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Original Research Article

A comparative study on the effect of intravenous Ringer lactate at 125 ml/hour versus 250 ml/hour on the duration of labour in nulliparous pregnant women

Shivika Mittal[1]*, Amit Gupta[2], Chanderdeep Sharma[3], Prashant Dhatwalia[4], Rita Mittal[5]

[1]Department of Obstetrics and Gynecology, Deendyal Upadhyay Zonal Hospital, Shimla, Himachal Pradesh, India
[2]Department of Obstetrics and Gynecology, Dr. Rajendra Prasad Government Medical College, Tanda at Kangra, Himachal Pradesh, India
[3]Department of Obstetrics and Gynecology, AIIMS Bilaspur, Himachal Pradesh, India
[4]Department of Anaesthesia, [5]Department of Obstetrics and Gynecology, IGMC, Shimla, Himachal Pradesh, India

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***Correspondence:**
Dr. Shivika Mittal,
E-mail: shivika.m24@gmail.com

ABSTRACT

Background: Several factors may influence the progression of normal labour. It has been postulated that the routine administration of intravenous fluids to keep women adequately hydrated during labour may reduce the period of contraction and relaxation of the uterine muscle, and may ultimately reduce the duration of the labour. However, the routine administration of intravenous fluids to labouring women has not been adequately studied although it is widely practiced, and there is no consensus on the type or volume of fluids that are required, or indeed, whether intravenous fluids are at all necessary. This study was conducted to study the effect of intravenous Ringer lactate at 125 ml/hour versus 250 ml/hour on the duration of labour.

Methods: In the study, patients were divided in two groups of nulliparous pregnant women in spontaneous early labour (between 3-5 cm dilatation), at term with singleton pregnancy and cephalic presentation, where one group received intravenous Ringer lactate at 125 ml/hour and the other group received Ringer lactate at 250 ml/hour. The duration of labour, mode of delivery and caesarean rates were measured in both groups along with incidence of prolonged labour and need for oxytocin augmentation.

Results: The incidence of prolonged labour and oxytocin augmentation were less in the group receiving intravenous RL at 250 ml/hour but was not statistically significant. Remaining outcomes were comparable in both the groups with no outcome reaching statistical significance.

Conclusions: Rate of fluid administration is one of the many variables which affects the labour outcomes. The incidence of prolonged labour and oxytocin augmentation was less in the group which received intravenous RL 250 ml/hour. There was no statistically significant difference in both groups in respect of duration of labour, mode of delivery and caesarean rates.

Keywords: Caesarean, Intravenous, Labour, Maternal hydration, RL

INTRODUCTION

Labour has been described as uterine smooth muscle contractions resulting in progressive cervical dilatation and effacement accompanied by the descent and expulsion of fetus.[1-5] There are several variables that may influence the normal progression of labour. A variable that has been studied minimally is the effect of maternal hydration. Oral fluids are restricted in some labour units because of concerns over prolonged gastric emptying time during

labour and chances of aspiration if general anesthetic is required at any point of time.[6] Adequate maternal hydration is vital for fetal oxygenation, delivery of nutrients, and removal of waste from contracting myometrium during labour.[7] It has been reported that adequately hydrated women had shorter duration of labour, and required less frequent oxytocin augmentation than poorly hydrated women.[8] While the physiological calorific requirement for a labouring uterus has been reported to be approximately ten grams of carbohydrates per hour, the actual amount of hydration that a labouring uterus requires for efficient contraction, has not been quantified.[9] Dehydrating labouring women also have alterations in the acid base balance of the fluid surrounding the myometrial fibers resulting in the decrease in the pH. Changes in pH have been shown to affect calcium signalling and force of myometrial contractility prolonging the course of labour. Prevention of dehydration in labour may therefore not only alleviate symptoms of thirst, but may also provide better hydration for the labouring, exercising uterus and ultimately prevent prolonged labour and avoid more intrusive intervention.[10,11]

Edwards et al in 2013 evaluated the effect of mode and amount of fluid hydration during labour. They conducted a randomized controlled trial of uncomplicated nulliparous women in spontaneous labour at 36 weeks or more gestational age. Women were randomized to receive lactated Ringer solution with 5% dextrose at (1) 125 ml/hour intravenously with limited oral intake, (2) 250 ml/hour intravenously with limited oral intake, or (3) 25 ml/hour intravenously with as much oral intake of clear liquids as required. Results were analysed by intent-to-treat analysis. A total of 311 out of 324 women were available for analysis. Groups 1 (n=105), group 2 (n=105), and group 3 (n=101) above did not differ significantly for mean labour duration (11.6±5.9, 11.4±5.5, and 11.5±5.9 hours, respectively; p=0.998), proportion of women in labour >12 hours (all groups 41%; p=0.998), proportion receiving oxytocin augmentation (59, 60, and 57%, respectively; p=0.923), or proportion delivered by cesarean (22, 17, and 17%, respectively; p=0.309). Indications for cesarean were similar between groups. No cases of pulmonary edema, maternal aspiration, or perinatal mortality occurred. Although apparently safe, neither increased i.v. hydration nor oral hydration during labour improves labour performance.[12]

In a meta-analysis in 2017, Ehsanipoor et al determined whether an i.v. fluid rate of 250 versus 125 ml/hour is associated with a difference in CS rate. They included all randomized controlled trials comparing i.v. fluid rates of 250 versus 125 ml/hour in nulliparous women in spontaneous labour at term with singleton pregnancies at ≥36 weeks. Studies were included regardless of the type of i.v. fluids used and regardless of whether oral intake was restricted during labour. Studies including multiparous women or women whose labour was induced were excluded. The primary outcome was the incidence of CS. Women who received i.v. fluids at 250 ml/hour had a significantly lower incidence of CS for any indication, a significantly shorter mean duration of labour of about one hour (mean difference -64.38 minutes) and a significantly shorter mean length of second stage of labour compared with those who received i.v. fluid at 125 ml/hour. No differences were found in the other secondary outcomes. There were no maternal or perinatal deaths and only one woman, in the 125 ml/hour group, developed pulmonary edema. The findings persisted regardless of the type of i.v. fluid used. No significant reduction in the incidence of CS was demonstrated in women with unrestricted oral intake; however, this was limited to only two studies evaluating 254 women. The findings provide evidence that the duration of labour in low-risk nulliparous women may be shortened by a policy of i.v. fluids at a rate of 250 ml/hour rather than 125 ml/hour. A rate of 250 ml/hour seems to be associated with a reduction in the incidence of CS compared to 125 ml/hour. The number needed to treat to prevent one CS is 18 women.[13]

There are no published protocols or guidelines available to address i.v. fluid management during labour to optimize care for women and their newborn. Thus, this study was conducted to compare the effect of i.v. RL at 125 ml/hour versus 250 ml/hour on the duration of labour in low-risk nulliparous women in spontaneous early labour.

Aims and objectives

To assess the effect of intravenous ringer lactate administration at 125 ml/hour versus 250 ml/hour on the duration of labour in low-risk nulliparous women at term in spontaneous active labour.

METHODS

This randomized controlled trial was conducted in the labour room of the department of obstetrics and gynecology of Dr Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh for a period of one year from 1st January, 2020 to 31st December, 2020. Two hundred low risk nulliparae with singleton gestation in spontaneous active labour were randomized into two groups after taking informed consent based on the following inclusion and exclusion criteria.

Inclusion criteria

Nulliparous women, age between 18-40 years, spontaneous early active labour (between 3-5 cm cervical dilation), singleton pregnancy, cephalic presentation, term pregnancies (period of gestation between 37-42 weeks).

Remaining women were excluded from the study.

Methodology

Enrolment was done as per the above inclusion and exclusion criteria and informed consent. Complete history including present pregnancy and obstetric history was

recorded in a precoded performa. A total of 200 women were randomised into one of the two groups by computer generated random number table.

Group 1

This group received i.v. RL at 125 ml/hour throughout labour till delivery of the fetus.

Group 2

This group received i.v. RL at 250 ml/hour throughout labour till the delivery of the fetus.

Partogram was used to monitor fetal heart rate, membrane status, colour of the liquor, cervical dilatation and effacement, station of the fetus, uterine contraction, maternal pulse, maternal blood pressure, maternal temperature, and drugs given with their rate and dose. Of these, the membrane status, the color of the liquor, cervical dilation and effacement and station of the fetus were assessed 4 hourly by per vaginal examination and the rest of the parameters were assessed half hourly and plotted on the partogram.

Amniotomy, oxytocin augmentation and administration of different drugs was allowed according to the labour room protocol.

Primary outcome

Primary outcome was duration of labour.

Secondary outcomes

Maternal- incidence of prolonged labour (active labour >720 minutes), need for cesarean section, need for augmentation of labour.

Analysis of variance (ANOVA) and Kruskal-Wallis tests were used for analysis of continuous variables, and Fisher exact tests were used for categorical data using Microsoft Excel v2301. All tests were two sided, and statistical significance was defined as $p<0.05$.

RESULTS

Our observations were as follows:

Table 1 shows the maternal parameters in both the groups.

There was no significant difference in the maternal parameters including age, POG, BMI and bishop score during admission in both the groups.

Table 2 shows the outcomes of the study. There was no statistically significant difference in the duration of labour (p=0.978) and incidence of caesarean section (p=1.000) in both the groups.

The incidence of prolonged labour was 8% in group 1 and 2% in group 2. Similarly, oxytocin augmentation was required in 13% and 9% women in group 1 and 2 respectively. This value, however, did not reach statistical significance, p=0.105 and p=0.366 respectively.

Table 1: Maternal parameters of women in both groups.

	125 ml/hr (n=100)	250 ml/hr (n=100)	P value
Age (years)	25.74	25.96	0.542
Period of gestation (weeks)	38.8314	38.7954	0.795
BMI (kg/m^2)	22.676	22.623	0.826
Cervical dilatation (cm)	4.05	4.02	0.715
Cervical effacement (%)	52.4	52.8	0.692
Bishop score	7.22	7.22	1.000
Artificial rupture of membranes (n)	50	54	0.571

Table 2: Outcomes of the study.

	125 ml/hr (n=100)	250 ml/hr (n=100)	P value
Duration of labour (minutes)	412.69	412	0.978
Prolonged labour (DOL>720m)	8	2	0.105
Cesarean delivery (%)	4	4	1.000
Spontaneous vaginal delivery (%)	90	91	0.809
Operative vaginal delivery (%)	6	5	0.756
Oxytocin use (n)	13	9	0.366

DISCUSSION

Maternal hydration during labour is vital for fetal oxygenation, delivery of nutrients, and removal of waste from the contracting myometrium during labour.[7] The labouring uterine smooth muscle may be compared to periods of prolonged exertion as is seen with prolonged exercise, for example, in distance runners. Several prospective randomized trials in the field of sports medicine have demonstrated that regular fluid replacement during exercise improved performance and prevented dehydration in long-distance runners.[14-16] Extrapolating the data from exercise physiology to uterine smooth muscle, may provide some insight as to why some women who may be inadequately hydrated undergo prolonged labour.[17] Uterine blood flow is not autoregulated and in the presence of decreased intravascular volume (which may occur secondary to dehydration), fluid may be

redistributed away from the uterus potentially aggravating the problem.[8]

Difficult labour (or dystocia) is characterized by abnormally slow labour progress arising from inefficient uterine contractions, abnormal fetal presentation or position, inadequate bony pelvis or abnormalities of the pelvic soft tissues of the mother.[18,19] Evidence suggests that up to one third of first-time mothers' experience delay in the first stage of labour.[20] Primary CS section (CS) rates are over 20% in many countries. This increase in primary CS especially in young mothers, is a matter of concern. One of the main reasons for this high rate in nulliparous women is dystocia or prolonged labour.[21] Glucose is the main substrate for the pregnant uterus. However, patients in the first and second stage of labour have limited or zero caloric intake secondary to concerns of aspiration pneumonia if operative delivery is anticipated. Adequate supplies of glucose are needed to maintain exercise tolerance and muscle efficiency, so these are important factors in the progress of human labour and parturition. Thus, it can be postulated that dysfunctional or prolonged labour, a leading indication for primary CS delivery, could, at least in part, be caused by inadequate uterine forces or inappropriately coordinated contraction because of presence of the low substrate.[22,23]

Augmentation of labour is the process of stimulating the uterus to increase the frequency, duration and intensity of contractions after the onset of spontaneous labour. It has commonly been used to treat delayed labour when poor uterine contractions are assessed to be the underlying cause.[24] The traditional methods of labour augmentation have been with the use of i.v. oxytocin infusion and artificial rupture of the membranes (amniotomy). Over the last few decades, efforts to avoid prolonged labour in institutional birth have led to the use of a range of practices to either accelerate slow labour or drive the physiological process of normally progressing labour. While interventions within the context of augmentation of labour may be beneficial, their inappropriate use can cause undue harm.[24]

The three most common i.v. solutions used in labouring patients are normal saline, ringer lactate (RL), and dextrose solutions.[18] The American College of Obstetricians and Gynecologists (ACOG) recommends that whenever i.v. fluids are necessary, the type of solution and the amount infused should be determined on an individual basis.[25] Normal saline and RL are isotonic solutions, meaning that they allow water to flow freely at a cellular level, without causing cells to swell or shrink. Dextrose solution is also an isotonic solution but does not act as one. It provides calories that the body can use for energy, but as the dextrose is used up, the solution becomes hypotonic and pulls water into the cells.[26]

There are a few limitations to the study. Variables such as patient's thirst, vomiting, amount of vomitus was not considered. Mucous membrane and tissue turgor, specific gravity of urine and osmolarity of serum and urine was not evaluated.

CONCLUSION

Labour is dependent on many factors and rate of fluid administration is one of the factors which affects the rate of prolonged labour and need for augmentation as depicted in the above study. According to the study, the duration of labour, mode of delivery and rate of cesarean delivery is not affected by the rate of fluid administration.

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