



STUDY OF LITHIUM ELIMINATION IN PATIENTS WITH CHRONIC RENAL DISEASE

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Abstract. Lithium belongs to the class of toxic elements. The maximum value permitted in blood is 3 µg/l, and 500 µg/l in urine [12]. Salt form is used as an antidepressant. There were analyzed blood samples collected from a sample of 50 subjects with normal renal function (creatinine <1.5 mg/dl), considered the control group, the average of creatinine being 0.99 mg/dl. The study group consisted of 50 patients with chronic renal disease. Blood samples were taken before and after dialysis and dialysis fluid samples, taken 0.5, 1, 2, 3, and 4 hours after, recorded with LD_{1...5}. From samples taken from both groups, concentration of lithium was determined. The authors also present the analytical technique based on atomic absorption spectrometry for determination of lithium in the samples mentioned above. Control group average was 0.42 µg/dl with values ranging from 0 to 2.7 µg/dl. Study group average was 3.29 µg / dl before and 1.58 µg/dl after dialysis. The averages of the five times of elimination of lithium in the dialysate were LD₁ = 13.85, LD₂ = 14.81, LD₃ = 12.85, LD₄ and LD₅ = 15,308 = 13.46 µg/l. The study includes analysis of lithium concentration by gender. Average clearance of lithium elimination during dialysis was 10.78 µg/min and total elimination average during the dialysis session was 2.59 mg. Student Test applied to the two groups both at coupling and at return does not differ, statistically speaking, significantly from the average of the control group. Given the small amount of lithium removed during a dialysis session, special attention should be paid to the potential antidepressant treatment based on lithium due to risk of accumulation and hence occurrence of iatrogenic acute poisoning.

Keywords: chronic kidney disease, lithium, atomic absorption spectrometry

Introduction

Lithium is a monovalent alkali metal which, usually, the human body lacks. Like all alkali metals, lithium is very reactive. It is used to treat manic-depressive psychosis, in lithium carbonate form. Lithium is completely absorbed after oral administration in 6-8 hours. Less than 10% of lithium is bound to plasma proteins. Half time is 14-30 hours. Removal from the body is made 95% through urine. In general, there is good correlation

between serum lithium levels and therapeutic / toxic effects. Values above 2 mmol/l indicate toxicity, as follows: 1.5 - 2.0 mmol/l extremity tremor occurs, at 2.0 - 2.5 mmol/l drowsiness appears and at values of over 2.5 mmol/l, it is considered life threatening, can trigger seizures. However, some patients without treatment response have adequate serum lithium levels, but lower erythrocyte concentrations. As lithium acts intracellular in these patients, erythrocyte lithium concentration determination could be more relevant than serum one [3]. Diet with low sodium concentration increases lithium concentration by decreasing excretion. Excessive consumption of caffeine and sodium reduce plasma levels of lithium [4]. In prolonged treatment with lithium, urinary osmolality, electrocardiogram, T₄, TSH, serum urea, creatinine and serum sodium are monitored. There are drugs that affect serum lithi-

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um: natriuretic diuretics reduce the renal clearance of lithium, metronidazole, NSAIDs and fluoxetine causes increases in these values. Methylparaben and N-acetylcysteine [10] lowers the concentration of lithium. In patients with chronic renal disease, elimination of lithium is done only by hemodialysis.

Material and method

This study is an analysis of prospective randomized study taken into two groups:

- A group of subjects with normal renal function
- control group – in which the concentration of lithium in the blood was determined;

A group of patients with chronic kidney disease, in which lithium concentration was determined from blood collected in before the dialysis session (coupling), at the end (return) and from five dialysate samples collected 30 min, 1, 2, 3 and 4 hours after start of dialysis.

Inclusion criteria for the control group were:

- normal renal function (creatinine <1 mg/dl);
- age must be between 3-60 years;
- not be under medical treatment with lithium preparations;
- subjects should belong to local habitat.

Inclusion criteria for the group of patients were:

- must be in a chronic dialysis unit project;
- age is between 18-65 years;
- not be under medical treatment with lithium preparations;
- dialysis efficiency measured by the parameter kt/V (creatinine by volume) > 1.2.

Control group subjects and patients in the study group will be analyzed under the following criteria: age and gender.

Patients performed: 13.5 hours per week of hemodialysis with an efficiency of $Kt/V > 1.2$, outlet dialysate flow is 500 ml/min. Vascular access is via arterio-venous fistula or long - life catheter.

Collected samples were the following:

- The control group - 1 ml blood collected on heparin tube and blood on biochemistry vacuum container to determine serum creatinine;
- The group of patients - 1 ml blood collected in heparinized tube at coupling and at restitution and 10 ml of dialysis fluid at the intervals required by the study protocol.

To determine the content of lithium in the dialysate liquid, there were harvested 10 ml of it before starting dialysis treatment.

For analytical examination of lithium, an atomic absorption spectrometry with atomization in graphite furnace - GF-AAS was used:

- AAS installation – Varian, composed of:
 - Atomic absorption spectrometer - SpectrAA 880;
 - Graphite tube atomiser - GTA 100
 - Autosampler PSD 25
 - Water refrigerated recirculator NESLAB CFT 33
 - Nitrogen generator - Domnik Hunter(purity 99.999%)
 - Analytical nitrogen - purity 99.999%
 - Analytical argon - purity 99.999%
- Equipment and common assets in a toxicology laboratory
- Reagents and consumables specific to AAS.

Sample preparation

Blood (1 ml) harvested from coupling (S_1) and return (S_2), is retained / transported in containers at 4° C. Outlet dialysate (10 ml) was harvested during the session at 30 min, 1, 2, 3 and 4 hours after the start of the maneuver, with LD_{1.5} code kept / transported in containers at 4° C.

Blood processing method consists of: mixing 200 ml blood with 800 ml B 5% antifoam and 1000 ml 1.6N HNO₃ water. After 20 minutes the liquid is centrifuged for 10 minutes at 2500 rotation/min. The supernatant is the matrix of the injection system. [5]

Outlet dialysate processing method consists in adding 1000 ml 65% nitric acid. After 20 minutes the liquid is centrifuged for 10 minutes at 2500 rotation/min. The supernatant is the matrix of the injection system.

Dialysate liquid used for dialysis patients was processed the same way as the dialysate.

Work parameters

For the determination of lithium concentration in the samples described in material and method, the following parameters were used for the GF-AAS installation:

- pipetting mode – automix
- the amount of sample injected - 10 ml
- a measurement - peak height
- calibration – in concentration
- smoothing - 9 points
- number of replicates - 2 for standard and sample
- lamp current - 5 mA
- wavelength - 670.8 nm
- slit width - 0.2 nm
- background correction – without
- drying - 85° C followed by 120° C
- roasting - 800° C
- atomization - 2700° C
- cleaning - 3000° C
- 4-point calibration curve - 0,10, 25 and 50 mg/l
- recalibration rate -16
- -automatic quality control - dispersion <10%

coefficient of correlation > 0.998; LDM 0.1 µg/l; LDI 0.04 µg/l [5]

Quality control of results is automatic, a reproducibility better than 10% being imposed. The New Rational calibration curve is obtained after Equation 1:

where:

A - is the absorbance of the sample

C - is the concentration of sample

$$A/C = a + b * A + cA^2$$

a, b, c, d - are the coefficients of the calibration curve

Correlation coefficient automatically imposed in the quality control is > 0.998. The calibration curve for lithium and the absorbance peak for the sample are presented in figure 1

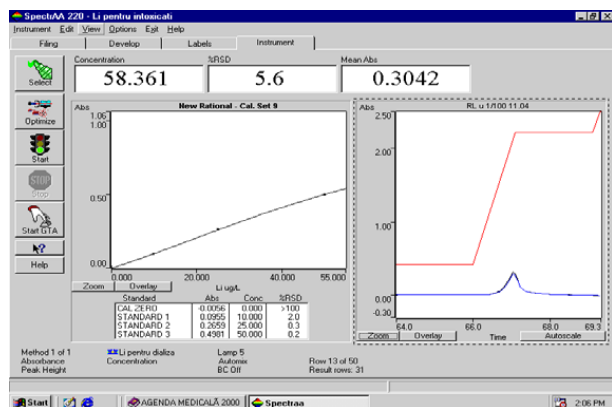


Figure 1. Calibration curve and the absorbance peak given by lithium

Sensitivity of the method is 0.08 µg/l.

GF-AAS system sensitivity of 0.04 µg/l.

For statistical analysis, Student test was used, be it odd or even.

To calculate the amount of lithium removed during dialysis session, the following relationship was used (2):

$$Q = \sum_{i=0}^5 DLD \frac{C(i) + C(i+1)}{2} (t_{i+1} - t_i)$$

where:

Q - quantity of deletions (µg)

DLD - dialysis liquid flow rate (l/min)

C (i) - lithium concentration in the dialysate (µg/l)

t_i - the time at which the determination was made (min)

Results and discussion

By analyzing blood samples from the control group were obtained for lithium values in Table 1.

The average age of control group is 39.82 years with a standard deviation of 13.06 and a standard deviation of the mean of 1.87.

Control group mean creatinine was 0.931 mg/dl with a standard deviation of 0.221 and a standard deviation of the mean of 0.03, showing a normal renal function for control group subjects. Limit values of creatinine are included in the 0.56 - 1.5 mg/dl.

The control group consisted of 37 men (74%) and 13 women (26%). The mean age of men (49.19 years) did not differ significantly from the average of sample women (38.77 years).

Nr	Name	Age	Gender	Creatinine(mg/dl)	Lithium(µg/dl)
1	PP	29	M	.8	0.7
2	AA	44	M	.9	0.3
3	CV	23	M	.7	0
4	ND	57	M	1	0.4
5	CG	60	M	.9	0
6	MT	57	M	.85	0
7	ZC	23	M	.95	0
8	NM	60	M	.8	0.1
9	RM	57	M	1.4	0
10	IC	60	M	.8	0
11	PM	56	M	.6	0
12	TA	23	M	.9	0.6
13	NO	30	M	.9	0.2
14	BV	32	M	.7	1.3
15	MG	43	M	.7	1.5
16	MF	45	M	.56	0
17	MS	41	M	1.12	2.56
18	PV	53	M	1.1	0
19	DS	44	M	.9	1.53

Table I.(continue on the next page) lithium values obtained from control group

Nr	Name	Age	Gender	Creatinine(mg/dl)	Lithium($\mu\text{g/dl}$)
20	LA	27	M	1.2	1.04
21	EMD	34	M	1.5	0.125
22	CC	42	M	1.4	0.422
23	DO	40	M	.8	0
24	SM	38	M	.9	0
25	IA	22	M	.7	0
26	SA	59	M	.66	0.144
27	SRC	25	M	1.2	0
28	BI	54	M	.6	0
29	VA	56	M	.8	0
30	MG	28	M	.9	0.38
31	MS	41	M	1	0
32	PM	23	M	1.1	0
33	NP	33	M	1.1	2.753
34	NA	3	M	.8	0
35	MN	42	M	.8	0
36	AG	45	M	.8	0
37	IM	38	M	.8	0
Mean M		40.18919		0.90918919	0.37983784
SD M		14.112323		0.22567649	0.70050999
MSD M		2.35		0.04	0.12
38	GL	41	F	.6	0
39	MJ	42	F	1.2	1.2
40	DC	42	F	1.18	0
41	BM	45	F	1.3	0
42	NN	47	F	.95	0
43	FC	27	F	.7	1.5
44	VA	51	F	1.2	1.6
45	ME	33	F	1	0
46	CE	51	F	.88	0
47	DA	46	F	.9	1.13
48	CM	32	F	1	1.05
49	SM	22	F	1.1	0.155
50	AM	25	F	.9	0.083
Mean F		38.7692308		0.99307692	0.516769231
SD F		9.88394191		0.20385389	0.657562311
MSD F		2.86		0.06	0.19
Mean Lot		39.82		0.931	0.42
SD Lot		13.06294		0.221306	0.685636
MSD Lot		1.87		0.03	0.1

Table I.(continued) lithium values obtained from control group

Creatinine average value in the group of men (0.91 mg/dl) did not differ significantly from the average of sample women (0.99 mg/dl).

Average value of lithium concentration in blood in the group of men (0.52 $\mu\text{g/dl}$) did not differ significantly from the average of sample women (0.42 $\mu\text{g/dl}$).

Average blood concentration of Li in the control group subjects is 0.42 $\mu\text{g/l}$, with a standard deviation of 0.7 and an average standard deviation of 0.02. Lithium concentration is slightly higher than

the maximum permissible value of 0.3 $\mu\text{g/dl}$ [12].

By analyzing blood samples collected before the dialysis procedure (S_1), at the end (S_2) and dialysate ($LD_{1 \dots 5}$) from the group of patients with chronic kidney disease, values in Table 2 were obtained.

Lithium concentration in the dialysate is below the detection limit of the method, considered zero. In order to perform mathematical calculations, the same zero value was attributed to samples that had absorbance below the detection limit of the method.

Statistical analysis of the group of patients using

NR	CODE	G	AGE	S1	S2	LD1	LD2	LD3	LD4	LD5
1	P4	M	50	4.151	2.234	1.943	12.542	14.787	12.576	10.3
2	P6	M	31	2.03	1.48	8.98	7.35	8.70	6.19	5.11
3	P8	M	72	.144	.314	.669	.609	.702	.707	.665
4	P9	M	58	4.08	0	14.32	14.99	0	20.64	12.34
5	P10	M	58	1.912	1.653	0.775	0.755	0.660	0.461	0.403
6	P11	M	22	3.658	4.14	24.885	23.247	18.980	16.451	13.524
7	P13	M	53	0.054	0	9.372	6.220	3.950	1.816	1.175
8	P14	M	60	0.947	0.326	47.12	46.4	45.46	45.7	49.41
9	P21	M	64	0	0	2.52	1.96	0	0	0
10	P23	M	70	0	0	0	0	0	0	0
11	P26	M	58	0	0	1.38	3.43	2.17	8.02	2.35
12	P27	M	70	1.95	1.45	12.57	5.53	3.54	2.86	2.61
13	P28	M	68	.205	0	2.752	2.009	1.465	.952	.417
14	P29	M	62	5.63	5.41	5.47	5.85	35.99	36.85	30.86
15	P30	M	30	3.76	2.09	37.39	33.35	26.85	19.77	15.43
16	P31	M	67	.54	2.3	17.76	12.18	4.73	11.1	7.42
17	P32	M	71	0	0	3.67	3.64	2.66	0.19	1.93
18	P33	M	69	0	0.37	38.5	55.0	53.3	53.4	45.6
19	P38	M	67	0	0	1.51	2.40	0.76	0	34.01
20	P39	M	84	0.10	0	6.92	5.08	4.91	13.60	12.71
21	P40	M	68	0.20	0.64	15.64	14.65	13.65	12.13	9.46
22	P41	M	47	0	0	2.32	1.94	1.55	3.88	2.86
23	P42	M	64	0.62	0	34.11	31.70	29.81	21.07	12.35
24	P43	M	76	0.34	0	8.29	5.36	3.40	1.83	1.70
25	P44	M	63	0	0	8.09	6.59	6.34	5.69	4.68
26	P45	M	51	1.80	1.19	36.04	14.68	6.53	4.41	3.14
27	P50	M	73	0	0	1.56	2.52	0.52	47.82	20.16
Mean M			60.222	1.18	0.874	12.761	11.851	10.793	12.893	11.134
SD M			14.428	1.658	1.381	14.051	14.29	14.80	15.723	13.748
MSD M			5.2	0.32	0.27	2.7	2.75	2.85	3.02	2.64
28	P1	F	73	28.36	3.98	2.23	18.97	23.35	23.18	21.87
29	P2	F	74	4.156	1.715	4.804	35.936	17.077	18.767	25.25
30	P3	F	60	.335	-	1.684	7.076	29.356	46.842	34.534
31	P5	F	74	5.43	4.53	39.75	38.89	35.27	37.42	37.06
32	P7	F	58	2.203	2.457	56.61	33.66	21.18	39.18	15.68
33	P12	F	68	0.692	0	9.373	13.446	3.838	6.654	21.735
34	P15	F	78	4.64	4.53	9.659	3.653	8.727	7.384	6.078
35	P17	F	34	4.473	2.951	31.899	28.101	13.671	24.622	18.787
36	P18	F	70	20.1	0	0	23.749	20.56	21.83	26.53
37	P19	F	52	0	.214	5.065	5.738	6.249	7.228	7.502
38	P20	F	55	2.06	1.55	4.51	1.54	0	2.70	4.20
39	P22	F	45	2.01	1.12	3.39	4.27	4.42	3.00	0.35
40	P24	F	61	50.95	27.57	2.604	24.764	23.865	13.913	14.810
41	P25	F	67	0	0	14.41	10.84	7.351	2.62	0.872
42	P34	F	55	0.67	0.32	24.27	17.61	9.91	8.07	6.55
43	P35	F	47	3.46	1.94	23.67	20.55	15.75	14.76	11.60
44	P36	F	63	1.01	0	34.93	33.40	32.97	33.13	33.63
45	P37	F	55	0.69	1.11	2.12	31.39	32.27	52.83	49.95
46	P46	F	63	0.49	0	4.84	4.88	4.71	4.51	3.72
47	P47	F	35	0.4	2.16	37.37	33.74	14.01	12.37	9.33
48	P48	F	58	0	0	11.33	10.22	8.64	7.50	6.16
49	P49	F	51	0	0	19.75	16.02	16.76	13.74	5.61
50	P51	F	33	0	0	3.70	2.01	1.20	15.05	10.76
Mean F			57.783	5.745	2.552	15.129	18.281	15.267	18.144	16.199
SD F			12.891	11.988	5.660	14.327	13.392	12.795	14.96	13.298
MSD F			2.48	2.31	1.09	2.76	2.57	2.46	2.88	2.56
Mean Lot			59.1	3.285	1.576	13.851	14.809	12.851	15.308	13.464
SD Lot			13.66	8.44	4.126	14.674	13.684	13.1	15.309	13.61
MSD Lot			1.95	1.21	0.59	2.1	1.96	1.87	2.19	1.94

Table II. Lithium blood concentrations before dialysis procedure (S_1) at the end (S_2) and in outlet dialysate ($LD_{1...5}$) from the group of patients (blood - $\mu\text{g/dl}$; outlet dialysate - $\mu\text{g/l}$).

the even Student test showed that the difference between the average blood level of lithium before the dialysis session $S_1 = 3.29 \mu\text{g/dl}$ compared with

that of the return $S_2 = 1.58 \mu\text{g/dl}$ is not significantly different from zero, with $T = 1.33213$, Student threshold = 2.57582 and $p = 0.1$, although the average at

return is less than the 1.71 µg/dl than at coupling.

Comparing the control group with the group of patients, odd Student test shows that the two environments differ significantly both for S₁ and S₂.

Odd Student test that analyzes the mean concentration of blood samples S₁ compared to average blood concentration of lithium in the control group, shows that the two environments are significantly different with T = 6.42574, Cochren threshold = 1.95996, p <0.01.

Applied to the mean concentration of blood samples S₂ compared to average blood concentration of lithium in the control group, it is shown that the two environments are significantly different with T = 9.32889, Cochren threshold = 1.95996, p <0.01.

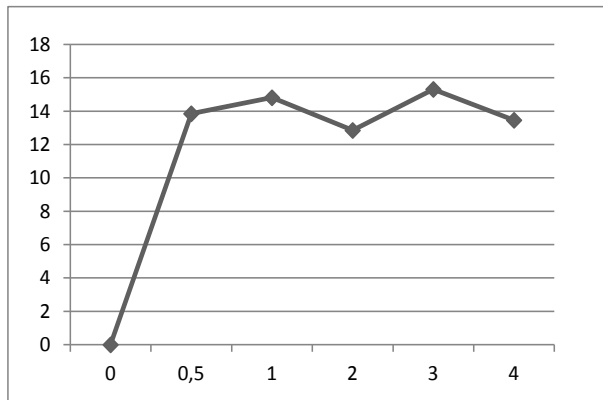


Figure 2. Variation of lithium elimination (mg/l) in the outlet dialysate

Mean lithium concentration in outlet dialysate samples LD1...5, is shown in Table 2.

The mean clearance of lithium had an average value of 10.78 µg/min. Comparing the control group with the group of patients, the odd Student test shows that the two environments differ significantly both for S₁ and S₂.

The amount of lithium removed from patients with chronic kidney disease in a dialysis session was 2.59 mg (Figure 2).

The group of patients consists of 27 men (54%) and 23 women (46%).The arithmetic mean age of men (60.22 years) did not differ significantly from the average age of the lot of women (57.78 years).

Statistically, there are some significant differences between the mean concentrations of lithium, both at coupling and return, between the lot of men (1.18 µg/dl at coupling and 0.87 µg/dl at return) and the lot of women (5.75 µg/dl at coupling and 2.55 at return).

The odd Student test applied to analyze the average quantities of lithium removed during the dialysis session LD1 ... 5 both from men and women revealed there are no statistically significant differences, although the amount of lithium removed from women is higher than that of men.

In Figure 3, the variation curves of lithium elimination in the outlet dialysate from men and women are presented.

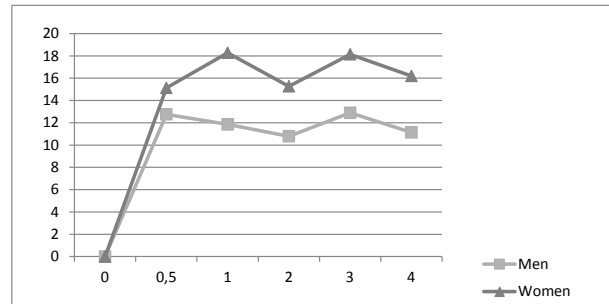


Figure 3. Variation of lithium elimination (mg/l) in the outlet dialysate in men compared to women.

Eliminating function of lithium through hemo-dialysis can be approximated with the Lagrange polynomial (3):

$$P(x) = A_{n-1}x^{n-1} + A_{n-2}x^{n-2} + \dots + A_1x + A_0$$

General expression of the Lagrange polynomial has the form given by equation (4)

$$P(x) = b_1 \frac{(x-a_2)(x-a_3)...(x-a_n)}{(a_1-a_2)(a_1-a_3)...(a_1-a_n)} + b_2 \frac{(x-a_1)(x-a_3)...(x-a_n)}{(a_2-a_1)(a_2-a_3)...(a_2-a_n)} + b_3 \frac{(x-a_1)(x-a_2)...(x-a_n)}{(a_3-a_1)(a_3-a_2)...(a_3-a_n)} + \dots + b_n \frac{(x-a_1)(x-a_2)...(x-a_{n-1})}{(a_n-a_1)(a_n-a_2)...(a_n-a_{n-1})}$$

Customizing the general expression of the variation of lithium in the outlet dialysate for patients with chronic renal disease in the analyzed group, the Lagrange polynomial has the following expression (5):

$$P(x) = b_1 \frac{(x-a_2)(x-a_3)(x-a_4)(x-a_5)(x-a_6)}{(a_1-a_2)(a_1-a_3)(a_1-a_4)(a_1-a_5)(a_1-a_6)} + b_2 \frac{(x-a_1)(x-a_3)(x-a_4)(x-a_5)(x-a_6)}{(a_2-a_1)(a_2-a_3)(a_2-a_4)(a_2-a_5)(a_2-a_6)} + b_3 \frac{(x-a_1)(x-a_2)(x-a_4)(x-a_5)(x-a_6)}{(a_3-a_1)(a_3-a_2)(a_3-a_4)(a_3-a_5)(a_3-a_6)} + b_4 \frac{(x-a_1)(x-a_2)(x-a_3)(x-a_5)(x-a_6)}{(a_4-a_1)(a_4-a_2)(a_4-a_3)(a_4-a_5)(a_4-a_6)} + b_5 \frac{(x-a_1)(x-a_2)(x-a_3)(x-a_4)(x-a_6)}{(a_5-a_1)(a_5-a_2)(a_5-a_3)(a_5-a_4)(a_5-a_6)} + b_6 \frac{(x-a_1)(x-a_2)(x-a_3)(x-a_4)(x-a_5)}{(a_6-a_1)(a_6-a_2)(a_6-a_3)(a_6-a_4)(a_6-a_5)}$$

In Table 3 pairs of values of lithium concentration based on time noted with a_{1..6} and b_{1..6} for men are given:

Replacing the expression (5) is obtained Lagrange polynomial average elimination of lithium in the group of men, the expression (6):

$$P(x) = 1.01x^5 - 11.07x^4 + 43.83x^3 - 75.61x^2 + 53.69x$$

The total amount of Li removed during the dialysis session in the group of men was 1.336 mg lithium. The mean clearance of lithium in the group of men was 5.57 ml/min.

In Table 4, pairs of values of lithium concentration based on time noted with a_{1..6} and b_{1..6} for women are given:

Variable	1	2	3	4	5	6
a	0	.5	1	2	3	4
b	0	12.761	11.851	10.793	12.893	11.134

Table III. Values $a_{1..6}$ and $b_{1..6}$ in the group of men with chronic renal disease

Variable	1	2	3	4	5	6
a	0	.5	1	2	3	4
b	0	15.129	18.281	15.267	18.144	16.199

Table IV. Values $a_{1..6}$ and $b_{1..6}$ in the group of women with chronic renal disease

Variable	1	2	3	4	5	6
a	0	.5	1	2	3	4
b	0	13.851	14.809	12.851	15.308	13.464

Table V. Values $a_{1..6}$ and $b_{1..6}$ in the group of patients with chronic renal disease

Replacing the expression (5) is obtained Lagrange polynomial average elimination of lithium in the group of women, the expression (7):

$$P(x) = 0.045x^5 - 2.023x^4 + 15.584x^3 - 43.965x^2 + 48.548x$$

The total amount of Li removed during dialysis session in the group of women was 3.844 mg lithium.

The mean clearance of lithium in the group of women was 16.01 $\mu\text{g}/\text{min}$.

In Table 5, pairs of values of lithium concentration based on time noted with $a_{1..6}$ and $b_{1..6}$ in the group of patients with chronic renal disease are given:

Replacing the expression (5) is obtained Lagrange polynomial average elimination of lithium in the group of patients with chronic kidney disease, expression (8)

$$P(x) = 0.5663x^5 - 6.909x^4 + 30.833x^3 - 61.004x^2 + 51.324x$$

The total amount of lithium removed during a dialysis session by the lot was 5.18 mg. The mean clearance of lithium in analyzed group was 21.58 $\mu\text{l}/\text{min}$.

Conclusions

Analysis of distribution of lithium in blood and outlet dialysate in patients with chronic kidney disease provide useful information on blood levels of these elements and the amount eliminated during the dialysis process.

Comparison of blood levels of lithium with those determined in the control group, give a correct assessment of the surplus that can occur in this kind of patients.

Although the average serum lithium concentra-

tion decreased after the dialysis process with 1.71 $\mu\text{g}/\text{l}$, mean peak plasma concentrations at the end of dialysis did not differ significantly from the average concentrations at the start of dialysis.

In women, the lithium concentration in blood collected at coupling and at return is greater than the lot of men, the mean values differ significantly.

Although average concentration of lithium in outlet dialysate collected from the group of men is less than the concentration in the group of women, statistically, they don't differ significantly.

The mean total amount of lithium removed from the group of women is 2.88 times the average quantity of lithium compared to the mean total amount removed from the group of men.

Both at the beginning of dialysis and at the end, the average serum lithium concentrations differ significantly from the control group, being higher than the permitted maximum.

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