REVIEW

5416 Recent progress in understanding mitokines as diagnostic and therapeutic targets in hepatocellular carcinoma
Wang J, Luo LZ, Liang DM, Guo C, Huang ZH, Jian XH, Wen J

ORIGINAL ARTICLE

Retrospective Cohort Study

5430 Clinical characteristics and risk factors of intracranial hemorrhage after spinal surgery
Yan X, Yan LR, Ma ZG, Jiang M, Gao Y, Pang Y, Wang WW, Qin ZH, Han YT, You XF, Ruan W, Wang Q

Retrospective Study

5440 Application effect of phloroglucinol injection in elderly patients with spastic abdominal pain in emergency department
Liu YF, Chen J

5447 Efficacy and prognosis of adjuvant treatment of endometrial cancer with medroxyprogesterone acetate COX regression analysis
Wang DR

5455 Serum vascular endothelial growth factor and cortisol expression to predict prognosis of patients with hypertensive cerebral hemorrhage
Zhang CY, Wang B, Hua XT, Fan K, Li YF

5462 Progress of ulcerative colitis patients during the COVID-19 pandemic
Suda T, Takahashi M, Katayama Y, Soga K, Kobori I, Kusano Y, Tamano M

Observational Study

5468 Effect of vitamin supplementation on polycystic ovary syndrome and key pathways implicated in its development: A Mendelian randomization study
Shen JY, Xu L, Ding Y, Wu XY

Prospective Study

5479 Evaluation of childhood developing via optical coherence tomography-angiography in Qamdo, Tibet, China: A prospective cross-sectional, school-based study

SYSTEMATIC REVIEWS

5494 Isolated left ventricular apical hypoplasia: Systematic review and analysis of the 37 cases reported so far
Bassareo PP, Duignan S, James A, Dunne E, McMahon CJ, Walsh KP
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5504</td>
<td>Identification of key genes and biological pathways in lung adenocarcinoma by integrated bioinformatics analysis</td>
<td>Zhang L, Liu Y, Zhuang JG, Guo J, Li YT, Dong Y, Song G</td>
</tr>
<tr>
<td>5519</td>
<td>Clinical outcomes of robotic-assisted and manual total hip arthroplasty in the same patient: A case report</td>
<td>Hu TY, Lin DC, Zhou YJ, Zhang ZW, Yuan JJ</td>
</tr>
<tr>
<td>5525</td>
<td>Emphysematous sloughed floating ball after prostate water vaporization Rezum: A case report</td>
<td>Alnazari M, Bakhsh A, Rajih ES</td>
</tr>
<tr>
<td>5573</td>
<td>Nasopharyngeal carcinoma with synchronous breast metastasis: A case report</td>
<td>Lei YY, Li DM</td>
</tr>
<tr>
<td>5580</td>
<td>Anti-melanoma differentiation-associated gene 5 and anti-Ro52 antibody-dual positive dermatomyositis accompanied by rapidly lung disease: Three case reports</td>
<td>Ye WZ, Peng SS, Hu YH, Fang MP, Xiao Y</td>
</tr>
<tr>
<td>5589</td>
<td>Anaphylactic shock induced by polyethylene glycol after bowel preparation for the colorectal cancer surgery: A case report</td>
<td>Park GW, Park N, Kuk JC, Shin EJ, Lim DR</td>
</tr>
<tr>
<td>5595</td>
<td>Knee locking caused by osteochondroma of the proximal tibia adjacent to the pes anserinus: A case report</td>
<td>Sonobe T, Hakezaki M, Matsuo Y, Takahashi Y, Yoshida K, Konno S</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Authors</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>5602</td>
<td>Complex inferior vena cava reconstruction during <em>ex vivo</em> liver resection and autotransplantation: A case report</td>
<td>Humaerhan J, Jiang TM, Aji T, Shao YM, Wen H</td>
</tr>
<tr>
<td>5610</td>
<td>Hemocholecyst caused by accidental injury associated with radiofrequency ablation for hepatocellular carcinoma: A case report</td>
<td>Tan YW, Zhang XY</td>
</tr>
<tr>
<td>5615</td>
<td>Pancreatic cavernous hemangioma complicated with chronic intracapsular spontaneous hemorrhage: A case report and review of literature</td>
<td>Li T</td>
</tr>
</tbody>
</table>
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Jackstone in the renal calyx: A rare case report

Hai-Feng Song, Lei Liang, Yu-Bao Liu, Bo Xiao, Wei-Guo Hu, Jian-Xing Li

**Abstract**

**BACKGROUND**
Jackstone is a rare entity of calculi in urinary tracts and has the characteristic appearance resembling toy jacks. They are nearly always reported to occur in the urinary bladder, we first report a rare case of jackstone located in the obstructed renal calyx.

**CASE SUMMARY**
We report a 46-year-old man presenting with intermittent, painless gross hematuria and left flank pain. Urinary computed tomography revealed staghorn stones and secondary hydronephrosis. A jackstone with radiating branches was found in one of the dilated renal calyx. Percutaneous nephrolithotomy was performed and endoscopic images were recorded during the operation. Postoperative stone composition analysis revealed it as calcium oxalate monohydrate stones.

**CONCLUSION**
Jackstones can occur in the renal collecting system besides the bladder. The unique appearance and imaging manifestations are the most important factors in the diagnosis of jackstones, and further exploration of the formation mechanism is required.

**Key Words:** Jackstone; Renal calyx; Obstruction; Case report

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Core Tip: As a rare entity, jackstone with the characteristic appearance resembling toy jacks is usually found in the urinary bladder. This study discusses a rare case of a jackstone in a hydronephrotic renal calyx which had never been described before. Jackstones are commonly composed of calcium oxalate monohydrate or calcium oxalate dihydrate. The exact pathophysiology of jackstone development remains poorly understood. Outflow obstruction may be the most common cause. Thus, when removing the stones, the obstruction should also be evaluated and treated to avoid recurrence.

INTRODUCTION
Jackstones are named for their radiating appearance, which resembles toy jacks[1]. They have been reported in different animals[2] and humans and are usually found in the urinary bladder but rarely found in the kidneys[3,4]. The most common jackstones include those composed of calcium oxalate monohydrate and calcium oxalate dihydrate[5]. Here, we report a rare case of a jackstone composed of calcium oxalate monohydrate located in a hydronephrotic renal calyx.

CASE PRESENTATION
Chief complaints
A 46-year-old man presented with intermittent, painless gross hematuria and left flank pain after activity for one month.

History of present illness
About one month ago, the patient developed intermittent gross hematuria and distending pain of the left flank for unknown reasons, without frequency, urgency, and painful urination. He also had no fever, nausea, and vomiting.

History of past illness
The patient had a history of primary hypertension for one year, he took 80 mg valsartan orally per day. The blood pressure was controlled well. He also had bilateral saphenous varicose veins for 20 years and never treated. The patient was allergic to sulfonamides.

Personal and family history
The patient’s personal and family history was not remarkable.

Physical examination
On physical examination, the vital signs were normal and there were no positive signs except percussive pain in the left renal region.

Laboratory examinations
The routine urine analysis showed full field of red and white blood cells. The urine culture indicated Enterococcus faecalis (> 100000 CFU/mL). The patient’s serum creatine was slightly elevated (135 μmol/L). NMP22 and urine cytology were negative. No abnormality was found in other routine blood tests.

Imaging examinations
Urinary computed tomography (CT) revealed staghorn stones in the left kidney, filling the renal pelvis and several calices with secondary hydronephrosis. A stellate stone with characteristic radiating spicules (suspected to be a jackstone) was found in one of the dilated upper renal calyces, measuring 0.8 cm × 1.0 cm with a maximum density of 1240 Hounsfield units (HU) (Figure 1). There was no stone or obstruction found in the ureter. Prostate calculi were also found on CT image.

FINAL DIAGNOSIS
The final major diagnosis was kidney stone, other diagnoses included hydronephrosis, urinary infection, kidney injury, and prostate calculi.
Figure 1 Computed tomography demonstrated a typical jackstone located in the left kidney with hydronephrosis. A: The axial computed tomography (CT) image. The red arrow points to the jackstone in the renal calyx; B: The coronal CT image. The red arrow points to the jackstone in the renal calyx.

TREATMENT

After antibiotics therapy (levofloxacin, 0.5 g, ivgtt) for three days, prone percutaneous nephrolithotomy was performed. Two standard channels were established to remove the stones. During the surgery, it was observed that the stones blocked the funnel of the upper calyx and a jackstone located in the dilated calyx (Figure 2). There was no obstruction at the ureteropelvic junction. All stones were completely removed using ultrasound lithotripsy and a double J stent and nephrostomy tubes were then placed.

OUTCOME AND FOLLOW-UP

The patient recovered smoothly with no complications occurred and was discharged 7 d after surgery. Nephrostomy tubes were removed during hospitalization. One month after, the left double-J stent was removed successfully. Postoperative infrared spectroscopy analysis demonstrated that the jackstone was composed of calcium oxalate monohydrate.

DISCUSSION

Jackstone is a type of urinary calculi with a distinctive appearance and are usually reported in the bladder. Despite its distinct shape, the clinical manifestations of jackstone are not unique or specific. Therefore, medical imaging examinations and visual inspection are necessary for diagnosis. Patients with jackstones often exhibit intermittent gross hematuria, obstructive lower urinary tract symptoms, and abdominal or flank pain, making these patients seek medical attention[3,6,7].

Jackstones located in the collecting system are extremely rare. In previous reports, jackstones were usually located in the renal pelvis[8,9]. Symeonidis et al[3] summarized 14 previously published cases of jackstones found in the urinary tract: 78.6% of patients had single jackstones; 2 cases had renal stones and the remaining 12 patients had bladder stones[3]. However, the exact pathophysiology of jackstone development remains poorly understood. Outflow obstruction may be the most common cause. Lim et al[7] reported two jackstone calculi in the renal pelvis in a 53-year-old man with ureteropelvic junction obstruction. They suggested that the capacious renal pelvis caused by obstruction enabled the formation of the jackstones[7]. In our case, the jackstone was located in an obstructed renal calyx, which has not been previously reported. This indicates that jackstone formation can be observed in any location where the obstruction is present in the urinary tract. However, in another case report by Goonewardena et al[8], a jackstone occurred in the renal pelvis without significant obstruction in the ureteropelvic junction demonstrated in the renogram curve. Therefore, the mechanism of jackstone's occurrence still remains uncertain and needs further clarification.

In our case, stone composition analysis using infrared spectroscopy revealed calcium oxalate monohydrate. According to previous reports, bladder jackstones were commonly composed of calcium oxalate monohydrate or calcium oxalate dihydrate. Grases et al[10] reported a jackstone in the renal pelvis composing of calcium oxalate monohydrate. Canela et al[5] used micro-CT and infrared spectroscopy to examine 98 jackstones, the largest case series of jackstones to date. They showed that jackstones had an X-ray transparent core within the outer projecting spines, with an outer shell that was always composed of calcium oxalate. Immunohistochemistry showed that the core was partially enriched with Tamm-Horsfall protein. They suggested that this protein-rich core might preferentially bind to more proteins in the urine, causing the spines to grow in a linear fashion and at a faster rate. Of note, in our case, the jackstone was fragmented intraoperatively, making it impossible to explore whether our jackstone could fit this pattern.
Figure 2 Endoscopic image of the jackstone during percutaneous nephrolithotomy. It shows that the jackstone with spiky branches is located in an obstructed renal calyx.

CONCLUSION

In conclusion, we report the case of a typical jackstone in a hydronephrotic renal calyx that has rarely been reported in the literature. The unique spike-like appearance and imaging manifestations resembling toy jacks were the most important factors for diagnosing jackstones. Although most studies attribute its occurrence to urinary tract obstruction, further investigation is still needed.

FOOTNOTES

Author contributions: Song HF and Liang L contributed to manuscript writing and editing, and data collection; Xiao B and Hu WG revised the manuscript; Liu YB and Li JX performed the patient’s surgery and made contributions to supervision; all authors have read and approved the final manuscript.

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