

Original Research Article

Impact of percutaneous nephrolithotomy operation on non-operated kidney: a single center based study

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Received: 25 March 2019

Accepted: 03 May 2019

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ABSTRACT

Background: Effects of percutaneous nephrolithotomy (PCNL) operation on ipsilateral renal function are widely known but functional changes in opposite kidney are limited. Authors have conducted this study to evaluate the impact of PCNL operation on the contralateral side during early post-operative period.

Methods: From 1st November 2016 to 30th September 2018, those patients presented with unilateral renal stone disease were enrolled. After exclusion they were subjected to PCNL operation under general anaesthesia. Along with preoperative period, 99 m Tc DTPA renal scan is repeated at 3rd and 14th post-operative period.

Results: Out of 121 patients enrolled we included 96 patients after exclusion. They are divided into 3 age groups, 19-32, 33-47 and 48-60 years. The mean GFR at pre-operative, post-operative day-3 and 14 of normal kidney in these 3 age groups are 47.32, 47.63 and 42.32 ml/min, 44.29, 45.78 and 40.63 ml/min and 47.10, 48.47 and 41.01 ml/min respectively. At post op day-3 there are reduction of mean GFR in all age groups but statistically not significant ($p > 0.05$). At post-operative day-14 GFR improved towards the pre-op value but the change is also not significant ($p > 0.05$).

Conclusions: There are reduction of GFR of contralateral normal kidney following PCNL operation in early post-operative period. So, along with operated kidney normal kidney also showed decrease GFR. It is better to avoid further trauma in post PCNL patient like avoidance of using nephrotoxic medication, contrast agents, ESWL, etc. This study can guide us to avoid further trauma of any kidney.

Keywords: GFR, Percutaneous nephrolithotomy, Post-operative, Renal function, 99m Tc DTPA

INTRODUCTION

Urolithiasis is one of the common urological problems affecting all age groups. In most of the country male to female ratio of urolithiasis is 1.3 to 5:1.¹

Stones size less than 5 mm may pass spontaneously.^{2,3} But prompt surgery may be indicated in a patient with

solitary functioning kidney, bilateral obstructing stone disease, and intractable pain etc.⁴

Since mid-1980's, less invasive modalities as extracorporeal shock wave lithotripsy, ureteroscopy, and percutaneous nephrolithotomy began to replace open surgery for management of renal stone disease.

The technique of percutaneous nephrostomy under anaesthesia with radiological guidance were first described by Fernström and Johansson in 1976.⁵ Since then percutaneous nephrolithotomy (PCNL) is preferred modality of treatment for renal stone disease.

Effects of PCNL on renal function was evaluated earlier on the operated side, but the knowledge regarding the effects of surgery on the opposite kidney function is limited. Operative trauma and ischemia at the operative site is expected, but the effects of surgery is not unilateral, it is bilateral.⁶

In pig model Handa et al, reported after unilateral percutaneous nephrostomy (PCN) there were bilateral reduction in renal function as well as perfusion with significant increase in serum creatinine.⁶

Nouralizadeh et al, also showed following unilateral PCNL a decrease in total creatinine clearance (CrCl) of 20% on first post-operative day.⁷

In one study Nazaroglu et al, demonstrated that there was decline in renal function with temporary increase in resistive indices following trauma induced by ESWL on unilateral kidney which leads to vasoconstriction in both kidneys.⁸

Vasoconstriction following PCNL in the contralateral kidney is due to hormonal and neural mechanism. Reno renal reflex is important neural reflex causing afferent and efferent vasoconstriction.⁹

Following denervation of unilateral kidney preventing renal plasma flow reduction in contralateral kidney following ESWL as demonstrated by Connors et al.¹⁰

Atici et al, showed after unilateral PCNL serum renin and aldosterone levels increases significantly because of bilateral vasoconstriction.¹¹

There are studies showing changes in GFR of the operated side following PCNL but the changes in the normal contralateral side are limited. This study was done for this purpose to find out the changes in the glomerular filtration rate (GFR) of normal opposite side in the early postoperative period. That knowledge of the changes of GFR in normal side after PCNL operation may act as a guide during postoperative follow-up and managing those at risk and in the selection of drugs.

METHODS

This was a hospital-based prospective, comparative, analytical study done from 1st November 2016 to 30th September 2018. Ethical approval was obtained from the ethical committee of that hospital (Memo no: Inst/IEC/2018/258).

Inclusion criteria

- Those patient present to our institution with unilateral solitary renal stone disease with age ranging from 19-60 years are included.
- Routine standard preoperative work up done in all the patient. A preoperative 99 m Tc DTPA renal scan was performed for comparison with a postoperative DTPA scan which was done on 3rd and 14th post-operative day. Informed written consent was taken. After exclusion of 21 patients, 96 patients were included for the study.

Exclusion criteria

Those patients having DM, hypertension, CKD, UTI, multiple stone disease, any previous intervention for stone disease or post-operative complications like sepsis, shock was excluded because these may cause renal functional alteration.

Those included in that study were subjected to standard PCNL operation. After general anesthesia 5 French urinary catheter was introduced into the ureter of operated side in lithotomy position using 21 French cystoscope sheath and 30 degree lens. Then patient was repositioned into prone. Under C-Arm guidance standard calyceal puncture done. Gradual dilatation of the tract done up to 28 French over 0.32 inch guide wire using alken dilator. Through 28 French sheath 15.5 French nephroscope was introduced and stone identified. Using pneumatic lithotripter all stone fragmented and removed and clearance was confirmed by C-Arm. 16 French nephrostomy tube introduced and clamped. At post op day -3 and day-14, 99 m Tc DTPA renal scan was performed.

Statistical analysis

Statistical Analysis was performed with help of Epi Info (TM) 7.2.2.2. EPI INFO is a trademark of the Centers for Disease Control and Prevention (CDC). Using this software, basic cross-tabulation, inferences and associations were performed. One way analysis of variance (ANOVA) that was used to compare more than two means at a time. T-test was used to compare the means.

RESULTS

General characteristic

Total 121 patients were enrolled for the study. Those who refused to participate- N=4, mean age=43.75 years and median age=42.5, (35- 55 years).

Those who participated in the study- N=117, mean age=40.89 years, median-42 years (19-60 years).

Those who were excluded N=21; mean age=42.09 years, Median-47 years (19-60 years).

Those who were included in the study, N=96, mean age=40.63 years, median 40 years (19-60 years).

These 96 patients were divided into 3 age groups 19-32 years, 33-46 years, and 47-60 years.

The Table 1 showing mean age (Mean±SD) of the patients is 40.63±11.05 years with ranging from 19-60 years and the median age is 40 years.

The total number of patients in 19-32 age groups are 26, 33-47 groups are 39 and 48-60 years age groups are 31.

There are reduction of mean GFR in normal contralateral kidney following PCNL in all age groups (19-32, 33-47, and 48-60 years) but one way analysis of variance (ANOVA) shows that there are no significant differences in mean GFR at post-operative day-3 in comparison to pre-operative level in patients of all 3 age groups

(p=0.12763), (p=0.251653), and (p=0.33097) respectively.

Table 1: Distribution of age of the patient.

Age (in years)	Number	%
19-32	26	27.08%
33-47	39	40.62%
48-60	31	32.30%
Total	96	100.0%
Mean±SD	40.63±11.05	
Median	40	
Range	19 - 60	

There are also normalization of GFR towards the pre-operative value at POD-14 in all age groups but no significant difference between the mean pre-operative GFR and GFR at post-operative Day-14 (p=0.910586), (p=0 .59501) and (p=0 .659569) respectively (Table 2). Distribution of mean GFR in pre op period, at post op day-3 and post op day-14, in this 3 age groups are showing in Figure 1.

Table 2: Distribution of Mean GFR in contralateral normal kidney at pre-operative period, post-operative day 3 and day-14 in different age groups.

Age in years	Pre op mean GFR (ml/min)±SD	Mean GFR at p/o DAY3 (ml/min)±SD	F-ratio Difference at POD3	P value Difference at POD3	Mean GFR at p/o Day 14 (ml/min)±SD	F-ratio Difference at POD14	P-value Difference at POD14
19-32	47.32±6.93	44.29±7.17	F=2.40016	P=0.12763 Not significant	47.10±7.30	F=0.01274	P=0.910586 Not significant.
33-47	47.63±7.13	45.78±7.01	F=1.33434	P=0 .251653 Not significant	48.47±6.76	F=0.28499	P=0.59501 Not significant
48-60	42.37±7.02	40.63±6.90	F=0.96061	P=0.33097 Not significant	41.01±15.51	F=0.19599	P=0.659569 Not significant

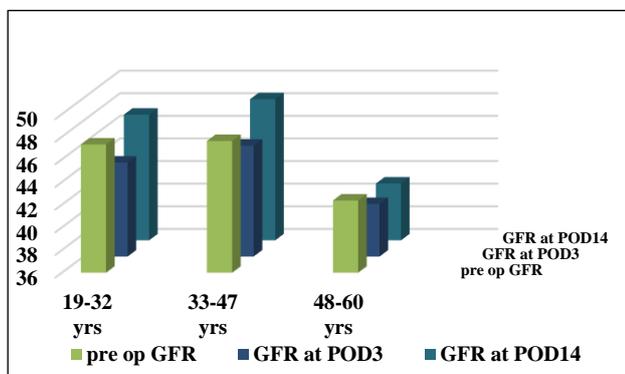


Figure 1: Distribution of GFR at different age groups at pre op, post-operative day-3 and post-operative-14.

DISCUSSION

In that study the mean pre-operative GFR, GFR at post-operative day-3 and 14 of normal kidney are 47.32, 47.63 and 42.32 ml/min (19-32 years group), 44.29, 45.78 and 40.63 ml/min (33-47 years group) and 47.10, 48.47 and 41.01 ml/min (48-60 years group) respectively.

There are reduction of mean GFR at post-operative day-3 and that change toward the pre-operative value at post-operative day-14 in all of these 3 age groups.

In one study Nouralizadeh et al, showed that PCNL was associated with significant renal trauma not only restricted to operative side, following unilateral PCNL

operation there was a decrease in total creatinine clearance (CrCl) of 20% on first post-operative day.⁷

DiBona GF et al, demonstrated that vasoconstriction following PCNL in the contralateral kidney seen in early post-operative period and it is due to hormonal and neural mechanism. Reno-renal reflex is an important neural reflex associated with afferent and efferent vasoconstriction.⁹

Atici et al, also showed similar finding after unilateral PCNL operation and there are bilateral renal insult as a result serum renin and aldosterone levels increases significantly and there are bilateral vasoconstriction.¹¹

In pig model Handa et al, reported after unilateral percutaneous nephrostomy (PCN) there was bilateral reduction in renal function as well as perfusion with significant increase in serum creatinine.⁶

Following denervation of unilateral kidney prevents renal plasma flow reduction in contralateral kidney following unilateral renal trauma like ESWL as demonstrated by Connors et al.¹⁰

Like aforementioned studies in our study also showed that after PCNL operation renal function decrease in the contralateral normal side as evident by decrease in mean GFR at post-operative day-3. That reach toward the pre-operative value at post-operative day-14 in all age groups but these changes are statistically not significant.

CONCLUSION

It was seen that GFR changes not only limited to operated side only in early post-operative period, but also normal contralateral kidney involved with reduction of mean GFR.

So, this study will guide us to establish a protocol for management of post PCNL patient, thus further trauma of any kidney like post-operative ESWL, use of contrast media, nephrotoxic drugs, etc. can be minimized.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee (no: Inst/IEC/2018/258)

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Cite this article as: Samaddar D, Sarkar D, Pal DK, Gupta S. Impact of percutaneous nephrolithotomy operation on non-operated kidney, a single center based study. *Int J Res Med Sci* 2019;7:2256-9.