

## Original Article

# Predicting factors for improvement of serum creatinine after percutaneous nephrostomy in adults with bilateral hydronephrosis associated with malignancy

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**Keywords:**

Bilateral hydronephrosis, percutaneous nephrostomy, serum creatinine, renal function

**Abstract**

**Objective:** Improvement of renal function in obstructive uropathy is a main goal of urinary diversion. In cases of failed internal diversion, percutaneous nephrostomy (PCN) is used to divert urine from the obstructed kidney. PCN also affect on quality of life, particularly having both sides. The objective of this study was to identify a predicting factor associated with improvement of renal function after bilateral PCNs and to avoid performing bilateral PCNs.

**Materials and Methods:** Data of all patients with bilateral hydronephrosis associated with malignancy who were performed bilateral PCNs in Siriraj Hospital between December 2011 and December 2016 were reviewed and collected. Success with PCN was defined as a serum creatinine less than 2 mg/dl or decreased more than 95% of initial serum creatinine.

**Results:** A total of 240 patients met the criteria. Mean age was  $64.6 \pm 14.9$  years old. Most common organ of malignancy was cervix. Mean initial serum creatinine (iCr) and nadir serum creatinine (nCr) were 7.7 and 1.9 mg/dl, respectively. On multivariate analysis, no significant predicting factors were demonstrated but only iCr tended to have a statistically significant ( $p = 0.058$ ). From receiver operating characteristics analysis, at cut-off value of iCr 5 mg/dl could demonstrate significant difference between success and failure ( $p = 0.027$ ). Sensitivity and specificity were 72.4% and 44.0%, respectively.

**Conclusion:** Only the iCr was more likely to be a predicting factor. At cut-off value of iCr 5 mg/dl, if a patient presented with iCr more than 5 mg/dl and unilateral PCN at dominant side did not improve serum creatinine, performing contralateral PCN might not help.

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## Introduction

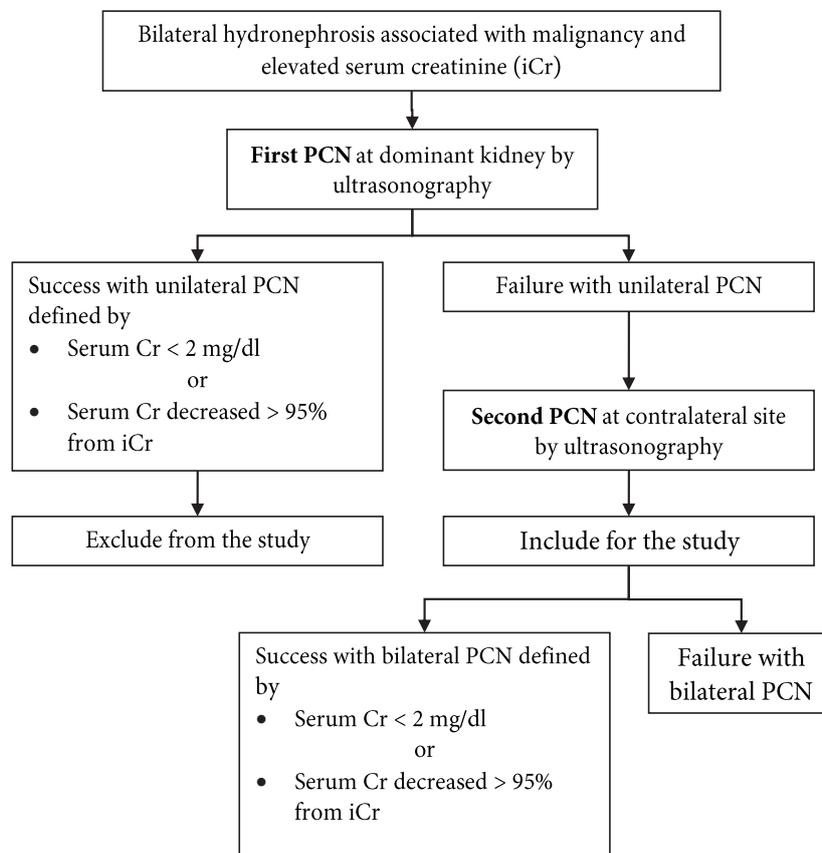
Approximately 10% of renal failure is caused by urinary tract obstruction and is known as obstructive uropathy<sup>1</sup>. A common cause of upper urinary tract obstruction is malignancy, particularly pelvic organ malignancy<sup>2,3</sup> or as a result of treatments, for example pelvic radiation. After a patient has developed a bilateral upper urinary tract obstruction, they may initially be asymptomatic but clinical presentations depend on etiology, location, degree and timing of the obstruction. Consequently, once overall renal function had declined, symptoms would manifest including uremia, oliguria, anuria, and volume overload<sup>4</sup>. Almost all cases require urinary diversion which reroute or bypass the urine. This procedure is a key step to improving renal function and stabilizing a patient. The rationale behind urinary diversion is to relieve symptoms and alleviate complications from renal insufficiency as well as facilitate systemic therapy<sup>4,5</sup>.

Percutaneous nephrostomy (PCN) is an external urinary diversion, used to decompress and divert urine directly from the obstructed

kidney<sup>6</sup>. Complications of PCN include bleeding, infection, and catheter related problems<sup>7</sup>. All PCN consequences have impact on quality of life because the patient is unable to adequately perform normal daily activity as a result of a catheter at the flank or back. In addition, the catheter needs changing regularly which is in itself restrictive. In order to avoid all associated issues of PCN, internal urinary diversion such as ureteric stent is always considered as a first step. When it fails, external urinary diversion such as PCN will be considered. The aim of this study was to identify a predicting factor that resulted in an improvement in serum creatinine after PCN in adults with bilateral hydronephrosis associated with malignancy.

## Materials and Methods

All patients with bilateral hydronephrosis associated with malignancy who were performed bilateral PCNs between December 2011 and December 2016 at our hospital were retrospectively reviewed. The study was approved by Ethical committee of Siriraj Hospital. All data including



**Figure 1.** Flow chart demonstrated patient selection in this study .

age, gender, degree of hydronephrosis using The Society of Fetal Urology (SFU) grading system<sup>8</sup>, organ of malignancy, initial serum creatinine (iCr), and nadir serum creatinine (nCr) were collected. iCr was defined as the last serum creatinine before PCN was performed as well as nCr was defined as the lowest serum creatinine after PCN was successfully performed. Most cases did not have baseline serum creatinine before occurring of bilateral hydronephrosis and timing from baseline to iCr was not completely recorded so that we had to define success PCN as serum creatinine was less than 2 mg/dl or decreased more than 95% of iCr after performing PCN to demonstrate a predicting factor which associated with improvement of serum creatinine and referred to renal function. A dominant kidney was defined by a greater cortical thickness or less degree of hydronephrosis on ultrasonography.

A patient who had history of previous renal and/or ureteral surgery, previous ureteric stent, diagnosed chronic kidney disease or single functional kidney or congenital anomalies in urinary tract before PCN and incomplete information was excluded from the study. PCN was performed by using ultrasound guidance. All patients with bilateral hydronephrosis were initially performed unilateral PCN on the dominant kidney. Serum creatinine was checked before first PCN and followed until stable at least 2 days. If it was still more than 2 mg/dl, contralateral PCN would be performed. After successfully performed bilateral PCNs, serum creatinine was followed until it was reached the lowest level, called nadir serum creatinine (nCr) (Figure 1).

### Statistical analysis

Statistical Package for Social Sciences (SPSS) version 17.0 was used to calculate and analyze the data set. In order to determine predicting factors, the Student T-test and ANOVA were used for normal distribution data as well as the Mann-Whitney U test was used for abnormal distribution data. The Chi-square test or Fisher Exact test was used for qualitative comparison. P-value less than 0.05 was indicated a statistical significance.

**Table 1.** Demographic data of 240 patients.

Demographic data	Results
Gender, n (%)	
Male	85 (35.4)
Female	155 (64.6)
Mean age $\pm$ SD (range) (years)	64.6 $\pm$ 14.9 (21-95)
Mean iCr $\pm$ SD (mg/dl)	7.7 $\pm$ 5.2
Mean nCr $\pm$ SD (mg/dl)	1.9 $\pm$ 2.1
Organ of malignancy – n (%)	
Urologic malignancy	88 (36.7)
• Bladder	66 (27.5)
• Prostate	22 (9.1)
Gynecologic malignancy	119 (49.6)
• Cervix	98 (40.8)
• Endometrium	14 (5.8)
• Ovary	7 (2.9)
Miscellaneous	33 (13.8)
• Colon	11 (4.5)
• Rectum	10 (4.1)
• Unknown	5 (2.0)
• Pancreas	4 (1.6)
• Lymphoma	2 (0.8)
• Breast	1 (0.4)
Degree of hydronephrosis by SFU grading system – n (%)	
• Grade 1	7 (2.9)
• Grade 2	90 (37.5)
• Grade 3	127 (52.9)
• Grade 4	16 (6.7)
Dominant kidney – n (%)	
• Right	105 (43.7)
• Left	135 (56.3)
Success with bilateral PCNs – n (%) <sup>*</sup>	182 (75.8)

<sup>\*</sup>Success with bilateral PCNs defined by serum Cr < 2 mg/dl or serum Cr decreased > 95% from iCr

### Results

A total of 251 patients with bilateral hydronephrosis associated with malignancy were performed bilateral PCNs and 11 patients were excluded from the study. All data of 240 patients who met the criteria were analyzed. Demographic data were demonstrated on Table 1. Mean age was 64.6 years and majority of cases was female (64.6%). Most common malignancy was cervical cancer (40.8%). Most common degree of

**Table 2.** Determining of predicting factors for improvement of serum creatinine.

Predicting factors	Success with bilateral PCNs	Failure with bilateral PCNs	P-value
Mean age $\pm$ SD	61.7 $\pm$ 14.1	62.3 $\pm$ 12.4	0.798
Mean iCr $\pm$ SD	7.4 $\pm$ 5.0	8.8 $\pm$ 5.6	0.058
Organ of malignancy – n (%)			0.680
• Urological malignancy	62 (34.0)	21 (36.2)	
• Gynecologic malignancy	88 (48.4)	29 (50.0)	
• Miscellaneous	32 (17.5)	8 (13.7)	
Degree of hydronephrosis – n (%)			0.388
• Grade 1	4 (2.1)	2 (3.4)	
• Grade 2	53 (29.1)	15 (25.8)	
• Grade 3	104 (57.1)	31 (53.4)	
• Grade 4	21 (11.5)	10 (17.2)	
Dominant kidney – n (%)			0.884
• Right	93 (50.5)	29 (50.0)	
• Left	89 (48.9)	29 (50.0)	

**Table 3.** Success and failure with bilateral PCNs at cut-off iCr 5 mg/dl .

Initial creatinine (mg/dl)	Equal or less than 5 mg/dl n (%)	Greater than 5 mg/dl n (%)	P-value
Success	80 (83.3)	102 (70.8)	0.027
Failure	16 (16.7)	42 (29.2)	

hydronephrosis was SFU grade 3 (52.9%) and most common of dominant kidney was left side (56.3%). Mean iCr was 7.7 mg/dl as well as mean nCr was 1.9 mg/dl. Comparing between iCr and nCr, there was statistically significant improvement ( $p < 0.05$ ).

On multivariate analysis, there was no statistically significant correlation among mean age, organ of malignancy groups, dominant kidney and success with bilateral PCNs. Only mean iCr was more likely to reach statistical significance. There was also no statistically significant correlation between degree of hydronephrosis and success with bilateral PCNs (Table 2).

Receiver operating characteristics (ROC) curve analysis was used to identify the cut-off value of iCr which was able to predict improvement of serum creatinine. If cut-off value of iCr was 5 mg/dl, it would demonstrate statistically significant difference between success and failure with bilateral PCNs ( $p = 0.027$ ). If iCr was equal or less than 5 mg/dl, failure with bilateral PCNs was 16.7%. On the other hand, if iCr was greater than

5 mg/dl, failure with bilateral PCNs was 29.2% (Table 3). Sensitivity and specificity were 72.4% and 44.0%, respectively.

## Discussion

PCN was usually a treatment of bilateral ureteral obstruction associated with malignancy. This procedure can improve renal function and alleviate the symptoms of uremia. PCN did not impact on quality of life in advanced stage malignancy with short survival<sup>6</sup> and suitable for palliative setting. Major concern of PCN was quality of life in long-term use particularly bilateral PCNs. Another study indicated that bilateral PCNs allowed significant improvement of renal function and was superior to unilateral PCN<sup>9</sup>. From our study, bilateral PCNs could significantly improve renal function ( $p < 0.05$ ) but we did not recommend to initially perform unilateral PCN at dominant side and waited for improvement of renal function for few days. If renal function was achieved, contralateral PCN would be avoided.

The study which compared renal function improvement between unilateral and bilateral PCNs in bilateral ureteral obstruction demonstrated that unilateral PCN at the greater cortical thickness may be appropriate for improving renal function<sup>6</sup>. In our study, we excluded a patient who was successful with unilateral PCN so that the degree of hydronephrosis classified by SFU grading system was not a significant predicting factor ( $p = 0.388$ ). In fact, degree of hydronephrosis depends on degree (complete or partial) and duration of obstruction. Longer period of complete ureteral obstruction was associated with diminished return of glomerular filtration rate<sup>10,11</sup>. Moreover, there are many other factors that influence returning of renal function after relief of obstruction including compliance of the collecting system and presence of pyelolymphatic backflow<sup>12</sup>. However, the degree of hydronephrosis on ultrasonography may not strongly correlate with renal function as DMSA renal scintigraphy<sup>13</sup>, it was used to initially and practically evaluate the dominant site and reasonably consider urinary diversion. This study may help urologists to make a better decision for performing bilateral PCN on a daily basis.

In this study, only one factor that might correlate the improvement of renal function from bilateral PCNs was iCr but it did not reach statistical significance ( $p = 0.058$ ). Therefore, ROC curve was used to identify a cut-off value of iCr that might guide the need for bilateral PCNs. At iCr 5 mg/dl, the failure rate was significantly different ( $p = 0.027$ ) as well as sensitivity and specificity were 72.4% and 44.0%, respectively. For clinical application, if a patient presented with iCr more than 5 mg/dl and first unilateral PCN did not achieve the improvement of serum creatinine, contralateral PCN should be avoided.

Because of retrospective design, some expectedly significant factors such as timing from baseline to iCr and iCr to nCr were not recorded as well as some important information would be missed. Therefore, a robust conclusion could not be drawn. Further prospective study would thoroughly answer this question.

## Conclusion

Bilateral PCNs were an effective treatment for improving renal function in bilateral hydronephrosis associated with malignancy. Only an initial serum creatinine (iCr) was more likely to be a predicting factor. At a cut-off value of iCr 5 mg/dl, if a patient presented with iCr more than 5 mg/dl and unilateral PCN at the dominant side did not improve serum creatinine, performing contralateral PCN might not help.

## Conflict of Interest

The authors declare no conflict of interest.

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