Medical Journal of the
Islamic Republic of Iran

Volume 18
Number 4
Winter 1383
February 2005

ASSESSMENT OF THE EFFECTS OF INCREASED INTRAVENOUS HYDRATION ON THE COURSE OF LABOR IN NULLIPAROUS TERM PREGNANCIES

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ABSTRACT

Physiologists have shown that increased fluids improve skeletal muscle performance in prolonged exercise.Typical orders provide for 125 mL of intravenous fluids per hour in patients taking limited oral fluids during labor. Our purpose in this study was to determine whether increased intravenous fluids affect the progress of labor. In a prospective randomized institutional clinical trial, one-hundred ninety-four nulliparous women with uncomplicated singleton gestations at term in spontaneous active labor with dilatation 2-5 cm and a cephalic presentation were selected. 82 were designed to receive 250 mL per hour of intravenous normal saline in dextrose water (first group), and 112 to receive 125 mL per hour of the same solution (2nd or control group).

Prerandomization variables such as mother's age, weight, previous pregnancy history, general health, sex and weight of the newborn, rupture of the membranes and presenting part were balanced between the two groups.

The frequency of labor lasting >10 hours was statistically higher in the 125mL group ([16.7%] vs [7.4%] $p< 0.0002$).

This study showed that increasing fluid administration for nulliparous women in labor is associated with a shorter duration of the first stage and possibly less need for augmentation of uterine contraction ([4.8% vs 6.25%] $p= 0.002$).Thus dehydration in labor may be a contributing factor for dysfunctional labor and need for cesarean-section, and oxytocin infusion.

MJIRI, Vol. 18, No. 4, 289-292, 2005.

Keywords: Intravenous hydration, Labor, Nulliparous, Term pregnancies.

INTRODUCTION

In 1918, Dr. Joseph DeLee warned that food must be encouraged throughout labor to avoid general weakness, delayed labor, and serious postpartum hemorrhage.[1]

Until the 1940s parturient women were encouraged to eat and drink as a mean of maintaining their stamina for the work of labor.[2] A literature review reveals no current research on nutritional needs of laboring women, and it has been suggested that 50-100 calories per hour are needed in active labor.[3]

Physiologists have shown that increased fluids improve skeletal muscle performance in prolonged exercise.[4-5] Higher infusion rates of isotonic solutions may reduce the incidence of labor exceeding 12 hours in duration.[6]

MATERIAL AND METHODS

A prospective randomized institutional clinical trial was conducted at the Iran University of Medical Sciences, Shahid Akbarabadi Hospital.

194 term pregnant nulliparous patients in spontaneous labor with gestational age of 38 weeks or more were randomly assigned to received either 250mL per hour of normal saline in dextrose water(1/3&2/3) or 125mL per

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hour of the same solution during the course of labor. All of our patients were singleton with cephalic presentation and no abnormal presentation or pelvic contraction. They were admitted due to beginning of labor and cervical dilatation was 2-5cm with either ruptured or intact fetal membranes. None of the patients had any history of hypertension, diabetes mellitus, renal diseases and also placenta previa, meconium in amniotic fluid, multifetal pregnancies, intrauterine fetal death or polyhydramnios. We excluded all of the patients with previous cesarean-section, metroplasty and chorioamnionitis, pyelonephritis or other febrile illnesses before random assignment.

Nothing was given by mouth, and nobody had epidural anesthesia and narcotic analgesia. Statistical comparisons between the two groups for differences was by chi–square, and a difference between the 2 groups of $p<0.05$ was defined as statistically significant. All data and accurate intravenous intake were recorded and nothing was given by mouth.

RESULTS

In the treated group (250 mL per hour) there were 7.4% (6 of 82 cases) of prolonged labor more than 10 hours, in comparison to 16.7% (18 of 112 cases) in the control group ($p<0.0002$).

Statistical assessment by chi square showed that over-hydration shortened the mean duration of the first phase of labor, and the difference between mean duration of the first phase of labor in the two groups were significant (Table I).

In the same assessment there was no difference of mean duration of the second phase of labor between the two groups. (sig1= 0.0000 and sig2 =0.000)

Need for the use of oxytocin due to uterine hypofunction occurred in 7 cases in the control group (6.25%) vs 4 cases (4.8%) in the treated group. There was a significant difference between the two groups. ($p= 0.002$).

Cesarean–section was performed for 4 cases (4.78%) and 15 cases (13.39%) in treated and control groups respectively. The causes of cesarean-section in the treated group were cephalopelvic disproportion (CPD) (1 case), meconium and fetal distress (3 cases), and in the control group, CPD (3 cases), placental abruption (1 case) and fetal distress (10 cases). The difference between the two groups is significant.

The 5-minutes Apgar-score in the treated group (250 mL/h) was 8 in 2 cases and 7 in 1 case; the 5 minutes Apgar-Score in the control group (125 mL/h) was 7 & 8 in the 4 and 5 cases respectively. The statistical difference between the two groups is significant ($p= 0.003$). All of the cases that needed NICU were due to meconium aspiration.

For the prevention and control of excessive bleeding we injected methyl ergonovine in 4(4.9%) and 6(5.35%) cases in the treated and control group respectively in the postpartum period.

There was a balance between mean and variance of pre-delivery data such as mother's age, neonatal weight and sex, amniotic membrane (intact or ruptured), cervical dilatation and effacement and presentation (Table II).

DISCUSSION

Fasting in labor had been an established practice since the 1940s.The major reason for this practice is the increased gastric emptying time that is present during labor. A laboring patient with a full stomach is at risk of developing aspiration pneumonia secondary to vomiting during intubation for administration of general anesthesia.[6]

The energy needs of laboring women have been compared to those of athletes in competition. When glucose is not available, fat supplies are utilized, resulting in a release of free fatty acids into the blood and tissues. These are eventually oxidized to ketones. Excessive production of ketones may lead to their excretion in the urine. Ketonuria (ketosis) should not be confused with ketoacidosis, a serious metabolic imbalance. The pregnant woman is more prone to ketonuria due to increased fetal demands, increased fat utilization, and pregnancy-induced hormone changes. The tendency toward keto-

Table I. Comparison between mean &variance of duration (minute) of the first & second and sum of the labor phases.

Duration of labor Mean& variance	First stage X±1SD	Second stage X±1SD	Sum of first & second stage X±1SD
Fluid therapy (250mL/h)	257.68±132.61	33.03±9.47	312±297
Fluid therapy (125mL/h)	361.34±177.9	38.80±16.79	451±213
p- value	0.0002	0.096	0.0002

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Table II. Comparison of pre-delivery data between the two groups (125 and 250mL/h).

Groups	Fluid therapy (125mL/h)	Fluid therapy (250mL/h)	*p* value
Mean mother's age	21.75±3.58	21.57±3.51	NS
Neonatal weight (g)	3129±351	3115±516.51	NS
Sex of neonates			
Male	49%	53%NS	
Female	51%	47%	NS
Amniotic fluid			
Intact	88.8%	94.4%	NS
Ruptured	11.2%	5.6%	NS
Cervical dilatation (cm)	3.18±1.05	3.46±1.81	NS
Effacement	44.46%±16	50.87%±14.34	
Station of presenting part	-2.85±0.449	-2.76±0.46	NS

sis is also seen in the adult human body in response to exertion and restricted food and drink.[7]

This is a surprising finding given the information from many studies on the effect of adequate fluid replacement in distance runners and other sustained forms of exercise.[8] Physiologists have shown that increased fluids improve skeletal performance in prolonged exercise. Several prospective randomized trials in distance runners and cyclists demonstrate that increased fluid intake improves exercise performance.[9] Generally speaking, this effect is limited to prolonged exercise, because shorter intensity studies, for < 21 minutes do not shown that fluid ingestion affects performance.[10] It is reported that exercise is impaired in distance runners who are dehydrated by as little as 2% of their body weight and that losses of >5% of the body weight can decrease the capacity for work by as much as 30%.[11]

Thus it is important that the subject of hydration be examined to determine whether uterine contractions might be affected by the amount of fluid replacement in labor.

One variable that has the potential to affect the course of labor but has not been evaluated before the year 2000 is the adequacy of maternal hydration.[12] Data from such exercise physiology studies may shed some light on the reasons that patients who labor for longer periods may be inadequately hydrated. Fluid loss is poorly self-regulated during exercise. If there's concern about dehydration, urine output can be monitored. Volume and color are indications of fluid level. Urine output decreases until intravascular volume is reduced by 3% but does not decrease further until levels of 7% reduction are reached. Levels of 7% usually are not seen because patients become syncopal at this point. The rate of fluid lost by sweating and by respiration is not reduced by dehydration, except in extreme degrees. Thus patients continue to lose fluid with exercise even when fluid is not replaced. Voluntary drinking rarely keeps up with fluid loss during sustained exercises and even those losing >2L/h rarely drink > 500mL/h.[13] Some physicians monitor ketones in urine to assess hydration. The American College of Sports Medicine suggests that 400 to1800 mL of fluids per hour must be ingested with sustained exercise.[14] Whether these data and recommendations from exercise literature can be translated into effects on the smooth muscle of the contracting uterus is speculative, because it is not possible to find other examples of smooth muscle that contracts vigorously only episodically and hence might be subjected to exhaustion. The amount of intravenous fluids, 125 mL/h, given to most laboring patients in our hospital compares in stark contrast to this recommendation. Perhaps labor does not result in amounts of insensible loss similar to those lost by long-distance runners, but fluid loss from sweating and respiration in labor is probably more comparable to loss during running than while lying still in bed. Restriction of fluids is associated with prolonged labor, and is often caused by health care providers, with augmenta-

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tion of labor with oxytocin and operative birth.[15-16] Emergency operative birth under general anesthesia then becomes a risk factor for aspiration. Typical orders provide for 125mL of intravenous (IV) fluids per hour in patients who are clinically dehydrated. Both the amount of fluid given to virtually all patients in our hospital (125mL/h) and the subjective impression that patients, especially those with long labor, are often thirsty and clinically dry led the authors to suspect the possibility that many of these patients are underhydrated. The cumulative dehydrating effect of inadequate fluid replacement compromising the delivery of oxygen and nutrients and the elimination of waste products would be expected to impair muscle performance with longer labor. This study was designed to determine whether increased IV fluids affect the progress of labor. We have observed in our study a statistically significant difference (nearly 96 minutes) in the first stage of labor in the group with a higher rate (250mL/h) of fluid administration (p= 0.0002).

The results of the study reconfirmed the hypothesis and previous study that patients with higher rates and ultimately higher volumes of intravenous fluid replacement have a lower frequency of prolonged labor and the similar trend toward a lower need for oxytocin may reflect a lower frequency of dysfunctional labor with more adequate fluid replacement. There also appears to be a strong trend toward overall shorter labors, restricted to the first stage of labor.

CONCLUSION

This study presents the novel finding that inadequate hydration in labor may be a contributing factor to dysfunctional labor and possibly the need for oxytocin augmentation and cesarean-section. Increasing fluid administration for nulliparous women in labor above rates commonly used is associated with a lower frequency of prolonged and dysfunctional labor, thus these factors should be considered in clinical management and in future studies focusing on variables that affect labor.

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