*Perinatal mortality in diabetic pregnancy compared with that of the hospital population. Royal Maternity Hospital, Belfast, 1940-1981.*

clinic visit. The aim was to maintain the plasma glucose as close as possible to 5 mmol/l at all times. Admission to hospital was arranged if at any time there was difficulty with diabetic control or any obstetric complication arose, particularly pre-eclampsia or polyhydramnios.

In the thirty-second week of pregnancy all patients were admitted for closer supervision of their diabetes and continuous intensive assessment of fetal wellbeing by clinical examination and ultrasonic scanning every two weeks. In addition, urinary oestriols and serum HPL were measured and cardiotocography was carried out twice weekly. As inpatients they were referred to the diabetic eye clinic for ophthalmoscopic examination to detect possible diabetic retinopathy. After the thirty-sixth week an x-ray of the abdomen was obtained for further examination of the gestational age and to help exclude fetal malformation. A week later amniocentesis was performed and the patient delivered at 38 weeks if fetal pulmonary maturity was confirmed by a lecithin-sphingomyelin area ratio (LSAR) of greater than 2.0. Induction of labour or elective caesarean section was carried out after

consideration of many factors. A paediatrician was always present at delivery and the baby admitted to the nursery for observation for at least 24 hours.

## RESULTS

One-hundred-and-sixty-nine insulin-dependent patients were treated, 86 per cent of whom had booked for confinement in the Royal Maternity Hospital, the remaining 14 per cent being transferred from other centres with complications such as poor diabetic control, severe pre-eclampsia or premature labour. Fifty-four per cent of patients resided in the Eastern Health and Social Services Board, the rest being evenly distributed among the other Health Boards in Northern Ireland.

Of the 169 pregnancies, seven ended as spontaneous abortions, one of which was at 24 weeks. The 162 which progressed beyond 28 weeks gestation included 4 sets of twins; therefore the number of babies born was 166. Of these, there were 161 live births, 5 stillbirths and 2 neonatal deaths; 3 of the 7 perinatal deaths were the result of congenital heart lesions. The perinatal mortality rate was 4.2 per cent and the stillbirth rate 3.0 per cent. Two further deaths occurred in the fifth week of life: in one case, the mother overlay the baby as a result of a hypoglycaemic coma, whilst another baby died from a congenital heart lesion. Both cases, by definition, are not 'perinatal deaths' but in each the maternal diabetes clearly made a major contribution. Thus, the total fetal loss in this series, including the 7 abortions, was 16 (10 per cent) (Table I).

TABLE I

*Outcome in diabetic pregnancy, Royal Maternity Hospital, Belfast, 1972-1981.*

PREGNANCIES	...	...	...	...	...	169
Spontaneous abortion	...	...	...	...	...	7
Twin pregnancy	...	...	...	...	...	4
INFANTS	...	...	...	...	...	166
Live birth	...	...	...	...	...	161
Stillbirth	...	...	...	...	...	5
Neonatal death	...	...	...	...	...	2
TOTAL FETAL LOSS	...	...	...	...	(16)	10%
STILLBIRTH RATE	...	...	...	...	...	3%
PERINATAL MORTALITY RATE	...	...	...	...	...	4.2%

The incidence of congenital abnormality was 16 per cent (Table II) and many of these were minor abnormalities such as tongue-tie or hypospadias. There were 11 major abnormalities, of which the most common was a heart defect: such lesions were responsible for 3 of the 7 perinatal deaths. The CNS abnormality was anencephaly and this pregnancy was terminated at 17 weeks. The bony abnormality was sacral agenesis, which although rare, has a well recognized association with maternal diabetes.<sup>3</sup> Only one baby had multiple abnormalities and this accounted for one of the perinatal deaths attributed to a heart defect.

TABLE II

*Congenital fetal malformations in diabetic pregnancy, Royal Maternity Hospital, Belfast.*

CVS	—	Heart lesions	8
CNS	—	Anencephaly	1
SKELETAL	—	Sacral agenesis	1
MULTIPLE	—	Heart, kidney, limbs	1
MINOR ABNORMALITIES, eg Hypospadias			15
TOTAL			26
Malformation rate			15.6%

The most common obstetric problems were pre-eclampsia (30 per cent) and polyhydramnios (17 per cent). The incidence of urinary tract infection, anaemia and monilial vaginitis did not differ significantly from that of the general population. During the last two years five patients were found to have proliferative retinopathy which required laser photocoagulation during or immediately following the pregnancy.<sup>4</sup>

The mode of delivery was by caesarean section in 52 per cent, there being an added complication such as pre-eclampsia in half of these cases. The forceps delivery rate was 20 per cent and is considerably higher than that for the general population, this figure being largely influenced by the increasing use of epidural anaesthesia.

## DISCUSSION

Perinatal mortality is the end-point by which the quality of antenatal and perinatal care is judged. It is defined as the number of stillbirths and deaths occurring in the first seven days of life per 1,000 live and stillbirths. The introduction of a combined metabolic/antenatal clinic at the Royal Maternity Hospital, Belfast, has brought about a considerable improvement in the prognosis for diabetic patients over the last 20 years, during which time the perinatal mortality rate has been reduced from 12 per cent to 4.2 per cent and the stillbirth rate from 19 per cent to 3 per cent. These results compare favourably with other large centres in the United Kingdom but are still approximately three times that for the general population.

The incidence of fetal malformation has proportionately increased and during this time congenital heart lesions were responsible for approximately half of the perinatal deaths. There is clear evidence that fetal abnormalities are more common in pregnancy complicated by insulin-dependent diabetes<sup>5</sup> and that with poor control in early pregnancy the incidence is further increased.<sup>6</sup> Data from Pedersen<sup>7</sup> suggested that control at the time of conception may be the most important factor and this has been confirmed by Fuhrman<sup>8</sup> who showed that pre-pregnancy counselling to achieve blood sugar levels at less than 8 mmol/litre around the time of conception significantly reduced the incidence of congenital abnormalities. In Belfast, the need for good pre-conceptional blood sugar control was first suggested in 1979<sup>9</sup> and subsequently Montgomery et al introduced an explanatory booklet for

patients attending the R.V.H. diabetes clinic; as yet no reduction in the incidence of congenital abnormalities has been noted.

The most significant improvement in achieving good diabetic control prior to and during pregnancy has been the introduction of capillary blood glucose self-monitoring by the mother, and this has been made sufficiently accurate in average hands by the use of a reflectance meter of which there are several makes now available. Since the introduction of the Glucometer (Ames) in 1979, it has become our policy to instruct all patients in its use when they are admitted to the antenatal ward following booking at the antenatal clinic. They are provided with this instrument while in hospital and for those who cannot afford to buy one, several are available for loan until confinement. Those unable to obtain an instrument are advised to use the Dextrostix strips with visual comparison with the scale on the bottle; this method provides a means of self-monitoring superior to random urine testing which used to be the routine for many diabetics. Just as good pre-pregnancy control is considered vital to reduce the incidence of congenital abnormalities, good plasma glucose control throughout pregnancy should reduce the incidence of late unexpected intra-uterine death. Such deaths may be attributed to acute fetal metabolic derangement secondary to an episode of rapid fluctuation of maternal plasma glucose and four occurred in our series despite the presence of normal placental function tests. It was because of this difficulty in predicting those cases most at risk from sudden fetal death that patients have been admitted in the past after 32 weeks gestation to allow optimal control of their blood sugars with, if necessary, daily adjustment of insulin dosage.

Similarly, the policy of delivering patients at 38 weeks was adopted to reduce the incidence of sudden intra-uterine death after this period; this gestational age was selected because the problems of prematurity are remote. However, in diabetic pregnancy the risk of respiratory distress syndrome is increased and, since the introduction of the amniotic fluid LSAR, diabetic patients have not been delivered until this ratio was greater than 2 unless there are other pressing indications. The false positive rate with this test is known to be increased in diabetes<sup>10</sup> and in the above series three babies developed respiratory distress syndrome when the LSAR was greater than 2. To overcome this problem, delivery is now deferred until the appearance in the liquor of phosphatidyl glycerol.<sup>11</sup>

The caesarean section rate in this series, while lower than previously, is still unacceptably high at almost 50 per cent; the rate for the general hospital population being approximately 10 per cent. In many cases the decision to deliver the patient by caesarean section was influenced by the presence in the uterus of a scar from a previous delivery by this method. However, the major contributory factor is the aim to deliver the diabetic patient prematurely at which time the cervix, particularly in the primigravid patient, is usually unfavourable for induction of labour. In centres where the uncomplicated diabetic pregnancy is allowed to progress a further two weeks to term it appears that a greater number of patients go into labour spontaneously with subsequent reduction in the incidence of induction of labour and caesarean section. Thus, with good diabetic control and adequate fetal surveillance such practice may be the only way to significantly reduce the caesarean section rate. However, as discussed above, it is very difficult to predict accurately fetal death in utero and one must question whether the increased risk of intra-uterine death would outweigh the risk of caesarean section.

For the future there should be increasing centralization of care for the pregnant diabetic, the benefits of which are evident from the continuing fall in the perinatal mortality demonstrated above and were clearly highlighted in the National Survey of Diabetic Pregnancies 1982 (unpublished data)<sup>12</sup> which showed that those centres delivering the largest number of diabetic patients produced better results, despite having to cope with referrals of the more difficult cases. The value of pre-pregnancy counselling is unquestioned and it is the responsibility of all physicians to undertake such counselling of their female diabetic patients in the reproductive age group. This provides an opportunity to offer contraceptive advice and should include counselling regarding the risks to the baby of poor blood sugar control at the time of conception. To provide such a service a pre-pregnancy clinic has been set up in the Royal Maternity Hospital, at which some patients who have been counselled attend at monthly intervals for assessment and appropriate adjustment of insulin. Other potential mothers are identified at their own diabetic clinics and seen there more frequently. It is not yet possible to insist on attendance at a centralized pre-pregnancy clinic as is practised in East Germany, but it is very important that the desirability of good pre-conceptional diabetic control should be known to potential mothers.

### SUMMARY

Over the last 10 years, 169 diabetic pregnancies were managed in the Royal Maternity Hospital, Belfast. The perinatal mortality was 4.2 per thousand and represents a considerable improvement over the 10 years reviewed. Congenital fetal malformations have become proportionately more common and accounted for almost half of the fetal loss.

The continuing improvement in perinatal mortality has largely been attributed to the intensive care of the pregnant diabetic by a team consisting of obstetrician, physician and neonatologist. However, to reduce perinatal mortality and morbidity it is essential that all insulin-dependent diabetic patients in the reproductive years should be counselled regarding the necessity for preconceptional diabetic control.

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