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CASE REPORT

Percutaneous nephrolithotomy in a patient with intrarenal arterial aneurysm

Stilianos Giannakopoulos · Thrasivoulos Pantazis · Vasilios D. Souftas · Christos Kalaitzis · Dimitra E. Antoniou · Stavros Touloupidis

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Abstract We report the case of a male patient with a left renal pelvic stone 2.5 cm in maximum diameter and a large upper pole intrarenal arterial aneurysm on the same side. The stone was treated with percutaneous nephrolithotomy (PCNL). This procedure was feasible even in this difficult clinical setting. Puncture of a calyx located at a safe distance from the aneurysm and meticulous surgical technique were essential in realizing the best possible outcome. To our knowledge, this is the first case of PCNL performed on a patient with a renal stone and an intrarenal arterial aneurysm.

Keywords Percutaneous nephrolithotomy · Renal artery · Aneurysm

Introduction

Since its first description in 1976 [1], percutaneous nephrolithotomy (PCNL) has gained wide acceptance in the treatment of upper urinary tract lithiasis. As experience accumulated over the past decades, there was a natural expansion of its indications to include more technically challenging cases. For example, treatment of stones in malrotated, ectopic and transplanted kidneys has been reported, demonstrating the feasibility of PCNL even in these difficult clinical settings [2, 3].

We further enrich the PCNL literature by reporting the case of a male patient with a renal stone and intrarenal arterial aneurysm who was treated with this procedure.

S. Giannakopoulos (✉) · T. Pantazis · C. Kalaitzis · D. E. Antoniou · S. Touloupidis
Department of Urology,
Democritus University of Thrace,
Dragana, 68100 Alexandroupolis, Greece
e-mail: stgian@otenet.gr

V. D. Souftas
Department of Radiology, Democritus University of Thrace,
Dragana, 68100 Alexandroupolis, Greece

Case report

A 65-year-old man was referred to our department with a left renal pelvic stone. One month before his admission, he had undergone unsuccessful in situ extracorporeal shockwave lithotripsy (SWL) at another hospital. His past history included open stone surgery on both kidneys 15 years previously, although the exact type of procedure was not specified. He was on antihypertensive medication for 7 years. No other medical problems were reported.

Results of a complete blood cell count and serum chemistries were within normal limits, and a urine culture was negative. Plain film of the kidney–ureter–bladder (KUB) and intravenous urogram (IVU) demonstrated a left renal pelvic stone 2.5 cm in maximum diameter (Fig. 1). Differential renal scanning demonstrated a 28 and 68% contribution to the total renal function for the right and left kidneys, respectively. Computed tomography (CT) of the abdomen was performed to further clarify the anatomic relations of the left kidney, given the history of open stone surgery. CT revealed a cystic, noncalcified mass located at the upper pole of the left kidney, extending downward as far as the level of the renal pelvis and protruding medially toward the renal pelvic wall. These findings raised the suspicion of an intrarenal arterial aneurysm (Fig. 2). CT angiography clearly demonstrated that this was a saccular intrarenal arterial aneurysm, 4.2 cm in maximum diameter, originating from an upper pole arterial branch (Fig. 3). Selective left

Fig. 1 KUB: radiopaque left renal stone

Fig. 2 CT (cross-sectional view at the level of the left renal pelvis): stone in the left renal pelvis and adjacent cystic, noncalcified mass (*arrow*) that raised the suspicion of an intrarenal arterial aneurysm

renal arteriogram confirmed the diagnosis. Because the left kidney was the better functioning organ and the renal pelvic stone was large enough to be followed, active treatment was recommended. PCNL was proposed as definitive treatment given the history of previous open stone surgery. After detailed consultation about the pros and cons of the procedure, informed consent was obtained.

General anesthesia was administered. With the patient in a supine position, a 6Fr open-end ureteral catheter was inserted into the left renal pelvis using a flexible cystoscope. The patient was then brought into the typical prone position for percutaneous surgery. Contrast was injected through the ureteral catheter to opacify the renal collecting

Fig. 3 CT angiography (cross-sectional view at the level of the upper pole of the left kidney): large intrarenal arterial aneurysm (*arrow*)

system. A lower pole calyx providing direct access to the pelvic stone was chosen for puncture. In this case, the lower pole access offered the additional advantage of being at a safe distance from the upper pole intrarenal aneurysm. An 18G needle was used, and a 0.038 in. Amplatz super-stiff guidewire was inserted into the pelvicalyceal system. An angled-tip angiographic catheter was used to send the wire down to the ureter. This maneuver was deemed absolutely necessary in this case to avoid subsequent maneuvers toward the upper or middle calyces in case the wire was coiled there. A safety guidewire was placed using an 8/10Fr coaxial dilation system, and the final dilation was performed using a 30 Fr balloon dilator with a 34 Fr Amplatz sheath. A 24 Fr nephroscope was used. The aneurysm was identified as a mass pushing the upper lateral side of the pelvic wall. Stone disintegration was performed using an ultrasound lithotriptor starting from the side of the stone opposite to the aneurysm and continuing at the same side throughout the procedure. Special care was taken to avoid contact of the tip of the probe with the pelvic wall at the side of the aneurysm. Larger fragments were removed with grasping forceps. At the conclusion of the procedure, a 22 Fr Foley-type nephrostomy tube was placed. The procedure was terminated successfully with no intraoperative or immediate postoperative complications. The postoperative course was uneventful. Postoperative KUB and nephrostogram were negative for residual fragments (Fig. 4). Second-look flexible nephroscopy under local anesthesia was performed 72 h postoperatively to insure a stone-free status. The patient was discharged on the 4th postoperative day. No late complications occurred. Stone analysis revealed a mixture of calcium oxalate monohydrate and calcium phosphate apatite (80 and 20%, respectively). Definitive treatment of the arterial aneurysm has not been undertaken yet.

Fig. 4 Postoperative KUB: stone was completely eliminated. Foley-type nephrostomy tube in place

Discussion

Renal artery aneurysms (RAAs) are uncommon and occur in approximately 0.09% of the general population [4]. Their location varies, but it seems that most RAAs occur at the main renal artery bifurcation [5]. The majority of these aneurysms are asymptomatic and in most cases encountered as an incidental finding, as computed tomography, magnetic resonance imaging and arteriographic studies are performed frequently for other diseases. Recognized complications associated with RAAs include renovascular hypertension, renal artery thrombosis, infarction from distal embolization, arteriovenous fistula formation and, the most dreaded risk, rupture [6]. Fortunately, rupture of RAAs is unlikely in most patients, and controversy still exists as to whether surgical repair should be undertaken in every case or not [5, 6].

The concomitant presence of an RAA and other urological renal disease poses a significant problem when intervention is required for the latter. Only sporadic cases of this unusual combination have been reported in literature [7, 8]. Urolithiasis is one of the most common urologic diseases affecting the kidney, and in the case of the concomitant presence of RAA, the standard treatment options are subjected to certain restrictions. For example, the role of SWL in these cases has not been established and only a few patients have been treated with this modality [9]. Our patient was initially submitted to SWL at another hospital, apparently without knowledge of the presence of the aneurysm. Given the size of the stone (2.5 cm in maximum diameter), SWL was probably not the best treatment option. Nevertheless, despite the failure to fragment the stone, no significant complication was related to the use of SWL in this case. However, we are not aware of the number of shock waves administered or the level of energy used.

We considered three treatment options for our patient, namely, ureteronephroscopic laser lithotripsy, PCNL and open stone surgery with simultaneous reconstruction of the aneurysm. Ureteronephroscopic laser lithotripsy was very attractive, but it was not chosen for two reasons. First, the procedure would have required a large amount of time, or should have been staged, because of the large size of the stone. Second, we were not confident about the energy that would have been delivered within the renal pelvis by the holmium:YAG laser. It is well known that this type of laser has a minimal penetration depth [10], but we were still concerned about possible injury to the renal pelvic wall and the adjacent aneurysm either by the energy released or by an inadvertent maneuver of the laser fiber itself. Combined open stone surgery and reconstruction of the aneurysm was also an option, but difficulties were anticipated because of the previous open stone surgery on the same side. In addition, open surgical reconstruction of the aneurysm on this patient's better functioning kidney, which had previously been operated on, was already a technically demanding procedure that would be further complicated by a pyelolithotomy. One could argue against our choice, but based on these considerations, initial treatment of the stone with PCNL was elected. The treatment of the aneurysm was left for a second stage. The main advantage was that the aneurysm was located at the upper pole of the kidney at a safe distance from the lower pole calyx, which, in this case, offered excellent access to the pelvic stone. PCNL generally offers a better view and a greater possibility of performing safe and precise maneuvers within the renal pelvis than ureteronephroscopic lithotripsy. The ultrasound lithotriptor is a fast, effective and safe means of intracorporeal lithotripsy and, as long as the probe is used carefully, there is little risk of perforating the pelvic wall [11].

Since the initial calyceal access for PCNL is probably the most crucial and dangerous step in treating such cases, the use of ultrasound or CT scan-guided puncture could be especially advantageous. Matlaga et al. [12] have reported the use of CT-guided percutaneous access for PCNL in a select group of patients with anatomical abnormalities. According to their results, this technique has been proved safe and effective. Although we have performed a typical fluoroscopically guided puncture, our strategy was actually dictated by the findings of the preoperative CT scan, which demonstrated a safe distance between the aneurysm and the accessed calyx. In case of a close relation between the appropriate access site and the aneurysm, an ultrasound or CT-guided puncture would have increased the safety margin.

After a thorough literature review, we were not able to locate other cases of PCNL in patients with intrarenal arterial aneurysms. Based on our experience from this case, we propose PCNL as a definitive treatment option for patients with renal stones and RAAs, provided that special attention is given to some technical details. Specifically, the access site should be at a safe distance from the aneurysm, the tract dilation should be carefully performed (preferably in one step using balloon dilators), and lithotripsy should be performed with special attention given to avoid contact of the tip of the probe with the pelvic wall adjacent to the aneurysm.

Conclusions

To our knowledge, we report the first case of PCNL performed on a patient with a renal stone and an intrarenal arterial aneurysm. This procedure is feasible, even in this difficult clinical setting. Puncture of a calyx located at a safe distance from the aneurysm and meticulous surgical technique are essential in realizing the best possible outcome.

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