

EFFECTIVITY OF PCNL WITH COMBINED ULTRASOUND AND FLUOROSCOPY

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ABSTRACT

Objective: To assess the effectiveness of Percutaneous Nephrolithotomy (PCNL) at age > 65 years and its complication. **Material & method:** Fifty-four patients with renal and proximal ureteral stones who underwent PCNL with ultrasound techniques combined with X-Ray at Sardjito and Pantirapih hospital, during 2007 to 2012. Laboratory data is in the form of hemoglobin, leukocyte count, trombocyte, haematocrit, natrium, potassium, chloride, BUN, creatinine both pre-operative and post-operative. The samples were divided according to age < 65 years old and above. In analyzing categorical data, we used chi-square test, whereas the numeric data analysis is using independent t-test with $p < 0.05$. **Results:** We found no significant differences between the age groups < 65 years and age > 65 years in stone location, presence of hydronephrosis, its grade and location. There also no difference based on operative time, intra-operative procedure, its complication and the day of DJ stents removal and nephrostomy. Both group showed similar result on laboratory findings. However, we found that the older age group have 2 days longer in the length of hospitalization than the younger age groups ($p = 0.05$) and history of diabetes mellitus and hypertension with $p < 0.05$. **Conclusion:** PCNL is a safe and effective procedure with minimal complications for the treatment of kidney and proximal ureteral stone, even for patients with co-morbidity. PCNL technique with guidance of ultrasound for early access would help to make the operating time shorter and less exposure to ionizing radiation.

Keywords: Percutaneous nephrolithotomy, age > 65 years old, effectiveness, safety.

ABSTRAK

Tujuan: Mengetahui efektivitas Percutaneous Nephrolithotomy (PCNL) pada usia > 65 tahun dan komplikasinya. **Bahan & cara:** Sebanyak 54 pasien dengan batu ginjal dan batu ureter proksimal menjalani PCNL dengan teknik ultrasound dikombinasikan dengan X-Ray di RS Sardjito dan RS Pantirapih, selama tahun 2007-2012. Data laboratorium dalam bentuk hemoglobin, jumlah leukosit, trombosit, haematocrit, natrium, potassium, chloride, BUN, kreatinin sebelum dan sesudah operasi. Sampel dibagi menurut usia kurang dan lebih dari 65 tahun. Dalam menganalisa data, kami menggunakan tes Chi-square, data numerik dianalisa menggunakan independent t-test dengan $p < 0.05$. **Hasil:** Kami tidak menemukan perbedaan signifikan di lokasi batu antara kelompok usia < 65 tahun dan kelompok usia > 65 tahun, adanya hidronefrosis, grade dan lokasinya. Tidak ada perbedaan berdasarkan waktu operasi, prosedur intra-operasi, komplikasi, hari pelepasan DJ-stent dan nefrostomy. Kedua kelompok menunjukkan hasil yang serupa pada temuan laboratorium. Bagaimanapun, kami menemukan kelompok usia lebih tua memiliki waktu tinggal di RS 2 hari lebih lama daripada kelompok usia lebih muda ($p = 0.05$), dengan sejarah diabetes mellitus dan hipertensi dengan $p < 0.05$. **Simpulan:** PCNL adalah tindakan yang aman dan efektif dengan komplikasi minimal untuk perawatan batu ginjal dan batu ureter proksimal, bahkan untuk pasien dengan co-morbiditas, dan dengan teknik PCNL dengan panduan ultrasound untuk perawatan pertama membantu waktu operasi jadi lebih pendek dan paparan radiasi lebih sedikit.

Kata kunci: Percutaneous nephrolithotomy, usia > 65 tahun, keefektifan, keamanan.

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INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the removal of a larger size of kidney and proximal

ureter stones which the most common choice throughout the world.^{1,2} In older patients usually having ESWL or conservative management by considering co-morbidities such as hypertension,

diabetes mellitus, renal insufficiency and hydronephrosis. Fluoroscopy is indispensable for PCNL.^{1,2}

Exposure to radiation due to prolonged fluoroscopy has unfavorable effect on health provider and patient.³ Using a fluoroscopy tube where the radiation is produced under the bed, can reduce patient's exposure 40 times for health worker and 150 times for the patient. Ultrasound can help to establish early access into collecting system so both patients and health workers are unexposed to radiation.³ Dilatation access requires accuracy and comfortiveness so that the need for C-Arm as a guide for dilatation with contrast media. Prior to the puncture, cystoscopy is performed to rule out bladder tumor and perform ureteric catheter insertion from distal end of ureter to the kidney which be operated to do retrograde pyelography with fluoroscopy.^{4,5}

PCNL is effective for radiopaque stones and cystine stones with a diameter > 20mm. ESWL and conservative management can be applied in older patients with kidney stones, considering PCNL carrying a higher risk in older patients compared to ESWL.^{1,5} Older patients with kidney stones are increasing with longer life expectancy.² Cardiorespiratory changes in older patients result in decreased patient tolerance to stressors which increased risk of bleeding, septic complications and other.⁶ Special attention should be given in older patients with urinary stones. When patients have cardiac risks, high risk of pulmonary complications of anesthesia, a minimally invasive procedure and observation a retreatment of choice.^{7,8} Anagnostou et al concluded that older age and associated morbidity is not an obstacle if the surgeon is very experienced.⁹

PCNL is already done in Yogyakarta by an urologist who introduced it the first time in Yogyakarta. PCNL uses guidance of ultrasound for early access into collecting system from the skin, followed by X-ray when dilated in order to create nephroscope access into the collecting system. In this study, we distinguish between patients older than 65 years and less than 65 years to see effectiveness of PCNL in both age groups. The usual prone position could be a challenge for both patient and the anesthesiologist.⁷ The most important in this research is to describe the experience with PCNL

puncture technique using ultrasound in Yogyakarta and see overall success.

OBJECTIVE

To assess the experience of PCNL with ultrasound for early access and fluoroscopy for dilated access into kidneys in terms of effectiveness and safety.

MATERIAL & METHOD

This study was a retrospective cohort analysis, conducted on patients of kidney stones with PCNL performed with ultrasound combined with x-ray imaging at Sardjito Hospital Yogyakarta, from 2007 to 2012.

Fifty-four patients underwent PCNL grouped by age into two categories such as older than 65 years and less than 65 years to assess the effectiveness of PCNL, especially in older age. In analyzing categorical data, we use chi-square test, whereas the numeric data is analysed by independent T-test with significance at $p < 0.05$.

In each patient data were collected in forms, such as gender, age, history of hypertension, history of diabetes, stone position, presence or absence of hydronephrosis, hydronephrosis grade and sides. Intra-operative and post-operative data were also recorded such as the number of punctures, the number of PCNL, DJ stents insertion, nephrostomy insertion, operating time, complications encountered in the form of bleeding, distal obstruction or infection. Other data are day of DJ stent removal, nephrostomy and discharge. Laboratory data in the form of hemoglobin, leukocyte count, trombocyte, haematocrit, natrium, potassium, chloride, BUN, creatinine both pre-operative, post operative and their changes are recorded for analysis.

RESULTS

During the period of 2007 until 2012 in Sardjito hospital there were 54 cases of kidney stones and proximal ureteral stones which underwent PCNL. Of the 54 patients, there were 22

Table 1. Gender data.

| Sex | Age < 65 years | Age > 65 years | Total | P |
|--------|----------------|----------------|-------|-------|
| Male | 17 (31.48%) | 15 (27.68%) | 32 | 0.269 |
| Female | 15 (27.78%) | 7 (12.96%) | 22 | |

Table 2. Data of previous disease history.

| | Age < 65 years | Age > 65 years | Total | p |
|------------------------------|----------------|----------------|-------|-------|
| History of Hypertension | | | | |
| Yes | 5 (9.26%) | 10 (18.52%) | 15 | 0.016 |
| No | 27 (50%) | 12 (22.22%) | 39 | |
| History of Diabetes Mellitus | | | | |
| Yes | 2 (3.70%) | 9 (16.67%) | 11 | 0.004 |
| No | 30 (55.55%) | 13 (24.07%) | 43 | |

Table 3. Data of stone position.

| | Age < 65 years | Age > 65 years | Total |
|------------------|----------------|----------------|-------|
| Stone position | | | |
| Superior calyces | 3 | 5 | 8 |
| Media calyces | 3 | 6 | 9 |
| Inferior calyces | 15 | 8 | 23 |
| Pelvis | 21 | 14 | 35 |
| Proximal Ureter | 2 | 0 | 2 |

Table 4. Data of hydronephrosis.

| | Age < 65 years | Age > 65 years | Total | p |
|----------------------|----------------|----------------|-------|-------|
| Hydronephrosis | | | | |
| Yes | 22 | 15 | 37 | 0.965 |
| No | 10 | 7 | 17 | |
| Hydronephrosis Grade | | | | |
| Grade 1 | 0 | 0 | 0 | 0.200 |
| Grade 2 | 14 | 6 | 20 | |
| Grade 3 | 6 | 9 | 15 | |
| Grade 4 | 2 | 0 | 2 | |
| Hydronephrosis side | | | | |
| Left | 5 | 5 | 10 | 0.775 |
| Right | 17 | 10 | 27 | |
| Bilateral | 0 | 0 | 0 | |

patients with age < 65 years, while 32 patients had aged > 65 years. By gender, it was found that men is dominant (32 people), while women were 22 people. There were no differences between the two age groups ($p = 0.269$).

Based on the previous history of the disease, 5 patients (9.26%) had a history of hypertension in the age group < 65 years and 10 patients (18.52%) in the age group > 65 years. While the history of DM only 2 patients (3.70%) at age < 65 years and 9 patients (16.67%) in the > 65 years. Significant differences between the age groups < 65 years and age > 65 years was seen for the history of DM and hypertension with $p < 0.05$.

Based on location of the stone, the stone in

the renal pelvis ranks highest followed inferior calyces in both age groups with their respective values □□(26.25% and 17.5%) and (18.75% and 10%). No significant difference was found between the two groups.

There were 37 cases of hydronephrosis with 22 cases in the age group < 65 years and 15 cases at age > 65 years. By hydronephrosis grade, in the age group < 65 years we found 14 cases (37.84%) with grade 2, 6 cases (16:21%) in grade 3, and 2 cases (5.4%) in grade 4, while in the age group > 65 years there were 6 cases (16:21%) in grade 2, and 9 cases (24.32%) in grade 3. Based on the hydronephrosis, right side was more dominant than the left one on

both groups with the number of each are 17 and 10 cases. There were no significant differences between the two groups on parameters in the stone presence or absence of hydronephrosis, hydronephrosis grade and location of hydronephrosis.

During surgery, both groups was performed PCNL with the number and amount of PCNL puncture each were 1 time. DJ stents were inserted in 7 cases and nephrostomies in 32 cases at age < 65 years, whereas the age group > 65 years, DJ stent was inserted in 5 cases and nephrostomies in 22 cases.

Based on operating time, both groups showed no difference in time span ranging from 90-100 minutes. In both age groups, there were no

significant differences based on number of punctures, the number of PCNL procedures, DJ stent insertion, nephrostomy installation and operating time.

Post-operative complication such as bleeding complications and infection were observed in one case each on the age group < 65 years. While complications such as distal obstruction was not found in both groups. Based on the day of DJ stents and nephrostomy removal, we also found no significant differences in both age groups on days 3 and 7. But the difference in length of hospitalization was reported, the older age group was treated 2 days longer than the younger age group.

Table 5. Comparison of intra-operative PCNL characteristics.

| | Age < 65 years | Age > 65 years | p |
|-------------------------|----------------|----------------|-------|
| Intraoperative | | | |
| The number of punctures | 1 | 1 | 0.698 |
| The number of PCNL | 1 | 1 | 0.335 |
| Inserted DJ stent | | | |
| Yes | 7 | 5 | 0.597 |
| No | 25 | 17 | |
| Inserted Nephrostomy | | | |
| Yes | 31 | 22 | 0.593 |
| No | 1 | 0 | |
| Duration of operation | 90.65 ± 45.58 | 99.77 ± 48.78 | 0.505 |

Table 6. Comparison of post-operative complication.

| | Age < 65 years | Age > 65 years | p |
|-------------------------------------|----------------|----------------|-------|
| Post Operative | | | |
| Bleeding complications | | | |
| Yes | 1 | 0 | 0.593 |
| No | 31 | 22 | |
| Complications of distal obstruction | | | |
| Yes | 0 | 0 | 1.000 |
| No | 32 | 22 | |
| Infectious complications | | | |
| Yes | 1 | 0 | 0.593 |
| No | 31 | 22 | |
| Day of DJ Stent removal | 3 | 3.36 | 0.825 |
| Day of Nephrostomy removal | 4 | 7.32 | 0.335 |
| Length of stay | 7 | 10.82 | 0.050 |

Table 7. Comparison of laboratory data pre-operative and post-operative.

| Parameter | Age < 65 years | Age > 65 years | p |
|----------------------------|-------------------|------------------|-------|
| Haemoglobin pre-operative | 13.15 ± 1.86 | 12.27 ± 1.87 | 0.094 |
| Haemoglobin post-operative | 11.41 ± 1.75 | 11.1 ± 1.08 | 0.429 |
| Haemoglobin change | 1.74 ± 1.21 | 1.17 ± 1.64 | 0.147 |
| Leukocyte pre-operative | 9.42 ± 3.41 | 8.77 ± 3.21 | 0.483 |
| Leukocyte post-operative | 13.1 ± 2.77 | 11.83 ± 3.03 | 0.116 |
| Leukocyte change | 3.67 ± 4.25 | 3.05 ± 3.40 | 0.570 |
| Platelet pre-operative | 281.218 ± 105.236 | 262.410 ± 83.657 | 0.487 |
| Platelet post-operative | 233.503 ± 89.315 | 240.090 ± 61.971 | 0.776 |
| Platelet change | 47.710 ± 77.38 | 22.318 ± 101.408 | 0.302 |
| Haematocrit pre-operative | 46.78 ± 42.04 | 45.57 ± 29.33 | 0.908 |
| Haematocrit post-operative | 33.77 ± 4.59 | 34.58 ± 3.89 | 0.498 |
| Haematocrit change | 13.01 ± 42.59 | 10.98 ± 28.69 | 0.846 |
| Sodium pre-operative | 139.5 ± 2.99 | 139.41 ± 4.39 | 0.928 |
| Sodium post-operative | 140.56 ± 4.06 | 140 ± 3.39 | 0.596 |
| Sodium change | -1.06 ± 4.06 | -0.59 ± 4.63 | 0.694 |
| Potassium pre-operative | 3.99 ± 0.37 | 3.89 ± 0.53 | 0.464 |
| Potassium post-operative | 3.96 ± 0.43 | 3.94 ± 0.59 | 0.870 |
| Potassium change | 0.29 ± 0.53 | -0.38 ± 0.61 | 0.668 |
| Chloride pre-operative | 104.08 ± 4.66 | 102.74 ± 4.47 | 0.294 |
| Chloride post-operative | 103.22 ± 3.17 | 103.91 ± 2.39 | 0.391 |
| Chloride change | 0.86 ± 4.84 | -1.17 ± 5.10 | 0.144 |
| BUN pre-operative | 16.91 ± 11.88 | 23.44 ± 19.43 | 0.132 |
| BUN post-operative | 14.27 ± 6.81 | 18.17 ± 8.79 | 0.076 |
| BUN Change | -2.64 ± 13.24 | -5.33 ± 22.11 | 0.579 |
| Creatinine pre-operative | 1.25 ± 0.52 | 2.07 ± 2.73 | 0.102 |
| Creatinine post-operative | 1.18 ± 0.46 | 1.62 ± 1.24 | 0.126 |
| Creatinine change | 0.68 ± 0.37 | -0.45 ± 2.88 | 0.542 |

Pre-operative and post-operative parameters include haemoglobin, leukocyte count, platelet count, hematocrit, sodium, potassium, chloride, BUN and creatinine in both groups revealed no significant differences.

DISCUSSION

Based on the data of sex distribution, the number of men was more dominant (32 people), while women were 22 people. There were no differences between the two age groups ($p = 0.269$). We found significant differences between the age groups < 65 years and age > 65 years for the history

of diabetes mellitus and hypertension with $p < 0.05$. Based on the location of the stone, the stone in the renal pelvis ranks highest followed by inferior calyces in both age groups with their respective values (26.25% and 17.5%) and (18.75% and 10%). No significant difference was found between the two groups.

Based on the hydronephrosis, right side more dominant than the left side in both age groups with the number of each of 17 and 10 cases. We found no significant differences between the two groups of parameters of stone location, presence of hydronephrosis, hydronephrosis, and grade of hydronephrosis.

Based on operative time at age < 65 years and age > 65 years, we also found no difference in the time span ranging from 90-100 minutes. In both age groups, there were no significant differences of the number of punctures, the number of PCNL, insertion of DJ stents, nephrostomy insertion and operating time. Distal obstruction complications were not found in both age groups. Based day of DJ stents and nephrostomy removal, there were no significant differences in both age groups on days 3 and 7.

But the difference in the length of hospitalization is observed, the older age group was treated 2 days longer than the younger age groups. Based on the parameters of pre-op and post-op that includes haemoglobin, leukocyte count, platelet count, haematocrit, sodium, potassium, chloride, BUN and creatinine in both groups did not show any significant differences.

CONCLUSION

PCNL is a safe and effective procedure with minimal complications for the treatment of kidney and proximal ureteral stones, even for patients with comorbidity. PCNL technique with the guidance of ultrasound for early access to the collecting system to shorten operating time and decrease exposure to radiation.

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