



ABDOMINAL COMPARTMENT SYNDROME FOLLOWING PERCUTANEOUS NEPHROLITHOTOMY: A CASE SERIES AND REVIEW OF LITERATURE

Urology

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ABSTRACT

Summary: Percutaneous nephrolithotomy (PCNL) is a standard treatment for large renal calculi, but rare complications like intra-abdominal irrigation fluid extravasation leading to abdominal compartment syndrome (ACS) are underreported. We present two cases of ACS post-PCNL. **1. Case 1:** A 43-year-old male underwent prone PCNL for a staghorn calculus. Intraoperatively, elevated airway pressure (35 cm H₂O) and abdominal distension prompted urgent supine repositioning. Ultrasound revealed intraperitoneal fluid; 2L was drained via McBurney's point incision, with subsequent ICU recovery. **2. Case 2:** A 41-year-old female with upper calyceal diverticular stone developed fever, distension, and peritonism 5 days post-PCNL. CT showed contrast extravasation into the peritoneal cavity. Diagnostic laparoscopy ruled out bowel injury, and drainage led to recovery. ACS is a rare but life-threatening PCNL complication. May arises from intraperitoneal fluid extravasation due to pelvic tears, prolonged operative time, or high-pressure irrigation. Vigilance for atypical presentations, multidisciplinary collaboration, and timely intervention are critical. This series underscores the need to include ACS in the differential diagnosis of postoperative peritonism after PCNL.

KEYWORDS

Abdominal compartment syndrome, Intra-abdominal hypertension, Percutaneous nephrolithotomy, Intra Peritoneal fluid extravasation, Peritonitis

INTRODUCTION

Fernstrom and Johansson in 1976 were the first to describe a technique for extracting renal calculi through a percutaneous nephrostomy under radiological control. Percutaneous nephrolithotomy (PCNL) is a technique commonly used to remove large or multiple kidney stones with the advantages of lower morbidity rates, decrease in post-operative pain and faster recovery. However, it is associated with multiple complications including bleeding, septicemia and injury to adjacent organs. Intra-abdominal irrigation fluid extravasation which leads to abdominal hypertension is a rare complication of PCNL with few cases reported. Almost all the cases are diagnosed intra operatively, the anesthesia team will report difficulty in ventilation and increased airway pressure to more than 20 mmHg & VBG shows metabolic acidosis with high lactic acid. We present the first case of intra peritoneal irrigation fluid extravasation presenting with peritonism and mimicking bowel injury following PCNL for upper calyceal diverticular stone.

Case Presentation

Case 1

A 43-year-old gentleman with a history of Left flank pain, Computerised Tomography of kidney reported large staghorn calculus of left kidney Fig 1. His pre operative workup were done and found no abnormality, hence he was admitted for prone PCNL. Under general anesthesia, we inserted a ureteric catheter up to a left ureteropelvic junction, then patient positioned prone, followed by two separate punctures upper & lower calyx under fluoroscopy by the triangulation method. Tract dilated upto 22F by co-axial dilator. Stone disintegration was difficult due to large size and hard consistency. After 90 mins the anaesthesiologist reported elevated airway pressure (35 cm H₂O). The operation was stopped and the patient was turned from the prone to the supine position. The abdomen was markedly distended and stony hard, and ultrasonography examination revealed fluid accumulated in hepatorenal recess and abdominal cavity. Immediate drain placement done intra-peritoneal through a small incision at McBurney point, draining 2 Litre clear fluid. The patient shifted incubated to ICU. The patient had a smooth postoperative course, extubated on the second postoperative day. Follow-up abdominal ultrasound showed no intra- peritoneal free fluid. We removed the drain and discharged the patient.

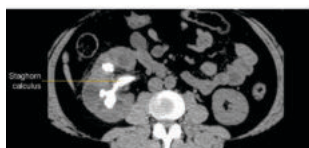


Fig 1



A: Cross-sectional CT image of Right Staghorn calculus

B: Fluoroscopic image before Initial Puncture

Case 2

A 41 year old women presented with dull aching right flank pain for 3-4 months. Pre operative CT Urography (Fig 2) reported Rt Upper calyx diverticular stone measuring 1.8 x 1 cm, other wise normally excreting both kidneys. Pre operative laboratory parameters were normal. Patient posted for prone PCNL under general anaesthesia. Patient was initially placed in lithotomy position. Ureteric catheter was inserted up to right ureteropelvic junction, followed by re positioning the patient in prone position. Then puncture of the upper calyx diverticulum done under fluoroscopy by the bulls eye technique. It was a smooth access on first trial, followed by single step dilatation. Pneumatic energy used for stone disintegration, the stone was hard and it took significant time for fragmentation. Total Nephroscopy time was 35 min. Intra operative fluoroscopy showed complete stone clearance. Immediate post operative period was uneventful. Oral feed started 24 hrs after operation and pt tolerated well. Patient was discharged on oral cefuroxime 500 mg and analgesic.

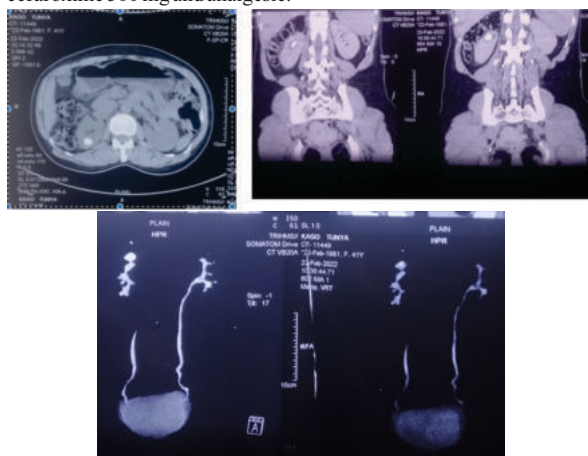


Fig 2: Pre PCNL CT images; a, b, c Shows Right upper calyx diverticular stone

After 5 days from discharge, patient reported back with complaints of distension & abdominal pain, vomiting and fever. On examination pt was febrile (Temp-104 F), Blood pressure-100/90 mm Hg, SPO2- 96% in room air, pulse rate-98/min. Chest -B/L clear air entry. Abdomen was distended with sluggish bowel sound and tender on palpation. Patient was admitted and antibiotics started(Piperacillin & Tazobactam + Inj Metronidazole 100ml) empirically. Laboratory parameters

showed (Table 1) S.Creat 1.6 mg/dL, WBC- 18,000 cu mm, Hb%-11 gm/dL.

Table 1 Pre & Postoperative laboratory reports of case 2

Test	Pre operative	1st POD	2nd POD	3rd POD	Reference range
Hb%(mg/dL)	10	10	10.6	11	12 to 15
WBC(Cell/ul)	18,000	14000	12000	11000	4,500-11,000
S.Cr(mg/dL)	1.6	1.4	1.2	1.0	0.5-1.04

Surgeon opinion taken in view of possibility of bowel injury/perforation. Erect abdomen x ray - didn't show any evidence of hollow viscus perforation. Ultrasound abdomen showed-moderate ascites, & ultrasound guided fluid aspiration revealed straw colour fluid. Computerised tomography abdomen pelvis done it reported marked free fluid in abdomen and pelvis with thin septations, type I right renal upper calyx diverticulum and on delayed phase there was extra renal excretion of contrast from upper calyceal diverticulum into peritoneal cavity as shown in the CT Images (Fig 3).

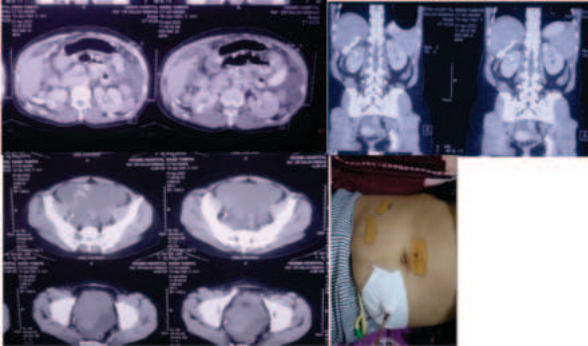


Fig 3: PostD PCNL CT images; A,B,C-Images C shows Urinary extravasation from the PCS and free fluid into the peritoneal cavity. D- Post Diagnostic laparoscopy port site

Patient was taken up for diagnostic laparoscopy with laparotomy consent. Intra operative findings-straw colour free fluid approx. 600 ml noted within the pelvis and hepato renal recess, no evidence of bowel perforation. Intravenous inj methylene blue was given to check for any contrast leak into the peritoneal cavity under vision which showed no evidence of contrast extravasation into peritoneal cavity. Through peritoneal lavage done with normal saline and two separate drain placed one in the pouch of douglas and second at sub hepatic space.

The patient had a smooth postoperative course, Follow-up abdominal ultrasound showed no intra peritoneal free fluid with minimal daily drain output. Drains were removed on 3rd post operative day and the patient discharged next day. Patient doing well on 1 month follow up.

DISCUSSION

Retroperitoneal Irrigation fluid extravasation is a common incident during PCNL more often seen in patients with thin renal parenchyma which can potentially lead to untoward consequences. Intra abdominal irrigation fluid extravasation which leads to abdominal hypertension is a rare complication with few reports only.

The abdominal compartment syndrome (ACS) represents the sequelae of abdominal hypertension, which is defined as intra-abdominal pressure (IAP) of 12 mmHg or more. ACS develops when IAP elevates over 20 mmHg and results in abdominal distention, respiratory distress & insufficiency, increased central venous pressure, and decreased urine out. ¹ Different clinical conditions associated with ACS includes massive intra-abdominal or retroperitoneal hemorrhage, severe gut edema or intestinal obstruction, and ascites. Intra abdominal hypertension always precedes ACS. Therefore, ACS is preventable given a timely and appropriate intervention that decreases morbidity and mortality. Balogh ZJ et al (2010)²

In our cases, **Case 1:** Due to the large stone and hard consistency considerable time was taken to fragment the stone and also due to the undilated pelvicalyceal system(PCS) second access through upper calyx had to be established. Intra-operatively small tear was noted at the upper calyx infundibulum due to tract dilatation. Intra abdominal fluid extravasation may have occur due to associated peritoneal tear occurred during the inadvertent collecting system tear.

Case 2: We did prone PCNL for Right upper calyceal diverticular calculi, Intra-operative no respiratory insufficiency noted. Complete Stone clearance achieved, nephroscopy time 35 min. Post operative recovery was uneventful and she was discharged on Day 2. She presented at Emergency department(ED) with fever, abdominal distention and diffuse abdominal pain after 5 days from discharge. Features were suggestive of peritonitis. Multidisciplinary team care given and we did diagnostic laparoscopy. No evidence of hollow visceral injury seen, thorough peritoneal lavage done and two drains kept -hepatic renal access and pelvis. Patient recovered uneventfully thereafter and was discharged on oral medication in 4th day.

The uniqueness of the second case is the delayed presentation and features mimicking peritonitis. To my knowledge ours is the first and only recorded case of intraperitoneal irrigation fluid extravasation after PCNL presenting with feature of peritonitis. Our aim for presenting this case is to draw attention of all the practising clinicians that patients presenting with feature of peritonitis at ED with recent history of PCNL, intra peritoneal extravasation of Irrigation fluid peritonitis should also be kept in the differential diagnosis.

Multiple factors resulting in extravasation of irrigation fluid to the intraperitoneal cavity resulting in ACS have been proposed. Ozer et al. reported difficulty during the dilation through the abdominal wall and renal parenchyma. ³ In contrast, Tao et al. attributed the fluid extravasation to a considerable amount of irrigation fluid used to clear the operative field, operative time of more than 1 hour, and renal pelvis mucosal tear.⁴ Peterson et al. and Ghai et al. proposed that the renal pelvis's accidental perforation caused the fluid extravasation.^{5,6}

Early detection of intra-abdominal extravasation and development of intra-abdominal hypertension can prevent morbidity and mortality. Intra operatively- increased Airway peak pressure and hemodynamic changes, along with discrepancy between records of irrigation fluid used and output, should raise the suspicion of increased IAP. Abdominal distention might be evident in patients in the supine position. However, it is difficult to detect in the prone position until the patient in the supine position again. Bedside abdominal ultrasound at operation theatre, will help in confirmation. Prompt drainage of the abdominal cavity will decrease IAP and airway peak pressure, improving blood return, and hemodynamic stability. Multiple drainage methods were used in the reported cases see Table 2. In all cases, the most important prognostic factor was early detection and proper drainage.

Table 2 Literature review of case reports of abdominal compartment syndrome post PCNL.

Author	Pati ent age	Surgic al positio n	Method of diagnos is	Predisposed factor	Managem ent	Prognosi s
Tao et al.	77	PRON E	Abdomi nal Ultrasou nd	Renal pelvis mucosal tear Usage of a large amount of irrigati on fluid	Drain insertion in right upper quadrant under ultrasound guidance	Total recovery Extubate d day 1 post-operation
Tao et al.	63	PRON E	Abdomi nal Ultrasou nd	Renal pelvis mucosal tear Usage of a large amount of irrigation fluid	Drain insertion in right upper quadrant under ultrasound guidance	Total recovery Extubate d day 1 post-operation
Ozer et al.	30	PRON E	Inspecti on and palpatio n	A technical error in the dilation	Peritoneal lavage	Total recovery Extubat ed directl y post-operation
Etemadi an et al.	46	PRON E	Diagnos tic peritone al tap	Ruptured thin renal cortex	Abdominal drain insert ion follow ed by expl oratory laparotomy	Total recovery

Sharma et al.	29	PRON E	Abdominal Ultrasound	-	Drain insertion under ultrasound guidance	Total recovery Extubated directly post-operation
Peterson et al.	25	Lateral Semi prone	Inspection and palpation	perforation of the renal pelvis	Exploratory laparotomy	massive gastrointestinal and retroperitoneal bleeding patient died
Ghai et al.	43	Prone oblique	Abdominal paracentesis	perforation of the renal pelvis	Drain insertion in left lower quadrant under local anesthesia	Totally recovered Extubated directly post-operation

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