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Original Research Article

Colonic perforation during percutaneous nephrolithotomy: can we predict it

Yogesh K. Swami[1,2]*, Y. P. S. Rana[3]

[1]Senior Consultant Urologist and Andrologist, Ayushyaman Kidney Hospital, Palanpur, Gujarat, India
[2]Assistant Professor General Surgery, Banas Medical College and Research centre, Palanpur, Gujarat, India
[3]Senior Consultant Urologist and Renal Transplant Surgeon, BLK MAX Super specialty Hospital, New Delhi, India

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***Correspondence:**
Dr. Yogesh K Swami,
E-mail: drykswami@gmail.com

ABSTRACT

Background: Colonic perforation though rare but is one of the most dangerous complications of Percutaneous nephrolithotomy (PCNL) which may lead to increase significant post operative morbidity in worldwide, therefore, the aim of this study was to explore colonic perforation during percutaneous nephrolithotomy- Can we predict it.
Methods: We reviewed retrospectively the data of 1270 PCNL procedures performed between April 2013 and April 2019 at Ayushyaman kidney hospital, Palanpur, North Gujarat, India. All parameters including demography, history, stone parameters, site of skin puncture and punctured calyx, were reviewed in all these patients.
Results: Colonic perforation was found in 10 patients (7 males and 3 females) and the mean age was 40.5±20.0. The left side was affected in 4 patients and the right side was injured in 6 cases. Conservative administration was the treatment planned for all patients. It included withdrawal of the nephrostomy tube outside the kidney to the colon as a percutaneous colostomy, insertion of a double-J ureteral stent, intravenous broad-spectrum antibiotics, bowel rest and total parenteral nutrition. Under this conservative management, entire healing of the colon was achieved in all cases.
Conclusions: Colonic perforation is rare complication in PCNL. High degree of suspicion, early diagnosis and timely management can prevent sepsis and peritonitis and minimize patient morbidity and mortality.

Keywords: PCNL, Retro-renal colon, Colonic perforation

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) was first illustrated by Fernstrom and Johansson in 1976, for the treatment of renal stones. Nowadays, PCNL is the treatment of choice for large (>2 cm), solid, infected, extracorporeal lithotripsy failure stones and those in the inferior calyx.[1,2] Even after knowledge of more than 30 years, PCNL is not without hurdle, such snag are acute and delayed Hemorrhage, fever and sepsis, hydropneumothorax, venous thromboembolism, renal dysfunction, gas embolism, electrolyte inequity, visceral perforation, and death. Colonic perforation is a unusual but one of the most hazardous complication of PCNL, occurring in the prone position at a rate of 0.3%.[3,4] Untreated colonic perforation can lead to renal abscess, nephrocolic or colocutaneous fistula, peritonitis and sepsis and even death.[4] The diagnosis of this injury is usually subtle owing to the unpredictability of symptoms and signs, which can take place instantly or numerous days after the procedure. Unrecognized colonic injury can lead to abscess formation and nephrocolic or colocutaneous fistula.[5] Peritonitis may also develop from intraperitoneal fecal soiling.[6] In previous literatures, the risk factors and defensive measures of colonic injury during PNL were not accurately determined because of the limited number of

patients in each report. Few reports have been published on the risk factors and management of colonic injury during PCNL. Therefore present study with our experience on the management of colonic perforation during percutaneous renal operations in ten patients with left and right renal lower calyceal stone.

METHODS

A total of 1270 PCNL procedures performed between April 2013 and April 2019. we retrospectively reviewed these data. All surgeries were performed here in Ayushyaman kidney hospital by a single Urologist. A standard protocol was followed in all patients and written informed consent was taken from all patients and relative prior starts of procedure. Routine preoperative evaluation with Intravenous pyelogram done in all patients, and in patients with a prior history of PCNL or open surgery in the ipsilateral kidney, in which the risk of perforation is higher, a computed tomography (CT) scan was used to assess the anatomic correlation between the colon and the kidney patients. Preoperative and operative parameters and demographic variables, such as age, sex, weight, history of previous ipsilateral stone intervention, stone side, stone location, site of skin puncture and punctured calyx, were retrospectively reviewed in all patients with colonic injury.

After preoperative workup all patients underwent spinal anesthesia and those with staghorn stones received general anesthesia. Cystoscopy was performed and a 5-Fr open-ended ureteral catheter was inserted into the lithotomy position. Patients were then placed in the prone position with pressure sites and chest support. PCNL was performed in the routine manner. Percutaneous access was created by fluoroscopy guidance as the standard approach. The nephrostomy tract was dilated using Alken dilators and Amplatz sheath (24 up to 30 F) was positioned in the renal collecting system. The nephroscopy was done with a rigid nephroscope. Small stones were removed with irrigation and/or grasping forceps and large ones were fragmented using laser or pneumatic devices and D-J stent was placed. A 22-Fr nephrostomy tube was fixed at the end of the procedure for 48 to 72 hours. Foley urethral catheter were removed 3 hours after removal of nephrostomy tube. On the second postoperative day, kidneys, ureters, and bladder (KUB) x-ray were routinely performed in all patients for evaluation of possible stone remnants. The study protocol was approved by institutional ethics committee human (IEC-H).

Statistical analysis

Data was analyzed using Statistical Package for Social Sciences, (SPSS) version 20 (SPSS Inc., Chicago, IL). Results for continuous variables are presented as mean ± standard deviation, whereas results for categorical variables are presented as percentage. The Pearson chi-square test was used to determine significant risk factors for categorical variables and the percentage of colonic perforation in relation to patient, renal, and stone characteristics, operative procedure details, and significant risk factors was done by univariate analysis. The level $p<0.05$ was considered as significance.

RESULTS

In this study, colonic perforation complicated PNL was observed in 10 patients (0.3%) out of the 1270 PCNL procedures.

Table 1: Patient's demographics and other characteristics.

Parameters		Variables and risk factors of colon injury	Level of significance
Mean age (years)		40.5±20.0 (21–75)	-
Mean body weight (kg)		58.3±6.4 (40-80)	-
Sex	Male	7 (40 %)	P<0.05
	Female	3 (30 %)	
Side of colon	Right	6 (60 %)	P<0.05
	Left	4 (40 %)	
Previous ipsilateral stone intervention	Open surgery	5 (50%)	P>0.05
	No open surgery	5 (50%)	
Punctured calyx	Upper calyx	0	P<0.001
	Middle calyx	0	
	Lower calyx	10 (100 %)	
Stone localization	Lower calyx	1 (10 %)	P<0.01
	Renal pelvis	3 (30 %)	
	Multiple calyx	6 (60 %)	
Stone number	Single	4 (40%)	P>0.05
	Multiple	3 (30%)	
	Staghorn	3 (30%)	
Site of skin puncture	Sub costal	10 (100%)	P<0.001
	Supracostal	0 (0%)	

Of the 10 patients, 7 (70%) were men and 3 (30%) were women ($p<0.05$), with a mean age of 40.5±20.0 years (range 21 to 75) and mean body weight of 58.3±6.4 kg (range 40 to 80). The percentage of colonic perforation in relation to patient, renal, and stone characteristics, operative procedure details, and significant risk factors were observed by univariate analysis are given in Table 1.

Figure 1: Colonic injury in patients.

Five (50%) patients had a history of ipsilateral stone intervention which was statically not significant ($p>0.05$). In present study, Single, multiple and Staghorn stones numbers were seen in 4 (40%, 3 (30%) and 3 (30%) patients, respectively which was statically insignificant. The right colon was injured in 6 (60%) patients as compared to left side of colon ($p<0.05$). All cases had lower caliceal punctures as compared to upper and middle calyx which was statically highly significant ($p<0.001$).

Colonic injury were diagnosed in 2 (20%) cases intraoperatively which is shown in figure 1. In 8 patients, colonic injury was diagnosed during the postoperative period; after removal of the nephrostomy tube, passage of gas and some fecaloid material was observed in these 8 cases. Stone localization was statically significant ($p<0.05$) in multiple calyxes 6 (60%) as compared to renal pelvis 3 (30%) and lower calyx 1 (910%). Site of skin puncture was Sub costal in all cases in our study.

Diagnosis and management

In our study, lower calyceal puncture was done, during which it was observed that relatively more force was required to puncture and dilate the tract. Dilatation done up to 24 F and 26 F Amplatz sheath placed. Stone visualized, fragmented with pneumatic litholcast and stone removed. During stone removal, gas coming out of peri amplatz region. At this point of time colonic injury was suspected, nephroscopy done again to confirm the suspicion. Gradually amplatz sheath taken out of renal parenchyma to visualize extra renal region and Colonic injury was confirmed. Fever was detected in all patients, but acute abdomen was not seen in any case. The conservative treatment was planned which included insertion of a double-J ureteral stent, withdrawal of the nephrostomy tube outside the kidney into the colon as a percutaneous colostomy, intravenous broad-spectrum antibiotics, bowel rest and total parenteral nutrition. Colostomy tube was removed on 5th postoperative day after performing colostogram and confirming that there was no any peritoneal leak. Colostomy bag was applied to collect any fecaloid material if came out. This bag was also removed after 10 days during which total output was approximately 10-15 ml and Puncture site was completely healed up within 15 days. One month after termination of fecaloid leakage, the double J stent was removed and patient underwent intravenous pyelogram to confirm a curative response. Under this conservative management, complete healing of the colon was seen within 15 days.

DISCUSSION

PCNL is a secure and successful technique to treat renal stones, particularly large or multiple renal calculi. in spite of the invasiveness of PCNL, its complication rates are low (3%-4%).[3,7] Iatrogenic colonic perforation is a severe but rare complication of PCNL. There are a small number of reports on the prevalence and management of this rare complication. Kachrilas et al studied 1026 patients undergoing PCNL and 5 patients reported colonic perforation.[5] Mousavi-Bahar et al analyzed the medical records of 671 PCNL procedures in a single urologic centre and found colonic perforation in 2 patients (0.3%).[2] A large retrospective study on this rare complication was done by El Nahas et al.[3] The authors reviewed 5039 patients who underwent the PCNL procedure, and the reported incidence of colonic perforation was 0.3% which was similar to our study.[8,9]

In our study, colonic perforation complicated PNL was observed in 10 patients (0.3%) out of the 1270 PCNL procedures. Of the 10 patients, 7 (70%) were men and 3 (30%) were women ($p<0.05$), with a mean age of 40.5±20.0 years (range 21 to 75) and mean body weight of 58.3±6.4 kg (range 40 to 80). The results of this study were similar to those reported from previous studies.[8-10] Present study showed the incidence of colonic perforation to be about 0.3%, lower than previous studies. Due to the low rate of colonic perforation, we did not change our approach and did not assess colonic injury at the end of the surgery routinely. However, in patients with a history of surgery in the ipsilateral kidney, in which the risk of perforation is higher, a computed tomography (CT) scan was used to assess the anatomic correlation between the colon and the kidney.

In our study, 5 (50%) patients had a history of ipsilateral stone intervention which was statically not significant ($p>0.05$) and ingle, multiple and staghorn stones numbers were seen in 4 (40%, 3 (30%) and 3 (30%) patients, respectively which was statically insignificant. The right colon was injured in 6 (60%) patients as compared to left side of colon ($p<0.05$). All cases had lower caliceal punctures as compared to upper and middle calyx which was statically highly significant ($p<0.001$). The results of

this study were similar to those reported from previous studies.[8-10] Previous studies have reported some risk factors for colonic perforation, including advanced patient age, a markedly dilated pelvic-calyceal system, megacolon, and horseshoe kidney.[5,11-13] In most studies, the most frequent etiology for colon perforation during PCNL is the retrorenal or posterolateral position of the colon.[3] Based on the abdominal CT scan, a posterorenal colon is usually found in 0.9% to 16.1% of the general population. This normal variation is higher in the prone compared to the supine position and in the left rather than the right side.[14-16] These findings may explain the greater risk of colonic perforation in the left side and prone position, which has been reported in previous studies.[3,17]

In our study, colonic injury were diagnosed in 2 (20%) cases intraoperatively which is shown in figure 1. In 8 patients, colonic injury was diagnosed during the postoperative period; after removal of the nephrostomy tube, passage of gas and some fecaloid material was observed in these 8 cases. Stone localization was statically significant ($p<0.05$) in multiple calyxes 6 (60%) as compared to renal pelvis 3 (30%) and lower calyx 1 (910%). Site of skin puncture was Sub costal in all cases in our study. The results of this study were similar to those reported from previous studies.[8,9,14] In our study, colonic perforation occurred in the 4 descending colon after left-sided PCNL, and this difference between the prevalence of left- and right-side injury was significant.

Limitations

The limitations of our study include the retrospective design and a lack of a statistical analysis for assessment of risk factors. Despite the limitations, we believe that our study included the largest case sample size and may contribute to the literature about the management of this dangerous complication.

CONCLUSION

Colonic perforation is a rare but serious complication of PCNL, which can be predicted by proper preoperative evaluation and keeping a high degree of suspicion in patient having high risk factors for colonic perforation. Early diagnosis and following basic principles of conservative management can minimize patient morbidity and mortality, resulting in excellent outcome in these patients.

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