



COST EFFECTIVENESS COMPARISON OF OPEN SURGERY WITH PERCUTANEOUS NEPHROLITHOTOMY (PCNL) IN NEPHROLITHIASIS PATIENTS IN H. ADAM MALIK HOSPITAL MEDAN

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ABSTRACT

Urinary tract stones are one of the three most common diseases in the field of urology in addition to urinary tract infections and benign prostate enlargement. Percutaneous nephrolithotomy (PCNL) monotherapy has the advantage of taking large stones with minimal morbidity, especially stones in the inferior calyx. This study aims to compare the cost effectiveness of PCNL compared to open surgery seen from all aspects. This study is an analytical study with a cross sectional design to see the comparison of the Cost Effectiveness between open surgery with percutaneous nephrolithotomy (PCNL) in patients with nephrolithiasis in the H. Adam Malik General Hospital Medan in the period of January - December 2018. Based on the results, it was found that PCNL procedures are superior in terms of cost-effectiveness compared to open pyelolithotomy with relatively shorter duration of action, shorter duration of treatment and less complication of action than open pyelolithotomy.

KEYWORDS : PCNL, Open surgery, nephrolithiasis, cost effectiveness

INTRODUCTION

Urinary tract stones are one of the three most common diseases in the field of urology in addition to urinary tract infections and benign prostate enlargement. In Indonesia urinary tract disease still occupies the largest portion of the number of patients in the urology clinic. The incidence and definite prevalence of this disease in Indonesia cannot be established with certainty. From domestic data published, there was an increase in the number of kidney stone patients who were treated at CiptoMangunkusumo Hospital from year to year starting 182 patients in 1997 to 847 patients in 2002, this increase was largely due to the availability of non invasive kidney stone breakers. ESWL (Extracorporeal Shock Wave Lithotripsy) which covers 86% of all treatments (ESWL, PCNL, and open surgery)¹.

In the last 3 decades the approach to urinary stone therapy has undergone substantial changes. The existence of minimally invasive and endourological procedure that can directly access visually both the upper urinary tract forces conventional surgery to be the second choice. Endourology referred to here is percutaneous nephrolithotomy (PCNL) which was first introduced in 1970, is an operation by placing a tool in the body to break or take stones. Understanding of the anatomy of renal vascularization, good radiological quality, and improved access to good punk will reduce the risk of complications, especially bleeding, as well as expertise in multiple puncture to access the upper part of the kidney, and complex kidney stones.²

PCNL monotherapy has the advantage of taking large size stones with minimal morbidity, especially stones in the inferior kalik, now PCNL is the main choice for the treatment of kidney stones that are > 20 mm in size, kidney print stones, and inferior calyx stones of > 10 mm.³

Published research usually only shows variables of fever, postoperative pain, blood loss, the incidence of urosepsis, or the presence of certain preoperative variables that affect kidney surgery, including age, obesity, type of nephrostomy used. Only one multiple regression analysis of the group design showed preoperative hemoglobin, multiple renal access, and stone size as predictors of independent postoperative transfusion.⁴ This study aims to compare the

cost effectiveness of PCNL compared to open surgery seen from all aspects.

METHODS

This study is an analytical study with a cross sectional design to see a comparison of the Cost Effectiveness between open surgery with percutaneous nephrolithotomy (PCNL) in patients with nephrolithiasis at H. Adam Malik General Hospital, Medan. This research was conducted at the H. Adam Malik General Hospital in Medan. Samples were all patients with nephrolithiasis who underwent open surgery or percutaneous nephrolithotomy (PCNL) in the H. Adam Malik Hospital Medan from January to December 2018. Inclusion criteria were patients with nephrolithiasis > 2 cm in all renal regions or < 2 cm in the lower calix. Patients with nephrolithiasis that differ between PCNL and open surgery, and have concomitant diseases such as diabetes mellitus, hypertension, malnutrition, secondary infections, blood clotting disorders, and consumption of blood-thinning drugs are excluded. Sample collection uses the consecutive method. The variables collected were type of surgery, cost of action, duration of action, need for blood transfusion, length of stay, and complications.

Categorical variables are presented by number or frequency (n) and percentage (%). Continuous variables are represented by mean \pm standard deviation or median value. Test the normality of numerical variables in the research subjects using the Kolmogorov-Smirnov or Sapphiro-Willk test. Unpaired T tests or Mann-Whitney tests were used to compare the numerical data of the two groups, while categorical data were tested using Chi Square or Fisher test. Processing and analysis of statistical data using SPSS statistical software, the value of p < 0.05 was said to be statistically significant.

RESULTS

Of a total 67 patients, 44 patients underwent percutaneous nephrolithotomy (PCNL) while 23 other patients underwent the open pyelolithotomy procedure. The mean age in the PCNL group was 49.68 (\pm 10.78) years compared to the open pyelolithotomy group of 49.13 (\pm 8.74) years. Based on gender variables, it was found that male and female sexes were 22 (50%) in the PCNL group compared with 14 men (60.9%) and 9 women (39.1%) in the open pyelolithotomy group.

Table 1. Patient' Characteristics

Characteristics	PCNL	Open Pyelolithotomy
Age (year)	49,68 (± 10,78)	49,13 (±8.74)
Gender		
Male	22 (50%)	14 (60.9%)
Female	22 (50%)	9 (39.1%)
Diagnosis		
Pyelumst	23 (52,3%)	3 (13.0%)
Print st	14 (31,8%)	18 (78.3%)
Inferior Calyx st	4 (9,1%)	0 (0%)
Multiple calyx st	3 (6,8%)	2 (8.7 %)
Complication		
Bleeding	14 (31,8%)	12 (52.1%)
Fever	6 (13,6%)	8 (34.7%)
Sepsis	0 (0%)	4 (17.3%)
Wound infection	0 (0%)	2 (%)
Without	24 (54,5%)	8 (34.7%)

The factors assessed in this study were complications when intraoperative and postoperative. Based on the data it was found that complications occurred in 20 cases of PCNL (45.5%) and 15 cases of open pielolithotomy. A common complication is bleeding, which occurred in 14 cases of PCNL (31.8%) and 12 cases of open pielolithotomy (52.1%).

In table 2 we conduct a cost-effectiveness analysis to compare the effectiveness of PCNL compared to open pielolithotomi. There are several variables that are measured and analyzed to determine the effectiveness of the PCNL procedure against the open pyelolithotomy procedure.

Table 2. Cost-effectiveness Analysis

Variable	PCNL	Open Pielolithotomi	P
Duration (minute)	172,39 (±52,94)	217,39 (±80,96)	0,015 ^a
Length of stay (day)	4.20(±0.97)	7.26 (± 1.25)	0,001 ^a
Transfusion			0,237 ^b
Yes	14 (31,8%)	14 (60.9%)	
No	30 (68,2%)	9 (39.1%)	
Complication			0,034 ^b
Yes	20 (45,5%)	15 (65.2%)	
No	24 (54,5%)	8 (34.7%)	

^aUsing the Mann-Whitney test because data is not normally distributed

^bUsing Chi Square

In table 2, an analysis between PCNL and open pielolithotomy is presented. For variable duration of operation, there was a statistically significant difference between the PCNL procedure and open pielolithotomi, where the average duration of PCNL surgery was shorter, namely 172.39 (± 52.94) minutes compared to open pielolithotomy for 217.39 (± 80.96) minute. P value obtained in this variable is 0.015.

Furthermore, the length of treatment days comparison was seen in patients who underwent the PCNL procedure and open pielolithotomy. The result was that patients who underwent PCNL had a shorter duration of treatment with 4.20 (± 0.97) days compared to open pielolithotomy with 7.26 (± 1.25) days. There is a statistically significant difference in this variable, with a P value of 0.001.

While based on the variable transfusion needs, there were 14 patients who underwent PCNL and needed blood transfusion (31.8%) compared with 14 people in the open pielolithotomy group (60.9%) who needed blood transfusion. There is no statistically significant difference in this variable with a P value of 0.766.

Fewer complications occurred in the group of patients who underwent PCNL where there were 20 people in the PCNL group who had complications (45.5%) compared to 15 people in the open pielolithotomy group (65.2%). The result, there is a statistically significant difference in this complication variable, as evidenced by the P value of 0.034.

Table 3. Cost-effectiveness Analysis by Average Cost-Effectiveness Ratio (ACER)

Cost-Effectiveness Variable	ACER PCNL (in 1000 rupiah)	ACER Open Pyelolithotomy (in 1000 rupiah)
Surgery duration	3.500 per hour	4.100 per hour
Length of stay	1.100 per day	1.272 per day

Based on the results of ACER calculations, it was found that PCNL had a lower ACER on both the hourly duration of the operation and the length of stay, with ACER Rp. 3,500,000 per hour of operation and Rp. 1,100,000 per day.

DISCUSSION

Of the 67 patients, 44 patients underwent PCNL and 23 patients underwent the open pielolithotomy procedure with an average age in the PCNL group of 49.68 (± 10.78) years compared to the open pielolithotomy group of 49.13 (± 8.74) years. The average age obtained in this study is quite similar to that of Zhang et al., Namely 54.3 ± 411.6 (19-80) for PCNL and 50.5 ± 11.1 (28-66) for open pielolithotomy⁵ according to nakamon et al average age obtained for PCNL 51.42 ± 8,80 and 48,3 (20-66) for open pielolithotomy.

The duration of PCNL in the study was found to be similar to Zhang et al., Namely 172.39 (± 52.94) minutes and 156.6 ± 41.2 (85-285) minutes. Whereas the duration of surgery on open pielolithotomy in the study was found to be faster than that of Zhang et al, namely 217.39 (± 80.96) vs. 282,1 ± 54,5 (187-340). And compare to study by nakamon et al, namely 52,62 (± 20,68) minutes and open pielolithotomi 84 (57-124) minutes for study by Cakici et al the duration was faster. The duration of surgery more significant in these studies, Zhang et al, Nakamon et al and Cakici et al (p=0,015 and <0,001).

In this study, length of stay in PCNL patients was 4.20 (± 0.97) and open pielolithotomi 7.26 (± 1.25), where Zhang et al. found a longer treatment time of 6.2 ± 2.7 (2-17) for PCNL, according to Nakamon et al found the length of stay longer, namely 4,78 (2,65) whereas for open pielolithotomy the time of treatment was found to be 10.3 ± 1.8 (8-14) (Zhang 2019), and shorter in Cakici et al 5,5 (3-8)

The number of blood transfusions in open pielolithotomy was found to be more than for PCNL, ie 60.9% (n = 14) vs. 31.8% (n = 14), although not significantly different (p = 0.237). In the study of Zhang et al., There were more blood transfusions in the open pielolithotomy group, namely 4/11 (36.4%) vs. 12/61 (19.7%). However, contradictory results were found where total bleeding in PCNL was higher than in open pielolithotomy, 695.5 ± 531.8 (10-2512) ml and 613.6 ± 528.7 (100-1800) ml. the different result show in Cakici et al for open pielolithotomi no need of tranfusion with the decrease of hemoglobin 1,8 (0,3-4,7) mg/dl with estimation blood loss 400-600 cc.

In this study complications were found in 20 people in the PCNL group (45.5%) and 15 in the open pielolithotomy group (65.2%), with no statistically significant differences. The most common complication in the open pielolithotomy group was bleeding (52.1%, n = 12).

According to the UAE algorithm, kidney stone therapy based on location and stone size, for upper and middle pole stones or renal pelvis with for stones more than 20 mm PCNL is the main therapeutic choice. While open surgery is generally

performed on indications of unavailability of PCNL facilities, failure of ESWL and PCNL measures, large size of multiple stones that require repeated ESWL and PCNL, presence of urinary anatomical abnormalities, extreme obesity, and contraindications to PCNL.

Cost-effectiveness analysis, which is a comparative analysis of effective intervention or treatment taking into account the costs incurred for conducting an intervention, is conducted to compare which procedure are taken to obtain maximum effects with minimal costs. Costs included in the INA-CBG's package that are calculated in costs include the direct medical costs which consist of drug costs, hospitalization fees, doctor fees (services), administration fees, laboratory fees, and medical equipment costs. Cost-effectiveness calculation is stated in ACER value (Average Cost-Effectiveness Ratio). Results from ACER were interpreted as average costs per clinical outcome unit.

Based on the rates of INA-CBG's Regional 1, type A hospitals, PCNL and open pyelolithotomy belong to the same category, namely the upper urinary tract procedure. This category has a package of costs ranging from Rp. 22,979,300 to Rp. 31,916,200. Whereas in terms of rates, the two procedures have different rates of Rp. 13,324,000 for PCNL and Rp. 18,653,000 for open pyelolithotomy.

Based on the results of the ACER calculation, it was found that PCNL had lower ACER both on the aspect of hourly duration of operation and length of stay, with ACER Rp. 3,700,000 per hour of operation and Rp. 1,100,000 per day of care. Based on the ACER value, it was found that the PCNL was more cost-effective than the open pyelolithotomy because the ACER value was more and with consideration PCNL had lighter side effects in terms of bleeding, fever, sepsis and surgical wound infection. Therefore, PCNL can be recommended as an option in the treatment of kidney stones measuring over 2 cm both based on medical indications and the cost effectiveness of actions.

CONCLUSION:

Based on the results of Cost-Effectiveness Analysis studies, it was found that PCNL procedures were superior in terms of cost-effectiveness compared to open pyelolithotomy with relatively shorter duration of action, shorter duration of treatment and less complication of action than open pyelolithotomy.

Suggestions for future research are to conduct studies with a wider sample and more homogeneous data to assess the cost-effectiveness of both actions, and study can continue to compare other therapeutic modalities so as to achieve modalities with high cost-effectiveness in channel stone therapy urinary tract.

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