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Chronic Diseases and Translational Medicine 2 (2016) 250–256

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Original Article

Management of symptomatic caliceal diverticular calculi: Minimally invasive percutaneous nephrolithotomy versus flexible ureterorenoscopy

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Received 26 April 2015

Available online 19 December 2016

Abstract

Objective: To retrospectively evaluate appropriate treatment for patients with symptomatic caliceal diverticular calculi, by comparing the therapeutic outcomes for those undergoing minimally invasive percutaneous nephrolithotomy (MPCNL) and flexible ureterorenoscopy (F-URS).

Methods: From March 2009 to May 2014, 36 consecutive patients with caliceal diverticular calculi were divided into 2 groups: 21 patients underwent MPCNL, and 15 were treated by F-URS. All procedures were performed by one surgical group, which ensured relatively constant parameters. Patient characteristics, operative time, hospital stay after surgery, stone-free rate, symptomatic improvement rate, complications, diverticular obliteration, and stone composition were analyzed retrospectively in the 2 groups.

Results: Patient preoperative variables were comparable between the two groups, with no significant difference ($P > 0.05$). Mean operative time was 136.9 ± 22.8 min in the MPCNL group and 117.3 ± 24.3 min in the F-URS group ($P = 0.019$). Hospital stay was significantly longer in the MPCNL group than in the F-URS group (9.4 ± 3.1 *vs.* 6.9 ± 2.1 days, $P = 0.010$). The stone-free rates after MPCNL and F-URS were 90.5% (19/21) and 60.0% (9/15), respectively ($P = 0.046$). Additionally, 71.4% (15/21) of patients in the MPCNL group and 46.7% (7/15) of patients in the F-URS group had symptomatic improvement at the 6-month follow-up ($P = 0.175$); the rates of complications in the 2 groups were 19.0% (4/21) and 13.3% (2/15), respectively ($P = 0.650$). Complete diverticular obliteration was achieved in 16 (76.2%) cases in the MPCNL group and 5 (33.3%) cases in the F-URS group ($P = 0.017$). The distributions of calcium oxalate and hydroxyapatite in the stones were 66.7% (14/21) and 33.3% (7/21), respectively, in the MPCNL group; however, the distributions in the F-URS group were 46.7% (7/15) and 53.3% (8/15), respectively ($P = 0.310$).

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Peer review under responsibility of Chinese Medical Association.

Production and Hosting by Elsevier on behalf of KeAi

http://dx.doi.org/10.1016/j.cdtm.2016.11.016

Conclusion: MPCNL is an effective method for the treatment of caliceal diverticular calculi. However, F-URS is an alternative technique in selected patients with a patent infundibulum, despite lower stone-free rates than with MPCNL. Fulguration of the diverticular lining with a high-power holmium laser and permitting the cavity to collapse are useful to increase the chance of diverticular obliteration.

Keywords: Caliceal diverticular calculi; Minimally invasive percutaneous nephrolithotomy; Flexible ureterorenoscopy

Introduction

Caliceal diverticula are smooth-walled, urine-filled cystic cavities lined with nonsecretory, transitional cell epithelium; these cavities communicate with the collecting system through a narrow diverticular neck. Caliceal diverticula are uncommon, and have been observed in 0.21–0.45% of routine intravenous urography (IVU) studies.[1] Caliceal diverticula are usually asymptomatic, but can cause pain, infection, calculus formation, abscess formation, hematuria, and sepsis.

The incidence of calculus formation in caliceal diverticula is reportedly 10–50%.[2] With advancements in technique, treatment has become progressively less invasive. Current minimally invasive treatments for patients with symptomatic caliceal diverticular calculi include extracorporeal shock wave lithotripsy (ESWL), flexible ureterorenoscopy (F-URS), percutaneous nephrolithotomy (PCNL), and laparoscopy. PCNL and F-URS have been reported to be associated with a better stone and symptom-free outcome.[3] Since its introduction, the holmium laser has been used for the treatment of various urologic diseases. Its unique coagulating and cutting ability allows multiple procedures, such as holmium laser enucleation of the prostate (HoLEP) and stone fragmentation. In addition, incision or fulguration of the diverticular neck is performed with the holmium laser in the treatment of caliceal diverticular calculi.[4,5]

In the present study, we retrospectively evaluated the safety and effectiveness of minimally invasive percutaneous nephrolithotomy (MPCNL) and F-URS for the treatment of symptomatic caliceal diverticular calculi.

Materials and methods

Patients

From March 2009 to May 2014, 36 patients with caliceal diverticular calculi were enrolled in this retrospective, nonrandomized study. These patients were treated either by F-URS (15 patients) or MPCNL (21 patients). In addition, all patients in both groups had a single diverticulum. The characteristics of the patients and stones in both treatment groups are summarized in Table 1; both groups were comparable regarding age, gender, stone size, caliceal diverticular location, and other characteristics. The indications for treatment included flank pain, hematuria, or recurrent urinary tract infections caused by stone burden, as well as patient choice. The choice between the different techniques was based on a joint decision by surgeons and patients; the patients were appropriately informed about the procedures and possible complications. Generally, patients with a patent infundibulum on intravenous urography (IVU) were treated by F-URS, whereas patients with stenotic infundibulum on radiography were managed with MPCNL.

Minimally invasive percutaneous nephrolithotomy

All MPCNL procedures were performed under general anesthesia. The patient was first placed in a

Table 1
Demographic data and stone characteristics.

Characteristics	MPCNL ($n = 21$)	F-URS ($n = 15$)	*P*
Age, years	41.7 ± 9.8	44.5 ± 9.0	0.376[a]
Men/women, *n*	9/13	5/10	0.738[b]
Left/right, *n*	12/9	10/5	0.732[b]
Stone size, mm	18.5 ± 6.2	14.7 ± 5.2	0.062[a]
Caliceal diverticular location, *n*			0.368[b]
Upper pole	5	6	
Midkidney	7	6	
Lower pole	9	3	
Caliceal diverticular size, mm	39.1 ± 15.8	35.8 ± 12.6	0.502[a]

Values are expressed as mean ± standard deviation or *n*. MPCNL: minimally invasive percutaneous nephrolithotomy; F-URS: flexible ureterorenoscopy.

[a] Mann–Whitney *U* test.

[b] Fisher's exact test.