BIOCHEMICAL CHANGES IN PROLONGED LABOUR

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One of the important causes of maternal mortality in developing countries like India, specially in Rajasthan state, is prolonged and difficult labour. The women who die usually suffer from rupture uterus but in many such cases Waboso (1973) observed that the uterus was found to be intact and death resulted from marked fluid, electrolyte and metabolic changes which may be further complicated by severe infection. Most of the cases die after prolonged labour without these changes being detected and without proper replacement of the electrolytes. Hence to correct this rather unsatisfactory situation, we undertook this study on the biochemical changes during labour in the city of Ajmer in Rajasthan State of India and to provide a more rational approach to the management of difficult and prolonged labour.

Material and Methods

The patients were selected from those admitted in Department of Obstetrics and Gynaecology of J.L.N. Hospital Ajmer. The women did not suffer from any chronic medical conditions and apart from those in prolonged labour were free from any obstetric complications.

Three groups of pregnant or parturient women were the subjects of the study: 50 women at term (38 to 41 weeks pregnant): 50 women in normal labour for 6 to 10 hours; and 50 women in whom labour had lasted a minimum of 24 hours or more. Of the cases of prolonged labour, only 26 cases were booked and the rest were emergency admissions. The ages ranged from 18 to 39 years, there were 30 primigravidae and 20 multigravidae.

Ten ml of blood was drawn from antecubital vein of each of the women and a sample of urine was obtained at the same time. Blood sodium, potassium, urea, creatinine, sugar, lactic acid and pH were estimated. Urine sugar, albumin, acetone, sodium, potassium, chloride, urea, and creatinine were also estimated.

Results

The pattern of biochemical changes in three groups of women in blood is shown in Table I. There was a fall in serum electrolyte concentrations in early labour and a further fall in prolonged labour affecting the sodium, potassium chloride and pH of the blood, while rise occurred in serum urea, creatinine and lactic acid. Using student 't' test the fall in sodium was statistically significant ($P < 0.01$) when values of early labour to those of term pregnancy and highly significant ($P < 0.001$) when values for late pregnancy, early and prolonged labour were

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TABLE I

Biochemical Profile of 150 Pregnant and Parturient Women in Blood

	Late pregnancy n = 50 Mean ± SEM	Early labour n = 50 Mean ± SEM	Prolonged labour n = 50 Mean ± SEM
Na mmol/1	146. 78 ± 0.702	143. 42 ± 0.709	132. 72 ± 0.939
K mmol/1	4. 44 ± 0.057	4. 42 ± 0.054	4.084 ± 0.05
Cl− mmol/1	107. 50 ± 3.075	104. 94 ± 3.46	101. 47 ± 2.066
Urea mmol/1	2. 87 ± 0.649	2. 88 ± 0.536	4. 22 ± 1.44
Creatinine mmol/1	94. 50 ± 0.343	118. 2 ± 0.38	133. 74 ± 0.33
Sugar mmol/1	4.228 ± 1.30	4.173 ± 1.06	5. 34 ± 2.50
Lactic acid mmol/1	1. 07 ± 0.009	1.117 ± 0.252	2. 88 ± 1.012
pH	7.402 ± 0.0073	7. 32 ± 0.0057	7.186 ± 0.0094

compared. Similarly, the chloride level fall was highly significant when values for early labour to those of term pregnancy ($P < 0.001$) and when values for prolonged labour with late pregnancy and early labour were compared ($P < 0.001$). The potassium levels fall significantly ($P < 0.05$) when values of early labour were compared to term pregnancy and highly significant fall noted when value of prolonged labour was compared with early labour and term pregnancy ($P < 0.001$).

A highly significant fall in pH level of blood was noted ($P < 0.001$) when values of early labour and term pregnancy were compared and also when values of prolonged labour to term pregnancy and early labour were compared ($P < 0.001$). There was a rise in blood lactic acid in prolonged labour and the rise was statistically significant when values of prolonged labour were compared to term pregnancy ($P < 0.001$), but not significant when compared to early labour ($P < 0.5$). A significant rise is noted when values of early labour is compared to term pregnancy ($P < 0.001$). There was a highly significant rise in blood urea in prolonged labour when values were compared with early labour ($P < 0.001$). The rise in serum level of creatinine was highly significant when values of prolonged labour were compared with those of term pregnancy and early labour ($P < 0.001$) and also when early labour and term pregnancy values are compared ($P < 0.001$). The bood sugar level showed a highly significant rise in prolonged labour ($P < 0.001$) when values were compared to term pregnancy and early labour.

The biochemical changes in urine in the 3 group of study are shown in Table II. The urinary concentration of sodium, potassium and chloride increases in early labour and the rise in values of sodium and potassium were highly significant ($P < 0.001$) when compared to late pregnancy but the rise of chloride level was not significant. In prolonged labour, a highly significant fall in concentration of sodium was noted ($P < 0.001$) while potassium showed a significant rise ($P < 0.001$) when values were compared to early labour. The chloride level showed a significant rise ($P < 0.001$) in prolonged labour when values were compared to early labour. The creatinine and urea showed a progressive rise in early and

TABLE II
Biochemical Profile in Urine of 142 Pregnant and Parturient Women

	Late pregnancy n = 50 Mean ± SEM	Early labour n = 50 Mean ± SEM	Prolonged labour n = 42 Mean ± SEM
Na mmol/1	105.594 ± 2.009	121.228 ± 1.707	119.514 ± 6.24
K mmol/1	24.338 ± 1.537	33.164 ± 1.455	38.393 ± 1.79
Cl⁻ mmol/1	103. 73 ± 6.772	109. 58 ± 8.368	128. 05 ± 11.203
Creatinine mmol/1	8.988 ± 1.892	10.052 ± 1.400	18. 99 ± 6.593
Urea mgm. %	4. 73 ± 0.2606	12.856 ± 0.212	16.571 ± 0.611

prolonged labour when compared to term pregnancy and the values were highly significant ($P < 0.001$).

Discussion

Biochemical changes in labour in temperate countries have been described by Hawkins and Nixon (1957 and 1958). Badoe (1968) and Elebute (1969) had shown that increased water loss occurs in tropical areas even under normal basal conditions. As the facilities that exist in many tropical and developing countries like India are often quite inadequate, cases of prolonged labour due to various obstetric causes are frequent not only in the rural areas but also in urban population. In addition, considerable delay is often inevitable in the transfer of some of these patients from villages with poor transport facilities to larger hospitals. The result is that many arrive in a state of severe shock due to excessive water and electrolyte loss often accompanied by haemorrhage in those with rupture uterus.

The present study was designed to provide some basis for improved care for women in prolonged labour. The serum electrolyte changes have been observed in the present study in prolonged labour affecting the sodium, potassium and chloride. Akinkugbe *et al* (1977) in their study observed a fall in serum electrolyte concentration in early labour and a further fall in prolonged labour affecting the sodium, chloride, potassium, bicarbonate and the osmolality of urine, while a rise occurred in serum urea and creatinine. The values were statistically significant for prolonged labour but the changes in the serum creatinine were not statistically significant. The urine osmolality was significantly different in all his 3 groups ($P < 0.001$), while chloride showed only one significant change ($P < 0.05$) between women in early labour and those in prolonged labour. In the present series, there was a fall in sodium level and increase in potassium level in urine in prolonged labour as compared to early labour which is also noted by Aninkugbe *et al* (1977). The increased level of chloride in urine in prolonged labour in the present series cannot be explained and can be attributed to technical errors. The increased level of urea and creatinine in urine in early and prolonged labour in the present series is attributed to increased muscular activity in early and prolonged labour.

The other well known complication of prolonged labour is metabolic acidosis due to relative starvation in labour. This complication often develops more rapidly tfian the electrolyte loss. The mainstay of treatment for the acidosis has been the

intravenous infusion of liberal amount of dextrose (5 or 10 per cent) in water. The present study coupled with others (Badoe, 1968; Elebute, 1969; Akinkugbe *et al* 1977) show that dextrose in water is unlikely to be adequate in the management of labour lasting as long as 18 hours or even less.

In addition, the complication of lactic acidosis that may follow such a measure has been highlighted by Ames *et al* (1975). In the present study, an increased level of blood lactic acid and a fall in pH level is noted during prolonged labour. The increased value of blood lactate in prolonged labour has been attributed to activity of the uterus or its contents. Further increased level in prolonged labour is also attributed to metabolic acidosis due to increased muscular effort, increased anoxia, decreased consumption of food and water leading to starvation, dehydration and hemoconcentration. The glycogen stores are used and due to anaerobic metabolism lactates are formed. The increase blood latctate is noted by Pearson and Davies (1973) in early labour and increase further in the second stage when excessive muscular efforts are required. As the labour advances, the muscular activity increases and brings increase in lactic acid production and resulting in increase in H ion concentration in blood and hence causes a fall in pH. Akinkugbe *et al* (1977) have shown a rapid and significant fall in serum bicarbonate within 6 hours of onset of labour and even more significant fall in prolonged labour due to metabolic acidosis, hence neutralisation of excessive H ion cannot occur and thus there is further fall in pH of blood.

The fall in serum potassium in early and prolonged labour was statistically significant in the present series and in Akinkugbe *et al* (1977) series. The fall in potassium was probably due to increased secretion of cortisol (Adadevoh and Akinla 1971) and adrenocorticotriphic hormone (Kauppila *et al* 1974) in labour leading to an increase in urinary loss. The much slower changes in serum sodium and chloride are due to active renal conservation, shown by the significant fall in osmolality of the urine assisted, as Tinckler (1966) pointed out, by reduced loss of electrolyte in sweat. Dehydration results from the water loss in sweat and urine and was reflected in the significant rise in serum urea level in early and prolonged labour in the present series. This is also noted in the study of Akinkugbe *et al* (1977).

This study thus provides an explanation for the severe morbidity and the occasional mortality that occurs in patients in whom obstructed labour is treated by caesarean section without the replacement of water and electrolytes. It should therefore be mandatory to obtain accurate data of electrolyte status in those patients and to institute replacement therapy even before the results of serum analysis are known. Hence it is recommended that rapid infusion of one litre of 5 per cent dextrose in water should be given in prolonged labour to correct first the metabolic acidosis and another litre of Hartmann's solution to make up the deficit of potassium, sodium and chloride and achieve rehydration. The serum electrolyte results which may follow later could then form the basis for accurate correction of biochemical derangement in the intrapartum and immediate postpartum period.

Summary

Serum electrolytes, creatinine, urea, sugar, lactic acid PH and urine electrolytes were estimated in 50 healthy pregnant women at term, 50 women in early labour

and 50 healthy parturients in prolonged labour. A significant fall in serum sodium, potassium and chloride is found in early labour and a further fall in prolonged labour is noted. The lactic acid in blood showed a significant rise while pH level showed a significant fall in prolonged labour. There was a significant rise in blood urea and creatinine values in prolonged labour. The rapid insensible loss of water was reflected in the rise in blood urea while homoeostatic mechanism maintained a slower fall in sodium and chloride by renal conservation.

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