Rectal tenesmus as a frequent symptom in renal colic: a retrospective study of 4758 patients from Emergency Department

Jie Zhu (zhujie7@mail.sysu.edu.cn)
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Yi Cao
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Yanhua Lu
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Miao Chen
Guangdong General Hospital
Menglei Yu
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Jingying Hou
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Liqiang Wen
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Tao Yang
Sun Yat-sen Memorial Hospital of Sun Yat-sen University
Bangrong Xing
The Third Affiliated Hospital of Sun Yat-sen University
Longyuan Jiang
Sun Yat-sen Memorial Hospital of Sun Yat-sen University

Research article

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Abstract

Background: To investigate the frequency of rectal tenesmus in urolithiasis patients presented with renal colic, and describe the clinical characteristics of these patients. Methods: A retrospective study across three large hospitals in Guangzhou was conducted, and all Emergency Department (ED) visits with renal colic during 2016 were included. Finally a total of 4758 patients were enrolled, and we collected then analyzed their medical histories, including general information, characteristics of renal colic, accompanying symptoms, as well as the signs, the typical examination results and the therapeutic effects. Results: The frequency of tenesmus in the patients with renal colic was 72.5%, higher than urinary irritation symptoms (23.4%) and the upper gastrointestinal symptoms (54.9%). Patients with tenesmus tended to suffer from renal colic during morning time (0:00-12:00) and at sleep or rest status. Higher likelihood of stones located in lower ureter ($p<0.001$) were found in this cohort of patients. Conclusions: Rectal tenesmus is a common accompanying symptom in patients presented with renal colic. This manifestation is related to certain characteristics of the patients and the stones. Future studies will be conducted to explore the feasibility of using rectal tenesmus in differential diagnosis for renal colic and other acute abdominal pain in ED. Trial registration The study was approved by the Institute Research Ethics Committee at the Sun Yat-sen University. The approval number is 2016 No. 59 of Sun Yat-sen Memorial Hospital. The study was retrospectively registered at http://www.chictr.org.cn/index.aspx (registration number: ChiCTR-RRC-17012373) in 15 August 2017.

Background

Renal colic is the most common cause of acute abdominal pain (AAP) in the emergency department (ED) [1]. The prevalence of urolithiasis varies from 1% to 20% worldwide [2,3]. In the ED, more than 30% of visits for AAP are eventually diagnosed with renal colic [1]. High-risk urolithiasis occurs in South China and is clustered in the coastal and karst regions with an incidence of approximately 11.63% in Guangdong province [4]. Geogenic factors, the proportion of Ca2+ to Mg2+ in the drinking water, and increased sweat and decreased urine because of the hot weather may play critical roles in the etiology of urolithiasis in Gangdong province [4]. Upper urinary stones cause the majority of urolithiasis cases, and can be kidney or ureteral stones. Most patients are referred to the hospital because of acute flank pain, the typical symptom of an upper urinary stone (especially ureteral stones). Vomiting and occasionally fever can also be present in the setting of ureteral stones, while renal stones may also be asymptomatic [5]. At present, to the best of our knowledge, there is no clear definition of the common accompanying symptoms of urolithiasis, and no prior research has investigated the characteristics of these symptoms.

Rectal tenesmus is the sensation of constantly needing to pass stool, despite an empty colon, or when only very little stool can be passed [6]. Rectal tenesmus can be accompanied by pain, cramping, and straining and is usually associated with inflammatory bowel disease or other colorectal diseases (e.g., irritable bowel syndrome, colorectal cancer, prolapsed hemorrhoids, and pelvic effusions) [7-9]. There is no report that addresses the presence of rectal tenesmus in diseases of the urinary system.

In our clinical work, we observed that the presence of tenesmus is notably common in patients with renal colic, which could be used to assist in clinical diagnosis. To date, evidence concerning such a symptom in this group of patients remains scarce. We addressed this limitation and performed a multi-center retrospective study using the databases of three large centers in Guangzhou (the largest city in southern China and the capital of Guangdong province) to illustrate the frequency and the significance of this symptom in patients with renal colic.

Methods

Patient enrollment

We retrospectively evaluated patients who referred to the emergency department of three large hospitals in Guangzhou (Guangdong General Hospital, Sun Yat-sen Memorial Hospital Sun Yat-sen University and the Third Affiliated Hospital Sun Yat-sen University) from Jan 2016 to Jan 2017. The inclusion criteria of the study were patients with renal colic and pain associated with urinary stones. Excluded from our analysis were patients with severe complications, those without complete documentation of accompanying symptoms and patients without a clear diagnosis. A total of 4758 patients were ultimately included for our analysis. This study received institutional review board approval, and written informed consent was obtained from all patients.

Evaluation and treatment

Presenting symptoms and other personal information were routinely collected at the time of the first emergency visit and abstracted from medical records. Physical examination was performed and recorded by the corresponding clinician(s). Basic laboratory (urine test, blood test), ultrasound and, in certain cases, kidney, ureter, and kidney ureter bladder (KUB) X-ray radiography or computed tomography (CT) were selectively performed based on the evaluation of the corresponding clinician(s).

General treatment included spasmolystics (m-trihydroxybenzene / drotaverine) and analgesia (ketorolac / diclofenac / tramadol). Antibiotics (cephalosporins) were prescribed only when required (i.e., significantly elevated white blood cells in the blood or urine). Invasive treatments (Double-J stent / emergent ureteroscopy) were indicated in drug-ineffective cases or in patients with severe hydronephrosis or infections. 421 patients underwent additional treatments (ureteroscopy / extracorporeal shockwave lithotripsy-ESWL) 2 weeks after emergent treatment. Recovery after treatment was also recorded.

Data collection

The following information was recorded: general information (e.g., gender, age, homeland, residence time in Guangzhou, estimated daily liquid intake, and estimated daily urine), detailed information on symptom occurrence (e.g., exact time of the occurrence of the symptoms with corresponding personal status, pain severity, previous history of renal colic or urolithiasis disease) and detailed accompanying symptoms (e.g., nausea and vomiting, tenesmus, and urinary irritation). Signs (fever, renal percussive pain,

abdominal tenderness or rebounding pain), typical examination results (primarily urine test, blood test and ultrasound) and general treatment effects were also recorded.

Statistical analysis

Statistical analyses were performed using SPSS V.19. (SPSS Inc., Chicago, IL, USA) .

Statistical significance was set at a two-tailed p-value < 0.05. Categorical variables were assessed with the chi-square and Fisher's exact test. Continuous variables were presented as the mean and standard deviation (SD) and were analyzed using the Mann-Whitney U test.

Results

General information

A total of 4758 patients presented with renal colic and were diagnosed with kidney or ureteral stones. Most patients were male (60.4%) and young (38.68 ± 10.52). Most of the patients came from South China (89.1%), including Guangdong, and spent a number of years living in Guangzhou (12.53±13.64). Accompanying signs and symptoms are shown in Table 1. It is notable that apart from flank pain (83.7%), rectal tenesmus was the most common accompanying symptom of kidney and ureteral stones with an incidence of 72.5%.

Patients' demographics and characteristics that presented with tenesmus

Renal colic patients with tenesmus were more likely to come from Guangdong or other parts of South China (p<0.001), spent more years in Guangzhou, had less daily urine volume before the occurrence (p<0.001) and were less likely to have a previous history of flank pain (p<0.001) or a diagnosis of a stone disease (p=0.007). These patients tended to develop symptoms during the morning (0:00-12:00) and while asleep or resting (Table 2). It is notable that the recommended amount of everyday water intake by World Health Organization is 1500 ml (Bellego), and the reported average 24 h urine output of adults is approximately 1600±300 ml [10-12].

Presence of tenesmus with other symptoms, signs, laboratory tests, and radiological examinations

As shown in Table 3, patients with tenesmus were more likely to suffer from abdominal pain (p=0.039) and urinary irritation symptoms (p=0.005). There was also an increased proportion of radiating perineal pain (p=0.030), abdominal tenderness and rebound pain in this group of patients (p<0.001 and 0.002).

Urine tests, ultrasounds and/or blood tests (complete blood count) were performed in the majority of renal colic patients, and these results were collected for analysis. Stones in patients with rectal tenesmus were more likely to be located in the lower ureter (p<0.001). A relatively smaller stone size was observed in this cohort, although there was no significant difference (Table 4).

Treatment efficiency

Most patients (78.3%) quickly improved after intramuscular injection of pain relief drugs (e.g., ketorolac, diclofenac). Intravenous injections (antispasmodics) or hospitalization was required for certain patients (16.6%), and invasive treatment was rarely performed (5.1%). The presence of tenesmus had no impact on treatment. As pain improved, rectal tenesmus naturally disappeared. After initial emergent treatment to alleviate symptoms, 421 patients underwent ESWL or ureteroscopy. A few of the patients had a component analysis of the stones. The most common types of stones were calcium oxalate, carbonate apatite and calculus urate.

Discussion

While ultrasound and KUB radiography have been traditionally used to detect urinary stones, their sensitivity and specificity remain unsatisfactory [13-14]. Non-contrast computed tomography has gained greater acceptance, as evidenced by its increased accuracy for diagnosing acute flank pain [15]. Laboratory analysis, including white blood cell count, urinalysis, electrolytes and uric acid levels, are primarily used to detect signs of infection, to provide important information to diagnose acute infectious abdominal diseases, such as appendicitis, and to assist in the metabolic evaluation of non-emergency patients [16]. Apart from the development of these examinations, a detailed medical history and physical examination are still important for immediate clinical evaluation and timely initial treatment [17]. A full description of the characteristics of renal colic and its accompanying symptoms is essential and informative to urologists and emergency medical technicians.

Abdominal pain (especially located at the xiphoid process or the ipsilateral lower abdomen), abdominal distention and vomiting/nausea are very common in these patients, which often make them difficult to differentiate from other causes of acute abdominal pain. In this setting, the European Association of Urology guidelines propose that the cause of abdominal pain should be identified when stones are absent in imaging [17]. It is notable that urinary irritation and perianal symptoms (frequent or urgent urination / perineal pain / perineal pain of radiation) only exist in fewer than a quarter of all patients, demonstrating their limited diagnostic value. No previous reports have focused on rectal tenesmus, which had a higher incidence than either upper gastrointestinal or urinary irritation symptoms in the current study, making it a prominent symptom in the differential diagnosis of renal colic in emergencies. This study was the first to propose rectal tenesmus as an accompanying symptom in patients with renal colic.

With respect to drinking, while the average quantity of consumed water is more than the international standard, because of the hot climate, more water is lost through the skin, and less urine is made. The function of the dilution crystallization salt is therefore reduced. This effect may be a reason for the high incidence of renal colic.

Family history and previous history may affect the formation of urinary stones through common living habits or environment.

The amount of urine occult blood seems to have no correlation with the number, size and location of the urinary stones. Occult blood has a relationship with urinary tract injuries and infections; therefore, it may be able to indirectly judge the existence of calculi.

The PH of urine usually acidic, which is consistent with the theory of acidic stones. Our statistical analysis observed that stone size and degree of pain have no correlation with the incidence of rectal tenesmus but may have a relationship with the stone position.

The specific mechanism of rectal tenesmus is unclear and likely to be multifactorial. Muscarinic antagonists have been widely applied for urolithiasis [18] and ureteral stent-related symptoms [19]. It is well-known that the muscarinic receptor (MAchR) is activated when renal colic occurs and functions as a parasympathetic nerve [20-21]. It is commonly thought that parasympathetic nerves act on the colorectal system to facilitate stool passage, resulting in tenesmus [22].

It is interesting that these patients were more likely to suffer from symptoms in the morning or when they are at rest or asleep. Parasympathetic nerves are more dynamic at rest [18], which increases the incidence of both renal colic and tenesmus. Prior research has found that carbachol negatively regulates oxalate transport by reducing SLC26A6 surface expression in human intestinal T84 cells through signaling pathways, including the M3 muscarinic receptor, thereby affecting oxalate absorption and stone formation [23]. However, whether patients with rectal tenesmus possess irritable parasympathetic nerves should be explored in further studies.

We propose several other possible anatomic hypotheses for this phenomenon: (1) the ureter and the rectum share the same embryonic origin [24], making it possible that they also share the same celiac ganglion in the reflex arc by pain stimulation. The nerve of the rectum and the anus is derived from the T11~S4 segment of the spinal nerve, while the nerve of the renal ureteral bladder is derived from the T9~S4 segment of the spinal nerve. Especially in the S1~S4 segment, the two sides have wide cross-control over pelvic organs. (2) as the localization of the splanchnic nerves is inaccurate, patients may have the sensation of rectal tenesmus because of stimulation from the ureters alone. In this study, the presence of tenesmus was related to urine irritation, and the location of the lower ureter. It is believed that stones in the lower ureter have a greater chance of irritating relevant nerves in the pelvis, contributing to both rectal and urinary irritation symptoms.

Apart from the above, abdominal pain was more prevalent in patients with tenesmus, although none was observed to actually suffer from intestinal disease, colorectal disease or accumulation of fluid in the pelvis. It was difficult to understand the cause for this. The splanchnic nerves might be more irritable in these patients. There were also some other interesting patient characteristics, such as less estimated daily urine volume, hometown location and previous diagnoses. However, these results should be interpreted cautiously and require further validation, as there is currently no definite explanation for these phenomena.

Patients with rectal tenesmus have the same therapeutic response. Pain treatments work well in these patients, even if many suffered from abdominal pain. These accompanying symptoms do not represent a worse prognosis or worse treatment outcome. Rectal tenesmus should be considered an accompanying symptom in renal colic patients, and extra concern on the part of clinicians is unnecessary.

The present work demonstrated the high frequency of rectal tenesmus in renal colic patients for the first time based on a large-sample multicenter study. We also described the clinical characteristics of this specific cohort of patients. However, there were several limitations related to the retrospective design of the study. The lack of a control group reduces the significance of our study, and more work would be required to demonstrate whether the presence of rectal tenesmus could assist clinicians in distinguishing urolithiasis from other diseases in renal colic patients. Furthermore, the analysis was largely based on subjective descriptions (patients' symptoms and clinicians' evaluation), whereas objective information (laboratory tests or radiologic examination) was less commonly used. Further standardized prospective evaluations are needed in future studies.

Conclusions

Rectal tenesmus is a common accompanying symptom in patients presenting with renal colic. This clinical manifestation was related to certain patient and stone characteristics, which requires a clinician's attention. Future studies would be conducted to explore whether rectal tenesmus could be one of the symptoms in the differential diagnosis for renal colic and other causes of acute abdominal pain in the emergency department.

Abbreviations

ED, emergency department

AAP, acute abdominal pain

KUB, Kidney Ureter Bladder

CT, computed tomography

SD, standard deviation

ESWL, extracorporeal shock wave lithotripsy

Declarations

Ethics approval and consent to participate

The study was approved by the Institute Research Ethics Committee at the Sun Yat-sen University. The approval number is 2016 No. 59 of Sun Yat-sen Memorial Hospital. And written informed consent was

obtained from all patients.

Consent for publication

Not applicable

Availability of data and materials

The datasets generated and analyzed during the current study are available in the Chinese Clinical Trial Registry, http://www.chictr.org.cn/index.aspx (registration number: ChiCTR-RRC-17012373)

Competing interests

The authors declare no conflict of interests.

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Authors' contributions

JZ designed the whole study, and was a major contributor in writing the manuscript. MC collected and preprocessed patient data from Guangdong General Hospital. BX collected and preprocessed patient data from The Third Affiliated Hospital. YC and YL collected and preprocessed patient data from Sun Yat-sen Memorial Hospital of Sun Yat-sen University, integrated data from multi centers, and performed statistical analysis. LJ supervised all work. All authors read and approved the final manuscript.

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Tables

Table 1 Prevalence of each accompanying symptoms and signs

Symptoms / Signs	Number (%)
Flank pain	3982 (83.7)
Tenesmus	3448 (72.5)
Abdominal pain	2879 (60.5)
Abdominal distention / nausea / vomiting	2611 (54.9)
Frequent or urgent urination or urine pain	1113 (23.4)
Perineal pain of radiation	78 (1.6)
Fever	25(0.5)
Renal percussive pain	4530(95.2)
Abdominal tenderness	923 (19.4)
Abdominal rebounding pain	41 (0.9)

Table 2 Correlation of rectal tenesmus with patients’ demographic information

	Rectal tenesmus absent		Rectal tenesmus present			
	Number	%	Number	%	Chi-square or Z	p value
Total Number	1310	27.5	3448	72.5		
Gender					0.422	0.516
Male	785	59.9	2087	60.5		
Female	525	40.1	1361	39.5		
Age, mean±SD	39.43±12.41		39.41±12.20		-0.675	0.500
Hometown					157.847	**<0.001***
Guangzhou City	285	21.8	801	23.2		
Guangdong Province (except Guangzhou City)	355	27.1	1124	32.6		
South China (except Guangdong Province)	412	31.5	1275	37.0		
Other	258	19.7	248	7.2		
Time of residence in Guangzhou (year) , mean±SD	7.18±6.11		14.36±14.95		-11.933	**<0.001***
Estimated daily water drinking (ml) , mean±SD	1743.48±702.10		1731.39±708.65		-0.762	0.446
Estimated daily urine volume (ml) , mean±SD	1070.89±341.91		1026.96±339.15		-4.314	**<0.001***
Visual Analogue Score (VAS) , mean±SD	8.97±0.72		8.95±0.71		-1.104	0.270
Time of symptoms occurring					2.046	0.153
Morning (0:00-12:00)	798	60.9	2115	63.2		
Afternoon and Evening(12:00-0:00)	512	39.1	1233	36.8		
Status when symptoms occurring						
Sleep	568	43.4	1405	40.7	2.665	0.103
Rest	390	29.8	1072	31.1	0.777	0.378
Work	250	19.1	733	21.3	2.739	0.098
Exercise	102	7.7	238	6.9	1.117	0.290
Previous history of flank pain					36.576	**<0.001***
Absent	692	52.8	2152	62.4		
Present	618	47.2	1294	37.5		
Previous diagnosis of stone disease					7.385	**0.007***
Absent	735	56.1	2084	60.4		
Present	575	43.9	1364	39.6		
Family history					0.635	0.425
Absent	648	49.5	1661	48.2		
Present	662	50.5	1787	51.8		

*statistically significant

SD=standard deviation;

Table 3 Correlation of rectal tenesmus with other accompanying symptoms and signs

	Rectal tenesmus absent		Rectal tenesmus present			
	Number	%	Number	%	Chi-square or Z	p value
Flank pain					2.933	0.096
Absent	196	15.0	580	16.8		
Present	1114	85.0	2868	83.2		
Abdominal pain					4.419	**0.039***
Absent	549	41.9	1330	38.6		
Present	761	58.1	2118	61.4		
Abdominal distention / nausea / vomiting					0.819	0.379
Absent	605	46.2	1542	44.7		
Present	705	53.8	1906	55.3		
Frequent or urgent urination / urinal pain					8.035	**0.005***
Absent	973	74.3	2672	77.5		
Present	337	25.7	776	22.5		
Perineal pain of radiation					4.693	**0.030***
Absent	1297	99.0	3383	98.1		
Present	13	1.0	65	1.9		
Fever					0.157	0.824
Absent	1304	99.5	3429	99.4		
Present	6	0.5	19	0.6		
Abdominal tenderness					18.366	**<0.001***
Absent	998	76.2	2737	81.8		
Present	312	23.8	611	18.2		
Abdominal rebounding pain					8.471	**0.002***
Absent	1307	99.8	3410	98.9		
Present	3	0.2	38	1.1		
Renal percussive pain					1.147	0.374
Absent	41	3.1	187	5.4		
Present	1269	96.9	3261	94.6		

*statistically significant

SD=standard deviation;

Table 4 Correlation of rectal tenesmus with examinations and treatment effects

	Rectal tenesmus absent		Rectal tenesmus present			
	Number	%	Number	%	Chi-square or Z	p value
Serum WBC, mean±SD	8.97±1.48		8.97±1.41		-0.599	0.549
NE%, mean±SD	60.94±6.41		60.75±6.34		-0.949	0.343
Urine occult blood					7.857	**0.049***
-	65	4.96	152	4.54		
+	583	44.5	1423	42.5		
++	442	33.7	1311	39.2		
+++	220	16.8	562	16.8		
Urine PH, mean±SD	5.74±1.01		5.75±1.01		-0.185	0.853
Stones location^						
No stone	186	14.2	339	10.1		
Kidney	53	4.0	173	5.2	2.565	0.109
Upper ureter	525	40.1	1182	35.3	1.649	0.199
Lower ureter	546	41.7	1654	49.4	22.535	**<0.001***
Stone numbers						
0	186		339			
1	1085		2851		3.906	**0.048***
2 or more(in kidney)	39		158		7.055	**0.008***
Largest diameter of stones	7.15±2.24		6.22±3.91		-1.415	0.157
Treatment effect					4.519	0.104
Alleviated by oral or muscle-injection	1036	79.1	2688	78.0		
Alleviated by intravenous injection or hospitalization	198	15.1	594	17.2		
Invasive treatment required	76	5.8	166	4.8		

^Both ultrasound and CT results were considered. *Statistically significant SD=standard deviation;