



ORIGINAL ARTICLE

# Is hydronephrosis a risk factor for complications in conventional percutaneous nephrolithotomy?

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**ABSTRACT... Objective:** To assess Hydronephrosis as a Risk Factor for complications in Conventional Percutaneous Nephrolithotomy. **Study Design:** Cross Sectional Descriptive study. **Setting:** Kidney Centre Post Graduate Training Centre, Karachi. **Period:** January to December 2020. **Material & Methods:** This study was done to know post-operative complications including bleeding, infection, and incomplete stone clearance in patients with or without hydronephrosis undergoing percutaneous nephrolithotomy. After applying the inclusion/ exclusion criteria it was found that the patients with hydronephrosis had less bleeding as compared to the no hydronephrosis group. In the same way, they also had fewer nephrostomy tubes placed, and chest drain insertion. All other complications were approximately the same in each group. Patients were selected using non-probability consecutive sampling technique. Percentage and frequencies were determined for quantitative variables. Mean and standard deviation were determined for quantitative variables. **Results:** Total 300 cases were studied fulfilling inclusion criteria. There were 70.07% male and 29.3% female cases. Age range of the patients was 18-60 years. There were 52.7% cases with hydronephrosis, placed in one group and 47.3% cases were without hydronephrosis placed in other group. Most common complication was postoperative bleeding reported in 48.9% cases with hydronephrosis as compared to 56.2% cases without hydronephrosis. Mean operative time was  $115.7 \pm 41.9$  minutes in patients with hydronephrosis and  $135 \pm 35.4$  minutes in patients without hydronephrosis. **Conclusion:** Patients with hydronephrosis experienced less postoperative complications, after PCNL as compared to those without hydronephrosis.

**Key words:** Hydronephrosis, Hydrothorax, Pneumothorax, Percutaneous Nephrolithotomy, Urolithiasis.

## INTRODUCTION

Renal stone disease is very common and affect 0.13% population. Percutaneous nephrolithotomy (PCNL) remains an integral part of treatment for large complex renal stones. Although it is widely used nowadays, postoperative complication rates are still relatively higher. An overall complication rate of 20.5% has been reported after PCNL<sup>1</sup>, namely fever and bleeding (most frequent), urinary leakage, hydrothorax, hematuria, urinary tract infection, pelvic perforation, and urinary fistula. Frequency of post-operative bleeding after PCNL can range from 0 to 20%. PCNL is used for large renal stones. Choice of treatment in renal stones depends on stone size, availability of equipment, any additional procedure required

and patient preference<sup>2</sup>

Hydronephrosis, defined as dilatation of the pelvicalyceal system because of failure of urine excretion. It is mainly sub-grouped into obstructive or non-obstructive Hydronephrosis.<sup>3</sup> Obstructive hydronephrosis is usually caused by urinary stones, blood clots, uretero-pelvic junction (UPJ) obstruction, stricture or external compression by tumor, fibrosis or others. The obstruction may be acute or chronic, unilateral or bilateral, partial or complete. On the other hand, Non-obstructive hydronephrosis is caused by reflux, residual or others.<sup>4</sup>

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The Society of Fetal Urology (SFU) grading system is used commonly to grade hydronephrosis in all age groups. There is a lack of data regarding hydronephrosis as a risk factor for complications after percutaneous nephrolithotomy (PCNL). The significance of hydronephrosis on surgical outcomes, after PCNL, is not well established. Previous studies demonstrate conflicting results regarding this notion. For example Hydronephrosis associated with a low number of complications after PCNL.<sup>6</sup> On the other hand association of Hydronephrosis with a higher residual stone<sup>7</sup> Urosepsis has been reported a common complication due to infection after PCNL. Most of the time urosepsis is not diagnosed clinically and remains untreated. It is associated with urinary tract infection accounting 5% of all sepsis types.<sup>8</sup> New guidelines mention urosepsis a medical emergency which need to be treated promptly by giving intravenous fluids to manage hemodynamic status and suitable intravenous antibiotics.<sup>9</sup>

Bleeding during PCNL is a major complication reported in 0-20% cases. Many studies have tried to evaluate risk factors of bleeding. Presence and absence of hydronephrosis is a main risk factor determining bleeding during the procedure. Renal cortex in patients without hydronephrosis is thick and space in renal calyces is minimum, hence making PCNL difficult for urologists with increased risk of renal hemorrhage. Post-operative fever and sepsis are other complications after percutaneous nephrolithotomy. According to a report ever occurs in 21-39% cases and urosepsis occurs in 0.3-9.3% cases. Urosepsis is a life threatening condition with high mortality rate.<sup>10</sup>

Therefore, in this study, we aim to analyze various known post-operative complications including bleeding, infection, incomplete stone clearance, etc., according to the presence or absence of hydronephrosis in percutaneous nephrolithotomy

(PCNL) patients.

Previously such study has not been conducted in our center; therefore, the results will help in improving future surgical practices and minimizing post-operative surgical complications.

**MATERIAL & METHODS**

A retrospective study was conducted at The Kidney Centre Post Graduate Training Centre, Karachi. Patients operated during twelve months duration from January to December 2020. Ethical approval was taken from the institutional review board (104-URD-072020). Data of the patients was taken from the hospital records. To assess the significance of hydronephrosis causing postoperative complications after PCNL. Inclusion criteria included age 18-60 years, single stone size 1 to 3cms, post- PCNL 20-22 Fr, Radio-opaque stones, Post PCNL complete clearance. Exclusion criteria was age more than 60 years or less than 18 years, Staghorn stone or multiple, radiolucent stone, Partial clearance after PCNL.

Two Independent Proportions (Null Case) Power Analysis

Numeric Results of Tests Based on the Difference: P1 - P2

H0: P1-P2=0. H1: P1-P2=D1 < > 0. Test Statistic: Z test with pooled variance

Note: Exact results based on the binomial were only calculated when both N1 and N2 were less than 100.

We calculated the sample size from the PASS II sample size calculator. The number of patients required 82 patients in each group to find the difference in para and postoperative complications between hydronephrosis and without hydronephrosis groups.

Sample Power	Sample Size Grp 1	Sample Size Grp 2	Prop   H1 Grp 1 or Treatment P1	Prop Grp 2 or Control P2	Diff if H0 D0	Diff if H1 D1	Target Alpha	Actual Alpha	Beta
0.8012	82	82	0.2840	0.1130	0.0000	0.1710	0.0500	0.0495	0.1988

Analysis plan: Data was entered and analyzed on SPSS 21. Cleaning and coding of data were done before analysis. Mean and Standard deviation was calculated for continuous variables like BMI, stone size and Hemoglobin levels. Frequency and percentages were calculated for all categorical data like Gender and group status of the patient. Differences between groups were assessed by t-test or Mann Whitney test for continuous variables and by Chi-square or Fisher exact test in case of categorical parameters. Statistical significance was considered at P-value <0.05.

## RESULTS

We enrolled 300 patients in our study in which 212 (70.07%) were male while 88 (29.3%) were female. Patients with hydronephrosis comprise 157 patients (52.7%) in our research, as compared

to 143 patients (47.3%) without hydronephrosis. Most of the patients with hydronephrosis had grade 3 hydronephrosis, 62(39.5%). (Table-I) when we observed the association between postoperative complications with 2 study groups, we found that significant bleeding, nephrostomy tube insertion, and chest drain were significantly associated with the absence of hydronephrosis. The patients with hydronephrosis had less bleeding as compared to the no hydronephrosis group [64 (48.9%) +82 (56.2%)] respectively with a p-value of 0.004. similarly, they also had fewer nephrostomy tubes placed [111 (48.9% vs 116 (51.1%)] and chest drain [8 (30.8%) vs 18 (69.2%)]. All other complications were approximately the same in each group. None of the patients died of hydrothorax or urinary fistula.

Variables	Mean ± Std & Median, IQR - Minimum- Maximum						P-Value
	Patients With Hydronephrosi			Patients Without Hydronephrosis			
Age (years)	41 ± 14.4 & 41 , 24	18	67	39.2 ± 14 & 40 , 22	18	66	0.246
BMI (kg/m <sup>2</sup> )	21.3 ± 3.3 & 20 , 5	17	29	21.4 ± 3.5 & 20 , 6	17	29	0.943
Weight (kg)	70.2 ± 14.1 & 69 , 24.5	46	104	67.7 ± 14.4 & 68 , 27	46	98	0.116
Height (cm)	160.4 ± 9.8 & 160 , 10	140	180	160.3 ± 8.8 & 160 , 10	140	180	0.625
Hospital stay (days)	3.5 ± 0.5 & 4 , 1	3	4	3.5 ± 0.5 & 4 , 1	3	4	0.386
Stone size (mm)	21.8 ± 6.8 & 20 , 8	10	40	20.9 ± 7 & 20 , 10	10	40	0.182
Pre-operative Hb (g/dl)	13.4 ± 1.2 & 13.4 , 1.8	10.3	16.3	13.2 ± 1.1 & 13.2 , 1.8	10.9	16.3	0.13
Post-operative Hb (g/dl)	11.2 ± 1.2 & 11.3 , 1.5	8	14.5	11.1 ± 1.1 & 11.2 , 1.3	8.4	14.2	0.284
Difference in Hb (g/dl)	2.2 ± 0.75 & 2.1 , 0.9	0.5	4.5	2.1 ± 0.6 & 2.1 , 0.8	0.4	3.7	0.752
Operative time (minutes)	115.7 ± 41.9 & 120 , 60	53	280	135 ± 35.4 & 134 , 35	64	267	<0.001

Table-I. Mean differences of parameters of two study groups.

Variables	Study Groups n (%)		N=300 Total	P-Value
	Patients With HDN	Patients Without HDN		
Post-operative fever	88 (52.1)	81 (47.9)	169 (56.3)	0.918
Significant bleeding	64 (43.8)	82 (56.2)	146 (48.7)	0.004
Pneumothorax	8 (36.4)	14 (63.60)	22 (7.3)	0.119
Urinary leakage	11 (36.7)	19 (63.3)	30 (10)	0.07
Urosepsis	2 (50)	2 (50)	4 (1.3)	0.925
Post op ICU admission	4 (50)	4 (50)	8 (2.7)	0.893
100% stone clearance	117 (50.4)	115 (49.6)	232 (77.3)	0.223
DJ stenting	117 (51.1)	112 (48.9)	229(76.3)	0.439
Nephrostomy tube insertion	111 (48.9)	116 (51.1)	227 (75.7)	0.036
Chest drain	8 (30.8)	18 (69.2)	26 (8.7)	0.021

Table-II. Association of hydronephrosis with post-operative complication of patients.

All baseline demographic data and clinical parameters were the same in both groups, ( $p > 0.05$ ). There was no significant difference in the drop between the 2 groups ( $2.2 \pm 0.75$  and  $2.1 \pm 0.6$ ), the p-value is 0.752. On the other hand, operative time was significantly decreased with patients with hydronephrosis ( $115.7 \pm 41.9$  and  $135 \pm 34.5$ ) respectively.

## DISCUSSION

PCNL surgeries have been a norm for patients to remain under observation postoperatively. The main reasons for this assessing patients for hemorrhage, observing for infection whether requires antibiotics treatment, imaging to exclude any residual stones, and ensuring adequate drainage of kidneys to prevent urinary stasis.<sup>10</sup> According to studies success rate of PCNL is more than 90% and postoperative bleeding is its common and serious complication which most of the times can be treated conservatively while sometimes (in 0.8% cases) arteriography and selective embolization is required.<sup>11,12</sup>

A study conducted in Korea by Kim et al reported that patients without hydronephrosis undergoing PCNL required longer hospital stay, prolonged operating time, lower stone clearance rate and higher blood transfusion rate due to bleeding complications as compared to the patients with hydronephrosis.<sup>13</sup> In our study, postoperative bleeding was observed in 64 (40.7%) patients who had hydronephrosis in contrast to 82 (57.3%) patients who had not had hydronephrosis, and the p-value was 0.004.

Wang et al studied outcomes of PCNL in 207 cases reported higher level of difficulty in accessing stone and more complications among those patients having staghorn stone ( $p=0.032$ ), previous ipsilateral open nephrolithotomy ( $p=0.026$ ) and stone in lower pole of kidney ( $p=0.039$ ).<sup>14</sup> In our study patients with staghorn stones or previously operated for nephrolithotomy ipsilateral were not included in the study.

According to Meng et al factors influencing postoperative bleeding after PCNL include operative time ( $p=0.005$ ), stone size ( $p=0.001$ ),

type of stone ( $p=0.001$ ) and degree of hydronephrosis ( $p=0.001$ ).<sup>15</sup> Similarly we found in our study stone size ( $p=0.182$ ) and operative time ( $p<0.001$ ) important factors determining postoperative bleeding.

Pimratana et al studied outcomes of hydronephrosis in PCNL in 85 cases. In their study mean stone size was  $48.2 \pm 16.6$  mm and mean body mass index was  $23.7 \pm 3.7$  kg/m<sup>2</sup>. Success rate of renal access was 98.8% and stone free rate was 64.7%. Complications reported were failure of stone access in 1.17% cases, need of blood transfusion in 7.1%, postoperative fever in 30.6% and urosepsis in 2.6% cases.<sup>16</sup> In our study, urosepsis was observed in both groups with 2 patients in each group (1.3%) with a p-value of 0.925. Postoperative ICU admission was noted in 4 patients in each group (2.7%) with a p-value of 0.893.8. Postoperative fever was reported in 52.1% cases with hydronephrosis and 47.9% cases without hydronephrosis. Mean stone size was  $21.8 \pm 6.8$  mm and  $20.9 \pm 7$  mm in both groups of patients with hydronephrosis and without hydronephrosis.

A study conducted in USA concluded incidence of silent hydronephrosis after PCNL in 16% cases which remains undiagnosed or untreated in 2% cases, usually due to residual stone or stricture formation. Majority of patients do not need any treatment for silent hydronephrosis and it is eventually resolved. Postoperative ultrasound should be done after PCNL to see hydronephrosis due to silent obstruction following PCNL.<sup>17</sup> According to a study conducted in China, percutaneous nephrolithotomy was done in 192 patients with severe hydronephrosis and outcomes were reported as overall stone free rate was 86.5% and overall complication rate was 18.2% include. Common complications were ureteral stricture in 5.2% cases and recurrence of stone in 2% cases. Most of the reported complications were minor.<sup>18</sup>

According to a study conducted on 246 patients, postoperative complications after PCNL were reported in 41.06% cases and out of them only 9.35% cases experienced major complications.

In Age, gender, body mass index, presenting complaints and history of previous surgery in their study cases were not determining rate of postoperative complications.<sup>19</sup>

A study conducted in India reported stone clearance rate of 85.7% in PCNL via single tract while additional tracts were made in 14.29% cases. Postoperative urinary tract infection was reported in 6.6% cases.<sup>20</sup>

The incidence of Pneumothorax, hydrothorax, and hemothorax are very rare post PCNL with an incidence of less than 2%. Pneumothorax and hydrothorax occur due to rupture of pleura. Supracostal (above 12th rib) approach and left-sided procedures have been associated with increased risk of thoracic complications.<sup>21-23</sup> In our study, Patients having hydronephrosis who had post-op pneumothorax complications were recorded as 8(36.4%) as opposed to incidence of 63.6% among patients without hydronephrosis. The p-value was 0.119.

This study aims to compare post-operative complications such as fever, Urosepsis, pneumothorax, bleeding in a patient with hydronephrosis, and without hydronephrosis after the PCNL. All other complications were approximately the same in each group. There are some limitations to the current study: not including patients aged more than 60 years or less than 18 years, Staghorn stones or multiple, Radiolucent stone, Partial clearance after PCNL. The outcome could be different if the limitations have been included.

## CONCLUSION

In this study we found out that patients with hydronephrosis had less bleeding as compared to no hydronephrosis group, similarly, they also had fewer nephrostomy tubes and chest drain insertion. All other complications were approximately the same in each group.

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