PERCUTANEOUS NEPHROSTOMY FOR RELIEF OBSTRUCTIVE UROPATHY : BENIGN VERSUS MALIGNANT DISEASE

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ABSTRACT

Objective: *This study aimed to find out the effectiveness of percutaneous nephrostomy (PCN) as palliative decompression of the obstructed urinary system.* ***Materials & Methods:*** *A case control study was performed with 118 patients (69 female and 49 male) with obstructive uropathy who were undergoing PCN during 2009 until 2012, retrospectively. The mean of age was 50.03 years. The PCN technique involves an ultrasound-guided puncture of the dilated collecting system with nephrostomy trocar than insert an 8 Fr nasogastric tube as nephrostomy catheter. Differences of renal function between benign and malignancy were assessed using Independent t-test. Changes in renal function after procedure were expressed as mean ± SD and analyzed using Pair t-test.* ***Results:*** *There was no procedure-related mortality. The most cause of malignancy was cervix cancer (36.4%) while the result of a benign process was 28.8% of urinary tract stones. Dialysis before procedure were performed in 43 (36.4%) consisting of 42 malignancies and 1 benign process. Improvement in renal function were statistically significant both benign and malignant groups seen in the levels of creatinine and blood urea nitrogen (BUN) before and after procedure ($p<0.001$). The mean differences were also statistically significant at the preoperative creatinine values between benign and malignant processes ($p=0.019$) but BUN levels before and after as well as postoperative creatinine levels showed no significant difference.* ***Conclusion:*** *PCN is a widely used technique, with a high technical success rate and low rate of complications. Obstructive uropathy due to benign processes had a better prognosis than malignancy after PCN treatment. Hemodialysis was mainly performed in patients with malignancy prior to PCN.*

Keywords: *Percutaneous nephrostomy, obstructive uropathy, benign, malignancy.*

ABSTRAK

Tujuan: *Penelitian ini bertujuan untuk menilai efektivitas dari nefrostomi perkutan (PCN) sebagai tindakan dekompresi paliatif pada obstruksi saluran kemih.* ***Bahan & cara:*** *Sebuah studi case control dilakukan pada 118 pasien (69 wanita dan 49 pria) dengan uropati obstruktif yang menjalani tindakan PCN pada kurun waktu 2009 sampai 2012. Teknik PCN yang dilakukan menggunakan pungsi dengan dipandu ultrasonografi pada kaliks ginjal yang terdilatasi dengan menggunakan trokar nefrostomi dan menggunakan selang nasogastrik ukuran 8 Fr sebagai kateter nefrostomi. Perubahan pada fungsi ginjal setelah tindakan ditampilkan dengan mean ± SD dan dianalisa dengan tes T-paired.* ***Hasil:*** *Tidak terdapat mortalitas akibat prosedur ini. Rerata usia adalah 50.03 tahun. Penyebab keganasan terbanyak adalah kanker serviks (36.4%), sedangkan penyebab proses jinak terbanyak adalah batu saluran kemih, yaitu 28.8%. Prosedur dialysis sebelum tindakan dilakukan pada 43 (36.4%) pasien, yang terdiri dari 42 pasien akibat keganasan dan 1 kasus jinak. Perbaikan pada fungsi ginjal secara statistik bermakna pada kedua grup, baik jinak maupun ganas, seperti terlihat pada tingkat kreatinin dan urea darah sebelum dan sesudah tindakan ($p<0.001$). Terdapat perbedaan rerata pada kadar kreatinin preoperative antara proses jinak dan keganasan ($p=0.019$), tetapi kadar BUN sebelum dan sesudah, serta kadar kreatinin postoperative menunjukkan perbedaan yang tidak signifikan.* ***Simpulan:*** *PCN merupakan teknik yang telah digunakan secara luas, dengan angka keberhasilan yang tinggi dan angka komplikasi yang rendah. Uropati obstruktif yang disebabkan proses jinak memiliki prognosis yang lebih baik dibandingkan akibat proses keganasan, setelah penatalaksanaan dengan PCN. Hemodialisis lebih sering dilakukan pada pasien dengan keganasan sebelum tindakan PCN.*

Kata kunci: *Nefrostomi perkutan, uropati obstruktif, jinak, ganas.*

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INTRODUCTION

The use of percutaneous nephrostomy (PCNL) for direct drainage to the kidney was initially reported by Goodwin in 1955.[1-4] Acute Obstructive Uropathy is the major cause of kidney function disease in the the world which leads to end-stage renal failure if untreated. In gynecology, obstetric surgery and trauma can lead to obstructive uropathy, and in the elderly, malignancy is the cause of obstructive uropathy.[5]

Treatment in the acute obstruction phase of infected upper urinary tract is drainage. Definitive therapy drainage could be performed concurrently if possible. In case drainage is not probable to be performed together with definitive therapy (in the case of renal insufficiency, infection, and complete obstruction), the first-line treatment is decompression of upper urinary tract obstruction.[6] The drainage option is ureteric stent or percutaneous nephrostomy. In patients where immediate treatment is required, percutaneous nephrostomy is the fast treatment in kidney decompression. Watson reported a promising result in 315 pyonephrosis patients with percutaneous nephrostomy.[7,8]

Percutaneous nephrostomy is one of the most important procedures in managing urinary tract obstruction accompanied by uremia and septicemia. Nephrostomy is carried as a temporary treatment before definitive treatment. Nephrostomy can also serve as a permanent urinary diversion. Morphological changes and renal damage in response to obstruction depend on the onset time, duration and degree of obstruction.[5,6] Time of renal damage incident in humans as a result of obstruction is unknown to date. In mice, it takes about 4 months, and in rabbits and dogs it takes 10 months and 18 months or more to occur after onset obstruction.[6]

Blood urea nitrogen (BUN) and serum creatinine are a good index for obstruction evaluation. Despite the fact that advances in modern endourology techniques have led to a decline in the primary indication for nephrostomy, PCN still plays an important role in the treatment of several urological conditions.[1,9] The scope of PCN has been expanded currently to non-emergency conditions involving urinary diversion of leaks, and the access of collection system for diagnostic and therapeutic procedures.[10-12] Drainage with percutaneous nephrostomy for urinary tract obstruction with local anesthesia has a low morbidity and failure rate, and therefore it becomes a preferable technique.[5]

Location of neoplasia is a factor that can significantly affect the survival rate of patients. Romero et al, in their research, described that urinary tract obstruction associated with prostate cancer and uterus cervix cancer usually had better outcomes than other types of neoplasia, with the survival increase of 1 year or more in 60% of patients. Patients with cervical carcinoma showed a better survival rate, while patients with adenocarcinoma of the prostate and bladder cancer had a poorer prognosis. All patients with prostate cancer died during hospitalization for percutaneous nephrostomy.[2]

OBJECTIVE

For those reasons, in this study we intended to assess the effectiveness of the percutaneous nephrostomy in patients with obstructive uropathy due to benign causes and malignancies in Sardjito Hospital.

MATERIAL & METHODS

This was a retrospective analytical using case-control study from 118 patients (49 men and 69 women). The mean of age was 50.03 years. Medical records obtained from Sardjito General Hospital during January 2009 – December 2012 to determine the effectiveness of percutaneous nephrostomy (PCN) and the survival rate of patients as palliative decompression of urinary tract obstruction. Patients with obstructive uropathy due to benign and malignancy (urogenital neoplasia) undergoing percutaneous nephrostomy treatment that have complete medical records, creatinine examination and blood urea nitrogen before and 3 days after percutaneous nephrostomy treatment are included in this study. Complications after treatment were assessed. Major complications (death during or soon after the interventional procedure for causes related to the procedure; haematuria requiring surgical management or blood transfusion; vascular laceration, pseudoaneurysm or arteriovenous fistula; infection requiring surgical management; sepsis; puncture of adjacent organs such as colon, spleen, lung); (2) minor complications (urine leakage; macroscopic haematuria with clot formation; infection treated with medical therapy; subcapsular or perirenal haematoma not requiring surgical intervention or blood transfusion); (3) tube complications (avulsion, kinking, fracture). Antegrade pyelography was performed after procedure. For this

type of study formal consent is not required.

All patient obstructive uropathy caused by malignant and benign were included. The patients who died before percutaneous nephrostomy treatment and Patients with renal parenchymal disease, obstructive uropathy resulting from bladder outlet obstruction without involving the ureteric orifices and patients with uncorrected coagulopathies (grossly deranged Prothrombin Time, Activated Partial Thromboplastin Time and Bleeding Time, Clotting time) were excluded. Changes in renal function in 7 days after the procedure were analyzed using the Independent t-test and Paired t-test.

All patients had normal pre-procedure coagulation and platelet (PLT) estimation [international normalized ratio (INR) >1.3; and PLT <30.000/dl were considered as a contraindications]. All procedures were carried out in a dedicated interventional room under ultrasound with haemodynamic monitoring facilities (continuous measurement of oxygen saturation and pulse rate with blood pressure recorded every 5 min). Only local anaesthetic was used (5 ml Lidocaine 2%) at the site of puncture. Access to the pelvicalyceal system (intermediate or lower pole calyces), usually located under ultrasound guidance. The patient was placed in a lumbotomy position, and cutaneous and subcutaneous incision of the access site was performed before the puncture. The technique involves an ultrasound-guided puncture of the dilated collecting system with nephrostomy trocar than insert an 8 Fr nasogastric tube as nephrostomy catheter. We did not use fluoroscopic guidance in this procedure. To fix the catheter, a suture to the skin with a thread (3/0 silk, B/Braun, Aesculap) was used. All patients received a prophylactic antibiotic regimen with a third generation cephalosporin beginning immediately before the procedure and continuing for the following 4 days.

RESULTS

Retrospective case-control studies had been conducted in patients who undergoing PCN from January 1st 2009 to December 31st, 2012 at Sardjito

Table 1. Characteristics of research variable.

Variable	
Age, mean ± SD	50.03 ± 11 .06
Blood urea nitrogen (BUN), mean ± SD	
Before surgery	65.26 ± 38 .07
After surgery	34.86 ± 22 .84
Creatinine, mean ± SD	
Before surgery	9.47 ± 6 .75
After surgery	4.23 ± 3 .48
Gender N (%)	
Male	49 (41 .5)
Female	69 (58 .5)
Diagnosis N (%)	
Benign	**42 (35.6)**
Urinary tract stones	34 (28 .8)
Pyonephrosis	3 (2.5)
UPJ Obstruction	2 (1.7)
Stenosis ureter	3 (2.5)
Malignancy	**76 (64 .4)**
Cervical Cancer	43 (36 .4)
Bladder Cancer	13 (11)
Prostate Cancer	2 (1.7)
Others	18 (15 .3)
Dialysis N (%)	
Yes	43 (36 .4)
No	75 (63 .6)

Hospital. Ultrasound performed prior to the procedure showed the presence of severe hydronephrosis (grade IV) in 54/118 (45.8%), whereas in 64/118 (54.2%) cases, hydronephrosis was grade II–III. The main cause of obstruction due to malignancy was cervical cancer of 36.4%, while the result of a benign process was 28.8% of urinary tract stones. Of overall patients, 43 (36.4%) of them required dialysis before surgery including 42 patients with malignancy and 1 patient with benign process (Table 1).

No death and other major complication was related to the procedure. Minor complications such as urine leakage and haematuria were found in 4/118 and 3/118, respectively. Tube complications that we found were 5/118 avulsions, 7/118 kinkings and no fracture. Twelve patients with tube complications, 6 of them requiring a new procedure and the other 6 patients treated by simply repositioning (table 2).

Clinically, mean of BUN and creatinine level in malignant obstructive uropathy patient with were higher than benign patient. However, mean differences were statistically significant in the preoperative creatinine values between the benign and malignancy (p=0.019) whereas BUN levels before (p=0.284), after (p=0.719), and creatinine level after surgery (p=0.458) showed no significant difference. In this study, a good improvement in kidney function was indicated in all patient, both in the benign and in malignancy group based on the level of creatinine and BUN, statistically significant (p<0.001) (Table 3).

Figure 1. Antegrade pyelography confirms correct positioning of the nephrostomic catheter with an insertion from the lower calices.

Table 2. Number of major and minor complications and tube complications.

Variable	Benign	Malignancy
Major Complication	0/42	0/76
Minor Complication	3/42	4/76
Hematuria	2/42	1/76
Urine leakage	1/42	3/76
Tube Complication		
Avulsion	2/42	3/76
Kinking	3/42	4/76
Fracture	0/42	0/76
Total Complication	7/42	12/76

Table 3. Comparison of creatinine and BUN levels before and after the PCN.

Variable	Before PCN	After PCN	
Blood Urea Nitrogen (BUN)			
All	65.26 ± 38.07	34.86 ± 22.84	< 0.001
Benign	61.28 ± 38.39	34.05 ± 22.78	< 0.001
Malignancy	67.46 ± 37.97	35.31 ± 23.02	< 0.001
Creatinine			
All	9.47 ± 6.75	4.23 ± 3.48	< 0.001
Before Surgery	7.70 ± 6.18	3.93 ± 3.22	< 0.001
After Surgery	10.45 ± 6.89	4.40 ± 3.62	< 0.001

* Mann U Whitney

DISCUSSION

Drainage in urinary tract obstruction with percutaneous nephrostomy has a low morbidity and failure rate. The degree of nephron damage as a result of obstruction depends on the length and the level of obstruction occuring.[5] Palliative decompression with nephrostomy of the urinary system is a widely-used method to maintain kidney function in elective and emergent situation.[7] In this study, the number of women was more than that of men, at 58.5%. When compared with Naem et al. and Wilson and Klahr, the incidence of obstruction occurred mainly in Men.[5] Sood et al. reported that the main cause of obstructive uropathy due to benign process was urinary tract stones, according to the study. But the most cause in malignancy was bladder cancer of 20%, different from this research that found cervical cancer of 36.4%.[4] Naeem et al. reported that 200 patients undergoing nephrostomy, 104 (52%) of them suffered from urinary tract stones, as well as the study reported by Anwar K et al. and Garcia E et al.[5] Such differences were caused by PCN in our institution which was performed for obstructive uropathy patients who cannot be managed with definitive surgery because of severe azotemia and electrolyte disorder. On the other hand, obstructive uropathy due to a benign process (urinary tract stone) can directly be managed with definitive surgery for stone evacuation.

Patients with malignant process with a total of 76 patients, 42 (55.3%) of those patients required hemodialysis before PCN treatment compared to only 1 (2.3%) patients with benign processes who underwent hemodialysis. The cause was that the malignant process tend to be bilateral obstruction with chronic process, while in the benign process, obstruction tend to be unilateral and got a compensation from healthy kidney.[4] Improvement of renal function after PCN was statistically significant in all patients and within the group of benign and malignancy. However, another study found that there was no significant improvement in renal function within the malignant group. Samarsinghe et al. reported no improvement of renal function in chronic obstruction and malignancy terminal.[5] The difference among such studies might be on account of the presence of hemodialysis treatment that mainly performed for the patient of malignancy so that the decrease of creatinine and BUN level was not purely caused by the PCN treatment. Naem et al reported that there was remarkable improvement after the procedure both clinically and biochemically as the mean blood urea level of 265 mg/dl before PCN dropped to 37 mg/dl and mean serum creatinine of 10.5 mg/dl dropped to 1.2 mg/dl respectively in 188 (94%) malignant and benign patients.[5] It was similar with Misra S et al, that reported mean serum creatinine fell from pre-intervention 516 lmol/l (range 239–1.019) to 168 lmol/l (range 85–265) post-nephrostomy (p\0.0001) value, with an average of 17 days (range 3–78) to reach the nadir creatinine.[8]

Since it was firstly introduced in 1955 by Goodwin et al as a minimum invasive treatment for urinary tract obstruction characterized by the presence of hydronephrosis, percutaneous nephrostomy (PCN) has been widely used in various clinical indications in the dilated and non-dilated urinary system. Although the advance in modern endourology techniques has led to the decline in the primary indication for nephrostomy, PCN still plays an important role in the treatment of several urological conditions.[1,9]

The development of urinary tract obstruction due to malignancy is often a nasty indication, and often has a short survival period measured in month.[13] Allen et al. found that the average of overall survival was only 96 days, with those in the low risk group average of 7 months and high-risk groups of 2 months.[14] Treatment for urinary tract obstruction due to malignancy is often a challenging case for urologists. Appropriate intervention for urinary tract decompression requires careful consideration in terms of technical, ethical and patient factors. Ishioka et al. demonstrated that patients with urinary tract obstruction were divided into three prognostic groups based on the status of the disease, the degree of renal dysfunction and overall metabolic condition.[15,16]

Percutaneous nephrostomy was more effective to improve renal function in the early stages of obstruction. Intervention in the malignant process was not very significant based on the improvement of renal function after PCN, which tend to be irreversible. Obstruction in the normal flow of urine resulted the urine to flow back, so that the kidney pressure increased. If the obstruction occurs in the urethra or bladder, back pressure would affect both kidneys, but if the obstruction occured in one of the ureter due to stones or stiffness, only one kidney was damaged. Partial or intermittent obstruction could be caused by renal stones that formed in the system of Calix pelviko kidney entering to the ureter and blocking it. Obstruction can be caused by a tumor

pressing ureter or scare tissue caused by an abscess or inflammation near the ureter and clamping the tract.[8,12]

The disease can be a result of an abnormal form on the base of the ureter or misplace kidney, which causes the ureter twisted or rigid. In elderly men, the most common cause is urethral obstruction in the system of bladder pelvic calicieal due to an enlarged prostate. Hydronephrosis can also occur in pregnancy due to uterus enlargement. Any cause of the urine accumulation in the kidneys calix pelvico system will result distention of the kidney pelvic calicieal system. At that time, renal atrophy occurs. When one kidney were damaged gradually, the other will enlarged gradually (hypertrophy compensatory), and ultimately renal function will be impaired.[8,12,14]

In this study, we used 8 fr NGT for nephrostomy tube that showed similar impairment in renal function compared to other nephrostomy tube. Complications of nephrostomy with guiding were uncommon, and reported mortality varied from 0.046–0.3%. Transient hematuria was common and generally resolved within 48-72 hours. Complications can occur in such following conditions: sepsis, bleeding, liver/spleen/pleura injury, colon injury and subintimal dissection of kidney pelvic calicieal system.[16] There were no death and other major complication was related to the procedure. Minor complications were found in 7/118 patients. Carafiello et al reported no major complications and the rate of minor complications was 3% (9/299 cases) using 8 Fr Glidex pigtail catheter (Flexima, Boston Scientific).[7] Romero et al, using 16 0r 18 fr Foley catheter, showed more complications. Nephrostomy procedures had 13 complications (7 major and 6 minor complications).[2]

Tube complications that we found were 5/118 avulsions and 7/118 kinkings. Romero et al found loss of the nephrostomy catheter was the most frequent postoperative complication.[2] the other study showed 43/299 (14.4%) tube avulsions, 4/299 (1.3%) cases of rupture of the catheter and 2/299 (0.7%) cases of catheter kinking. Catheter avulsions rates were then analyzed based on the fixation system to the skin.[7]

In this study we used 8 Fr NGT as nephrostomy tube and give a good impairment in renal function. Until now, we didn't found other studies that used 8 Fr NGT as nephrostomy tube. This study had several limitations. First, the results may have been influenced by fewer sample compared to the others. Second, we don't use fluoroscopic guidance for nephrostomy procedure that can reduce kinking complications.

CONCLUSION

PCN is a widely used technique, with a high technical success rate and low rate of complications. Obstructive uropathy due to benign processes had a better prognosis than obstructive uropathy due to the malignant process after percutaneous nephrostomy treatment. Nasogastric tube can be used as nephrostomy tube. Hemodialysis was mainly performed in patients with malignancy prior to percutaneous nephrostomy. Safety of the procedure is strictly related to correct indications and technical procedures (reduced risk of bleeding and vascular lesions), adequate antibiotic prophylaxis (reduced risk of sepsis) and proper maintenance of the catheter and drainage bag, associated with catheter fixation catheter to the skin with adhesive plaque and suture stitches (low risk of dislodgements). The operator's experience and combined sonographic–fluoroscopic guidance are further factors that increase the safety of the procedure.

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