

# SERUM POTASSIUM IN MOTHER AND FETUS DURING NORMAL DELIVERY AND CESAREAN SECTION

H. ZAKUT (\*)  
M. TVERSKOY (\*\*)  
E. FURMANN (\*)

(\*) Department of Obstetrics and Gynecology

(\*\*) Department of Anesthesiology,

Rebecca Sieff Hospital, Safed, Israel.

## SUMMARY

The influence of i.v. succinylcholine in term pregnant women on serum potassium of the fetus and of their own blood samples of two groups were taken to estimate the potassium level of women and their fetuses:

34 women delivering spontaneously and 24 by cesarean section using general endotracheal anesthesia.

No significant differences were found in the newborns of serum potassium level of both groups, a finding which teaches, that succinylcholine given to the mother, has no significant influence on the serum potassium level of the newborn. Likewise, no significant change was foreseen in the serum potassium level in women after introduction of succinylcholine during cesarean section, in contrast to an increase of the serum potassium reported in the literature.

A major problem, that arises during cesarean section, beside that of preventing newborn depression by drugs given to the mother during surgery, is that of the prevention of biochemical disbalance in his body. One of those drugs in use is succinylcholine for endotracheal intubation performed during general anesthesia. Following the introduction of depolarizing muscle relaxants into clinical practice, data indicating that these substances increase blood plasma potassium levels began to appear in the medical literature<sup>(1,2)</sup>. Articles in Journals of Anesthesiology repeatedly confirmed this finding<sup>(3,7)</sup>, which has been incorporated into many standard textbooks<sup>(8-10)</sup> and is generally accepted. However, exists also the contrary opinion that there is no connection between serum potassium and succinylcholine induced muscle depolarization<sup>(11)</sup>.

In their recent thorough studies Bali et al.<sup>(12-15)</sup> demonstrated consistant small increase in plasma potassium following succinylcholine, although the timing and degree of the peak increase varied with the induction agent. In these as well as the majority of other studies, the timing of blood sampling was according to the clock rather than to clinical observation. Since both the rate of injection and the timing of patient response are variable, potassium ions are of fundamental importance in electrolyte balance, previous study<sup>(16)</sup> was undertaken in order to reveal the changes in serum potassium concentration at different clinical stages of the induction of endotracheal anesthesia with thiopentone sodium and succinylcholine chloride.

Reviewing the literature we found that succinylcholine passes the placenta<sup>(17,18,19)</sup>. Drabkova et al.<sup>(20)</sup> using labeled <sup>14</sup>C succinylcholine on monkey embryos of the macaca mulata species, found that the greatest concentration of the succinylcholine in the embryo appears 5-10 minutes after the injection to the mother. From

our experience the extraction of the baby during uncomplicated cesarean section takes about 4-6 minutes. According to the knowledge that the administration of succinylcholine causes a rise of serum potassium<sup>(5, 16, 21)</sup> we decided to study the influence of succinylcholine injected to mothers during cesarean section, on the newborn serum potassium levels as well as in the mother's serum.

## MATERIAL AND METHODS

The study was carried out on 58 pregnant women at term, admitted for delivery, and their newborns. All the women were in good general health condition with no abnormal findings on clinical examination or laboratory investigation performed during pregnancy including normal renal function tests and E.C.G.

The women's ages ranged between 17 to 37 years.

The women were divided into two groups: the first one included 24 pregnant women who underwent lower segment cesarean section performed under general anesthesia.

The second group, the control one, was composed of 34 women who delivered spontaneously by a normal vaginal delivery without any pathology.

All the first group received 0.5 mg i.v. atropine on the operating table and the induction of anesthesia was by i.v. injection of 5% propomid \* up to the required point of anesthesia followed immediately by i.v. injection of succinylcholine in a single dose of 1.25 mg per

kilo body weight for relaxation, prior to the endotracheal intubation.

The continuous respiration was by combination of gases  $N_2O/O_2$  at a ratio of 3/2. According to our approach, the women did not receive any other medication up to the extraction of the newborn.

In the first group two tests of serum potassium were performed on mother's blood: one test was before starting anesthesia and the second immediately after the newborn extraction. Contemporaneously, at the time of the second blood test taken from the mother, blood withdrawal was also done from the umbilical cord of the newborn for serum potassium. This blood was taken immediately after the tying of the umbilical cord.

In the second group, the same two tests of serum potassium in mothers were done: the first was performed at the first stage of labour and the second immediately after delivery. Blood was taken for serum potassium from the umbilical cord of the newborn, after it was tied, while taking blood for the second time from the mother. The level of the serum potassium was measured by the photometric system with an accuracy of  $\pm 0.1$  mEq/lit.

## RESULTS

The results, after they were processed statistically by the « student test », are shown in table no. 1.

The absolute levels of serum potassium in the mother in both tests ( $x_1$ : mean of the first test and s.d.,  $x_2$ : mean of the second test and s.d. and  $x_3$ : mean of the umbilical cord blood potassium after birth.

Table 1. — Serum potassium levels (mEq/lit) during cesarean section. Anesthesia and in normal deliveries:  $x_1$  = maternal initial blood sample;  $x_2$  = maternal second blood sample;  $x_3$  = fetal blood sample.

	Cesarean section n = 24	Limit of 95%	Normal deliveries n = 34	Limit of 95%
$x_1$	$4.220 \pm 0.093$	$\langle 4.023 - 4.417 \rangle$	$4.197 \pm 0.041$	$\langle 4.113 - 4.280 \rangle$
$x_2$	$4.192 \pm 0.128$	$\langle 3.921 - 4.463 \rangle$	$4.188 \pm 0.046$	$\langle 4.094 - 4.282 \rangle$
$x_3$	$4.933 \pm 0.176$	$\langle 4.560 - 5.306 \rangle$	$4.868 \pm 0.080$	$\langle 4.705 - 5.031 \rangle$
$\frac{x_3}{x_1}$	$1.169 \pm 0.035$	$\langle 1.094 - 1.244 \rangle$	$1.160 \pm 0.022$	$\langle 1.115 - 1.205 \rangle$
$\frac{x_3}{x_2}$	$1.177 \pm 0.047$	$\langle 1.077 - 1.277 \rangle$	$1.162 \pm 0.019$	$\langle 1.123 - 1.201 \rangle$

Table 2. — Serum potassium levels (mEq/lit) during cesarean section anesthesia. Before and after administration of succinylcholine.  $x_1$  = maternal initial blood sample;  $x_2$  = maternal second blood sample.

$x_1$	4.3	4.2	4.8	4.4	4.1	3.9	3.8	3.6	4.5	4.2	4.2	5.0	4.7	4.0	4.2	4.1	4.2	4.2	4.2	4.0	3.6	5.5	3.4	4.2
$x_2$	4.4	4.2	5.0	3.7	4.1	4.2	4.0	3.4	4.9	4.2	4.2	4.3	3.7	4.0	4.0	4.2	4.2	3.9	4.2	3.2	4.2	5.4	3.1	5.4

$x_3/x_1$  - The relationship between mean serum potassium in the newborn to the mean of the beginning level of the serum potassium in the mother.

$x_3/x_2$  - The relationship between mean serum potassium in the newborn to the mean serum potassium in the mother at the same time.

The levels of serum potassium in the cesarean section group are presented in table 2, in which

$x_1$  - First blood test for potassium in the mother.

$x_2$  - Second blood test for potassium in the mother after the injection of succinylcholine.

## DISCUSSION

The effect of succinylcholine on the newborn serum potassium level was not seen during the above mentioned anesthetic procedure.

It was found that the absolute levels of the serum potassium in the fetus ( $x_3$ ) as well as the relative levels  $x_3/x_2$  and  $x_3/x_1$  were not significantly different in cesarean section as compared to spontaneous deliveries. It can be presumed that the treatment dose of succinylcholine in a single dose to the mother, has no effect practically, on the levels of serum potassium in the newborn (the range in absolute levels as well as the relative levels, in both groups coincide).

Consideration should be taken to the finding (shown in table 2) of no increase in the serum potassium level of the mother at the time of the extraction of the fetus, even with the introduction of succinylcholine. In 7 out of the 24 women

that underwent cesarean section no changes were noticed in the potassium level, while in other ten of them decrease of serum potassium was found, which is in contrast to the expected in the medical literature data. Seven women showed an increase of serum potassium after introduction of succinylcholine. The finding can be explained in the thinning effect of the blood after extraction of the newborn, when the venous pressure in the lower extremities of the woman giving birth is decreased and the venous return intensified.

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