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ORIGINAL ARTICLE

Standard percutaneous nephrolithotomy alone versus in combination with intraoperative anterograde flexible nephroscopy for staghorn stones: A retrospective study

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Abstract This study aimed to compare the outcomes of standard percutaneous nephrolithotomy (PCNL) to PCNL with intraoperative antegrade flexible nephroscopy (IAFN) for treating stones of staghorn nature. We retrospectively analyzed patients treated using PCNL between January 2007 and July 2013. A total of 1250 patients were treated using PCNL, and 166 patients had staghorn stones. All patients had been subjected to a complete blood count, routine biochemical analyses, coagulation tests, a complete urine analysis, and urine cultures. Patients with a positive urine culture had been treated with appropriate antibiotics until the urine culture became negative. After purchasing a flexible renoscope in March 2012, we routinely used this tool to improve the stone-free (SF) rate. The 105 patients who underwent standard PCNL prior to March 2012 were classified as Group 1, and the 61 patients who underwent PCNL + IAFN after that date were classified as Group 2. The two groups had similar and homogeneous demographic data. The fluoroscopy and total operative times were significantly higher in Group 2 than in Group 1 ($p < 0.01$). Additionally, the hospitalization time ($p < 0.01$) and the mean hematocrit decrease ($p < 0.01$) were significantly lower in Group 1. In both groups, the SF rates were higher than 85%, similar to those reported in the literature. Although Group 2 had a slightly better SF rates, this difference was not statistically significant. For staghorn calculi,

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PCNL combined with IAFN yields excellent outcomes. However, similar prospective studies on larger cohorts should be performed to support our findings.
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Introduction

Staghorn stones occupy a significant volume of the collecting system and are typically defined as stones that are allocated within at least one calyx and the pelvis. The stone is called a complete staghorn when it fills the entire collecting system. Staghorn stones have a composition of magnesium ammonium phosphate and calcium carbonate, or/and they are infection-associated stones, which have microorganisms with urease activity [1]. These types of stones can cause flank pain, progressive renal deterioration, pyonephrosis, obstruction, or fatal sepsis [2]. For this reason, complete stone retrieval is crucial.

As residual stones cannot be properly identified during percutaneous nephrolithotomy (PCNL), the precise determination of surgical success may not be possible [3]. Owing to the use of radiocontrast agents, the intraoperative diagnosis of residual fragments using fluoroscopy is difficult. Postoperative diagnosis of residual fragments increases the need for auxiliary procedures. The use of multimodal diagnostic tools is necessary to verify stone clearance.

Although PCNL remains the first choice of treatment [4], this procedure has a relatively low stone-free (SF) rate when used for large stone burden. Shock wave lithotripsy (SWL), flexible ureterorenoscopy, and PCNL may be used in combinations to increase SF rates.

In this study, we aimed to evaluate the outcomes of standard PCNL (Group 1) and PCNL with intraoperative antegrade flexible nephroscopy (IAFN; Group 2) for staghorn stones in terms of hemorrhage, number of access, fluoroscopy and total operative time, hospital stay, and SF rates.

Methods

After local ethics committee (Diskapi Yildirim Beyazit Training and Research Hospital, Ankara, Turkey) approval was granted, we retrospectively evaluated the patients who were treated using PCNL between January 2007 and July 2013. A total of 1250 cases had been treated using PCNL, and 166 of these patients had suffered from staghorn stones.

Pediatric patients and patient with a history of SWL were excluded. All patients had been subjected to a complete blood count, routine biochemical analyses, coagulation tests, complete urine analysis, and urine culture. Patients with a positive urine culture had been treated with appropriate antibiotics until the urine culture became negative.

After our department purchased a flexible nephroscope in March 2012, we routinely used this tool to increase the SF rates. The 105 patients who underwent standard PCNL prior to March 2012 were classified as Group 1, and the 61 patients who underwent PCNL + IAFN after that date were classified as Group 2.

All patients underwent the operation using general anesthesia. A 6F ureter catheter was placed in the ureter using a rigid cystoscope in the lithotomy position, and then patients were repositioned into the prone position. No nephrostomy catheter had been placed preoperatively in any patients. After selecting the most appropriate calyx to reach the stone, an access site was created using an 18-gauge needle with the aid of retrograde pyelography. The nephrostomy tract was formed with plastic amplatz dilators (Elit Flex, Ankara, Turkey) under fluoroscopic imaging. In all patients, 30F working sheaths were used to perform the operation using a 27F nephroscope (Karl Storz, GmbH, Tuttlingen, Germany). A pneumatic lithotripter was used for stone disintegration. Stone fragments were extracted using stone grasping forceps.

When 4-mm or larger fragments were present, another appropriate tract was formed for stone removal. The surgery continued until an SF state was achieved using rigid nephroscopy or until the bleeding reduced vision. When a hemorrhage occurred, a nephrostomy tube (Elit Flex) was placed, and the operation had to be ended. These patients were treated with a second-look PCNL, an antegrade flexible nephroscopy or SWL.

After March 2012, all patients who had fluoroscopic residual stone that was unreachable with the initial PCNL access were treated with IAFN (Group 2). At this point, when a single access was used for PCNL, another access site was not planned, and IAFN was preferred. Using this approach, we planned to use Holmium laser to improve the SF rates. We used a 7.5F flexible nephroscope (Karl Storz, Flex X2, GmbH) with a Holmium laser (Dornier MedTech GmbH, Wessling, Germany) to achieve stone clearance. We preferred 8–12 W of total energy for defragmentation of residual stones. Because of the large stone burden, we routinely placed an 18F nephrostomy tube in all cases.

Each group was compared in terms of fluoroscopy, operative time, and hospital stay, as well as the number of access sites, the hematocrit decrease, and the SF rates. The operative and fluoroscopy times were calculated beginning with the first access site needle puncture and ending with the placement of the nephrostomy tube. Hospital stay was evaluated from the date of the operation until the date of discharge. The hematocrit decrease was calculated using the complete blood count, which was obtained prior to and 1 hour after the operation.

To evaluate the SF status, all patients were evaluated using kidney, ureter, and bladder (KUB) graphy and

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