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Efficacy of Potassium Citrate Solution in Treatment of Renal Microlithiasis in Children One Month to Fifteen Years Old

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Abstract

Background and Aim: The present study was conducted to determine the efficacy of potassium citrate solution in the treatment of renal microlithiasis in children one month to fifteen years old in Shahrekord Pediatric Nephrology Clinic.

Methods: Sixty children aged 1 month to 15 years presenting to Shahrekord Pediatric Nephrology Clinic with one or two renal microlithiasis measuring less than 3 mm in size on ultrasound were included in this clinical trial study. Available sampling was used to select the participants. The children were randomly divided into two groups of placebo (water) and potassium citrate solution. After three months, the number and size of the stones and the stone outcome were recorded in both groups and analyzed using the SPSS software and appropriate statistical tests.

Results: Thirty-four children were boys (56.7%) and 26 were girls (43.3%) with a mean age of 61.62± 47.54 months. Three months after the intervention, the mean number and size of microlithiasis decrease significantly in both groups ($P < 0.001$). Although the decrease was larger in the group receiving potassium citrate than the placebo group, the difference was not statistically significant ($p<0.05$). In addition, the outcome of the renal microlithiasis was similar in both groups with no significant differences ($p<0.05$).

Conclusion: The results of this study showed that potassium citrate solution had no effect on the treatment of one or two renal microlithiasis in children and the use of supportive therapy is still sufficient in these patients.

Keywords: Microlithiasis; Child; Potassium Citrate

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Introduction

Urolithiasis is a common disease that can cause complications such as urinary tract obstruction and kidney damage in severe cases. It may also be a sign of other important diseases.

The most important predisposing factors for urolithiasis in children are urinary metabolic causes, infections, and urinary stasis.

However, in recent years, the most common etiology of urinary stones has changed from urinary tract infections to metabolic causes. Kidney stones in children include calcium oxalate stones, uric acid stones, stones associated with hypocitraturia, cysteine stones, and other metabolic disorders.

The goal of treating urinary tract stones in children is to eliminate the stone, maintaining kidney function, and preventing the recurrence of stones. Surgical treatment and removal of stones may be necessary in some cases (1,2). Kidney stones more than 4 mm or evidence of urinary tract obstruction will increase the need for surgical intervention (2). Medical treatments include salt restriction and increased potassium citrate intake. The use of thiazide diuretics is also suggested.

Microlithiasis is characterized by stones measuring less than 3 mm in the calyx, pelvis, or ureter of the kidney on ultrasound (4,5), which are known as callus microlithiasis if they are only in the calyx. Only a few limited reports are available regarding the diagnosis, management, long-term follow-up, and ultimate outcome of microlithiasis.

Lack of adequate studies has hindered the acceptable development of guidelines for the management and follow-up of pediatric microlithiasis (6).

Methods

In this clinical trial study, 60 children aged 1 month to 15 years that presented to Shahrekord Nephrology Clinic and had microlithiasis less than 3 mm on ultrasound were included in the study.

The subjects were selected using available sampling. Inclusion criteria were age 1 month to 15 years and the presence of one or two kidney stones smaller than 3 mm.

Exclusion criteria were renal hydronephrosis, presence of three or more microlithiasis, urinary reflux, and recurrent urinary tract infections.

Sixty subjects were included in the present study considering the results of a study by Sorkhi et al using the following formula:

$$n=\frac{2(z_{1-\frac{a}{2}}+z_{1-B})^2\ SD^2}{d^2}30$$

*Significance level for differences between groups was considered <0.05

The patients were randomly divided to two groups by choosing a card. In the first group, placebo solution (water) was prescribed and conservative and supportive measures such as breast milk consumption, prevention of dehydration and restricted salt consumption were recommended. The case group received potassium citrate solution (22% potassium citrate powder and 68.8% citric acid purchased from Merck Co., Germany in distilled water prepared in one center by one person) for three months. The drug and placebo were given to participants in identical bottles. Then, to evaluate the presence or absence, size, and number of the microlithiasis, the patients in both groups were examined by ultrasound after three months and the results were compared.

The SPSS software was used for data analysis. In this study, descriptive and inferential statistics, independent test and chi-square tests were used to compare and evaluate the variables. The significance level of the tests was set at P <0.05.

Study limitations:

1- Patient may discontinue treatment.
2- Drug side effects may occur.

Results

In this study, the children were divided to two groups of potassium citrate (16 boys and 14 girls) and placebo (18 boys and 12 girls).

The mean age of the children was 73.2 ± 49.26 months in potassium citrate group and 50.82± 43.98 months in the placebo group. T-test showed no significant difference in the mean age between the two groups (p <0.05).

According to chi-square test, there was no significant difference in sex, type of milk consumed, medical history, history of urinary tract infection, history of hospitalization at birth and drug history causing kidney stones between the two groups (p<0.05). The test results also showed no statistically significant difference in the mean age at birth between the two groups (p <0.05) (Table 1).

Three months after the intervention, the mean number and size of microlithiasis decrease significantly in both groups (P <0.001) (Table2). Although the decrease was larger in the group receiving potassium citrate than the placebo group, the difference was not statistically significant (p<0.05) (Table3). In addition, the outcome of the renal microlithiasis was similar in both groups with no significant differences (p<0.05) (Table4).

Table 1. Patients' characteristics

Group / variable	Patient group citrate	Placebo group	P. value *
Male	16(53.3%)	18(60%)	
female	14(46.7)	12(40%)	
Prematurity history	1(3.6%)	4(13.3%)	**0.186**
Age of children (month) (Mean and standard deviation)	73.2 +- 49.26	50.81 +- 43.98	**0.073**
Age of birth (week) (Mean and standard deviation)	38.46 +- 1.03	37.96 +- 1.43	**0.138**

P < 0/05 was considered significant

Table2. Number of microlithiasis on ultrasound in study groups

groups / variable		Potassium citrate (Mean±standard Deviation)	Placebo	P. value *
	Before intervention	1.67± 0.61	1.37 ± 0.56	**0.051**
	Three month post intervention	0.23± 0.5	0.27 ± 0.45	**0.788**

Table3. microlithiasis size on ultrasound

groups / variable		Potassium citrate	Placebo	P. value *
	Before intervention	2.1± 0.56	1.88 ± 0.46	**0.097**
	3 month post intervention	0.33± 0.75	0.33± 0.62	**0.955**

Table 4. Outcomes of microlithiasis in patients

Groups / variable	Potassium citrate	Placebo	P value*
UTI	1(3.3%)	1(3.3%)	**1**
Use of analgesic	4(13.3%)	5(16.7%)	**0.70**
Spontaneous excretion	24(80%)	21(90%)	**0.37**
Drug intolerance	3(10%)	0(0%)	**0.07**

Discussion

Miller et al conducted a review study in 2007 and found that renal stones smaller than 3 mm usually passed spontaneously within 4 weeks (8).

Sarica et al performed a review study in 2006. The results showed that children with a family history of renal stone had to consume plenty of fluids and citrate (9).

In 2017, Mohammad Jafari et al reported that potassium citrate was effective in treatment of renal stone smaller than 7 mm (10).

In 2011, Sorkhi et al found that the rate of improvement after potassium citrate treatment was %78.7 until 12 months and % 92.3 until 24 months(7).

In this study, the number and size of microlithiasis significantly decreased in the group receiving potassium citrate for three months, but there was no significant difference between the two groups. On the other hand, most studies have shown the effectiveness of potassium citrate in kidney stones larger than 3 mm; however, in the present study, the aim was to determine its effectiveness in microlithiasis or stones smaller than 3 mm for which it had no significant difference with placebo.

Conclusion

According to the results of the above study, it seems that the administration of potassium citrate solution has no effect in the treatment of one or two microlithiasis in children and in these patients the use of supportive therapy is still sufficient, but in the case of larger stones or three or more microlithiasis, separate studies will needed.

Conflict of Interest

The author declares no conflicts of interest.

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