Safety and Efficacy of Flexible Ureterorenoscopy and Holmium:YAG Lithotripsy for Intrarenal Stones in Anticoagulated Cases

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Purpose: We compared perioperative outcomes in patients undergoing ureterorenoscopy and Ho:YAG lithotripsy for renal calculi with or without anticoagulation.

Materials and Methods: We reviewed the records of all patients undergoing flexible ureterorenoscopy and Ho:YAG lithotripsy for renal calculi at 2 institutions from 2001 to 2007. We identified 37 patients on anticoagulation with Coumadin®, clopidogrel or aspirin in whom anticoagulation therapy was not discontinued before surgery. Data on the anticoagulation group were retrospectively compared to those on a contemporary matched cohort of 37 controls without anticoagulation who underwent a similar operative procedure. The 2 groups were compared with regard to the stone-free rate, and intraoperative and postoperative complications with specific reference to bleeding and thromboembolism.

Results: The 2 groups were matched for stone size, stone location, number of stones, bilateral procedures and concomitant ureteral stones. Anticoagulation group patients were older (58.2 vs 50.4 years, $p = 0.0209$) and had a greater American Society of Anesthesiologists score (2.8 vs 1.9, $p < 0.0001$) compared to the control group. No procedure had to be terminated in the anticoagulation group due to poor visibility from bleeding. The median postoperative hemoglobin decrease was greater in the anticoagulation group than in the control group (0.6 vs 0.2 gm/dl, $p < 0.0001$). The stone-free rate (81.1% vs 78.4%, $p = 0.7725$), intraoperative complications (0% vs 3%, $p = 0.3140$), postoperative complications (11% vs 5%, $p = 0.3943$) and hemorrhagic or thromboembolic adverse events were comparable in the 2 groups.

Conclusions: When necessary, ureterorenoscopy and Ho:YAG lithotripsy can be performed safely and efficaciously for renal calculi in patients on anticoagulation therapy without the need for perioperative manipulation.

Key Words: kidney, kidney calculi, lasers, anticoagulants, endoscopy

During the last decade there has been a rapid development in small caliber flexible URS, Ho:YAG laser lithotripsy and various ancillary instruments for stone manipulation and retrieval.[1] Flexible URS is being increasingly used for a large number of diagnostic and therapeutic procedures involving the upper urinary tract, allowing the entire renal collecting system to be accessed safely and effectively.[2]

Stone disease in patients on chronic oral AC therapy poses a difficult management problem. Many such patients on chronic AC therapy have multiple associated comorbidities, making perioperative discontinuation of AC therapy significantly risky for adverse thromboembolic events. Therapeutic modalities, such as extracorporeal shock wave lithotripsy, percutaneous nephrolithotomy, or laparoscopic or open stone treatment, are contraindicated in patients on active AC therapy.[3–5] Flexible URS may be the only surgical option available for stone disease. There is a paucity of published information regarding the safety and efficacy, especially with flexible URS, in patients on AC that is not discontinued perioperatively. We evaluated the safety and efficacy of flexible URS and Ho:YAG laser lithotripsy for intrarenal calculi in patients on active oral AC.

MATERIALS AND METHODS

Between July 2001 and January 2007, 692 patients were treated with flexible URS and Ho:YAG laser lithotripsy for renal calculi at 2 institutions. Of these patients 37 (5.3%) were identified who underwent a procedure while on active AC. Chronic AC included Coumadin in 14 patients (37.8%), clopidogrel in 5 (13.5%), and 81 and 325 mg oral aspirin in 13 (35.2%) and 5 (13.5%), respectively. Indications for AC were coronary artery disease in 8 patients, hyperlipidemia and hypertension in 7, a mechanical cardiac valve in 5, atrial fibrillation in 4, myocardial infarction in 3, cerebrovascular disease in 3, DVT in 2, and lupus anticoagulant, ischemic colitis, factor V Leiden, total hip replacement and an unknown reason in 1 each (table 1). The median duration of AC therapy was 15 months (range 1 to 120).

Data on the AC group were retrospectively compared to those on a contemporary cohort of 37 control patients not on AC therapy who underwent flexible URS and Ho:YAG laser lithotripsy for intrarenal calculi. Control patients were matched for stone size, stone location, the number of stones,

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TABLE 1. *Anticoagulation therapy etiology*

	No. Coumadin	No. Clopidogrel	No. Aspirin
Overall	14	5	18
Mechanical prosthetic heart valve	5	—	—
Chronic atrial fibrillation	4	—	—
Coronary artery disease	—	2	6
Myocardial infarction + stenting	1	2	—
DVT	2	—	—
Lupus anticoagulant	1	—	—
Ischemic colitis	1	—	—
Cerebrovascular disease	—	—	3
Hyperlipidemia + hypertension	—	1	6
Factor V Leiden	—	—	1
Total hip replacement	—	—	1
Unknown	—	—	1

the number of bilateral simultaneous procedures, and the number and size of concomitant ipsilateral ureteral stones. Preoperative clotting parameters were available in all patients. Intraoperative and postoperative outcomes were compared between the 2 groups. Specifically the groups were compared for clotting parameters (normal prothrombin time less than 13 seconds, normal partial thromboplastin time less than 34 seconds and normal INR less than 1.1), changes in preoperative and postoperative hemoglobin, the stone-free rate, and intraoperative and postoperative complications, including hemorrhagic and thromboembolic adverse events.

All patients underwent noncontrast computerized tomography before surgery. Any associated ipsilateral ureteral stones or contralateral renal stones were treated at the same setting when indicated.

All patients underwent flexible URS using a 7.5Fr Karl Storz™ 11278 AUA1 Flex-X™, 8.7Fr ACMI™ DUR-8 Elite or 6.9Fr Olympus™ URF-P3 flexible ureterorenoscope. Ureteral balloon dilatation was performed when necessary. A ureteral access sheath was used based on individual surgeon preference. Lower pole stones were typically relocated to a more favorable location using a 2.4Fr nitinol basket before laser lithotripsy. Ho:YAG laser lithotripsy was performed using a 200 or 365 μm laser fiber set at 10 W (1.0 Joule $\times$ 10 Hz). Stone(s) were completely fragmented into a gravel size of less than 2 mm. Basket retrieval at the end of laser lithotripsy was performed based on individual surgeon preference.

A systematic inspection of the collecting system was performed at the end of the procedure to confirm adequate fragmentation. A 6Fr Double-J® stent was routinely inserted in all patients and removed a minimum of 1 week after the procedure. All patients were discharged home within 24 hours after the procedure following postoperative hemoglobin determination, urine color assessment and confirmation of stable vital signs. Any residual fragment greater than 2 mm on postoperative computerized tomography followup at 1 month was considered treatment failure.

Summary statistics are reported using the mean or median for continuous variables and percents for categorical variables. Statistical comparison of the 2 groups (AC vs control) was performed using the Wilcoxon rank sum test for continuous data and the chi-square test for categorical data with SPSS® software. For further analysis the 4 subgroups (Coumadin vs clopidogrel vs aspirin vs control) were also compared using the Kruskal-Wallis test for continuous data and the chi-square test for categorical data with statistical significance considered at $p = 0.05$.

RESULTS

Compared to the 37 patients in the control group the 37 in the AC group were older (58.2 vs 50.4 years, $p = 0.0209$) and had a greater American Society of Anesthesiologists score (2.8 vs 1.9, $p < 0.0001$, table 2). The 2 groups were comparable in terms of the number of lower pole stones (32% vs 32%, $p = 1.0$), number of multiple stones (43% vs 46%, $p = 0.3636$) and concomitant ureteral stones (22% vs 19%, $p = 0.7725$) requiring simultaneous treatment. The groups were also similar in terms of preoperative flank pain/colic (57% vs 70% of patients), baseline hemoglobin (13.8 vs 13.5 gm/dl), baseline serum creatinine (1.0 vs 0.9 mg/dl), a preexisting Double-J stent (46% vs 35% of patients), renal stone size (13.2 vs 11.1 mm) and associated ureteral stone size (8.3 vs 6.7 mm) (table 2). However, clotting parameters, such as prothrombin time (14 vs 10.7 seconds, $p = 0.0051$), partial thromboplastin time (31.9 vs 28.4 seconds, $p = 0.0419$) and INR (1.3 vs 0.9, $p = 0.0284$) were significantly prolonged in the AC group compared to those in controls.

Table 3 lists perioperative outcomes. A ureteral access sheath was used more frequently (22% vs 3%, $p = 0.0128$) and mean operative time was significantly longer (69.9 vs 57.8 minutes, $p = 0.0146$) in the AC group. Intraoperative visibility was satisfactory for allowing successful completion of the procedure in all patients on AC. No patient required blood transfusion in either group. The median postoperative hemoglobin decrease was 0.7, 0.65, 0.3, 0.6 and 0.2 gm/dl in patients on aspirin, Coumadin, clopidogrel and overall AC, and in controls, respectively (AC vs control $p < 0.0001$). The figure shows the changes in preoperative and postoperative hemoglobin. No patients in either group experienced major bleeding complications perioperatively. Table 4 lists detailed hemorrhagic and thromboembolic adverse events.

The single intraoperative complication in the entire series (superficial proximal ureteral perforation) occurred in the control group. Four patients in the AC group experienced postoperative complications, including macroscopic hematuria 3 days or longer in duration in 3 and urinary tract infection in 1, compared to 2 in the control group, including urinary tract infection and DVT in 1, and severe dysuria in 1. The stone-free rate at 1 month did not differ significantly among the 4 subgroups or between the 2 groups (81.1% vs 78.4%, $p = 0.7725$).

DISCUSSION

Currently there are several alternatives for the surgical treatment of renal and ureteral calculi. Factors such as stone characteristics, anatomical detail, patient factors and surgeon preference typically determine the choice of surgical intervention.

Uncorrected bleeding diathesis is an absolute contraindication to stone treatment with shock wave lithotripsy, percutaneous nephrolithotomy, open surgery or laparoscopy.[3–5] Several indications, therapeutic goals and recommended durations of therapy exist for the use of aspirin, clopidogrel and Coumadin. The prevention of thromboembolic complications from DVT, atrial fibrillation, valvular heart disease and coronary stenting are the main indications for AC therapy,