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### Original Research Article

## Comparison of the Effect of Different Serums on the Acid-base Status of Women Elective Cesarean Section Candidates

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### ABSTRACT

**Introduction:** Ringer-lactate serum has not been used for fluid therapy around cesarean section due to its positive effects on acid-base status, and few studies have compared these two. The type of serum was not performed in cesarean section, so the aim of this study was to compare the effects of 0.9% sodium chloride serum with Ringer lactate serum on maternal acid-base status in elective cesarean section. **Material and Methods:** This study is a clinical experience that was performed with the participation of 60 women candidates for elective cesarean section in Al-Zahra Hospital (Tabriz University of Medical Sciences). Women were divided into two different groups and in each group different serum was injected for the patient; Before and after cesarean section, 2 cc of arterial blood was taken from women and the number of acid-base changes was measured at different times. **Results:** maternal pH and BE in the 0.9% sodium chloride group changed from 7.4 and -1.1 before surgery to 7.32 and -4.8 after surgery, respectively. Which indicates the occurrence of acidosis in this group that these changes are statistically significant ( $p=0.01$ ). In the ringer lactate group, only in BE before and after surgery, it indicates acidosis in this group (from -0.6 to -3.1) and is significant ( $p=0.01$ ). **Conclusion:** it can be concluded that 0.9% sodium chloride in comparison with lactate ringer causes acidosis in mothers under elective cesarean section with spinal anesthesia.

**Keywords:** Acid-Base, Cesarean Section, Serums Therapy.

## Introduction

Crystalloids are solutions containing water and easily permeable ions, which mainly contain sodium and chlorine [1]. Crystalloid solutions can be hypotonic, isotonic, or hypertonic relative to plasma. One of the most widely used solutions is 0.9% sodium chloride, which has a sodium and chlorine concentration of 154 meq / L and therefore has an SID of zero [2]. Its osmolarity is 285 mosml / kg, which is very similar to plasma. Injection of two liters of 0.9% sodium chloride fluid increases the volume of extracellular fluid (ECF) and progressively decreases hematocrit and albumin, increases chlorine and decreases in bicarbonate [3]. Sodium chloride infusion of 0.9% leads to hyperchloric metabolic acidosis. Although the outcome is unclear in people undergoing surgery, an increase in kidney injury and the need for RRT has been seen in intensive care patients compared to chlorine-free solutions. Infusion of large volumes of 0.9% sodium chloride (50 cc/kg) caused abdominal discomfort, nausea and vomiting; It may also interfere with tissue perfusion, inflammatory responses, and progressive coagulopathy [2, 3]. Balancing crystalloids have been proposed as an alternative to unbalanced solutions to reduce their harmful effects [4]. By substituting serum chloride for 0.9% sodium chloride with lactate or acetate, a crystalloid solution is obtained. It should be noted that balancing solutions containing organic anions (such as lactate, acetate, gluconate, etc.) in vitro have an SID similar to 0.9% isotonic sodium chloride and equal to zero. But in vivo, the metabolism of these anions increases SID and decreases soluble osmolarity [5, 6]. The most common alternative to 0.9% sodium chloride is lactate (Hartmann) ringer solution, which has a combination of ionic components close to the blood. This solution has a lower chlorine content than 0.9% sodium chloride and is a more balanced crystalloid. Lactate ringer solution is a modified solution of ringer containing racemic lactate (L and D). Its calculated osmolarity is 265 mosml / kg and its osmolarity is approximately lower than that of plasma and other hypotonic solutions [7]. Lactate ringer is composed of sodium chloride, sodium lactate, potassium chloride and calcium chloride with ionic concentrations of 130 mEq, 109 mEq chlorine, 29 mEq lactate, 4 mEq potassium and 3 mEq calcium. The compartment distribution of the balancing fluids is similar to that of a crystalloid, and after administration, the buffer produces bicarbonate by entering the citric acid cycle [8]. Lactate is predominantly oxidized by the liver and converted to gluconeogenesis and converted to bicarbonate. Excess fluid excretion in balanced crystals is much faster than isotonic saline.

This is because the transient decrease in tonicity after infusion of balanced crystalloid suppresses ADH secretion and leads to diuresis following an increase in intravascular volume. In patients with renal insufficiency, high levels of lactate D are associated with encephalopathy and heart poisoning. Lactate-containing fluids should be limited in patients with hepatic impairment [9]. Considering that the maternal acid-base status of the mother during childbirth is effective on the infant-base acid and the obvious changes of the infant acid-base in the first minutes can have adverse effects on the hemodynamic status of the baby up to the first week and given that serum chloride 0.9% sodium is routinely used in medical centers, but so far Ringer-lactate serum has not been used for fluid therapy around cesarean section due to its positive effects on acid-base status, and few studies have compared these two. The type of serum was not performed in cesarean section, so the aim of this study was to compare the effects of 0.9% sodium chloride serum with Ringer lactate serum on maternal acid-base status in elective cesarean section [10].

## Material and Methods

This study was a clinical experience that was conducted during 2020 in Al-Zahra Hospital (affiliated to Tabriz University of Medical Sciences) with the participation of 60 pregnant women. The minimum sample size based on similar articles and taking into account the amount of pH changes in the two groups and the test formula of two averages related to a variable can be examined in two independent communities and taking into account alpha 5%, and beta equal to 0.2 equal to 24 people. Was obtained in each group; Participants in the study were randomly selected from all eligible women referred to the operating room of Al-Zahra Hospital and were randomly divided into two groups. Participants were randomly assigned to one of the two groups of sodium chloride or lactate ringer, respectively, using a random list prepared using online statistical software ([www.randomizer.org](http://www.randomizer.org)); In this method, two groups were defined in the relevant software and the volume of each group was also determined. Then, each person who entered the study was placed in one of the two relevant groups based on the random software list. To ensure that the mothers' division was unaware, the anesthesiologist was responsible for performing the procedure and could not be blind during the study, but the data collection was done by another person and the data collector as well as the statistical consultant (data analyzer) of the group type. Participants were unaware and were blind during the study; Therefore, this study was a three-way blind.

Inclusion criteria included: full-time pregnant mother, singleton pregnancy, anesthesia class II or ASA class I, candidate for elective cesarean section with spinal anesthesia, age 18 to 45 years and willingness to participate in the study and exclusion criteria. Includes, gestational hypertension, preeclampsia, eclampsia, HELLP syndrome, obesity, underlying maternal diseases such as any history of heart, lung, liver, kidney, emergency cesarean section such as fetal bradycardia, placenta previa or other peripartum bleeding conditions, Existence of acid-base disorder in the mother's primary ABG, any contraindications to regional anesthesia, sensitivity to local anesthetics or failure of spinal anesthesia after three attempts and turning it into general anesthesia, abnormal bleeding and more than 1000 cc Blood and product transfusions were required during surgery for any reason. To ensure intravenous for all mothers, angiocatheter No. 18 was installed and immediately the infusion of fluids according to the desired group as the only fluid during the operation began and continued during the operation until the mother was transferred to the ward. In group 1, preoperative infusion of serum sodium chloride 0.9% and in group 2, Ringer's lactate serum was started. Upon entering the operating room, standard monitoring included HR (heart rate), NIBP (non-invasive blood pressure), RR (respiration rate) (electrocardiogram), ECG, and (arterial oxygen saturation) SPO<sub>2</sub>, and vital signs of the mother, including blood pressure. Heart rate, SPO<sub>2</sub> were recorded every 2 minutes to 10 minutes and then every 5 minutes to 30 minutes and then every 10 minutes until the end of the operation. Intravenous blood samples were checked for urea and creatinine for all mothers before surgery. Also, before spinal anesthesia in the operating room, by subcutaneous anesthesia with half a milliliter of 2% lidocaine, one milliliter of arterial blood sample was taken from the mother in a heparinized insulin syringe from the radial artery and arterial blood gases were analyzed for acid-base status. In ABG sample, PH, HCO<sub>3</sub><sup>-</sup>, Base Excess, PCO<sub>2</sub>, Po<sub>2</sub> factors were analyzed and recorded and compared in two groups. If there was an acid-base disorder in the initial ABG sample, the participant was excluded from the study process. Spinal anesthesia in a sitting position under sterile conditions was performed by midline method from L3-L4 or L4-L5 space between the vertebrae with Quincke needle number 25 and 10 mg of bupivacaine 0.5% (2) and 10 micrograms of fentanyl injected (2) And immediately the mother was in the supine position and to avoid pressure on Vanakawa, the bed was tilted 15 degrees to the left. The level of sensory block was assessed by pin prick test and surgery was allowed to begin if the level of anesthesia reached T4-T5. During and after surgery and in recovery until the mother was

transferred to the ward, accurate and continuous monitoring of the mother (by an anesthesiologist) was performed and in case of any possible complications, immediate intervention was performed. Possible side effects of sympathetic block include hypotension of 20% or more in systolic or bradycardia with HR below 50 treated with vasopressors and atropine, as well as other complications (respiratory depression, nausea and vomiting, chills, pruritus). And was treated. The use of vasopressor and atropine in the two study groups were recorded and compared. After the baby was removed, 30 units of oxytocin were injected into the mother's serum by infusion. At the end of the surgery, with continued fluid infusion, the mother was transferred to recovery. After stabilization in recovery and before transfer to the ward, an arterial blood sample was taken from the radial artery to analyze arterial blood gases. PH less than 7.32 and BE less than 3- were considered and recorded for acidosis mother. The amount of bleeding was calculated by observing the blood in the suction container and by observing the gases, and in case of abnormal bleeding above 1000 ml, it was compensated with fluids and, if necessary, with blood products, and these people were excluded from the study. Total volume of intraoperative infusion fluid, amount of bleeding, urinary outflow and total time of surgery and anesthesia were recorded. All study data were collected through a questionnaire prepared for this purpose. Data were analyzed using SPSS software version 21. The normality of the data was evaluated using K.S test [29-31]. Frequency (percentage) was used to describe qualitative data, mean (standard deviation) was used for quantitative data, and median (25th and 75th percentiles) was used for non-normality. Chi-square test was used to analyze the qualitative data in these two groups and independent t-test was used for quantitative data if normal and Mann-Whitney test was used if there was no normality [32-35]. To analyze quantitative data in time sequence in these two groups, if normal, paired t-test and repeated measures analysis of variance were used, and if not normal, Wilcoxon and Friedman test were used [35-37]. Differences and changes with P less than 0.05 ( $P < 0.05$ ) between the two groups and at different times were considered statistically significant. This study was carried out with the approval of the ethics committee of Tabriz University of Medical Sciences and obtaining informed consent from all participants.

## Results

The situation related to the incidence of maternal acidosis in the two groups was compared between the two groups. As can be seen in Table 1, maternal pH and BE in the 0.9% sodium chloride group changed from 7.4 and -1.1 before surgery to 7.32 and -4.8 after surgery, respectively. Which indicates the occurrence of acidosis in this group that these changes are statistically significant ( $p=0.01$ ). In the ringer lactate group, only in BE before and after surgery, it indicates acidosis in this group (from -0.6 to -3.1) and is significant ( $p = 0.01$ ). All the studied factors are significant between the two groups, which indicates a higher acidity in the sodium chloride group of 0.9%.

**Table 1:** Table 1: Status related to maternal acidosis before and after surgery in two groups of participants

Variable	Groups	Mean±SD	P Value
PH	Ringer Lactate	7.25±0.07	<b>0.01</b>
	N/S	7.20±0.11	
PCO2	Ringer Lactate	50.36±5.55	<b>0.01</b>
	N/S	48.11±3.45	
HCO3	Ringer Lactate	21.59±3.59	<b>0.01</b>
	N/S	18.74±2.96	
BE	Ringer Lactate	-3.89±0.89	<b>0.01</b>
	N/S	-3.15±0.55	

All variables related to the incidence of short-term complications are insignificant between the two groups ( $P<0.05$ ). Hypotension was the most common complication among other complications which was observed in 39.6% of participants. In all groups, 3 patients (6.2%) needed to use atropine and 3 patients (6.2%) needed to use phenylephrine. In both of these drugs, 2 patients (8.3%) were from lactate ringer group and 1 patient (4.2%) from sodium chloride group were 0.9%. Also, 19 patients (39.6%) from all groups needed to use ephedrine, of which 9 patients (37.5%) from the lactate ringer group and 10 patients (41.7%) from the sodium chloride group were 0.9%. And no significant difference was observed between the two groups.

## Discussion

The aim of this study was to compare the effect of Ringer's lactate serum with 0.9% sodium chloride on the acid-base status of mother and infant in elective cesarean section. The percentage is that this difference is significant. In a study by Emmanuel Ayebale et al. (2017), which examined the effects of lactate ringer and 0.9% sodium chloride on emergency cesarean section, showed that the amount of maternal metabolic acidosis was significantly lower in the lactate ringer group [9]. In a study by Nessler et al., 31% of patients in the 0.9% sodium chloride group developed metabolic acidosis, and patients in this group developed hyperkalemia during surgery ( $k < 6$ ) and required treatment. Hartmann solution (lactate ringer) seems to reduce metabolic acidosis compared to ringer, which can be due to the initial nature and ionic composition of the solution or the compensatory process such as conversion of lactate to bicarbonate or bicarbonate to carbon dioxide, etc [10-12]. Almost all the results of these studies are consistent with the results of the present study in that Ringer's lactate serum performs better in not significantly altering the pH [13-15]. Regarding the effect of 0.9% sodium chloride on acid-base status, almost all studies, both significant and insignificant, point to the effect of 0.9% sodium chloride exacerbation on acidosis status and it seems that prescribing Lactate ringer compared to 0.9% sodium chloride leads to good results in keeping the body pH constant [6, 16-18]. In this study, the rate of urinary output in mothers of Ringer-Lactate group was less than 0.9% sodium chloride group, but this difference was not significant. In a study by Reid et al. (2003), which compared the effects of a two-liter infusion of 0.9% sodium serum with ringer lactate serum for two hours in healthy volunteers, showed that urinary output was 0.9% lower in the sodium chloride group [19-21]. In the study of Nouraie et al., the rate of urinary output at the end of the first 24 hours after kidney transplantation was not significantly different between the two groups of 0.9% sodium chloride and lactate ringer [22-25]. According to the results of the above studies, the results of the present study are inconsistent with the study of Reid et al., But with the light study, which indicates a decrease in urinary output (albeit insignificantly) [26-28].

## Conclusion

From this study, it can be concluded that 0.9% sodium chloride in comparison with lactate ringer causes acidosis in mothers under elective cesarean section with spinal anesthesia, but none of

them have a significant effect on the acid-base status of the baby. Therefore, Ringer's lactate serum seems to be a good alternative to 0.9% sodium chloride serum, especially in mothers who are at higher risk of acidosis, with better results, although this needs to be studied more comprehensively.

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