ORIGINAL PAPER

UROLITHIASIS

Simultaneous and synchronous bilateral endoscopic treatment of urolithiasis: a multicentric study

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Introduction The general prevalence of bilateral urolithiasis has risen to 15% and bilateral non-simultaneous treatment has been reported to have good outcomes. The objective of this study was to evaluate the effectiveness and safety of simultaneous bilateral endoscopic surgery (SBES).

Material and methods An international multicenter analysis was performed between May 2015 and December 2017. All patients with bilateral stone disease that underwent SBES were included. Patients were treated under general anesthesia in either the supine or lithotomy position. Demographic, clinical, intraoperative and postoperative data were analyzed.

Results A total of 47 patients were included. Mean age was 53.8 years and 70% of the patients were males. The mean American Society of Anesthesiology (ASA) score was 2. The mean diameter of right- and left-sided stones was 29.43 mm (2–83 mm) and 31.15 (4–102 mm), respectively. Staghorn stones were treated in 18 cases (8 right-sided and 10 left-sided), four of them were defined as complete staghorn. The procedures performed were 42 cases of bilateral URS and PCNL and ureteroscopy. Additionally, 5 bilateral flexible ureteroscopy (fURS) cases were described. Intraoperative complications occurred in five patients: four of them were classified as Clavien-Dindo (CD) I and one as CD II. Postoperatively, there were two cases with CD I, 6 with CD II and one CD IIIa.

The stone-free status was 70%. Residual stones (30%) were detected only on the side treated for high-volume (complete) staghorn calculi.

Conclusions SBES is a feasible, effective and safe procedure. It may potentially avoid repeated anesthetic sessions as needed for staged procedures and reduce the length of patients' hospital stay.

Key Words: bilateral ‹› endoscopy ‹› PCNL ‹› simultaneous ‹› stones ‹› ureteroscopy

INTRODUCTION

Urolithiasis is a recurrent disease that is increasing in frequency owing to lifestyle and dietary habits that significantly affect the quality of life of patients. The incidence of urolithiasis ranges from 5% to 9% in Europe and from 7% to 13% in North America. The general prevalence of bilateral urolithiasis

among this patient population has risen to 15%. The increasing incidence of bilateral disease poses treatment challenges, bearing in mind the goals of reducing surgical morbidity and minimizing costs.

The treatment of bilateral urolithiasis has accordingly become a hot topic of discussion among urologists. Many publications have reviewed the safety and feasibility of bilateral endourological management of stones by means of bilateral non-simultaneous, same-session procedures (BNS), including renal surgical approaches: retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL), and endoscopic combined approach (ECIRS) as well as ureteral semirigid ureteroscopic lithotripsy (URSL) and flexible ureteral ureteroscopic lithotripsy (fURSL). These studies have reported good results and complication rates comparable to those achieved with unilateral treatments [3, 4]. Reports on simultaneous treatment, by two surgeons in tandem, each of them approaching one of the affected urinary systems, are limited. The aim of this study was to further extend the assessment of feasibility, effectiveness, and safety of SBES endoscopic management of urolithiasis.

MATERIAL AND METHODS

A multicenter study involving six countries with senior endourolgic surgeons was performed. Records of all consecutive patients who underwent SBES endoscopic treatment between May 2015 and December 2017 were retrospectively reviewed. Exclusion criteria included active UTI and infectious stones (diagnosed in a previous surgery with stone analysis and clinical suspicion including stone appearance). Demographic data and characteristics of individual cases were collected, whereby staghorn stones were subclassified as partial (occupation of <2 calyces) or complete (defined as complete occupation of the calyceal system).

Evaluation of surgical procedures included the patient's position, the procedure in each renal unit, median blood loss and exit strategies. Intra- and postoperative complications were recorded using the specific Clavien-Dindo classification for PNCL. Stone-free rates were evaluated at 1 month follow-up.

RESULTS

The records of 47 patients, with 94 treated kidneys, were reviewed (Table 1). Of these, 70% were males; the mean age was 53.8 years and the median American Society of Anesthesiology (ASA) classification score was 2.

The mean diameter for renal stones was 29.43 mm (2–83 mm) for the right side and 31.15 (4–102 mm) for the left. Eighteen cases were described as partial staghorn (eight in the right kidney and ten in the left) and four patients had complete staghorn stones. The mean size of ureteral stones was 36.6 mm and 29 mm for the right and left side respectively.

The procedures performed were 47 of SBES shown in Table 2. All patients were placed in a supine position. The procedures included 5 bilateral flexible ureteroscopies and 42 PCNL with contralateral ureteroscopy (in 12 cases the PCNL started as ECIRS followed by a contralateral ureteroscopy while the PCNL was in process). Mean operative time was 140 min (49–240 min) and mean hospital stay, 3.3 days (1–15 days).

Intraoperative complications were identified in five patients. Four were classified as Clavien-Dindo (CD) I (one renal mucosal injury due to accidental rip-off of the laser fiber, a gluteal burn, hypothermia and a PCNL liver puncture that did not require any additional treatment) and one as CD II (bleeding that later required a transfusion). In 15 cases an intraoperative grade I ureteral injury was described. The median blood loss was 46.8 ml (preoperative Hb: 13.36 g/dl; postoperative Hb: 12 g/dl).

Table 1. *Demographics*

Patients	n = 47
Gender, n (%)	
Male	33 (70)
Female	14 (30)
Age, median, years	55 (16–80)
ASA score, n (%)	
I	15 (31.3)
II	26 (54.2)
III	6 (12.5)
IV	1 (2.1)
BMI, mean, CI 95%	26.1 (23.52–28.79)
Comorbidities, n (%)	
Hypertension	29 (60.4)
Diabetes	15 (31.3)
Positive Urine culture, n (%)	11 (22.9)
Previous Antibiotics, n (%)	42 (87.5)
Single linear stone size, mean mm	
Kidney: Right/Left	29.4 (2–8 3) / 31.1 (4–102)
Ureter: Right/Left	36.6 (2–54) / 29 (4–50)
Staghorn, n (%)	22 (45)
Partial	18 (37.5)
Complete	4 (8.3)
Preoperative GFR, mean, ml/min/173 cm	87 (26–190)

ASA – American Society of Anesthesiology; BMI – body mass index; GFR – glomerular filtration rate.

Table 2. *Summary of surgical interventions*

Patients	n = 47
Operative time, mean, min	140 (49–240)
Positioning, n (%)	
Lithotomy	15 (31)
Supine Valdivia position	14 (29.7)
Modified supine Valdivia-Galdakao position	19 (40)
Procedure combination, n (%)	
PCNL with contralateral ureteroscopy	42 (89%)
Bilateral ureteroscopy	5 (11%)
Ureteral access sheath, n (%)	
Right/ Left	24/25 (51.1/44.7)
Energy Source, right/left, n (%)	
Laser	20/22 (41.7/45.8)
Pneumatic	4/2 (8.3/4.2)
Combined (US+PN)	11/11 (22.9/22.9)
Basket removal	2/2 (4.2/4.2)
Exit strategy, n (%)	
JJ stent	
URS/RIRS	31 (65.9)
PCNL	32 (68)
Nephrostomy tube	
PCNL	17 (36.2)
Instrument Damage, n (%)	2 (4.2)

PCNL – percutaneous nephrolithotomy; URS – ureteroscopy; RIRS – retrograde intrarenal surgery

Table 3. *Outcomes and postoperative complications*

Patients	n = 47
Postoperative GFR, mean, ml/min/173 cm	85 (26–178.4)
Postoperative Hb decrease, g/dL	1.3
Hospital stay, median, days	3 (1–15)
Complications, Clavien Dindo (CD), n (%)	
Intraoperative	5 (10)
Fever	– –
Hematuria	1 (2.1)
Blood Transfusion (CDII)	1 (2.1)
Other	4 (8.5)
CD I	4 (8.5)
Postoperative	9 (19.1)
Fever	5 (10.6)
Hematuria	2 (4.2)
Blood transfusion	1 (2.1)
Other	2 (4.2)
CDI	1 (2.1)
CDII	– –
CDIII	1 (2.1)
Follow up 1 mo	
Fever	3 (6.3)
Other	1 (2.1)
Stone Free Rate (%)	70

GFR – glomerular filtration rate; Hb – hemoglobin

A double J stent was inserted after the procedure in 46 patients (i.e., only one remained tubeless). Seventeen patients had a postoperative nephrostomy tube after a PCNL. Operative data is summarized in Table 2.

Postoperative complications (Table 3) occurred in nine patients: two CD I (a cutaneous rash and a case of auto-limited hematuria), six CD II (one transfusion and five patients with fever, one of whom had sepsis with candidemia), and one CD IIIa (placement of a nephrostomy tube due to acute double J obstruction after URS without posterior ureteral damage). Mean postoperative glomerular filtration rate (GFR) reduction of 2 ml/min/173 cm was not statistically significant (Tables 1, 2, 3).

During the course of the first month of follow-up, three patients presented to the emergency room with fever; two were treated with ambulatory oral antibiotics and one was readmitted for IV treatment with fluconazole. One patient was readmitted owing to gastrointestinal bleeding with no correlation to his urological process. The stone-free rate (SFR), defined as the absence of stones, was 70% as assessed by CT-KUB; the remaining 30% of patients had high-volume staghorn stones preoperatively, with unilateral residual fragments.

DISCUSSION

Management of bilateral urolithiasis is challenging and complex. In order to reduce patient's hospital stay, loss of work days, repeated anesthesia sessions and possibly costs, BNS and SBES interventions has been attempted [4, 6]. However, reports on simultaneous treatment, by two surgeons in tandem, each of them approaching one of the affected urinary systems, are limited. To our knowledge the first series of bilateral simultaneous treatment was reported by Chung et al. who performed simultaneous bilateral endoscopic surgery (SBES), RIRS in four patients with significant comorbidities. The procedures were performed by two surgeons operating simultaneously in tandem resulting in initial proof of feasibility and safety. Then Giusti et al. described a series of SBES with PCNL and RIRS [5, 6]. As such, paralleling with Chung et al. [6] and Giusti et al. [8] descriptions, our study represents the first large multicenter series of this approach, although a number of studies have described bilateral, same-session (but not synchronous and simultaneous) surgery, including RIRS and PCNL.

The profile of patients potentially eligible for BNS was defined by Williams and Hoenig. These authors stated that surgery on the contralateral kidney should not proceed in patients in whom the first surgery had resulted in a fall in hemoglobin (Hb) of >3 g/dL, an operative time of >180 min, hypotension, or acidosis. Also, they suggested the following exclusion criteria for SBES endoscopic treatment: stone burden of >1000 mm^2, complex intrarenal

anatomy, age >50 years, ASA score >2, preoperative Hb <12 g/dL, and morbid obesity. In the present study, the mean BMI of patients was 27, patients with complete staghorn stones were treated, the average age was 53 years, and seven patients had an ASA score of 3–4, which may reflect a more typical spectrum of patients with bilateral urolithiasis.

For unilateral PCNL, the CROES study group reported a transfusion rate of 5–18%, a fever rate of 10% and a sepsis rate of 0.9–4.7%. These findings are comparable to our results for SBES endoscopic treatment, with two cases of transfusion, one of sepsis, and a very similar fever rate, having into consideration that some patients had high stone burdens.

In this series complications were also comparable with the unilateral and bilateral surgery. In a series of 60 patients with bilateral renal stones (mean stone burden of 1177 mm^2) who underwent BNS bilateral PCNL, Conort et al. reported a mean operating room occupation time of 188 min and a complete stone-free rate (SFR) of 75% in one session. When grading complications using the CD classification, they reported 16 patients (17%) with CD I–II, including fever, two with CD IIIb, one with CD IVa, and one with CD IVb. Similarly, in our series the mean operative time was 140 min and the SFR reached 70%; we also had a 25% rate of minor complications (CD I–II) but no cases of CD IV or V. Blood transfusion was not necessary in any of the patients.

In the present study, we found a reduced mean blood loss of only 46.8 ml and just two patients needed transfusions being comparable to the literature. Silverstein et al. comparing BNS and asynchronous PCNL for patients with bilateral stones reported a similar mean blood loss in the two groups, at 357 and 282 ml respectively, while the transfusion rate was also comparable, at 28.6% and 36.8% respectively. Further, in the study by Silverman et al., mean hospital stay was significantly lower in the synchronous group, at 3.6 vs. 7.2 days, similar to our own result of 3.3 days and possibly meaning that a second hospitalization for a second surgery may be avoided. When the CROES group compared unilateral and BNS ureteroscopy they found that patients who underwent same-session bilateral ureteroscopy and multiple stone treatments had lower stone-free rates, higher retreatment rates, and longer operative times compared to patients who underwent ipsilateral ureteroscopy and single stone treatment. To our knowledge, the largest single-center series on this subject is that described by Peng et al, comprising 464 patients. These authors reported similar complication rates and SFR in single-stage bilateral and unilateral RIRS, at the expense of increases in operative time from 65 to 100 min and in hospital stay from 1 to 2 days. A systematic review of the bilateral simultaneous (i.e., same-session) ureteroscopic approach by Geraghty et al reported a mean SFR of 92%, a mean operative time of 68 min and a mean hospital stay of 1.6 days. Interestingly, a comparison of cases from 2003 to 2012 and from 2013 to 2016 revealed that over the latter period the incidence of pain requiring analgesia fell from 8.3% to 2.8% and the incidence of fever declined from 4.2% to 2.8%, possibly owing to improvement in the armamentarium and greater surgical expertise in high-volume centers. Notably, in this review the complication rate was 26% whereas in another systematic review, Rai et al. reported a 50% complication rate in ureteric stone surgery. Most of the complications in the Geraghty et al. study were minor, as in our series.

In a series of 26 patients who underwent PCNL and same-session contralateral RIRS, Mason et al. reported a SFR of 92% when considering residual fragments of 4 mm or less to be acceptable, with performance of a second-look procedure in 19%. The stone burden was 443 mm^2. Mean operative time was 149 min, mean hospitalization time was 2.5 days, and Hb fell by 1.3 g/dl, these results being similar to those in the present series. Mason et al. reported two major complications of acute renal insufficiency and clot obstruction requiring urgent stenting which, like our only CD IIIb complication (a case of acute obstruction), resolved uneventfully after catheterization. We consider that our own lower SFR of 70% is to be explained by our definition of SFR as absence of stones and by the fact that 46% of our patients had partial or full staghorn stones, which are known to require more than one procedure and have been reported to be associated with an SFR of 56.9% when treated in a single surgical session [11].

In the initial report by Chung et al. of SBES RIRS in four patients with significant comorbidities, three patients needed a secondary procedure (yielding a 92% SFR) but no major complications were reported. Later, Giusti et al. [5] published a successful case report of a PCNL and RIRS carried out in tandem by two surgeons. These were the first five cases of SBES RIRS reported in the literature that inspired our multicenter study.

This retrospective multicenter study of SBES RIRS reveals similar complication rates, SFR, operative time, and hospital stay compared with previous series that have investigated bilateral, same-session surgery but without two surgeons operating in tandem. In our opinion one of the advantages of SBES surgery is a reduction in stone burden, potentially permitting avoidance of secondary procedures.

A limitation of our study is the heterogeneity of the sample, which is a consequence of the study's mul-

ticenter nature, with each center treating patients according to local protocols.

CONCLUSIONS

Simultaneous and synchronous bilateral endourological surgery for stone disease appeared to be a feasible and safe. It shows comparable outcomes to other bilateral same session and unilateral surgical series while potentially reducing the operative time and patients' inconvenience of having multiple staged procedures.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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