Raised white cell count in renal colic: Is there a role for antibiotics?

Adam Alleemudder, Xin-You Tai, Anuj Goyal, Jhumur Pati
Department of Urology, The Royal London Hospital, Whitechapel, UK

Aims: To determine the use of antibiotics in patients with renal colic and an elevated white cell count (WCC) in the absence of other features of infection.

Materials and Methods: A retrospective audit of patients presenting to an emergency department with renal colic caused by a solitary ureteric stone over a 6 month period.

Statistical Analysis Used: Student’s t-test.

Results: Fifty patients met the inclusion criteria for this study. In 42 patients (84%) the urinalysis showed hematuria only and all urine culture results were negative for microbial growth. The mean WCC was $11.5 \times 10^9$ (4-22.1) and was raised in 34 patients (80.9%). The mean neutrophil count was $8.75 \times 10^9/L$ (2.3-18.6) and C-reactive protein (CRP) 15.9 (1-192). Antibiotics were commenced in 34 patients (80.9%) based solely on the raised WCC. In eight patients (16%) there were leucocytes and/or nitrites on urinalysis and all urine cultures were positive for growth (coliforms in five, streptococcus in two and candida in one specimen). The mean WCC was $10.5 \times 10^9/L$ (7.7-16.5) and was raised in four patients. The mean neutrophil count was $8.4 \times 10^9/L$ (4.9-15.2) and CRP 40.79 (3-86). One patient had pyrexia. All eight patients were commenced on antibiotics based on the WCC and/or urinalysis result.

Conclusions: Over three-quarters of the patients (80.9%) in this study who presented with renal colic were unjustifiably commenced on antibiotics based solely on an elevated WCC. Antibiotic use in renal colic should be reserved for when there are features of sepsis or the urinalysis is positive. Further work is required to determine the significance of the observed results and the threshold for starting antibiotics.

Key Words: Antibiotics, infection, renal colic, white cell count

INTRODUCTION

Renal colic is a major cause of morbidity worldwide. The incidence and prevalence of stone disease vary among other factors, with the geographical area; the lifetime risk of developing renal colic is higher in western countries, such as the United States (13-15%) but is even higher in warmer climates such as Saudi Arabia (20.1%). The peak age for developing a stone episode is between 40 and 60 in men, who are almost twice as likely to be affected than women, although this difference is becoming less as a result of lifestyle factors and obesity.

Renal colic is the most common presentation of flank pain to the emergency department; a survey in the United States estimated the annual burden of emergency department visits...
with a primary diagnosis of renal colic to be more than 1,100,000.\(^5\) Initial evaluation requires blood and urine tests in addition to diagnostic imaging. An elevated white cell count (WCC) is a common finding, usually prompting antibiotics to be commenced when features of underlying infection or positive culture results are absent. To date, there are no published studies or guideline recommendations regarding the significance of an elevated WCC in renal colic or the role for antibiotics. Our aim was to determine the use of antibiotics in patients with renal colic and an elevated WCC in the absence of other features of infection.

**MATERIALS AND METHODS**

A retrospective audit was made of 92 patients presenting with acute renal colic to the emergency department of a district general hospital between April and October 2011. There were no local guidelines for the use of antibiotics in this setting during the study period. The only inclusion criteria were those with a solitary ureteric stone confirmed on non-contrast computed tomography. Those with multiple ureteric or renal stones were excluded to introduce a standard for comparing results. The information collected for each patient included the WCC and neutrophil count, C-reactive protein (CRP), urinalysis and urine culture results, clinical observations and presenting features of the patient, the size and position of the stone on imaging and whether antibiotics had been commenced on admission. A literature search using Medline and the Cochrane database was undertaken.

**RESULTS**

The results of the study are shown in Table 1. There were 42 patients excluded from the study due to incomplete data and/or did not meet the criteria for having a solitary ureteric stone. Of the remaining 50 patients included in the study, 28 were male and 22 female. The mean age was 42.6 years (23-58). A solitary ureteric stone was confirmed on imaging in all patients with a mean size of 6.2 mm (1.4-7.3). The stone was on the left in 26 cases. One patient with urinalysis positive for nitrites was pyrexial at 38.5° on admission. The remaining 49 patients had no other clinical features to indicate infection. Urinalysis showed hematuria only in 42 patients (group one) and in addition, nitrites and/or leukocytes in eight patients (group two). Urine specimens were sent for microbiological culture regardless of the result before antibiotics were commenced and showed no microbial growth for all in group one and in group two there were five coliform, two streptococcal and one candida infections confirmed. In group one, there were 34 patients (80.9%) with an elevated median WCC of 11.5 × 10⁹/L (4-22.1). The median neutrophil count was elevated at 8.75 × 10⁹/L (2.3-18.6) and CRP 15.9 (1-192). In group two, four patients (50%) had an elevated median WCC of 10.5 × 10⁹/L (7.7-16.5). The median neutrophil count and CRP were also elevated at 8.4 × 10⁹/L (4.9-15.2) and 40.7 (3-86), respectively. There was no significant difference between the two groups in terms of the WCC, neutrophil, and CRP counts (\(P > 0.05\)).

All 34 patients (80.9%) in group one with an elevated WCC were commenced on antibiotics by the admitting clinician. In group two, antibiotics were commenced in all eight patients (100%) based on the urine urinalysis and/or hematological results.

An online literature search using the terms “WCC,” “leucocytosis,” “renal colic,” “kidney stones,” “antibiotics” failed to identify any articles for reference.

**DISCUSSION**

In recent years there has been an increase in the prevalence and incidence of kidney stones, which commonly presents to the emergency department as renal colic.\(^6\) Several factors have been implicated including widespread application of more accurate and sensitive imaging modalities for diagnosis, changes in dietary practice through increased consumption of animal protein and sodium, and global warming causing climate change.\(^7\) The condition is usually self-limiting with a stone less than 5 mm passing spontaneously over several weeks in 90% of cases.\(^8\)

A common finding on admission is an elevated WCC, which under normal circumstances and considering other factors would indicate the presence of infection. It would appear that in a large number of patients, antibiotics are unjustifiably being used based solely on this result regardless of the clinical status of the patient or available culture results.

The WCC was elevated in 80.9% of patients in this study, despite there being no other features to suggest infection,
which resulted in the use of antibiotics. The highest recorded count in this group was $22.1 \times 10^9/L$. An associated elevated mean neutrophil ($8.75 \text{ vs. } 8.4 \times 10^9/L$) and CRP ($15.9 \text{ vs. } 40.7 \text{ mg/L}$) counts were also observed in both groups regardless of whether infection was present. The cause for this remains unknown and it is unclear why the observed results are not found universally in all patients with renal colic.

One reason speculated for the elevated WCC is the production of colony stimulating factor resulting from inflammation caused by the stone rather than infection. This would not only explain the rise in CRP but also the neutrophilia as these cells are regarded as first responders to a site of inflammation not necessarily caused by bacteria. Furthermore, there also may be demargination of white blood cells resulting from pain and stress associated with renal colic to cause the observed effect. However, it is important to identify coexisting conditions that may account for the raised WCC, such as the use of steroids, underlying malignancy or hematological disease.

There is clearly a low threshold for commencing antibiotics in renal colic as demonstrated in this study. This may be to eliminate the fear of leaving an infected obstructed system untreated where pyonephrosis and potentially fatal urosepsis can develop. Over three-quarters of the patients with negative urine culture results were started on antibiotics simply for having an elevated WCC. Whilst it seems plausible to commence antibiotics only when there are nitrates and/or leucocytes in urine or other clinical features of infection are present, in the majority this seems unjustified when there are cost implications and growing concerns with antibiotic resistance. Caution, however, must be taken in those who are more susceptible to infections, including elderly, immunosuppressed or diabetic patients. Clinical judgment must prevail as to when to use antibiotics.

Interestingly, the serum WCC has been identified as the most significant predictor for spontaneous stone passage over stone size and side affected in patients with a stone size $<10 \text{ mm}$. This is in addition to several other factors that have been described previously including ureteral jet during bladder duplex Doppler ultrasound, the degree of pain, pyonephrosis or perinephric fat stranding, and the presence of perinephric fluid collections. It would appear there is a proportional relationship between the WCC and the degree of inflammation with a higher count promoting more favorable conditions for stone passage.

The authors acknowledge several limitations with this study. Firstly, the population used was small, but it does provide a snapshot of the practice occurring at a particular unit which may reflect a wider pattern. Future prospective studies with larger databases evaluating WCC significance in renal colic pathophysiology is required to confirm the results. An assumption that was made for each patient was the obstruction caused by the stone was incomplete and the urine analyzed for infection was derived from both kidneys. If the obstruction was complete, the urine collected would be from the non-infective contralateral kidney and a false negative result would be obtained. A thorough culture screen for each patient to include blood cultures and a chest X-ray to highlight other potential sources of a raised WCC was not performed. Furthermore, patient co morbidities as discussed above that may influence the WCC were not taken in to account.

In conclusion, a significant proportion of patients presenting with renal colic will have an elevated WCC. In most cases, the observed WCC is unlikely to be the result of infection and immediate antibiotics should be withheld unless there other features present to suggest otherwise. Preliminary results from this study would indicate a significant and unjustified use of antibiotics in renal colic, but further work is required into this area to determine the actual significance of the raised WCC and the threshold count that would require intervention.

REFERENCES

1. Ramello A, Vitale C, Marangella M. Epidemiology of nephrolithiasis. J Nephrol 2000;13 Suppl 3:S45-50.
2. Bultitude M, Rees J. Management of renal colic. BMJ 2012;345:e5499.
3. Scales CD Jr, Curtis LH, Norris RD, Springhart WP, Sur RL, Schulman KA, et al. Changing gender prevalence of stone disease. J Urol 2007;177:979-82.
4. Smith RC, Levine J, Dalrymple NC, Barish M, Rosenfield AT. Acute flank pain: A modern approach to diagnosis and management. Semin Ultrasound CT MR 1999;20:108-35.
5. Brown J. Diagnostic and treatment patterns for renal colic in US emergency departments. Int Urol Nephrol 2006;38:87-92.
6. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976-1994. Kidney Int 2003;63:1817-23.
7. Romero V, Akinhar H, Assimos DG. Kidney stones: A global picture of prevalence, incidence, and associated risk factors. Rev Urol 2010;12:e86-96.
8. Segura JW, Preminger GM, Assimos DG, Dretler SP, Kahn RL, Lingeman JE, et al. Ureteral Stones Clinical Guidelines Panel summary report on the management of ureteral calculi. The American Urological Association. J Urol 1997;158:1915-21.
9. Sfoungaristos S, Kavouras A, Perimenis P. Predictors for spontaneous stone passage in patients with renal colic secondary to ureteral calculi. Int Urol Nephrol 2012;44:71-9.
10. Miller O 2nd, Hemphill RR. Urinary tract infection and pyelonephritis. Emerg Med Clin North Am 2001;19:655-74.
11. Manthey DE, Teichman J. Nephrolithiasis. Emerg Med Clin North Am 2001;19:633-54.
12. Coll DM, Varanelli MJ, Smith RC. Relationship of spontaneous passage of ureteral calculi to stone size and location as revealed by unenhanced helical CT. AJR Am J Roentgenol 2002;178:101-3.

How to cite this article: Alleemudder A, Tai X, Goyal A, Pati J. Raised white cell count in renal colic: Is there a role for antibiotics?. UrolAnn 2014;6:127-9.

Source of Support: Nil, Conflict of Interest: None.