Factors predicting the spontaneous stone passage in patients with ureteric colic due to distal ureteric stone

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ABSTRACT

Prediction of spontaneous passage of ureteric stone is a difficult task. In this study, we evaluated factors that can predict spontaneous passage of distal ureteric stone in patients presenting with ureteric colic. This is a prospective study among patients presenting to the emergency department with ureteric colic due to distal ureteric stone. Passage of stone was evaluated by ultrasonography in two weeks and four weeks time. Those patients who received medical expulsion therapy or who needed intervention before four weeks were excluded. A total of 63 patients were included in the study and 37 (58.7%) of them passed the stone within four weeks while 26 (41.3%) did not. There was statistically significant difference between the two groups with regards to stone size (p=0.020) ; total white blood cell (WBC) count at the time of colic (p=0.003) and neutrophil percent (p<0.001) ; while the difference in age (p=0.407) was not significant. Stone passage also did not correlate with gender and side of stone. Multivariate logistic regression analysis revealed that neutrophils percent (p<0.001) and total WBC count (p=0.006) were the most significant predictors for stone passage followed by the stone size (p=0.009). This study concludes that neutrophil percent and WBC count at the time of ureteric colic are the most significant predictors for spontaneous passage of distal ureteric stone. While stone size also predicts; age, gender and side of stone does not have influence on the passage of stone.

Keywords: Predictors, spontaneous passage, ureteric colic, ureteric stone.

INTRODUCTION

Urolithiasis is a common condition encountered in urological practice worldwide with an estimated life time risk of 5-12%.[1] Prevalence of ureteric stone ranges from 3% to 5%, which accounts for 20% of all urolithiasis cases.[2,3] Recurrence of urinary stone is also very high, estimated to be 10% within one year and 50% within 10 years, which further adds to the burden of the disease to the society.[4] Most patients with ureteric stone present with ureteric colic. Although the initial management of the colic episode is well established, further management of the stone is still not standardized since it is difficult to predict the spontaneous passage of ureteric stone. Active intervention has high success rate with extracorporeal shock wave lithotripsy (ESWL) or uretero-renoscopic lithotripsy (URSL), but there is risk of procedure related complication and cost factor should also be taken into account. On the other hand, conservative treatment avoids complication of procedure and is cost effective, but, at the same time there are chances that the patient may develop recurrent pain, infection and renal impairment. Thus, identifying particular patients who would pass stone on active monitoring and others who would require active stone removal would greatly help to take correct decision in the management of these patients. Several factors have been proposed as potential predictors of spontaneous stone passage (SSP), and in most of the series, size and location have been regarded as the most important predictors. However, sometimes small distal ureteric stones do not pass spontaneously and on the other than, large proximal stones have been documented of spontaneous passage. Sfoungaristos *et al* in 2012 have reported that white blood cell (WBC) count and neutrophil count can significantly contribute to the prediction of SSP.[5]

In this study we have evaluated the role of WBC count and neutrophil percent in the prediction of SSP among the patients who presented with acute ureteric colic due to distal ureteric stone in the emergency department.

MATERIALS AND METHODS

We prospectively evaluated patients presenting to the emergency department of Nepal Medical College Teaching Hospital with ureteric colic due to distal ureteric stone of size 4-10 mm within a period of six months from November 2012 to April 2013. These patients had complete blood count, blood urea, serum creatinine, urine microscopy and culture, ultrasonography (USG) of abdomen and plain x-ray of kidney ureter and bladder region (KUB) at the time of presentation to the emergency room. The diagnosis of ureteric stone was based on clinical history along with identification of stone in the distal ureter in USG

Table 1: Patient characteristics

Characteristics	Spontaneous Passage	No Spontaneous Passage	P value
Age in years (Mean ± SD)	38.92 ± 14.326	42.15 ± 16.330	0.421
Sex			0.068
Male	13	16	
Female	23	11	
Side			0.383
Right	20	12	
Left	16	15	
Size (mm, Mean ± SD)	6.50 ± 1.665	7.48 ± 1.553	0.020
WBC Count (Mean ± SD)	9830.56 ± 2717.963	8055.56 ± 1354.858	0.003
Neutrophil % (Mean ± SD)	73.53 ± 7.991	61.85 ± 10.946	< 0.001

of abdomen or presence of hydroureteronephrosis in USG of abdomen combined with typical radio-opaque shadow in the line of ipsilateral distal ureter in the x-ray KUB. X-ray intravenous urography or plain CT scan of abdomen was done whenever diagnosis was doubtful. The size of the stone documented was the dimension perpendicular to the long axis of the ureter. Exclusion criteria were ureteric colic of >4 hours duration, fever at the time of presentation, patients who received medical expulsion therapy, multiple ureteric stones, positive urine culture, pregnant woman, systemic illness or diagnosed infection at any part of the body and patients who required intervention within four weeks. Primary pain was managed by intramuscular diclofenac in the emergency room, then kept on oral non-steroidal anti-inflammatory drug and the patients were followed up in Urology clinic every week up to four weeks with either USG of abdomen or x-ray KUB depending upon whichever revealed the stone better. Stone passage was documented on follow up if radio-opaque shadow in was seen in the x-ray previously. KUB disappeared along with disappearance of hydronephrosis or stone in USG of abdomen. Analysis of data was done using Statistical Package for the Social Sciences (SPSS) version 18. Descriptive statistics were presented as the mean ± standard deviation. A univariate analysis was performed to identify the significance of age, sex, side of stone, size of stone, total WBC count and neutrophil percent in the prediction of SSP. A multivariate logistic regression analysis was performed to know the power of predictability of different variables which were shown to be statistically significant in univariate analysis.

RESULTS

Over a period of 6 months, 84 patients fulfilled the study criteria. However 9 patients needed intervention within four weeks and 12 patients did not come for follow-up for 4 weeks. Data from the remaining 63 patients were analyzed. Among 63 patients, 29 were male and 34 female. Mean age of the patients was 40.28years (range 13-72). Stones were in right side in 32 patients and in left side in 31 patients. 36 out of 63 patients (53%) had SSP of stone within four weeks (Fig 1).

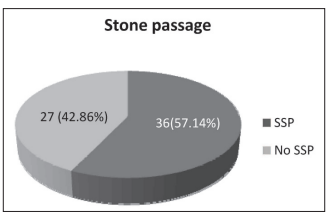

Fig. 1. Proportion of spontaneous stone passage. (SSP: Spontaneous stone passage)

In univariate analysis, age and sex of the patient, and side of the stone did not have statistical significance in relation to passage of stone, whereas size of stone, total WBC count and neutrophil percent were significantly different between patients with SSP and those who failed to pass stone (Table-1).

The average size of the stones that passed spontaneously was 6.50 mm, whereas stones that did not pass had average size of 7.48 mm (p=0.020).

Multivariate logistic regression analysis was done to know the power of predictability of different variables, and interestingly it showed that neutrophil percent was the most important predictor (Table-2).

Table 2: Multivariate logistic regression analysis

Variables	P value
Neutrophil %	< 0.001
WBC count	0.005
Size of stone	0.009

DISCUSSION

Most ureteric stones are diagnosed in the emergency room when the patient presents with ureteric colic. Once the primary management of a ureteric colic episode is done, several treatment modalities are available for definitive management of the stone rang ing from conservative therapy to non-invasive ESWL, minimally invasive URSL and laparoscopic or open ureterolithotomy.

ESWL and URSL have high success rates up to 63%-86% and 57%-92% respectively.[6,7] These procedures are not complication free and add to the cost of the treatment as well. On the other hand, conservative therapy with an expectation of natural stone passage is attractive and cost effective since a significant number of ureteric stones pass spontaneously. However the later is associated with pain, uncertainty of stone passage and potential risk of deterioration of renal function. Therefore identifying those patients who will need intervention and those who will spontaneously pass stone would enable selection of appropriate treatment modality.

Several factors have been studied as predictors of SSP; the most widely studied ones are stone size and location. Preminger *et al* reported a roughly linear relationship between stone size and likelihood of stone passage with passage rates of 87, 72, 47 and 27% for stones measuring 1, 4, 7 and 10 mm respectively.[8]Similar finding was previously reported by Hubner *et al* before the advent of ESWL from a meta-analysis of 2704 patients.[9] In our study, average size of stones which passed spontaneously was significantly smaller than that of stones which failed to pass (p=0.020).Another factor reported, which is a determinant of SSP, is the location of stone in the ureter. Studies have shown that more distal the stone is at the time of diagnosis, more are the chances of SSP.[10,11] In our study we included stones at distal ureter only, to get homogenous group of patients. It is recommended that if SSP is not seen after 4-6 weeks of observation, intervention is necessary to prevent the risk of renal damage.[12,13] Hence, we followed our patients for four weeks before considering intervention.

Total WBC count and neutrophil percent are two parameters that are recently evaluated as predictors of SSP. Sfoungaristos et al evaluated 156 patients with ureteric colic between June 2010 and June 2011 and found that increased concentration of serum WBC and neutrophils at the time of the acute phase of a renal colic were associated with increased likelihood of spontaneous passage.[5] In another study, the same authors have found that WBC count is the most significant predictor of SSP followed by stone size.[14]

In our study there was statistically significant difference between WBC count and neutrophil percent between patients with SSP and those who failed to pass stone spontaneously, suggesting that these parameters can predict the chance of SSP. Neutrophil percent had the highest predictive power in multivariate logistic regression analysis.The reason behind this finding is that those ureteric stones that are progressing distally produce more inflammatory reaction in the ureteric wall in comparison to the stones which remain static. Since WBC count and neutrophil percent are markers of inflammation, their numbers increase in those cases where stones are propagating distally and subsequently, have more chance of spontaneous passage. However while applying this finding to assess the chance of SSP of ureteric stone, one should exclude other possible conditions that can affect the WBC count and neutrophil percent like presence of urinary tract infection or infection in other parts of the body, use of steroids and haematological disorders.

Our study did not show statistically significant relationship of gender and side of the stone to SSP. Most of the previous studies also did not show significance of gender in predicting SSP.[15,16] However two studies have confirmed that right sided stones are more likely to pass than left sided stones.[12,14]

One limitation of our study is the small sample size. Further studies with larger sample size are necessary and recommended to emphasize the significance of WBC count and neutrophil percent. The results of our study conclude that neutrophil percent and total WBC count at the initial phase of ureteric colic significantly contribute to the prediction of SSP. Evaluation of these factors help in identifying those patients who are likely to pass stone and thus prevent unnecessary interventions for stone removal. At the same time early intervention in those patients who are unlikely to pass stone spontaneously based on these factors will prevent painful episodes or possibility of renal damage associated with watchful waiting.

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