COMPARISON OF SERUM SODIUM, SERUM POTASSIUM, AND BLOOD HEMOGLOBIN CHANGES AFTER TRANSURETHRAL RESECTION OF THE PROSTATE BETWEEN IRRIGATION WITH NORMAL SALINE AND STERILE WATER

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ABSTRACT

Objective: *This study aims to know whether there are significant differences of blood sodium, potassium and hemoglobin level among patients post transurethral resection of the prostate (TURP) who was irrigated by using normal saline and the sterile water.* ***Material & Method:*** *This is a single blind randomized clinical trial study performed from September 1, 2008 until August 31, 2009. Thirty-one subjects participated in this study. The subjects were divided into two groups, 14 subjects for normal saline (group I) irrigation and 17 subjects for sterilized water irrigation (group II).* ***Results****: There are statistically differences ($p < 0,05$) between hemoglobin concentrations changes in group I, and hemoglobin and sodium concentration changes in group II. There were no statistically differences ($p > 0,05$) in sodium and potassium changes in group I and potassium in group II. There are no statistically differences in hemoglobin, sodium, and potassium changes among two groups.* ***Conclusion:*** *Normal saline irrigant for irrigation after TURP give more stable post operative electrolyte profile compared to sterilized water.*

Keywords: *Transurethral resection of the prostate, irrigation, serum sodium, potassium level differences.*

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INTRODUCTION

There are many treatments for benign prostatic hyperplasia. Although open prostatectomy is associated with the greatest subjective and objective improvements in these patients, transurethral resection of the prostate (TURP) does not come far behind, but introduction of TURP was aimed to decrease effects of surgery on patients with this condition. Gradually, TURP was viewed as having achieved the position where it was always referred to as the "gold standard".[1]

Transurethral resection (TUR) syndrome occurs in 2% of the patients. The syndrome is characterized by mental confusion, nausea, vomiting, hypertension, bradycardia and visual disturbance. Usually, the patients do not become symptomatic until the serum sodium concentration reaches 125 mEq/dL. The risk is increased if the gland is larger than 45 g and the resection time is longer than 90 minutes.[1]

Hangstrom (1955) weighed patients preoperatively and calculated that approximately 20 ml/min of fluid was absorbed by the patient. However, there was significant patient variation. Oester and Madsen (1969), using a double-isotope technique, demonstrated that the average amount of fluid absorbed by patient was 1000 ml and one third of this fluid was absorbed intravenously.[1] Dilution resulted from fluid absorption during operation. There are no references on amount of fluid absorption occurring after the operation.

Transurethral resection of the prostate will open blood vessels. Irrigation is performed to avoid blood clot formation. If the irrigating fluid has high pressure, the fluid will enter into blood circulation with consequences. Hypotonic irrigating fluid will cause hemolysis. Irrigating fluid with low sodium level will cause serum sodium dilution. If the sodium dilution is

continued until below 125 mEq/dL, TURP syndrome and death may result.

Each hospital has different irrigation solution recommendations. In Sardjito Hospital, we use sterilized water. Other hospitals use normal saline as post TURP irrigation to avoid TURP syndrome.

OBJECTIVE

To determine differences in serum sodium and potassium level, and blood hemoglobin changes after TURP between group with normal saline and sterilized water irrigation.

MATERIAL & METHOD

This study is a single blind randomized clinical trial. The study was done from 1st September 2008 until 31st Augusts 2009. Inclusion criteria were (1) All patients who underwent TUR prostate, (2) Bleeding time and clotting time within normal limits, (3) Serum potassium level 3,00 mmol/L until 5,50 mmol/L before study, (4) Serum sodium level 130 mmol/L until 146 mmol/L before study, (5) Hemoglobin more than 10 mg/dl before study.

The exclusion criteria were (1) Patient who refused study enrollment, (2) Renal function disturbance, (3) Urinary retention during study, (4) Patients receiving blood transfusions during study, (5) All medications were abandoned.

Subjects were divided into 2 groups. Group 1 received normal saline for irrigation post TURP and group 2 received sterilized water.

Immediately after TURP, peripheral blood samples of each patient were obtained from the median cubital vein. Twenty-four french three way catheters with 40 ml balloon and traction in the right thigh were done. The lowest point of 1 liter irrigation bag was placed 60-70 cm from the pubic symphisis with flow of 20 cc/minutes. Each subject received intravenous normal saline 2 cc/kgs/bw as maintenance. The traction was released 4 hour after operation. Peripheral blood samples were obtained 24 hours after TURP. Serum sodium, potassium level, and blood hemoglobin were analyzed in Clinical Pathology Laboratory Sardjito Hospital, Yogyakarta. Blood hemoglobin was analyzed with impedance method with *automatic Sysmex Se 9500*. Serum sodium and potassium level were analyzed with ISE (Ion Selective Electrode) method with *automatic electrolyte analyzer Beckman Coulter synchron CX 9 pro*.

RESULTS

This study was enrolled 31 subjects divided into 2 groups. Subjects were ranged from 54 until 83 years old with average 69,97 years. Age distribution statistics as in figure 1.

Figure 1. Age distribution.

The subjects were divided, 17 subjects as group 1 and 14 subjects as group 2.

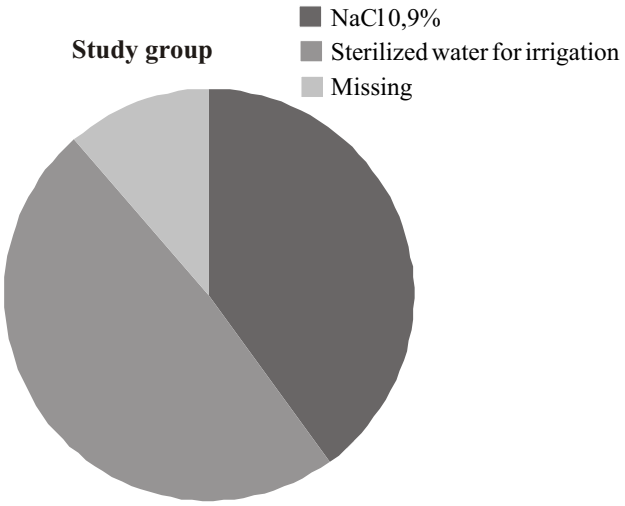

Figure 2. Study groups.

Normal data distribution was examined by Kolmogorov-Smirnov normality test (Table 1). Serum sodium and potassium and blood hemoglobin were normally distributed (p > 0,05) so parametric tests were performed.

Table 1. Kolmogorov-Smirnov normality test

	Kolmogorov-Smirnov [a]
Pre study hemoglobin	,200*
Pre study sodium	,200*
Pre study potassium	,085
Post study hemoglobin	,200*
Post study sodium	,015
Post study potassium	,200*

*: This is a lower bound of the true significance
a: Lilliefors significance correction

There was statistically significant difference (p < 0,05) in blood hemoglobin level before and after treatment. There were no statistical difference (p > 0,05) in serum sodium and potassium level before and after treatment (Table 2. Paired samples T-test for group 1).

Table 2. Paired samples T-test for group 1.

		Sig. (2-tailed)
Pair 1	Pre study hemoglobin-post study hemoglobin	,000
Pair 2	Pre study sodium-post study sodium	,263
Pair 3	Pre study potassium-post study potassium	,234

There was statistical difference (p < 0,05) in blood hemoglobin and serum sodium level before and after treatment. There were no statistically significant differences (p > 0,05) in serum potassium level before and after treatment (Table 3. Paired samples T-test for group 2).

Table 3. Paired samples T-test for group 2.

		Sig. (2-tailed)
Pair 1	Pre study hemoglobin-post study hemoglobin	,001
Pair 2	Pre study sodium-post study sodium	,012
Pair 3	Pre study potassium-post study potassium	,387

Comparison between both groups showed no significant difference in study parameters between groups I and II (Table 4, p > 0,05).

Table 4. Comparison between two group of hemoglobin, serum sodium, and potassium changes.

		N	Mean	Std. Deviation
Hemoglobin changes	Group 1	14	-1,0857	,85652
	Group 2	17	-,8824	,93088
Sodium changes	Group 1	14	-1,0714	3,42848
	Group 2	17	-2,5718	3,71723
Potassium changes	Group 1	14	-,1664	,49882
	Group 2	17	-,1388	,64350

Table 5. Independent samples test.

		T-test for Equality of Means		
		t	df	Sig. (2-tailed)
Hemoglobin changes	Equal variances Assumed	-,627	29	,535
	Equal variances not assumed	-,632	28,602	,532
Sodium changes	Equal variances Assumed	1,158	29	,256
	Equal variances not assumed	1,167	28,586	,253
Potassium changes	Equal variances Assumed	-,131	29	,897
	Equal variances not assumed	-,134	28,918	,894

DISCUSSION

Post TURP irrigation will interfere hemoglobin, sodium, and potassium serum level. Improper irrigation can cause hemolysis, and blood dilution which can decrease serum sodium level. Morbidity and mortality can occur.

The absorbed volume varies greatly and cannot be predicted in individually, although it tends to be larger in extended operation and more hemorrhage. The uptake of 1 L fluid, corresponding to an acute decrease in serum sodium concentration of 5-8 mmol/L, is above the threshold where risk of absorption-related symptoms is statistically increased.[2]

The absorption of irrigating fluid is a cause of complications. The ideal irrigation fluid for endoscopic resection should be a user friendly, nonconductor medium that does not interfere with diathermy, has a high degree of translucency and osmolarity similar to that of serum, and causes only minimal side effects when absorbed. Originally sterile water was used as irrigation fluid but water absorption caused hemolysis, resulting in postoperative and occasionally lethal hemoglobinuria.[3]

In Sardjito Hospital we use sterile water for post TURP irrigation, some other hospital use normal saline. In Indonesia we use sterilized water for irrigation and/or normal saline. Each of fluid has advantages and disadvantages, and we always concerned about patient safety.

Using distilled water as the irrigation solution in TURP has been evaluated in a number of studies. Mommsen and colleagues showed that the concentration of serum sodium decreased and plasma free hemoglobin increased significantly, but without significant change in hemoglobin level, after TURP using distilled water.[4]

Norlen et al (2010) reported dilutional hypokalemia when distilled water was used as an irrigant. [5]

In this study we saw that normal saline gives better electrolyte profile than sterile water although not statistically significant. It could happen because normal saline has similar tonicity with the cells thus avoiding hemolysis. Irrigating fluid may not entering the circulation because only irrigation was only with low pressure.

Clot retention is one of exclusion criteria. We decided clot retention as exclusion criteria, because it is very difficult to determine irrigant volume entering the circulation caused by retention. Renal insufficiency also becomes an exclusion criteria because it may be difficult to predict potassium level stability.

CONCLUSION

Normal saline irrigation post TURP gives more stable electrolyte profile than sterile water for irrigation.

REFERENCES

1. Fitzpatrick, Mebust 40. Minimally invasive and endoscopic management of benign prostatic hyperplasia. In: Retik AB, Vaughan ED, Wein AJ. Campbell's Urology. 8th ed. Philadelphia: Saunders. 2002; 2: 1379-421.
2. Hahn RG. Review irrigating fluids in endoscopic surgery. Brit J Urol; 1997. p. 669-80.
3. Michielsen DPJ, Debacer T, De Boe T, Lersberghe CV, Kaufman L. Bipolar transurethral resection in salinean alternative surgical treatment for bladder outlet obstruction? American Urological Association. J Urol 2007; 178: 2035-9.
4. Aghamir SHK, Alizadeh F, Meysamie A, Rad SA, Edrisi L. Sterile water versus isotonic saline solution as irrigation fluid in percutaneous nephrolithotomy. Cited from www.uj.unrc.ir. J Urol 2009; 6 (4): 249-53.
5. Singhania P, Nandini D, Sarita F, Hemant P, Hemalata I. Transurethral resection of prostate: A comparison of standard monopolar versus bipolar saline resection. Cited from http://www.brazjurol.com.br/march_april_2010/Singhania_183_189.htm. Int Braz J Urol 2010; 36 (2): 183-9.