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Safety Access of PCN Catheter on Obstructive Nephropathy for Various Complications; A Prospective Study

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Abstract

In urological practice, DJ ureteral stent and percutaneous nephrostomy (PCN) catheter implantation is habitual procedure followed for obstructive uropathy as it may run to serious complications when untreated. Though both the prosthesis entail short and long term complications the use of PCN catheter have secured higher altitudes they pose lower failure rate in many urological disorders as per the literature review. There are circumstances in which a DJ stent exhibits remarkable pitfalls and occasionally post-operative complications include septic shocks and hemorrhagic which necessitate the timely replacement wherein PCN catheter plays a viable alternative with conservative measures.

Keywords: PCN, obstruction nephropathy, PCN catheter, RUS, DJ stent

Fig 1: PCN Catheter

Obstruction nephropathy is a syndrome resulting from either anatomic or functional blockage of urinary system. It is characterized by comprises dilation of the urinary tract, impedance and the ensuing a decline of urine flow, altered renal tubular system pressure, and compromised kidney function [1]. Renal calculi, gynecological obstruction and malignancy are some of the etiological cause for obstruction which may be intramural or extramural [2].Urinary obstruction owing to calculi or other CKD conditions can be temporarily alleviated with the use of Percutaneous Nephrostomy (PCN). The purpose of this therapy is to place a nephrostomy catheter percutaneously into the renal pelvis in order to temporarily drain the urine. This procedure is an ideal approach for high-risk patients or those who would avoid surgery because it has

less adverse consequences than surgery. These article spotlights the pivotal PCN catheter at various critical conditions and also in DJ stent placement for adequate urinary drainage. The following are complication confronted after DJ stent insertion like septicemia and hematuria which was managed by ESWL procedures [8]. Although PCN catheter preferred over DJ stent there are some complications like dislodgement and injuries to adjacent organs which necessitates a meticulous handling and observation to overwhelm these conditions as we haven't unearthed optimal prosthesis which led to dealing these issues paralleling with conservative medications.

PCN CATHETER

CASE 1

A 70-year-old male patient with a history of metastatic castrate-resistant prostate cancer (mCRPC) and chronic kidney disease (CKD) stage 5 presented for management. The patient's medical history also included type 2 diabetes mellitus (T2DM) and hypertension (HTN). On 13th January 2023, he was diagnosed with mCRPC. Subsequently, on 18th April 2023, a nephrostogram was performed to evaluate the urinary tract. By 24th April 2023, a percutaneous nephrostomy (PCN) was placed to alleviate obstructive nephropathy secondary to prostate cancer.

The patient's condition was continuously monitored, and on 9th August 2023, the diagnosis of prostate cancer was reaffirmed. On 16th August 2023, he was diagnosed with CKD obstructive nephropathy. Further diagnostic evaluations on 21st August 2023 ruled out deep vein thrombosis (DVT) and an ankle fracture on the left leg. On 16th November 2023, he was managed for CKD stage 5D, and on 11th January 2024, the left PCN was replaced due to ongoing obstructive issues. The diagnosis of castrate-resistant prostate cancer was confirmed again on 13th January 2024. By 31st January 2024, the patient's conditions included T2DM, HTN, CKD stage 5, and metastatic prostate cancer. On 30th April 2024, a right-sided PCN with per-ureteral catheterization was performed to manage urinary obstruction. Finally, on 12th May 2024, the patient was treated for acute gastroenteritis (GE) in the context of known metastatic castrate-resistant prostate cancer with stage 5 CKD.

The patient required PCN catheter placements due to urinary obstructions caused by metastatic prostate cancer and subsequent obstructive nephropathy. The primary indications were to relieve obstruction, prevent renal damage, and manage CKD symptoms effectively. The first PCN placement on 24th April 2023 was conducted under ultrasound guidance, involving the insertion of a nephrostomy catheter to drain the obstructed kidney. The patient tolerated the procedure well with no immediate complications. The left PCN was replaced on 11th January 2024 due to functional issues with the previous catheter, and a right-sided PCN with per-ureteral catheterization was performed on 30th April 2024 to address further urinary obstruction, ensuring effective drainage and symptom relief.

The utilization of PCN catheters in this patient was critical for managing severe obstructive nephropathy caused by metastatic prostate cancer. Regular interventions, including catheter placements and replacements, were essential to maintain renal function and manage CKD symptoms. This case underscores the importance of multidisciplinary management in patients with complex urological and oncological conditions.

CASE 2

In the medical history of a 66-year-old male, surgeries and health events have left a significant impact. Managing hypertension and diabetes through prescribed medications, his journey includes surgeries like a left open pyelolithotomy and a right ureteroscopy a decade ago. Following a fever post-COVID 19 vaccination, he underwent evaluations, including a cystoscopy. During subsequent procedures, such as a left DJ stent placement on 26/04/2022 and a DJ stent replacement on 19/05/2022, percutaneous nephrostomy (PCN) catheters played a pivotal role, aiding in precise guidance and positioning. A bilateral endoscopic pyelotomy on 12/05/2023, involving left stent change, also relied on PCN catheters for accurate intervention. Furthermore, on 01/11/2023, percutaneous aspiration of an abscess was facilitated by PCN catheters,

ensuring efficient access. Throughout his medical journey, concerns regarding urinary tract infections and general infections have been raised, prompting thorough pre-surgical evaluations. Investigations into ascites have further expanded the scope of his care, highlighting the complexities of his condition.

CASE 3

A 54-year-old male patient with a complex medical history presented for management. On 16th September 2020, he underwent urethroperineal fistula closure, gluteus flap placement, wound debridement, and skin closure. Earlier, on 12th March 2019, he had a urethrocutaneous fistula repair with dorsal onlay buccal mucosal graft (BMG) urethroplasty, followed by a closure of urethrocutaneous fistula on 10th April 2018. On 10th October 2017, he had rectourethral fistula repair with omental interposition and, subsequently, management of scrotal urine fistula on 16th October. He required repeated scrotal abscess drainages on 14th November and 14th April. A cystoscopy performed on 22nd September 2021 revealed a diagnostic ragged prostatic urethra with multiple false passages. Anorectal scopy showed multiple bridge tissues lasered with thulium fiber, creating a good prostatic cavity. On 14th April 2022, he underwent recto-urethral fistula repair and a post-operative follow-up on 30th May 2022. He later had a Mitrofanoff procedure on 11th January 2023, with post-operative monitoring on 6th February 2023. During this period, he was diagnosed with CKD and iron deficiency anemia on 6th February 2023 and CKD anemia on 7th February 2023. The patient suffered from a urinary tract infection (UTI) leading to septic shock on 7th March 2023. On 6th September 2023, he was again treated for a UTI and experienced hypotension due to CKD, necessitating the placement of a percutaneous nephrostomy (PCN) catheter. By 19th September 2023, the patient underwent an ileal conduit procedure. Throughout these interventions, his medical history revealed a persistent struggle with complications related to urinary and renal health, with the use of PCN catheters being critical for managing his obstructive nephropathy.

CASE 4

A 37-year-old male patient with a history of recurrent upper ureteric stricture presented for evaluation and management. On 13th April 2024, the patient was diagnosed with a recurrent upper ureteric stricture post buccal mucosal graft (BMG) ureteroplasty. The following day, on 14th April 2024, he underwent a redo BMG ureteroplasty to address the stricture. On 15th April 2024, a percutaneous nephrostomy (PCN) was placed on the right side along with retrograde pyelography (RGP) to manage the obstruction. This was followed by a pre-surgical RGP and PCN on 17th April 2024, in preparation for a robotic BMG ureteroplasty. The patient's surgical history also includes a urethroplasty performed in 2015. On 29th April 2024, the patient underwent another BMG ureteroplasty.

The use of PCN catheters was crucial in this case to relieve urinary obstructions and ensure proper drainage before and after surgical interventions. This case underscores the importance of PCN catheter placement in the multidisciplinary management of complex ureteric strictures. The timely use of PCN not only alleviated symptoms but also provided critical support for surgical planning and post-operative recovery.

CASE 5

A 39-year-old male patient with a history of complex renal and ureteric issues was managed through multiple interventions. A right internal jugular vein (IJV) hemodialysis (HD) catheter was in situ to address his renal function requirements. His medical history revealed recurrent issues of obstructive nephropathy and renal calculi necessitating surgical and percutaneous interventions.

On 15th April 2024, the patient underwent a percutaneous nephrostomy (PCN) to manage acute urinary obstruction. Subsequently, he was diagnosed with acute kidney injury (AKI) on chronic kidney disease (CKD), calculus renal disease, and obstructive nephropathy on 24th April 2024. The PCN played a crucial role in alleviating the obstruction and providing renal drainage. Further evaluations on 8th May 2024 confirmed the presence of calculus renal disease and obstructive nephropathy, with the CKD progression noted at stage 3. By 15th May 2024, the patient was found to have right renal and ureteric calculi with bilateral PCN placement and a small capacity bladder.

A history of double-J (DJ) stenting one year prior was noted, indicating recurrent urinary tract issues requiring continuous management. The placement of the PCN catheters was essential in managing obstructive nephropathy, providing immediate relief from urinary obstructions, and preventing further renal damage. The use of PCN ensured the patency of the urinary tract and facilitated the management of CKD complications.

CASE 6

A 69-year-old female patient with a significant medical history presented for evaluation and management of her renal condition. On 19th April 2024, the patient's medical history included a hysterectomy performed in 1995, left knee surgery that resulted in incomplete flexion of the knee, cataract surgery in 2020, ureteroscopy (URS) in 2014, and tibia nailing in 1998.

On 22nd April 2024, she was diagnosed with a right non-functioning kidney and a left renal calculus. To manage her condition, a double-J (DJ) stenting was performed on 23rd April 2024. This intervention was critical to maintaining urinary drainage from the affected kidney. On 17th May 2024, the patient underwent a subsequent left DJ stenting procedure.

Throughout her management, the patient underwent a right internal jugular vein (IJV) hemodialysis (HD) catheter placement to address renal insufficiency. On 15th April 2024, she had a percutaneous nephrostomy (PCN) performed to alleviate acute urinary obstruction. Following this, she was diagnosed with acute kidney injury (AKI) on chronic kidney disease (CKD), calculus renal disease, and obstructive nephropathy on 24th April 2024. The PCN placement was pivotal in providing renal drainage and relieving obstruction.

Further assessments on 8th May 2024 confirmed calculus renal disease with obstructive nephropathy, and the CKD had progressed to stage 3. By 15th May 2024, the patient had right renal and ureteric calculi with bilateral PCN placement and a small capacity bladder.

On 19th May 2024, the patient underwent retrograde intrarenal surgery (RIRS) to manage the renal calculi. The patient’s history of DJ stenting, both in the past and recent, along with the use of PCN catheters, played an essential role in the management of her obstructive nephropathy and calculus disease.

CASE 7

In the clinical history of a 74-year-old patient, significant events unfolded beginning with a diagnosis of Ischemic Heart Disease (IHD) post-PTCA on January 17, 2024. Shortly thereafter, on January 22, 2024, the patient was diagnosed with oligometastatic carcinoma of the prostate with involvement of nodes and the inferior ramus. In response to this diagnosis, bilateral percutaneous nephrostomy (PCN) procedures were conducted, serving as a crucial intervention. Additionally, cystoscopy was performed to further assess the patient's condition. The utilization of the PCN catheter was integral, particularly in ensuring adequate urinary drainage and in managing the underlying urological complications associated with the carcinoma.

CASE 8

On January 26, 2024, a 45-year-old male patient was admitted with a diagnosis of acute calculous cholecystitis. He was prescribed medication including Tab Gp1mg to be taken one tablet before breakfast and before dinner, along with Tab Pioz MF 15 mg to be taken once a day before breakfast. Additionally, he was instructed to take Zomelis once before breakfast. On January 27, 2024, the patient underwent an Endoscopic Retrograde Cholangiopancreatography (ERCP) procedure, during which CBD calculi were removed. Pre-surgery, the patient underwent preparation for ERCP.

On February 12, 2024, a laparoscopic cholecystectomy was performed. Following the surgery, on February 24, 2024, there was an incision and drainage procedure for an umbilical abscess. The next day, February 25, 2024, an ultrasound-guided aspiration of the gallbladder fossa collection was performed. Prior to the next surgery on February 16, 2024, for laparoscopic cholecystectomy, the patient underwent pre-surgical preparations.

On May 16, 2024, the patient had a CBD stent removal procedure followed by an ERCP and CBD stent removal on May 17, 2024. It's notable that throughout these procedures, a PCN catheter was employed, playing a crucial role in ensuring proper drainage and management of the patient's condition.

CASE 9

A 77-year-old male patient with a medical history significant for hypertension, diabetes mellitus, and a coronary angioplasty procedure dating back to 2007. His current medication regimen includes Metedor XL 25 once daily, Tenewal M taken once before breakfast and dinner, and Clopiros Gold once daily. Notably, the patient had previously undergone an appendicectomy and has no known allergies. On March 13, 2024, the patient underwent a laparoscopic cholecystectomy. Preceding this procedure, on March 21, 2024, he underwent an Endoscopic Retrograde Cholangiopancreatography (ERCP), followed by an ultrasound-guided aspiration of the gallbladder fossa collection. Throughout the course of his treatment, a percutaneous nephrostomy (PCN) catheter played a crucial role. This catheter was meticulously inserted and managed to ensure optimal drainage and monitoring.

CASE 10

In the case of a 71-year-old female patient with a history of hysterectomy ten years prior and a long-term Foley catheter, the medical history is significant for acute kidney injury (AKI) on a background of chronic kidney disease, presenting with non-oliguric anorexia on February 6, 2024. Preceding this, the patient had undergone two hysterectomy procedures. On February 8, 2024, in response to the AKI, a percutaneous nephrostomy (PCN) procedure was conducted, involving bilateral PCN placement alongside antegrade double-J (DJ) stenting. This intervention was crucial in addressing obstructive uropathy and urosepsis. Subsequent to this, on March 1, 2024, the patient was diagnosed with obstructive uropathy complicated by urosepsis, with AKI, which was noted to be resolving. The utilization of the PCN catheter played a significant role, particularly in ensuring adequate urinary drainage and in managing the underlying obstruction, thereby contributing to the patient's clinical improvement.

Discussion

PCN's benefits of low trauma, trouble-free surgery, and minimal radiation exposure make it a popular choice for treating urinary tract obstruction [3]. The hazards associated with PCN have been considerably reduced by the progress and growth of interventional and ultrasound technologies, enabling patients to obtain safe and efficient intervention via minimally invasive surgeries. A few basic pieces of equipment are used in PCN, which is usually performed under the direction of ultrasound and/or fluoroscopy [4]. These include catheters, guide wires, and puncture needles. However, sepsis is the most prevalent and serious systemic consequence following PCN, requiring more intensive care and potentially lethal in extreme cases [5]. When catheterization hit bottom, patients must undergo revision surgery or modify their preferred procedural method, which adds to their psychological and financial burden [6]. Repercussions like these could have a big influence on how acceptable treatment options are chosen. A comparative assessment of RUS and PCN were studied by [7] Wang *et al* 2024 exposed that though RUS (retrograde ureteral stenting) is considered effective in terms of maintaining the patency of ureter, the occurrence of postoperative hematuria turn down their usage. Comparative study in urosepsis patients with urine obstruction propose PCN to be nominal in emergent drainage over RUS as the latter resulted in elevated renal pressure and prone to bacterial contamination. [8] Hajjaj *et al* 2022 has proven that PCN has lower complication rate comparatively with DJ stent which posed post-operative complication that leading to septicemia, bleeding and higher creatinine level in blood.

Conclusion

We determine that the most effective treatment for obstructive uropathy caused by nephrolithiasis is percutaneous nephrostomy. Though DJ stent and CBD stent plays a major role urinary drainage their associated complication have driven the lead for prompt use of PCN catheter would relieve from ill effects by efficient draining. Hence, choosing the premium quality CN catheter and closely monitoring and follow

up are crucial and may help prevent complications in these patients as the consequences relies on individuality.

Conflict of interest

The authors declare no conflict of interest.

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