PROGNOSTIC PARAMETERS FOR THE RECOVERY OF RENAL FUNCTION IN PATIENTS WITH OBSTRUCTIVE UROPATHY

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ABSTRACT

Objective: *The aim of this study was to determine the prognostic parameters for the recovery of renal function in patients with obstructive uropathy after the release of obstruction.* ***Material & methods:*** *This is a retrospective cohort study. Secondary data from the patient's medical record was used to determine whether the ratio of blood urea nitrogen (BUN)/creatinine, hemoglobin, hyperkalemia, blood glucose, renal parenchymal thickness, and obstruction etiology are prognostic parameters for recovery of renal function in patients with obstructive uropathy after release of obstruction. Bivariate was used to analyze the data using Chi-square and Fisher's exact test with significance level of $p<0.05$ to evaluate the significance.* ***Results:*** *Based on total of 66 research samples, it was found that renal parenchymal thickness was ≥10 mm ($p=0.001$), hemoglobin level was ≥ 10 mg/dL ($p=0.001$), and BUN/creatinine ratio was ≥ 10 ($p=0.003$), it had significant correlation with the recovery of renal function, meanwhile, obstruction etiology variable ($p=0.566$), and hyperkalemia ($p=0.792$) did not provide significant recovery of renal function.* ***Conclusion:*** *Renal parenchymal thickness, hemoglobin level, and BUN/Creatinin ratio are the prognostic parameters for recovery of renal function after release of obstruction.*

Keywords: *Obstructive uropathy, blood urea nitrogen/creatinine ratio, haemoglobin, hyperkalemia, renal parenchymal thickness.*

ABSTRAK

Tujuan: *Tujuan penelitian ini untuk menentukan parameter prognosis perbaikan fungsi ginjal pada pasien obstruksi uropati setelah dilakukan release obstruksi.* ***Bahan & cara:*** *Penelitian ini merupakan studi kohorretrospektif. Menggunakan data sekunder dari rekam medis pasien untuk menentukan apakah rasio blood urea nitrogen (BUN)/kreatinin, kadar hemoglobin, hiperkalemia, kadar gula darah, tebal parenkim ginjal, dan etiologi obstruksi merupakan parameter prognosis perbaikan fungsi ginjal pada pasien obstruksi uropati setelah dilakukan release obstruksi. Data dianalisis bivariate menggunakan Chi-square dan Fisher's Exact test dengan level signifikan $p<0.05$.* ***Hasil:*** *Sebanyak 66 sampel penelitian, diperoleh bahwa tebal parenkim ginjal ≥10 mm ($p=0.001$), kadar hemoglobin ≥ 10 mg/dL ($p=0.001$), dan rasio BUN/kreatinin ≥ 10 ($p=0.003$) memiliki hubungan signifikan dengan perbaikan fungsi ginjal, sedangkan variabel etiologi obstruksi ($p=0.566$), dan hiperkalemia ($p=0.792$) tidak meyebabkan perbaikan fungsi ginjal secara signifikan.* ***Simpulan:*** *Tebal parenkim ginjal, kadar hemoglobin, dan rasio BUN/kreatinin merupakan parameter prognosis perbaikan fungsi ginjal setelah dilakukan release obstruksi.*

Kata kunci: *Obstruksi uropati, rasio blood urea nitrogen/kreatinin, hemoglobin, hiperkalemia, tebal parenkim ginjal.*

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INTRODUCTION

Obstructive uropathy is anatomical and functional blockages at all levels of the urinary tract from the renal, ureters, bladder, to urethra. Each year, as many as 1 of 500 patients hospitalized in the United States is diagnosed with obstructive uropathy. Blockage of urine flow leads to the increase in pressure on proximal from the blockage, hydronephrosis, progressive damage of the nephron, to terminal renal failure.[1-4]

Research conducted on dogs showed that after total unilateral obstruction for 1 week, renal will have complete recovery, in addition, if the total unilateral obstruction was conducted for 14 days, renal will have 70% recovery; in contrast, there will no recovery of renal function after total obstruction for 6 weeks. Recovery of post-

obstructive renal function in humans has not been predictable.[1]

Jones et al (1988), reported that there were 2 phases for renal function recovery of post-release of obstruction. The first phase occured for 2 weeks after the release in which there was increase in tubular function, and the second phase occured after the next 10 weeks where the glomerular filtration rate would gradually recover.[1,5]

Renogram is a gold standard for predicting the prognostic of postoperative renal function, but this examination is still limited to be used because of the availability of tools and the expensive cost. Therefore, it is necessary to have parameters to assess the prognostic of renal function in obstructive uropathy, whether it is still reversible or irreversible.[3]

Beland (2010), reported that renal parenchymal thickness measurements with USG were more accurate than measurements of renal axis length when it was associated with glomerular filtration rate. Serum creatinine test was a simple and widely accepted test as a parameter of renal function. In this study, a renal function evaluation was performed by evaluating serum creatinine changes.[6,7]

OBJECTIVE

The aim of this study was to determine the prognostic parameters for the recovery of renal function in patients with obstructive uropathy after the release of obstruction.

MATERIAL & METHODS

This is a retrospective cohort study. The data was taken from medical record of Central Public Hospital Dr. Sardjito. The study was conducted at Central Public Hospital Dr. Sardjito from January 2014 to December 2015. The population of the study was the patients with obstructive uropathy who were treated and performed surgery at Central Public Hospital Dr. Sardjito from period of January 2014 to December 2015. Patients, who routinely perform hemodialysis, were excluded. The minimum number of samples was determined by the Lemeshow equation, and then it was obtained a minimum sample of 47 patients. First, the researcher selected patient with obstructive uropathy, then influencing factors was traced retrospectively. The collected data consisted of demographic data (age, sex, and weight), blood test results (hemoglobin, potassium, blood sugar and BUN/creatinine ratio), renal ultrasound examination (renal parenchymal thickness) and obstructive etiology. Patients performed serum creatinine evaluation at the first week, by the end of the first month and second after they release of obstruction. Analysis was performed to determine the factors affecting the improvement of renal function. Bivariate analysis was performed using Chi-Square and Fisher Exact test.

RESULTS

There were 66 patients with average age of 54 years, consisting of 36 men (55.5%) and 30 women (45.5%). Sample distribution based on sex is shown in table 1.

The causes of obstructive uropathy were categorized into two groups, obstruction caused by urinary tract stones and obstruction caused by tumor. In this study, it was found that there were 50 patients (76%) suffered from obstruction caused by urinary tract stones, while obstruction caused by tumors was found in 16 patients (24%).

The average of creatinine serum before operation had conducted was 8.01 ± 5.84 mg/dl. Evaluation was performed after one week of post-treatment, then it was found that serum creatinine significantly decrease into 3.82 ± 2.40 mg/dl. Evaluation that was performed after one month of post-treatmet found that serum creatinine significantly decrease into 2.83 ± 1.92 mg/dl, while evaluation performed after two month of post treatment found that the average of creatinine serum was 2.41 ± 1.35

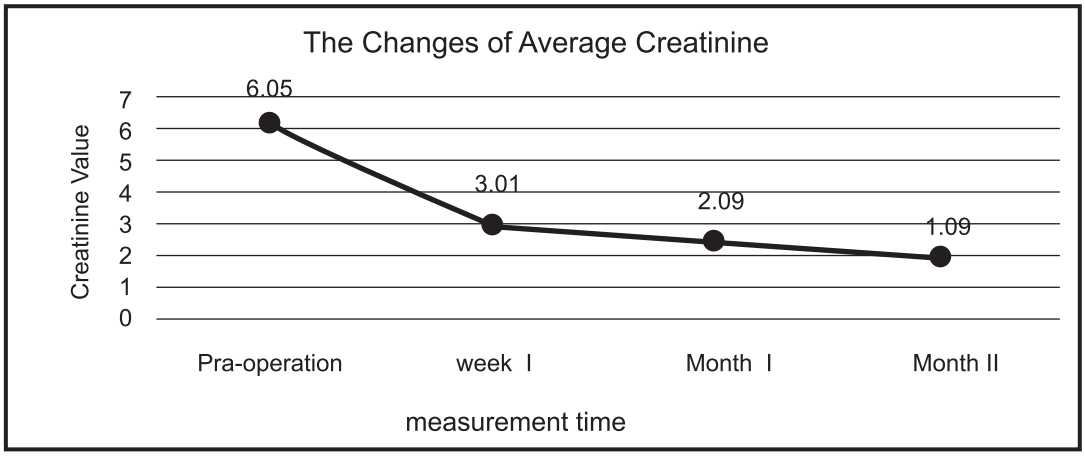
Tabel 1. Sampel distribution based on sex.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Men	36	54.5	54.5	54.5
	Women	30	45.5	45.5	100.0
	Total	66	100.0	100.0	

mg/dl (table 2). Wilcoxon test showed that statistically, there was significant decrease in post-treatment creatinine serum at the first week evaluation (p=0.001), the first one month (p=0.001), and 2 month evaluation (p=0.001). The result of Wilcoxon test was illustrated in graphic 1.

The finding showed that the average of creatinine/BUN ratio was 9.001 (2.69-18.64), the average of Potassium was 5.1042 (2.08-9.20), the average of GDS was 122.545 (67-423), the average of renal parenchymal thickness was 10.0773 (4.000-16.00), the average of hemoglobin was 10.730 (5.30-15.60) with the value of GFR average was 12.7898 (2.34-36.91).

The result of bivariate analysis with Chi-Square showed that the variables providing significant effect on the decrease in renal function were hemoglobin (p=0.001), BUN/Creatinin ratio (p= 0.003), renal parenchymal thickness (p=0.001), and GFR (p=0.003), meanwhile, obstruction etiology (p=0.566), and hyperkalemia (p=0.792) did not cause significant decrease in creatinine. Diabetes mellitus variable did not meet the requirement to be tested with Chi-Square so that Fisher's Exact Test was performed with p value = 0.114, therefore, the variable is not statistically significant. The result of bivariate analysis is shown in table 2.



Graphic 1. The changes of average creatinine before release of obstruction.

Table 2. Variables assumed to affect renal function.

Variable		Creatinine 3		Total	p
		<2mg/dl	≥2mg/dl		
Etiology	Stone	26	24	50	0.566
	Tumor	7	9	16	
Haemoglobin	≥ 10.00	28	14	42	0.001
	< 10.00	5	19	24	
GDS	< 200	29	33	62	0.114
	≥ 200	4	0		
Parenchymal thickness	≥ 10 mm	30	11	41	0.001
	< 10 mm	3	22	25	
Hyperkalemia	≥ 5.5	10	11	21	0.792
	< 5.5	23	22	45	
BUN/Cr rasio	≥ 10	19	7	26	0.003
	< 10	14	26	40	

DISCUSSION

In clinical practice, blood urea nitrogen (BUN) and serum creatinine examinations are still widely accepted as a parameter in evaluating renal function, these examinations are very practical and easy. Decreased in renal function leads to the increased in BUN and creatinine in blood. BUN and creatinine examinations are the simplest method to monitor renal function. In this study, it was found that renal function was recovered when there was a decrease in creatinine value into <2 mg/dL after the release of obstruction.[8,9]

This study showed that renal parenchymal thickness of ≥ 10 mm was significantly correlated with a decrease in creatinine <2 mg/dL. Beland et al, reported that renal parenchymal thickness measured by USG reflected renal function. Roger et al, reported that there was potential for recovery of renal function when the parenchymal thickness was 10-15 mm and irreversible changes when the parenchymal thickness was less than 10 mm.[3] In this study, the average of renal parenchymal thickness was 10.077 + 2.15 mm. Chi-square analysis showed significant correlation between renal parenchymal thickness and decrease in serum creatinine in which function improvement would be possible if parenchymal thickness was ≥ 10 mm (p=0.001). These results are in line with the report by Roger et al, stating that there was a correlation between the renal parenchymal thickness with the recovery of renal function, so that renal parenchymal thickness can be used as a parameter for recovery of renal function. Handri et al, reported on sonography description of patients with chronic renal failure at Central Public Hospital Kariadi in Semarang, it found shrinkage in kidney size with the thinning of the renal parenchymal, the lower of glomerular filtration rate, the thinner of renal parenchymal. Yamashita et al, provided different results in which the parenchymal thickness was not correlated with decreased in renal function.[10-14]

Harraz et al, reported that the recovery of hemoglobin levels. Dwinnell used BUN/creatinine ratio renal function was affected by serum creatinine levels 10 : 1 as a parameter to predict prerenal or post renal abnormalities. Our study also used BUN/ creatinine ratio 10 : 1 as Dwinnel did. The results showed that patients with a BUN/creatinine ratio of >10 were significantly correlated with decrease in creatinine of <2 mg/dL. Therefore, the BUN/ creatinine ratio can be used as a prognostic parameter for the improvement of renal function.[15,16]

Harraz reported that the decrease in creatinine was affected by hemoglobin levels when the patient went to hospital. In this study, the average of hemoglobin was 10.73 g/dL, whereas the lowest hemoglobin was 5.30 g/dL and the highest was 15.60 g/dL. This is consistent with a Pali's report that patients with CKD had an average hemoglobin grade of 8.87 g/dL. Analysis with Chi-Square showed that hemoglobin level significantly affected renal function with p value = 0.001. This suggests that hemoglobin levels can be used as parameters for recovery of renal function.[17-19]

Kidney has a major role in managing blood potassium levels by excretion of potassium in the tubules. In patients with decreased in chronic renal function, the potassium levels will increase gradually as a response of body adaptation. In this study, it was obtained the average of potassium level of 5.10. Analysis with Chi-square showed that there was no significant correlation between serum potassium levels and decrease in serum creatinine. These results are different from previous research, stated that increased in serum potassium levels had a correlation with decreased in renal function. Other reports indicated that there was a weak correlation because increased in potassium was affected by many factors.

The etiologic obstruction variable categorized as stone and tumor had no significant correlation with decrease in serum creatinine p=0.566. This is in line with a report from Sukmagara that the etiologic obstruction had no significant correlation on the decrease in creatinine after nephrostomy had performed.

Patients were grouped into diabetes mellitus and non diabetes mellitus in accordance with the results of blood glucose examination. Results of analysis with Fisher's exact test showed there was no significant correlation with decrease in serum creatinine. This result is also consistent with a report from Sukmagara that diabetes mellitus did not have correlation with decrease in creatinine. Another report from Harraz showed that serum creatinine decrease did not correlate with the presence of diabetes mellitus.[2,19,20]

CONCLUSION

There is a significant correlation among renal parenchymal thickness, BUN/creatinine ratio, and hemoglobin levels with decreased in creatinine levels after release of obstruction. Renal parenchymal thickness was >10 mm, hemoglobin level

was >10 g/dL, and BUN/Creatinin ratio was >10 as prognostic parameter for recovery of renal function after release of obstruction.

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