THE VALUE OF MATERNAL GLUCOSE INFUSIONS IN FOETAL ANOXIA

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The majority of perinatal morbidity and mortality is accounted for by foetal and neonatal anoxia. The problem of foetal distress has very rightly been referred to as "Obstetrician's dilemma". Beyond doubt, this is the one condition which taxes both the skill of the doctor as well as his patience.

With advances in obstetrical management, it has largely been possible to lower the maternal mortality. The reduction of perinatal mortality and therefore, improvement of foetal salvage, however, still poses a problem.

Newer methods like foetal phonocardiography, scalp blood examination and examination of the liquor have been added in the recent past to assess foetal distress more correctly.

The significance of glucose in the blood and tissues during anoxia has been previously studied in the foetus and newborn by (Cornblath and Reisner, 1965) and many others. From the earliest stage of asphyxia, the foetus switches over to anaerobic metabolism to meet its tissue demands. The available data suggest that depletion or mobilisation of cardiac glycogen provides the energy available for anaerobic survival.

Thus, if a constant supply of glucose could be maintained to the foetus, it may be possible to prevent it from resorting to its' glycogen stores as has been reported by Gelli (1961).

Furchgott and Lee (1961) have reported that glucose also improves the contractability of cardiac muscle related to increases in creatinine phosphate. The latter could be easily depleted during impaired oxidative metabolism.

The survival of the foetus under anoxia has been considerably prolonged by the administration of glucose alone or in combination with alkali to maintain pH (Usher 1961).

As an extension of Usher's work has emerged the concept of supplying glucose to the foetus by way of maternal infusion (Milner and Hales, 1965; Romney and Gabel, 1966, Paterson, *et al* 1967).

Material and Methods

A total of 50 deliveries at the S. N. Hospital Agra, were observed. In the cases under study, there was either obvious evidence of foetal distress or it was presumed that there was a risk of foetal anoxia.

The cases selected fell into one or more of the following categories—prolonged

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labour, foetal distress, breech presentation, caesarean section, forceps delivery, premature labour and toxaemias of pregnancy.

A detailed history of the patient was taken with special emphasis on the obstetric history to select high risk cases.

An abdominal examination was carried out to judge clinically the gestational period and approximate size of the baby.

Results

There were 32 cases of prolonged labour and 10 cases of caesarean section done for varying causes in which the foetus was at risk. A miscellaneous group included 2 premature deliveries, 2 breech presentations, 2 full term pre-eclamptics and 2 cases of foetal distress from unknown cause. (Table I).

TABLE I

Comparison of the Mean, Maternal and Cord Blood Sugar Levels in Various Groups.

Group	Blood sugar in (mgm/100 ml.) Maternal		Cord		Maternal foetal gradient	Statistical analysis		
	Mean	S.D.	Mean	S.D.		'n'	't'	'p'
I	129.5	16.5	74.0	8.6	55.5	98	5.4	$<.01$
II	171.8	15.13	114.7	14.03	57.1	98	3.7	$<.01$
II	200.5	20.06	147.6	20.46	52.9	48	8.9	0.001

The foetal heart rate was counted for one minute in the phase of relaxation. Foetal heart was designated as normal if its rate was 120 to 140 $\pm$ 10 per minute. Any case deviating from this level was labelled as foetal distress.

An initial maternal venous blood sample was collected before starting the infusion. To all these cases, a 5 per cent glucose infusion was started and was continued upto the time of delivery.

The foetal heart rate was carefully monitored and progress of labour watched.

In the cases of prolonged labour, serial maternal blood samples were collected.

With the delivery of the baby, a sample of cord blood was drawn from the umbilical vein in a 5 c.c. syringe. The baby was submitted to an Apgar scoring.

The blood samples, collected in oxalated tubes, were subjected to blood sugar estimation by the Somogyi-Nelson method.

In the cases of foetal anoxia it was observed that maternal blood sugar was higher than both the control and glucose loaded cases of normal delivery. Thus, in comparison to group I, the gradient between mean maternal blood sugar levels was 71.0 which was statistically significant ($p < .01$).

In comparison to group II cases, the gradient was 28.7 which is again statistically significant ($p < .01$).

The cord blood sugar levels were also higher in comparison to the control and study groups of normal delivery cases, the gradient being 73.6 and 32.9 respectively.

The higher levels of maternal and foetal blood sugar in foetal anoxia cases receiving glucose infusions in comparison to normal delivery cases who were also given infusion, have been documented by Romney and Gabel, (1966).

In comparison to the pre-infusion levels in cases of prolonged labour, the

maternal blood sugar showed an abrupt rise in the first 30 minutes after infusion. After this, the rise in the blood sugar was more gradual though sustained.

Comparing the maternal and cord blood sugar levels in Group I cases, a materno-foetal gradient 55.5 was observed ($p < .01$). In group II cases, the materno-foetal gradient was 57.1 ($p < .01$) while in group III cases, the gradient was 52.9 ($p < .001$). All the values were statistically significant.

From our observations, it is evident that there exists a definite correlation between the maternal and foetal blood sugar.

Our findings of a close correlation between maternal and foetal blood sugar levels are comparable with those of Dawes *et al* (1963) who reported that the foetal blood glucose is relatively lower than the maternal level and fluctuated with it.

From close observations in the cases of prolonged labour associated with foetal distress in our series, it could be seen that in some of the cases of foetal tachycardia there was a definite improvement of the foetal heart rate following infusion. However, in those cases exhibiting bradycardia, no improvement could be observed following infusion. Foetal bradycardia usually signifies the terminal stage of foetal anoxia. It is most often preceded by tachycardia. With the concentrations of glucose used in our series, it appears that it is not possible to reverse foetal bradycardia. The number of cases with bradycardia is too small to draw any definite conclusions but we did observe that the condition of foetus did not worsen by the fact that the foetal heart rate did not fall any further and ultimately, the foetal salvage was good.

Romney and Gabel (1966) using a much higher concentration of glucose have reported a reversal of foetal bradycardia to normal.

In those cases of prolonged labour where there was no evidence of foetal distress at the start of infusion, the foetal heart rate was maintained within normal limits throughout the period of infusion.

In the present series, the Apgar scores of the glucose-treated foetal distress cases was above 5 in 75 per cent of cases.

The foetal salvage in our series of foetal distress cases was 96 per cent. One baby delivered by a difficult midcavity forceps following obstructed labour expired after 8 hours of birth while one of the premature babies died.

Summary and Conclusion

Hypoglycaemia in the newborn, which may be assumed to be existing prenatally in many situations is found to be associated with such complications as low birth weight, maternal diabetes toxaemias of pregnancy, prematurity and prolonged labour.

Avoidance of serious metabolic alterations in such cases could appear to be mandatory and if these can be corrected before birth, the newborn should be benefited.

The present study confirms the value of glucose infusion to the mother.

Even in those cases where there is a possibility of foetal asphyxia with its effect on the cardiac glycogen stores, raised levels of blood glucose would ensure against such a catastrophe.

References

1. Cornblath, M. and Reisner, S. H.: New Eng. J. Med., 273: 378, 1965.
2. Dawes, G. S., Jacobson, H. N., Mott, J. C., Shelley, H. and Sfafford, A.: J. Physiol., 169: 167, 1963.

3. Furchgott, R. F. and Lee, K. S.: Circulation, 24: 416, 1961.
4. Gelli, M. G.: Acta Obst. & Gynec. Scand., XLVII: 2, 1961.
5. Milner, R. D. G. and Hales, C. N.: Brit. Med. J., I: 284, 1965.
6. Phillips, L., Paterson, P. and Wood, C.: Am. J. Obst. & Gynec., 98: 938, 1967.
7. Romney, S. L. and Gabel, P. V.: Am. J. Obst. & Gynec., 96: 698, 1966.
8. Usher, R.: Paed. Clin. North America, 8: 529, 1961.