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Efficacy of Percutaneous Nephrolithotomy in Patients with Neurogenic Bladder Dysfunction

Nörojen Mesane Disfonksiyonu Olan Hastalarda Perkütan Nefrolitotominin Etkinliği

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Abstract

Aim: Patients with neurogenic bladder dysfunction (NBD) are at increased risk of urolithiasis. We review our experience with percutaneous nephrolithotomy (PCNL) on this group of patients with special attention paid to the risks of surgical complications.

Methods: A total of 18 cases with NBD underwent PCNL at our institution. Neurogenous lesions included traumatic spinal cord injuries in 8 cases, sequel of cerebrovascular accident in 2, meningitis in 2, polio in 4 and kyphoscoliosis in 2. Percutaneous access was achieved under fluoroscopic guidance with a patient in the prone position and tract was formed using balloon dilation system. Stone disintegration was accomplished with a pneumatic lithotripter.

Results: There were 8 staghorn stones, 6 pelvi-calyceal stones, and 4 isolated renal pelvic stones. The mean operation time was 97.5±18.7 (range: 80-120) minutes and the mean hospitalization time was 3 (range: 2-5) days. Stone-free status was achieved in 13 (72.2%) renal units. 4 (22%) patients with 2 staghorn stones and 2 pelvi-calyceal stones had clinically insignificant residual fragments (CIRF). Hydropneumothorax was encountered in 1 case with kyphoscoliosis, in whom an intercostal access was necessary.

Conclusion: PCNL in patients with NBD is safe and effective, with outcomes comparable to that of patients without such a disorder. *(The Medical Bulletin of Haseki 2010; 48: 76-9)*

Key Words: Neurogenic bladder dysfunction, urolithiasis, percutaneous nephrolithotomy

Özet

Amaç: Nörojenik mesane disfonsiyonu (NMD) olan hastalar ürolityazis açısından yüksek risk taşırlar. Çalışmamızda cerrahi komplikasyonlar açısından dikkat gösterilen bu hasta grubundaki perkütan nefrolitotomi (PCNL) tecrübelerimiz sunulmaktadır.

Yöntemler: Kliniğimizde NMD ve böbrek taşı olan 18 hastaya PCNL uygulandı. Hastaların 8'inde travmatik spinal kord yaralanması, 2'sinde serebrovasküler atak sekeli, 2'sinde menenjit, 4'ünde polio ve 2'sinde kifoskolyoza bağlı nörojenik hasar vardı. Ameliyathanede pron pozisyonda floroskopi altında böbreğe giriş yapıldıktan sonra balon dilatasyon ile giriş yolu oluşturuldu. Taşlar pnömotik litotriptör ile parçalandı.

Bulgular: Hastaların 8'inde staghorn taş, 6'sında pelvis ve kaliks taşı, 4'ünde ise izole pelvis taşı vardı. Ortalama operasyon süresi 97.5±18.7 (80-120) dakika, ortalama hastanede kalış süresi ise 3 (2-5) gün olarak saptandı. Hastaların 13'ünde (%72.2) tam taşsızlık sağlandı. Staghorn taşı olan 2 hastada ve pelvis ve kaliks taşı olan 2 hastada da klinik önemsiz rezidü fragman (KÖRF) saptandı. İnterkostal giriş yapılan kifoskolyozlu 1 hastada pnömotoraks gelişti.

Sonuç: PCNL, NMD'u olan hastalarda, sağlıklı bireylerle karşılaştırılabilir etkinlik ve güvelikte uygulanabilir bir işlemdir. *(Haseki Tıp Bülteni 2010; 48: 76-9)*

Anahtar Kelimeler: Nörojenik mesane disfonksiyonu, ürolityazis, perkütan nefrolitotomi

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Introduction

The technological developments provided significant alternatives in the management of urinary stone disease in the last 30 years (1). Percutaneous nephrolithotomy (PCNL) is indicated for patients with stones that are unlikely to be cleared by shockwave lithotripsy or ureteroscopy owing to stone or anatomic factors.

Patients with neurogenic bladder dysfunction (NBD) with or without urinary diversion are at an increased risk of urolithiasis, recurrent stone disease and surgical morbidity owing to a variety of factors, including immobilization, metabolic disorders and high rate of urinary tract infection and colonization (2-6).

We aim to present our experience and to show the feasibility and effectiveness of PCNL on specific patient population with NBD.

Methods

A total of 18 NBD patients underwent PCNL at our institution from December 2004 to January 2008. Neurogenous lesions included traumatic spinal cord injuries (SCI) in eight cases, sequel of cerebrovascular accident in two, meningitis in two, polio in four, and kyphoscoliosis in two patients. Their bladder management included clean intermittent catheterization in 12 and indwelling urethral catheter in six cases.

Preoperative complete blood count, serum creatinine, platelet count, bleeding and coagulation profile, and urine cultures were obtained from all patients, while radiological evaluation included intravenous urography (IVU) and urinary tract ultrasonography, with addition of non-contrast computed tomography (CT) in selected cases. Aspirin and non-steroidal anti-inflammatory drugs were stopped one week before intervention. Patients with positive urine cultures were commenced on culture-specific oral or intravenous antimicrobial agents before admission. Regardless of their size, stones were basically classified as simple (isolated renal pelvic or isolated calyceal stones) or complex (partial or complete staghorn stones, pelvi-calyceal stones).

Each patient underwent PCNL beginning with cystoscopy and insertion of a ureteral catheter. Patients were then placed in the prone position and percutaneous access was obtained at a single setting using C-arm fluoroscopy. Following proper calyceal puncture, the tract was dilated with high-pressure balloon dilator (NephromaxTM, Boston Scientific) and a 30Fr Amplatz sheath was placed. Nephroscopy was performed with a 26Fr rigid nephroscope. Additional tracts were created, when indicated, during the same session. Stone clearance and the integrity of the collecting system were confirmed intraoperatively by fluoroscopy and antegrade nephrostography. Based on the results of the renal imaging, a 14 Fr nephrostomy tube was placed into the renal pelvis or the involved calyx at the end of the procedure in the majority of cases.

Antibiotic prophylaxis was maintained by quinolones. The first dose (500 mg ciprofloxacin) was administered intravenously when anesthesia was initiated, followed by a second dose 12 hours later. The patients were then given oral ciprofloxacin until their nephrostomy tubes were removed, unless their postoperative urine culture revealed significant colony forming units of uropathogens that were treated accordingly. A fever of 38 ^{o}C or above was considered significant.

On postoperative day one, the Foley and ureteral catheters were removed, if the urine was not hematuric. A plain film of the kidneys, ureters and the bladder was obtained. In cases rendered stone-free or in those with no clinically significant residual fragments, the nephrostomy tube was removed on postoperative day two after antegrade nephrostography showing ureteral drainage down to the bladder.

Results were classified as 'stone-free', presence of 'clinically insignificant residual fragments (CIRF)', and 'unsuccessful (presence of residual stones)'. Clinically insignificant residual fragments were considered as <4 mm, non-obstructing, non-infectious, and asymptomatic residual fragments. Percutaneous nephrolithotomy procedure was considered successful, if patient was either free of stones or had any CIRF (7). Major and minor complications encountered during follow-up were documented.

Results

We performed PCNL on 12 men and 6 women aged 21 to 60 years for 18 renal units affected. The most common presentation for stone disease was pyelonephritis or urinary tract infection. Urine colonization or infection was seen in 14 patients. The isolated bacteria varied and many were usual organisms, with the most commonly isolated organism Escherichia coli.

Six patients had a history of failed extracorporeal shockwave lithotripsy (ESWL) treatment. There were 14 patients with complex stones (8 staghorn and 6 pelvi-calyceal stones), whereas four had simple stones (4 isolated renal pelvic stones). The mean operation time, excluding cystoscopic ureteral catheter placement, was 97.5±18.7 minutes (range: 80- 120) and the average access number was 1.6, and of the 18 renal units, 12 required more than one access site. Subcostal access was required in 16

patients and 11^{th}-12^{th} intercostal access was preferred for two patients with kyphoscoliosis.

Average urethral catheterization time was 1.04±0.2 (range: 1-3) days, average nephrostomy tube duration was 2.8±0.4 (range: 1-7) days and mean hospital stay was three (range: 2- 5) days.

Stone-free status, defined as removal of the whole stone burden to visual completion with no fragments seen on follow-up imaging, was achieved in 13 (72.2%) of 18 renal units. Four (22%) patients with two staghorn stones and two pelvi-calyceal stones had CIRFAs auxiliary treatment modalities, only this case required re-PCNL. At an average follow-up of six (range: 2-10) months, four (22%) patients had recurrent stone disease.

Major complications were encountered in two (11.1%) patients, and minor complications were observed in six (33%) patients. As major complications, in one (5.6%) renal unit, the operation had to be terminated perioperatively due to respiratory problem secondary to laryngeal oedema and the patient required a re-PCNL session. No patients had urosepsis after PCNL. Hydropneumothrorax was observed in one (5.6%) patient with kyphoscoliosis requiring intercostal access perioperatively, and was successfully treated with chest tube placement.

As minor complications, bleeding necessitating blood transfusion was observed in two (11%) cases with staghorn stones having multiple accesses. Additionally, four (22%) patients, having positive colony forming units in the urine cultures preoperatively and treated accordingly, had fever >38ºC postoperatively. No double-J ureteral stent was required in the postoperative period for any renal unit due to urine leakage.

Discussion

Urinary stone disease is a common complication in patients with neurogenic voiding dysfunction, especially in patients with SCI and indwelling urinary catheters (2,8). The incidence of nephrolithiasis is estimated as 7% within 10 years after SCI (2). Several factors were proposed for the formation of renal stones in patients with NBD. They include stasis of urine, increased excretion of urinary calcium, alkalinity, infection by urea-splitting organisms, and immobilization, especially as a result of SCI (5). Other factors can be the level of SCI and completeness of neurological dysfunction (9). Patients with SCI have also chronic bladder dysfunction with high intravesical pressures, residual urine, chronic urethral or suprapubic catheters, and recurrent urinary tract infections that lead to upper tract deterioration by reflux or ureterovesical junction obstruction (10).

Treatment modalities for renal stones in NBD patients are PCNL, ESWL and open lithotomy, as in the normal population. Open lithotomy has high risk for complications in NBD patients, especially in SCI population (11). If the postoperative period is longer, as with open lithotomy, the incidence of postoperative morbidity will be higher (6). Surgical wounds are reported to take longer time to heal, and in the presence of bacteriuria they frequently become infected secondarily (6). In our series, open lithotomy was not preferred for the treatment of any renal stones.

Extracorporeal shockwave lithotripsy can be an alternative for treatment of renal stones in this patient population. Jonathan et al. noted a 73% stone-free success rate for SCI patients with a mean stone burden of 2.9 cm (range: 0.2-8). Of the renal units, 78% required only a single session treatment (12). Similarly, Riehle et al. obtained a 75% stone-free rate in a 3 months period (13). Also similar results were obtained in the series of Lingeman et al. (14) and Drach et al. (15). Jonathan et al. explained their high success rate with high percentage of struvite composition that could be easily disintegrated by shock waves and concluded that the morbidity associated with ESWL is low and ESWL was effective for the treatment of unbranched and partial staghorn calculi in the SCI population (12). We prefer PCNL as first line modality for these patients in our center. Our reasons can be explained as large stones or staghorn calculi in these patients. Moreover; they generally have abnormal body habitus, or complex genitourinary reconstruction. There is also a strong motivation for disintegrating stones in one session in this group of patients. In our series, three patients were referred to our center for PCNL with the history of failed ESWL treatment.

With the advent of PCNL in the ambulatory population, the treatment of surgical stone disease has been more effective and results in less morbidity than open lithotomy (16). In our series, stone-free status, defined as removal of the all stone burden to visual completion with no fragments seen on follow-up imaging, was achieved in 13 (72.2%) of 18 renal units. Jonathan et al. reported a success rate of 96%, which compares favorably with the success rate of 75% to 98% after PCNL in ambulatory patients (17). Our success rate is lower than the series of Jonathan et al. The usage of flexible nephroscopy can explain this difference. Though we have a flexible nephroscope in our center, we do not have a proper laser and ultrasonic device supporting the avaiable nephroscope.

The complication rates after PCNL in an ambulatory population is 8.5% (18). Jonathan et al. reported a complication rate of 7% (17). In our series, there were not many complications. Beside the smaller size of our series

when compared with others, the reason for differences in complication rates can be explained with choice of patients, technical points, and access numbers per operation.

Chen et al. reported a 35% stone recurrence rate within 5 years in patients with SCI, with the risk factors being male, white, and tetraplegic rather than paraplegic (18). In another series, Jonathan et al. observed a 43% stone recurrence rate at 6 months follow-up (17). Our stone recurrence rate was 22% in 18 patients at 6 months. However, we cannot make risk stratification, due to the small number of study population.

The optimal and current urological management of these patients may prevent stone recurrences. If not, self-catheterization, pharmacotherapy and/or sphyncterotomy can be performed to reduce the incidence of recurrent infection, renal dysfunction and formation of struvite stones (10).

As a conclusion, the majority of renal stones can be removed by percutaneous surgery. PCNL is a safe and effective method in patients with NBD and outcomes are comparable to that of patients without such a disorder. The major complications are rare, but they are significant. Decreased hospitalization time and rapid convalescence period also eradicates some of the complications observed after open surgery.

References

1. Pearle MS, Clayman RV. Outcomes and selection of surgical therapies of stones in the kidney and ureter. In: Kidney stones: Medical and surgical management, 1995; pp 709-55.
2. Chen Y, DeVivo MJ, Roseman JM. Current trend and risk factors for kidney stones in persons with spinal cord injury. Spinal Cord 2000;38:346-53. (Abstract)
3. Kohli A, Lamid S. Risk factors for renal stone formation in patients with spinal cord injury. Br J Urol 1986;58:588-91. (Abstract) / (PDF)
4. Cohen TD, Streem SB, Lammert G. Long term incidence and risk factors for recurrent stones following contemporary management of upper tract calculi in patients with a urinary diversion. J Urol 1996;155:62-5. (Abstract) / (Full Text) / (PDF)
5. Tori JA, Kewal RL. Urolithiasis in children with spinal cord injury. Paraplegia 1979;16:357-65. (Abstract)
6. Culkin DJ, Wheeler JS, Nemchausky BA, Fruin RC, Canning JR. Percutaneous nephrolithotomy in the spinal cord injury population. J Urol 1986;136:1181-3. (Abstract)
7. Lingeman JE, Coury TA, Newman DM, et al. Comparison of results and morbidity of percutaneous nephrostolithotomy and extracorporeal shock wave lithotripsy. J Urol 1987;138:485-90. (Abstract)
8. Wan J, Fleenor S, Kielezewski P, McGuire EJ. Urinary tract status of patients with neurogenic dysfunction presenting with upper tract stone disease. J Urol 1992;148:1126-8. (Abstract)
9. Bors E. Neurogenic bladder. Urological survey 1957;7:177-250.
10. McGuire EJ, Savastano JA. Urodynamics and management of the neuropathic bladder in spinal cord injury patients. J Amer Par Soc 1985;8:28-32. (Abstract)
11. Donovan WH, Carter RE, Bedbrook GM, Young JS, Griffiths ER. Incidence of medical complications in spinal cord injury patients in specialized, compared with non-specialized centres. Paparaplegia 1984;22:282-6. (Abstract)
12. Lazare JN, Saltzman B, Sotolongo J. Extracorporeal shock wave lithotripsy treatment of spinal cord injury patients. J Urol 1987;140:266-9. (Abstract)
13. Riehle RA, Fair WR, Vaughan ED. Extracorporeal shock wave lithotripsy for upper urinary tract calculi. One year's experience at a single center. JAMA 1986;255:2043-6. (Abstract) / (PDF)
14. Lingeman JE, Newman D, Mertz JHO, et al. Extracorporeal shock wave lithotripsy: the Methodist Hospital of Indiana experience. J Urol 1985;135:1134-7. (Abstract)
15. Drach GW, Dretler S, Fair W, et al. Report of the United States Cooperative Study of Extracorporeal shock wave lithotripsy. J Urol 1986;135:1127-33. (Abstract)
16. Brannen GE, Bush WH, Correa RJ, Gibbons RP, Elder JS. Kidney stone removal: percutaneous versus surgical lithotomy. J Urol 1985;133:6-12.
17. Rubenstein JN, Gonzalez CM, Blunt LW, Clemens JQ, Nadler RB. Safety and efficacy of percutaneous nephrolithotomy in patients with neurogenic bladder dysfunction. Urology 2004;63:636-40. (Abstract) / (Full Text) / (PDF)
18. Chen Y, DeVivo MJ, Stover SL, Lloyd LK. Recurrent kidney stone: 25 year follow up study in persons with spinal cord injury. Urology 2002;60:228-32. (Abstract) / (Full Text) / (PDF)