Do patients with ureterolithiasis treated conservatively return to follow up?

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Introduction: *Distal ureteral stones (DUS) are common in patients presenting to the emergency department (ED) with renal colic. The majority of DUS will pass spontaneously and therefore conservative care is common. Follow up is imperative as some of these stones might not pass and potentially lead to complications. The aim of our study was to evaluate the rate of compliance with follow up and to find predictive variables for it.*

Materials and methods: *We retrospectively surveyed the medical records of all patients who had a non-contrast computed tomography (NCCT) at our ED between 01/03/16 and 31/5/17. We included patients with a DUS smaller than 10 mm that were treated conservatively. We obtained demographic, clinical, laboratory and imaging data. Compliance to follow up was evaluated by surveying the medical records and by calling the patients. We then compared the characteristics of patients who returned for follow up to those who did not.*

Results: *A total of 230 consecutive patients were included in our cohort: 194 (84%) patients were male and the average age was 46 y (21-82); 138 patients (60%) returned for a follow up visit while 92 patients (40%) did not. Univariate analysis revealed stone size and admission to hospital to be predictive of compliance to follow up while multivariate analysis revealed only hospital admission to be predictive of compliance.*

Conclusions: *Only 60% of the patients with DUS treated conservatively return for a follow up visit. Hospital admission, which likely reflects appropriate patients counseling by a urologist and adequate follow up scheduling, was found to be associated with increased compliance with follow up.*

Key Words: ureterolithiasis, ureteral stone, follow up, compliance

Introduction

The prevalence of kidney stone disease is estimated to be nearly 10%[1] with studies showing an increase in prevalence over the years.[2,3] Most cases of renal colic presenting to the emergency department (ED) are caused by a small stone in the distal ureter, and these have a reported expulsion rate of 70%-90% in different series.[4-9] Given the high expulsion rate, conservative treatment and ambulatory follow up are common practice, with surgical intervention offered to those who either remain symptomatic or have an absolute indication for intervention. Ambulatory follow up is crucial to detect patients who failed to expel their stone as they are exposed to complications such as recurrent urinary tract infection, ureteral strictures, and irreversible kidney damage.[10,11]

Compliance to medical follow up was shown to be suboptimal in several medical fields, with different studies reporting compliance rates of 50%-60%.[12-23]

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Efforts to identify predictive variables for compliance with follow up found several variables, which were not consistent throughout the different studies.

Given the reported low follow up rates and the potential implications of retained ureteral stones, we evaluated the follow up compliance rate of patients with distal ureteral stones (DUS) elected for conservative ambulatory care. Secondary end point targeted potential predictive variables to follow up compliance.

Materials and methods

After gaining the approval of the local institutional review board, we retrospectively surveyed the medical records of all patients with a DUS up to 10 mm in diameter on non-contrast computed tomography (NCCT) done at a large urban tertiary hospital between 01/03/16 and 31/05/17. We included patients who were discharged for ambulatory care directly from the ED or after admission to the urology department. All patients were scheduled for follow up visit as done routinely at our department 2-4 weeks after discharge with instructions to repeat an ultrasound exam and serum creatinine level. We excluded patients who underwent primary surgical intervention, either ureteroscopy or renal drainage, as these patients represent a different group of patients with potential different compliance rate. Also excluded were patients with proximal ureteral stones, stone larger than 10 mm or patients presenting with fever or intractable pain. Compliance to follow up was evaluated 3 months after patient discharge using an integrated hospital-community medical record system which allows access to patients' clinic visits, laboratory and imaging studies done both at different hospitals and community clinics. We searched for follow up physician visits, follow up laboratory and imaging studies and surgical interventions. When no such follow up was detected, the patients were contacted directly to ascertain whether they continued follow up or not. We calculated compliance rates and divided our cohort to patients who complied with follow up (group 1) and those who did not (group 2).

We collected demographic, clinical, laboratory and imaging data which are presented in Table 1. Insurance status was not collected as all patients at our health system are insured.

Imaging data was collected using the PACS version 11 software. The information gathered from the NCCT scan imaging, such as stone size, distance from the uretero-vesicle junction (UVJ), presence of "rim sign" and perinephric stranding was determined by a single urologist. Measurement of stone size was done on the coronal CT plane where stone diameter was maximal. Measurement of the distance between the stone and UVJ was done in the plane where the best view of both stone and bladder was noted. "Rim sign" was considered positive when the urologist could identify a soft tissue ring around the stone. Hydronephrosis was graded as either none to mild hydronephrosis or moderate to severe. A senior urologist confirmed the initial imaging interpretations and clinical data collection to establish unity of the obtained information. We used univariate and multivariate analysis to search predictive variables for compliance. Study variables at baseline are described as mean and standard deviation for continuous variables and proportions for discrete variables, stratified by the eventual outcome. Percent of missing data is detailed per variable. Missing data was multiply imputed 10 times. Univariate and multivariate analysis was performed separately on each imputed dataset, with the results pooled using Rubin's laws. On clinical grounds, it was determined that the variables age, gender, symptom duration, visual analogue scale (VAS) pain score and creatinine blood level at presentation be included in the final analysis. Other variables were chosen for inclusion based on univariate significance testing. Multivariate modeling was performed using standard logistic regression. The statistical analysis was performed using the R statistical package.

Results

Between March 2016 and May 2017, 281 consecutive patients had a DUS smaller than 10 mm on NCCT. Fifty-one patients required primary surgical intervention and were excluded from the study, leaving 230 patients in the final cohort, of which 151 patients were discharged directly from the ED and 79 were admitted to the urology department and later discharged for ambulatory care. As shown in Figure 1, 60% of our cohort (138 patients) returned for follow up visit (group

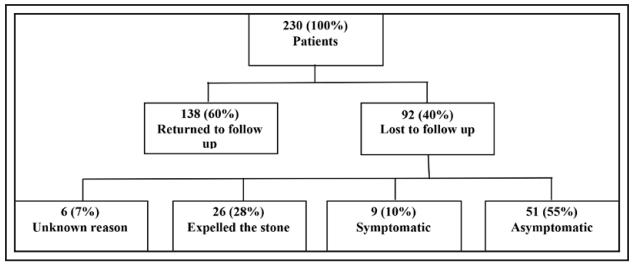

Figure 1. Patient follow up compliance distribution

TABLE 1. **Univariate analysis**

Variable	Total 230	Compliant with follow up 138 (60%)	Non-compliant with follow up 92 (40%)	Missing data (%)	p value
Gender				0	0.824
Male	194 (84.3%)	117 (84.8%)	77 (83.7%)		
Female	36 (15.7%)	21 (15.2%)	15 (16.3%)		
Age (yrs. mean)	46 ± 13.5	47.02 ± 13.4	44.82 ± 13.6	0	0.229
Symptom duration (days, mean)	5.57 ± 17.9	7.19 ± 22.1	3.16 ± 7.9	13.9	0.120
VAS pain score (mean)	6.93 ± 3.3	6.85 ± 3.3	7.05 ± 3.3	13.5	0.642
Hospital admission (%)				0	< 0.001
Yes	79 (34.3%)	61 (44.2%)	18 (19.6%)		
No	151 (65.7%)	77 (55.8%)	74 (80.4%)		
History of stone disease (%)				2.2	0.788
Yes	86 (38.2%)	51 (37.5%)	35 (39.3%)		
No	139 (61.8%)	85 (62.5%)	54 (60.7%)		
History of surgery for stone removal (%)				2.9	0.176
Yes	18 (8.1%)	14 (10.4%)	4 (4.6%)		
No	203 (91.9%)	121 (89.6%)	82 (95.4%)		
Urinary symptoms (%)				24.3	0.665
Yes	83 (47.7%)	49 (48.5%)	34 (46.6%)		
No	91 (52.3%)	52 (51.5%)	39 (53.4%)		
Nausea (%)				25.7	0.276
Yes	110 (64.3%)	73 (67.6%)	37 (58.7%)		
No	61 (35.7%)	35 (32.4%)	26 (41.3%)		
Rim sign (%)				0.4	0.962
Yes	32 (14%)	19 (13.9%)	13 (14.1%)		
No	197 (86%)	118 (86.1%)	79 (85.9%)		
Hydronephrosis (%)				0	0.578
Moderate/severe	58 (25.2%)	33 (23.9%)	25 (27.2%)		
None/mild	172 (74.8%)	105 (76.1%)	67 (72.8%)		
Perirenal stranding (%)				0	0.744
Yes	132 (57.4%)	78 (56.5%)	54 (58.7%)		
No	98 (42.6%)	60 (43.5%)	38 (41.3%)		
Distance to urinary bladder (mean ± SD)	5.9 ± 12.3	6.9 ± 12.9	4.59 ± 11.3	0.4	0.164
Stone size (mean ± SD)	3.3 ± 1.1	3.5 ± 1.1	3.13 ± 1	0.4	0.030
Creatinine (mean ± SD)	1.1 ± 0.3	1.17 ± 0.3	1.1 ± 0.3	0	0.068

VAS = visual analogue scale

1) while 40% (92 patients) did not comply with follow up (group 2). Of non-compliant patients, 28% (26 patients) reported they have seen the stone pass and therefore did not return for follow up, 55% (51 patients) remained asymptomatic and thought follow up was unnecessary, 10% (9 patients) reported they were still symptomatic but either thought the symptoms were not related to the stone or were unable to return for

TABLE 2. **Multivariate analysis**

Variable	OR	CI	p value
Gender	1.01	0.44-2.29	0.986
Age	1.01	0.99-1.03	0.56
Symptom duration	1.01	0.98-1.04	0.47
VAS pain score	0.99	0.9-1.08	0.784
Creatinine	2.02	0.63-6.49	0.237
Stone size	1.1	0.83-1.47	0.512
Hospital admission	2.77	1.44-5.36	0.003

VAS = visual analogue scale

follow up and the remaining 7% (6 patients) were lost to follow up. After the patients were called and instructed on the importance of follow up, the potential consequences of retained stones and urged to return to follow up, only 6.8% (5 patients) of patients in group 2 complied.

Univariate analysis revealed that patients in group 1 were more likely to have been hospitalized (OR = 3.26, CI 95% = 1.76-6.02, $p < 0.001$) and their stone tended to be larger (OR = 1.33, CI 95% = 1.03-1.73, $p < 0.03$). Multivariate analysis, Table 2, revealed only hospitalization to be predictive of compliance to follow up (OR = 2.77, CI 95% = 1.44-5.36, $p = 0.003$).

Discussion

The incidence of nephrolithiasis is rising over the past several decades leading to an increased number of patients referred to the ED due to ureterolithiasis. Most of these patients will ultimately be found to have a ureteral stone with favorable characteristics for spontaneous expulsion and under such circumstances, will be discharged with a recommendation to return for follow up at outpatient clinics to confirm passage of the stone and resolution of the symptoms. Follow up of patients with ureteral stone under conservative care is important as some of these patients will not expel their stone and are at potential risk for complications related to the retained stone. These complications may include recurrent urinary tract infections, ureteral strictures, and loss of renal function.[10,11]

Compliance is a major factor influencing treatment success rates in many medical fields and was evaluated previously in several studies. These studies reported poor compliance rates averaging 50%-60%,[12-23] suggesting successful patient follow up is a significant challenge and might represent a major factor influencing patient morbidity and even mortality. Interestingly, follow up compliance rates were similar regardless of the medical scenario, i.e post-ED discharge follow up,[12] concerning skin or breast lesions follow up,[15,17,20,21] post-surgical follow up,[18,22] post intensive care unit discharge follow up[16] and even for cancer surveillance.[14,19,23]

In our study, only 60% of patients with DUS who were discharged for ambulatory management returned for follow up, a similar rate to that reported in other medical disciplines. The MIMIC study, which retrospectively searched for predictive variables for ureteral stone expulsion, reported that nearly 80% of their cohort had complied with follow up after they were discharged on conservative management.[24] This rate is higher than that found in our study and in other studies evaluating compliance with follow up in a variety of medical fields. This discrepancy might be explained by the broad definition of follow up used in the MIMIC study which included any outpatient visit, imaging, telephone consultation or admission to hospital.

Inquiring for the reasons for non-adherence with follow up, patients stated three main causes. Most patients (55%) reported they were asymptomatic and therefore felt follow up was unnecessary. Twenty-eight percent reported they have seen the stone pass and thus thought no follow up was required and 10% stated they still had symptoms but did not return because they felt the symptoms were unrelated to the stone or due to socioeconomical issues.

This data shows that at least 65% of patients who do not adhere to follow up recommendations are at risk of harboring a retained stone, exposing them to related morbidity. The rest of the patients potentially passed their stone, although even this group of patients might benefit from follow up as knowledge of stone

composition and blood and urine chemistry may help estimate the risk of recurrence and guide proper treatment and surveillance. Unfortunately, reaching out to the non-compliant patients and urging them to return for follow up had marginal effect on overall compliance rate.

Given the low compliance with follow up and its importance, we searched for predictive variables that can identify patients less suitable for ambulatory care. We therefore compared patients who were compliant to those who were not. Univariate analysis, Table 1, revealed stone size and patient hospitalization to the urology department to be predictive for follow up compliance. Multivariate analysis, however, revealed only hospitalization rate to be significantly different between the two groups, Table 2, with an odd ratio of 2.77 (1.44-5.36, CI 95%). Several possible reasons can explain why hospitalization increases compliance with follow up. Admission may strengthen patient doctor relations and convey the importance of follow up to the prevention of potential complications. In addition, hospitalized patients were scheduled an ambulatory appointment for follow up while patients discharged from the ED were instructed to make their own appointments. Moreover, not all patients with DUS discharged from the ED were seen by a urologist. This might have influenced patient counseling and potentially reduced compliance rate. Considering the above mentioned, we believe that establishment of appropriate patient-urologist counseling as well as adequate follow up scheduling may increase the follow up compliance rate.

Previous studies evaluating compliance with follow up have also tried to identify predictive variables for patient's compliance.[12-14,16,18,19,21-23] Although some factors were identified, only the insurance status of the patient was consistently found to be predictive of compliance with follow up across the different studies. This is not surprising as the financial burden of continued medical care might dissuade some patients from complying with follow-up recommendation. Moreover, the lack of a consistent predictive variable for compliance other than insurance status reinforces the notion that our ability to identify non-compliant patients is limited.

Only a minority of the patients with DUS will eventually need surgical intervention. The ability to identify these patients is important as loss to follow up under such circumstances may potentially result in complications. Several studies have reported on clinical and radiological parameters that pinpoint which patients with ureterolithiasis are likely to undergo surgical intervention.[25,26] These studies showed that stone size, stone location, pain duration and pain intensity are predictive for the need for intervention. Given the low follow up compliance rate and our inability to predict it, the results of our study suggest that patients with unfavorable parameters for spontaneous stone expulsion should be advised to undergo primary intervention or to be meticulously instructed regarding follow up appointment and actively followed by the discharging doctor.

One of our study's major strengths was its ability to acquire follow up data on most of our cohort, which assured an accurate evaluation of patient compliance rate. This was achieved by using an integrated hospital-community electronic patient record unique to our medical group enabling medical data acquisition from both hospital and community clinics as well as telephone calls to those patients with no recorded follow up visit.

The retrospective nature of our study leads to several limitations. Our patient medical record lacks epidemiological factors such as marital status, income and educational status which are potential factors for low compliance rate yet were unavailable for analysis. Another limitation is the different healthcare systems available in different countries which incorporate different financial support. Our medical healthcare system is financed nearly completely by the state, which might increase compliance rate in comparison to other medical health systems in which the patients have to finance the follow up visits. We lack data regarding complications that resulted from non-compliance to follow up, which could have substantiated follow up importance. Nevertheless, given the high prevalence of stone disease in the general population, the high rate of non-compliant patients and the fact that up to 30% of DUS do not pass spontaneously, there is a potential risk that a significant number of patients who require intervention are lost to follow up, and so, even if the risk for complication is low, the overall number of patients suffering complication might be high.[10,11] Moreover, follow up compliance is important not only for its potential ability to prevent complications but also for its role in patient education and prevention strategy optimization.

Conclusions

Based on our study, only 60% of patients with DUS comply with follow up, of which more than 50% had no evidence the stone had passed. Given the low compliance rate and the potential harm of retained ureteral stone it is important to identify parameters that can increase compliance to follow up. We noted

that hospitalization of patients increased compliance with follow up significantly which probably reflects an appropriate patient-urologist relationship as well as lower patient bureaucratic load. We therefore suggest that patients with DUS in whom spontaneous passage is less likely and elect not to undergo primary intervention to be seen by a urologist and actively followed to increase their follow up compliance. □

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