

Received: 05 August 2023 / Accepted: 17 October 2023 / Published online: 31 October 2023

DOI 10.34689/SH.2023.25.5.006

UDC 611.146.2. - 616-007.415. - 61-072.72

RELATIONSHIP BETWEEN RETROAORTIC LEFT RENAL VEIN AND PATIENTS PRESENTING TO THE EMERGENCY DEPARTMENT WITH MICROHEMATURIA

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Summary

Introduction: Microhematuria is the presence of an abnormally high number of erythrocytes in the urine. This microscopic hematuria, not visible to the naked eye, can generally be detected through urine analysis. The causes of microscopic hematuria encompass a range of pathological conditions, from simple urinary tract infections to urolithiasis, trauma, urological cancers, and vascular diseases.

Method: A single-center and retrospective research in an educational and research hospital's emergency department. Patients who presented to the emergency department between January 2020 and April 2023, were diagnosed with microhematuria based on laboratory tests, and underwent abdominal computed tomography were included in the study.

Finding: Out of the 1499 patients with detected microhematuria in the emergency department and whose retrospective abdominal CT scans were evaluated, 780 (52%) were female, and the mean age of the patients was 43.9 ± 18.2 (min: 18; max: 95). Based on the patients' medical histories and the results of tomographic examinations, urinary tract stones were identified as the most common cause of microhematuria, followed by cystitis, pyelonephritis, kidney stones, and left retroaortic renal vein.

Discussion: In the emergency department, investigating the etiology of microscopic hematuria detected during the evaluation of symptomatic or other presenting patients may be necessary. This is because, although the causes of microhematuria are often benign, it is essential to catch malign causes in the early stages. In addition to benign and malignant causes, there may be rare but significant congenital malformations that require monitoring.

Conclusions: A significant association between retroaortic left renal vein and microhematuria has been observed. After excluding the potential common causes of microhematuria, renal vascular anomalies should be considered as a possibility. Clinicians should consider retroaortic left renal vein as a differential diagnosis in patients with unexplained microhematuria and radiology experts should keep this anatomical variation in mind when evaluating abdominal CT scans.

Keywords: retroaortic left renal, microhematuria, renal vascular anomalies, Emergency Department.

Резюме

ВЗАИМОСВЯЗЬ МЕЖДУ РЕТРОАОРТАЛЬНОЙ ЛЕВОЙ ПОЧЕЧНОЙ ВЕНОЙ И МИКРОГЕМАТУРИЕЙ У ПАЦИЕНТОВ, ОБРАЩАЮЩИХСЯ В ОТДЕЛЕНИЕ НЕОТЛОЖНОЙ ПОМОЩИ

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Введение: Микрогематурия – это наличие аномально высокого количества эритроцитов в моче. Эту патологию, невидимую невооруженным глазом, обычно можно обнаружить с помощью анализа мочи. Причины микрогематурии охватывают широкий спектр патологических состояний: от простых инфекций мочевыводящих путей до мочекаменной болезни, травм, онкологических заболеваний урологического профиля и сосудистых заболеваний.

Методы: Одноцентровое ретроспективное исследование в отделении неотложной помощи образовательного исследовательского госпиталя. В исследование были включены пациенты, поступившие в отделение в период с

января 2020 г. по апрель 2023 г., у которых на основании лабораторных исследований была диагностирована микрогематурия и которым была проведена компьютерная томография брюшной полости.

Результаты: из 1499 пациентов с выявленной микрогематурией, поступивших в отделение неотложной помощи и которым были оценены ретроспективные КТ брюшной полости, 780 (52%) были женщинами, а средний возраст пациентов составил $43,9 \pm 18,2$ (мин: 18; макс: 95). На основании истории болезни пациентов и результатов томографических исследований наиболее частой причиной микрогематурии были выявлены камни мочевыводящих путей, за ними следовали цистит, пиелонефрит, камни в почках и левая ретроаортальная почечная вена.

Обсуждение: В отделении неотложной помощи может возникнуть необходимость в выяснении этиологии микроскопической гематурии, обнаруженной при обследовании симптоматических или других пациентов. Это связано с тем, что, хотя причины микрогематурии часто бывают доброкачественными, важно выявить злокачественные причины на ранних стадиях. Помимо доброкачественных и злокачественных причин, могут встречаться редкие, но значительные врожденные пороки развития, требующие наблюдения.

Заключение. Наблюдалась значительная связь между ретроаортальной левой почечной веной и микрогематурией. После исключения потенциальных частых причин микрогематурии следует рассматривать возможность аномалий почечных сосудов. Клиницисты должны учитывать ретроаортальную левую почечную вену в качестве дифференциального диагноза у пациентов с необъяснимой микрогематурией, а эксперты-рентгенологи должны учитывать эту анатомическую вариацию при оценке КТ брюшной полости.

Ключевые слова: ретроаортальный отдел левой почки, микрогематурия, почечные сосудистые аномалии, отделение неотложной помощи.

Түйіндеме

ЖЕДЕЛ ЖӘРДЕМ БӨЛІМШЕСІНЕ ҚАРАЛҒАН НАУҚАСТАРДА РЕТРОАОРТАЛЫҚ СОЛ ЖАҚ БҮЙРЕК ВЕНАСЫ МЕН МИКРОГЕМАТУРИЯ АРАСЫНДАҒЫ БАЙЛАНЫС

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Кіріспе: Микрогематурия-бұл зәрдегі эритроциттердің қалыптан тыс жоғары санының болуы. Қарапайым көзге көрінбейтін бұл патологияны әдетте зәр анализі арқылы анықтауға болады. Микроскопиялық гематурияның себептері қарапайым зәр шығару жолдарының инфекцияларынан уролитияға, жарақаттарға, урологиялық профильдегі онкологиялық ауруларға және қан тамырлар ауруларына дейінгі патологиялық жағдайлардың кең ауқымын қамтиды.

Әдістемелері: бұл зерттеу білім беру және зерттеу ауруханасының жедел жәрдем бөлімшесінде бір орталықты ретроспективті зерттеу ретінде жоспарланған. Зерттеуге зертханалық зерттеулер негізінде микрогематурия диагнозы қойылған және іш қуысының компьютерлік томографиясы жүргізілген 2020 жылдың қаңтары мен 2023 жылдың сәуірі аралығында бөлімшеге түскен пациенттер енгізілді.

Нәтижелері: жедел жәрдем бөліміне түскен және іш қуысының ретроспективті КТ-сы бағаланған 1499 микрогематуриямен ауыратын науқастардың 780-і (52%) әйелдер болды, ал пациенттердің орташа жасы $43,9 \pm 18,2$ болды (мин: 18; макс: 95). Науқастардың медициналық тарихына және томографиялық зерттеулердің нәтижелеріне сүйене отырып, микрогематурияның ең көп тараған себебі зәр шығару жолдарының тастары, одан кейін цистит, пиелонефрит, бүйрек тастары және сол жақ ретроаорталық бүйрек венасы анықталды.

Талқылау: жедел жәрдем бөлімшесінде симптоматикалық немесе басқа науқастарды тексеру кезінде анықталған микроскопиялық гематурияның этиологиясын анықтау қажет болуы мүмкін. Себебі микрогематурияның себептері жиі қатерсіз болғанымен, қатерлі себептерді ерте сатысында анықтау маңызды. Қатерсіз және қатерлі себептерден басқа, бақылауды қажет ететін сирек кездесетін, бірақ елеулі туа біткен ақаулар болуы мүмкін.

Қорытынды. Ретроаорталық сол жақ бүйрек венасы мен микрогематурия арасында айтарлықтай байланыс байқалды. Микрогематурияның ықтимал жалпы себептерін жоққа шығарғаннан кейін бүйрек тамырларының ауытқуларын қарастырған жөн. Клиницисттер түсініксіз микрогематуриясы бар науқастарда дифференциалды диагноз ретінде ретроаорталық сол жақ бүйрек венасын қарастыруы керек, ал рентгенологтар іш қуысының КТ-ны бағалау кезінде осы анатомиялық вариацияны ескеруі керек.

Түйінді сөздер: сол жақ бүйректің ретроаорталық бөлімі, микрогематурия, бүйрек тамырларының ауытқулары, жедел жәрдем бөлімшесі.

Bibliographic citation:

Isik B., Sarcan E., Kazci O., Muratoglu M. Relationship between retroaortic left renal vein and patients presenting to the emergency department with microhematuria // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2023, (Vol.25) 5, pp. 52-56. doi 10.34689/SH.2023.25.5.006

Исик Б., Саркан Э., Казчи О., Мурат-оглы М. Взаимосвязь между ретроаортальной левой почечной веной и микрогематурией у пациентов, обращающихся в отделение неотложной помощи // *Наука и Здравоохранение*. 2023. 5(Т.25). С. 52-56. doi 10.34689/SH.2023.25.5.006

Исик Б., Саркан Э., Казчи О., Мурат-оглы М. Жедел жәрдем бөлімшесіне қаралған науқастарда ретроаорталық сол жақ бүйрек венасы мен микрогематурия арасындағы байланыс // *Ғылым және Денсаулық сақтау*. 2023. 5 (Т.25). Б.52-56. doi 10.34689/SH.2023.25.5.006

Introduction

Microhematuria is the presence of an abnormally high number of erythrocytes in the urine. This microscopic hematuria, not visible to the naked eye, can generally be detected through urine analysis [2]. The causes of microscopic hematuria encompass a range of pathological conditions, from simple urinary tract infections to urolithiasis, trauma, urological cancers, and vascular diseases [7]. The etiology of microscopic hematuria detected in patients presenting to the emergency department with side pain or other causes is sometimes not clearly understood. This is possibly due to the existence of rare or diagnostically challenging anatomical variations. In today's medical landscape, with the advancement of imaging techniques like abdominal computed tomography (CT) scans used to investigate the etiology of microscopic hematuria, the incidental discovery of various anatomical anomalies is increasing. One of these variations is the retroaortic left renal vein (RLRV), which refers to the condition where the left renal vein passes behind the aorta and drains into the inferior vena cava (IVC). It's approximately observed in about 2% of cases [9]. Although not frequently encountered, understanding the clinical significance of RLRV can assist physicians in preventing potential complications or misdiagnoses during surgical procedures [8]. However, the importance of congenital renal vein anomalies should not be overlooked, as they pose an increased risk of complications during retroperitoneal surgery and can also lead to clinical symptoms such as hematuria. The presence of a RLRV can alter renal venous flow dynamics, potentially leading to renal parenchymal changes. This condition may render individuals prone to microhematuria. Furthermore, the presence of RLRV could also serve as an indicator of other venous anomalies or compression syndromes that could contribute to microhematuria [14].

In the current literature, research on RLRV is primarily concerned with preventing iatrogenic injuries, especially during surgical procedures like renal transplantations [3]. There is limited research available on the possible connection between RLRV and renal function, potential pathological conditions, or even the potential relationship between RLRV and microhematuria.

The aim of this study is to investigate whether RLRV (Right Lateral Renal Variant) plays a role in the etiology of unexplained microhematuria. This study aims to explore the potential relationship between the presence of RLRV and microhematuria in abdominal CT scans conducted in the emergency department.

Materials and Methods

Study Design: This study was designed as a single-center and retrospective research in an educational and research hospital's emergency department. Patients who presented to the emergency department between January 2020 and April 2023, were diagnosed with microhematuria based on laboratory tests, and underwent abdominal computed tomography were included in the study. Our emergency department has a daily patient admission rate exceeding 1,000. The emergency department provides initial treatment to all adult patients, and there is a computed tomography scanner available 24 hours a day. The study was conducted in accordance with the Helsinki Declaration. After obtaining approval from the ethics committee under decision number AEŞH-EK1-2023-370 on July 19, 2023, data were collected through an archive scan from the hospital information system.

Study Protocol and Patient Selection: A total of 1499 patients aged 18 and above, who presented to the emergency department with various complaints and were found to have microhematuria in laboratory tests, were included in the study.

The study was conducted by 2 emergency medicine specialists and 1 radiology specialist. The pathologies causing microhematuria were determined through the correlation of patients' imaging and medical histories. Ratios and percentages were recorded as the final data. Patients with conditions such as congenital kidney disease, solitary kidney, duplicated collecting systems, chronic kidney disease, hypertension, and diabetes were excluded from the study.

Microscopic hematuria is measured by the presence of blood (erythrocytes or hemoglobin) in urine analysis or on a measurement strip. Urine samples were centrifuged at 1500 rpm for 5 minutes and then examined under a high-power microscope (400x) for observation. According to the guidelines of the American Urological Association, the presence of 4 or more red blood cells was defined as positive microhematuria. To determine the etiology in patients with detected microhematuria, multi-detector abdominal computed tomography was performed. Retroaortic left renal vein was identified in the retrospective abdominal computed tomography examinations of these patients. The left renal vein passing behind the abdominal aorta and draining into the inferior vena cava was considered as a retroaortic renal vein.

Primary Outcome: Among the potential causes of microhematuria are urinary tract stones, cystitis, pyelonephritis, and kidney stones. However, this study has

revealed a relationship between microhematuria and RLRV beyond the most common potential causes. It has been observed that RLRV, in addition to posing an increased risk of complications during surgery, is also associated with clinical symptoms such as hematuria.

Statistical Analysis: Descriptive analyses were conducted to summarize the collected data in the study. Frequency tables were used to present the distribution of different categories for categorical variables. For continuous variables such as age, the mean and standard deviation (\pm SD) were calculated, along with the observed minimum (min) and maximum (max) values.

Results

Out of the 1499 patients with detected microhematuria in the emergency department and whose retrospective abdominal CT scans were evaluated, 780 (52%) were female, and the mean age of the patients was 43.9 ± 18.2 (min: 18; max: 95) (Table 1).

Table 1.

Demographic Characteristics of Patients.

Rate	n (%)
Age	
Mean \pm SS (min-max)	43.9 \pm 18.8 (17- 95)
Gender	
Female	780 (52.0)
Male	719 (48.0)

Based on the patients' medical histories and the results of tomographic examinations, urinary tract stones were identified as the most common cause of microhematuria, followed by cystitis, pyelonephritis, kidney stones, and left retroaortic renal vein (Table 2).

Table 2.

Causes of Microhematuria.

Final Diagnosis	n (%)
Ureteral Stone	
Cystitis	347 (23.1)
Pyelonephritis	300 (20.0)
Kidney Stone	192 (12.8)
Retroaortic Left Renal Vein	54 (3.6)
Papillary Necrosis	44 (2.9)
Transitional Cell Carcinoma	34 (2.3)
Glomerulonefrit	32 (2.2)
Drug Intoxication	11 (0.7)
Renal Cell Carcinoma	11 (0.7)
Prostate Cancer	10 (0.7)

Discussion

In the emergency department, investigating the etiology of microscopic hematuria detected during the evaluation of symptomatic or other presenting patients may be necessary. This is because, although the causes of microhematuria are often benign, it is essential to catch malign causes in the early stages. In addition to benign and malignant causes, there may be rare but significant congenital malformations that require monitoring [15]. Therefore, having robust diagnostic tools in emergency departments is crucial. In recent times, CT scans have been widely utilized in emergency departments. While CT scans

provide high sensitivity and specificity in many cases, their accuracy in detecting anatomical variations considered rare among the causes of microhematuria, such as retroaortic left renal vein, depends on the quality of images and the experience of the interpreting radiologist. Anomalies like RLRV and IVC are sometimes incidentally discovered during preoperative assessments [5]. The study retrospectively examined patients with detected microhematuria who underwent abdominal computed tomography scans in the emergency department of a tertiary healthcare hospital. The most common causes of microhematuria, similar to the literature, were found to be ureter stones, cystitis, pyelonephritis, and kidney Stones [2,7,6,12]. In the study conducted by Sarier and colleagues, microhematuria was found to be more common in women [11]. Similarly, in this study, it was also observed that microhematuria was more frequent in women. There are studies that mention the increased risk of complications during retroperitoneal surgery due to RLRV [8,4]. This study has identified that RLRV, unlike other studies, is among the causes of microhematuria. This is likely due to the radiologist's awareness of the relationship between RLRV and microhematuria and their interpretation accordingly during the reevaluation of retrospective abdominal CT scans. Arslan and colleagues demonstrated in a study that in a case with RLRV, symptoms such as shortness of breath, fatigue, microscopic and macroscopic hematuria, labile hypertension, proteinuria, pelvic congestion, and varicocele emerged [1]. RLRV has the potential to cause posterior nutcracker syndrome and consequently microhematuria [10]. Although the relationship between microhematuria and RLRV is relatively rare, it is essential to consider that RLRV could be among the causes of microhematuria, especially when common causes of microhematuria are excluded. The detection of RLRV in routine abdominal CT scans may be challenging. However, in cases of unexplained microhematuria, a careful review of the imaging by an experienced radiologist could lead to the diagnosis [13]. Understanding the potential relationship between RLRV and microhematuria can provide crucial insights for patient management. If such a relationship is identified, clinicians could interpret a coincidentally detected RLRV on abdominal CT as a potential risk factor for microhematuria. Thus, physicians can make appropriate referrals for the follow-up and further investigations of these patients. Therefore, we believe that the potential implications of this study are significant and warrant comprehensive exploration of the possible relationship between RLRV and microhematuria.

However, one of the limitations of this study is its retrospective nature, which may result in insufficient inquiry into factors such as medications that could cause hematuria in the patients' medical history, as well as an unclear understanding of their family history of hereditary diseases. Furthermore, in this study, RLRV types were not evaluated. To assess their relationship with retroaortic left renal vein (RLRV), a broader dataset and more comprehensive analysis of Type 1, Type 2, Type 3, and Type 4 RLRV are required.

Conclusions

A significant association between retroaortic left renal vein and microhematuria has been observed. After

excluding the potential common causes of microhematuria, renal vascular anomalies should be considered as a possibility. Clinicians should consider retroaortic left renal vein as a differential diagnosis in patients with unexplained microhematuria and radiology experts should keep this anatomical variation in mind when evaluating abdominal CT scans. Therefore, we believe that this study underscores the need for a comprehensive investigation of the potential relationship between RLRV and microhematuria. Enhanced participant-based research and advanced clinical observations are required to assess the association between microhematuria and RLRV more precisely and meaningfully.

Funding: There was no grant funding.

Publication details: This material has not been published in other publications and is not pending review by other publishers.

References:

1. Arslan H., Etilik O., Ceylan K., Temizoz O., Harman M., Kavan M. Incidence of retro-aortic left renal vein and its relationship with varicocele // *Eur Radiol.* 2005. Vol.15 (8). P.1717-1720.
2. Davis R., Jones J.S., Barocas D.A., Castle E.P., Lang E.K., Leveillee R.J. Diagnosis, evaluation and follow-up of asymptomatic microhematuria (AMH) in adults: AUA Guideline // *J Urol.* 2012.Vol.188(6 Suppl). P. 2473-2481.
3. Dilli A., Ayaz U.Y., Kaplanoglu H., Saltas H., Hekimoglu B. Evaluation of the left renal vein variations and inferior vena cava variations by means of helical computed tomography. // *Clin Imaging.* 2013. Vol.37 (3). P.530-535.
4. Eldefrawy A., Arianayagam M., Kanagarajah P., Acosta K., Manoharan M. Anomalies of the inferior vena cava and renal veins and implications for renal surgery // *Cent European J Urol.* 2011. Vol.64 (1). P.4-8.
5. Kante A., Ba B., Bengaly B., Daou M., Coulibaly B., Ouattara D. A rare anomaly of the left renal vein in the laboratory of anatomy of bamako (Mali) // *Forensic Medicine and Anatomy Research.* 2019. Vol. 7. P. 31-35.
6. Kim T.H., Oh S.H., Park K.N., Kim H.J., Youn C.S., Kim S.H. Factors associated with absent microhematuria in symptomatic urinary stone patients // *Am J Emerg Med.* 2018. Vol. 36 (12). P.2187-2191.
7. Linder B.J., Bass E.J., Mostafid H., Boorjian S.A. Guideline of guidelines: asymptomatic microscopic haematuria // *BJU Int.* 2018. Vol.121 (2). P.176-183.
8. Sampaio F.J., Passos M.A. Renal arteries: anatomic study for surgical and radiological practice // *Surg Radiol Anat.* 1992. Vol.14 (2). P.113-117.
9. Satyapal K.S., Haffejee A.A., Singh B., Ramsaroop L., Robbs J.V., Kalideen J.M. Additional renal arteries: incidence and morphometry // *Surg Radiol Anat.* 2001. Vol.23 (1). P. 33-38.
10. Sillo T.O., Jones K.E., Willetts I.E. Haematuria and the retro-aortic left renal vein // *BMJ Case Rep.* 2012. bcr0220125836.
11. Sarier M., Demir M., Emek M., Turgut H. Hematuria frequency and association with abnormal urological findings in medical check-up patients // *Niger J Clin Pract.* 2022. Vol.5 (3). P. 310-314.
12. Skaggs A.W., Loehfelm T.W., Fananapazir G., Dall'Era M., Corwin M.T. Utilization and Yield of CT Urography: Are the American Urological Association Guidelines for Imaging of Patients With Asymptomatic Microscopic Hematuria Being Followed? // *AJR Am J Roentgenol.* 2021. Vol.216 (1). P. 106-110.
13. Takebayashi S., Ueki T., Ikeda N., Fujikawa A. Diagnosis of the nutcracker syndrome with color Doppler sonography: correlation with flow patterns on retrograde left renal venography. // *Am J Roentgenol.* 1999. Vol.172 (1). P. 39-43.
14. Trigaux J.P., Vandrogenbroek S., De Wispelaere J.F., Lacrosse M., Jamart J. Congenital anomalies of the inferior vena cava and left renal vein: evaluation with spiral CT // *J Vasc Interv Radiol.* 1998. Vol.9 (2). P. 339-345.
15. Willis G.C., Tewelde S.Z. The Approach to the Patient with Hematuria // *Emerg Med Clin North Am.* 2019. Vol.37 (4).755-769.

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