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Etiological Profile and Diagnostic Utility of Urine Microscopy in Microhematuria - A Hospital-Based Study

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ABSTRACT

Background: Microhematuria is a common clinical finding that may indicate various renal or urological conditions. While often detected incidentally, its etiological distribution varies, and the diagnostic role of urine microscopy remains a critical, cost-effective tool for distinguishing glomerular from non-glomerular causes.
Objective: To describe the etiological profile and evaluate the diagnostic performance of urine microscopy in patients presenting with microhematuria in a tertiary care setting.
Materials & Methods: A cross-sectional hospital-based study was conducted at a Government Medical College in Nagpur, India, from January to December 2025. The study included 192 participants (aged ≥18 years) with microhematuria, defined as ≥3 RBCs per high-power field (HPF). Midstream clean-catch urine samples were centrifuged and examined under light microscopy to evaluate RBC morphology, casts, and other parameters.
Results: Out of 1748 samples, microhematuria was detected in 192 (10.98%), with the highest prevalence in the 41–50 age group (26%) and a male predominance (1.59:1). While 30.73% of patients were asymptomatic, common symptoms included dysuria (23.96%) and flank pain (19.27%). Lower urinary tract pathology was the leading etiology (34.37%), followed by glomerular causes (29.17%) and non-glomerular renal pathologies (25%). Dysmorphic RBCs were observed in 81.36% of glomerular cases. The presence of RBC casts showed a highly significant statistical association with glomerular disease ($p < 0.00001$).
Conclusion: Urine microscopy is a powerful diagnostic modality, not merely a screening tool. The strong correlation between dysmorphic RBCs, RBC casts, and glomerular pathology allows for high diagnostic accuracy in differentiating the origin of hematuria. Incorporating detailed microscopy into routine protocols is essential for early detection and guided management, particularly in resource-limited settings.
Keywords: Microhematuria; Urine Microscopy; Dysmorphic Red Blood Cells; RBC Casts

INTRODUCTION

Hematuria is defined as the presence of red blood cells (RBCs) in the urine. It is broadly categorised into gross hematuria, visible to the naked eye, and microscopic hematuria (microhematuria), detectable only by laboratory analysis despite normal-appearing urine. Microhematuria is typically defined as the presence of ≥3 RBCs per high-power field (HPF) on microscopic examination of properly collected urine specimens. [1,2]

Microhematuria may arise from a broad spectrum of etiologies involving both the renal and urinary tracts. Glomerular causes include intrinsic kidney diseases such as IgA nephropathy and vasculitis, where dysmorphic RBCs and RBC casts on urine microscopy can be key diagnostic clues suggesting glomerular bleeding. Nonglomerular causes include urinary tract infections, urolithiasis, benign prostatic hyperplasia, urothelial tumours, and other structural abnormalities. [3,4]

Despite its clinical importance, the etiological distribution of microhematuria varies across populations and healthcare settings, and there is ongoing debate regarding the most cost-effective and evidence-based diagnostic strategies. Current guidelines emphasise risk stratification based on age, smoking history, degree and persistence of microhematuria, and other risk factors for genitourinary malignancy to determine the extent of further evaluation, including imaging and cystoscopy. [2,5]

Given this clinical heterogeneity, hospital-based studies that profile the causes of microhematuria and assess the utility of urine microscopy provide essential data for optimizing diagnostic pathways, reducing unnecessary invasive testing, and improving patient outcomes. This study aims to describe the etiological profile and evaluate the diagnostic performance of urine microscopy in patients presenting with microhematuria in a tertiary care setting.

MATERIALS & METHODS

A cross-sectional study was conducted in the Department of Microbiology at Government Medical College, Nagpur, Maharashtra, India, from January 2025 to December 2025. The permission from the Institutional Ethical Committee was obtained. The sample size was calculated as follows.

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:

n = required sample size (138.24)

Z = standard normal deviate at 95% confidence interval (1.96)

p = prevalence of microhematuria (assumed as 10% based on previous literature)

q = 1 − p

d = allowable error (absolute precision), taken as 5%

(Although the minimum required sample size was 139, data were available for 192 participants, all of whom were included in the study)

Inclusion criteria

Patients aged 18 years and above with the presence of microhematuria, defined as ≥3 red blood cells per high power field (HPF) in a centrifuged urine sample were included. Both inpatients and outpatients were taken up for the study.

Exclusion criteria

The patients with gross hematuria visible to the naked eye and those who were not willing to participate in the study were excluded.

A midstream clean-catch urine sample was collected in a sterile, wide-mouthed container from study participants. Samples were processed within 1–2 hours of collection. Urine samples were centrifuged at 2000–3000 rpm for 5 minutes. The supernatant was discarded, and the sediment was resuspended and examined under light microscopy. The following parameters were evaluated: Number of RBCs per HPF; RBC morphology, categorized as isomorphic or dysmorphic; Presence of RBC casts, WBCs, WBC casts, Epithelial cells, crystals, and bacteria.

Statistical Analysis

Data obtained were entered into Microsoft Excel. The results were analysed statistically by IBM statistical package for the social sciences (SPSS) statistics 20.0. The Chi-square test and Fisher's exact test were used in calculating the p value. The p values of less than 0.05 were considered statistically significant.

RESULT

Among 1748 urine samples collected to perform urine microscopy, 192 (10.98%) showed the presence of microhematuria. It was most commonly observed in the 41–50 years age group (26%).

Table 1: Age-wise distribution of microhematuria cases

Age group (years)	Number of cases (n=192)	Percentage (%)
18-30	36	18.75
31-40	43	22.40
41-50	49	25.52
51-60	40	20.83
>60	24	12.50

Male predominance was noted among microhematuria cases, with male to female ratio of 1.59:1. Out of 192 microhematuria cases detected by urine microscopy, 118 (61.46%) were males, and 74 (38.54%) were females.

Approximately 30.73% of patients were asymptomatic, with microhematuria detected incidentally. Most of the patients presented with urinary symptoms like dysuria, accounting for 23.96% (46/192). This was followed by flank pain (37/192, 19.27%), hypertension (27/192, 14.06%), edema (20/192, 10.45%) and fever (16/192, 8.33%)

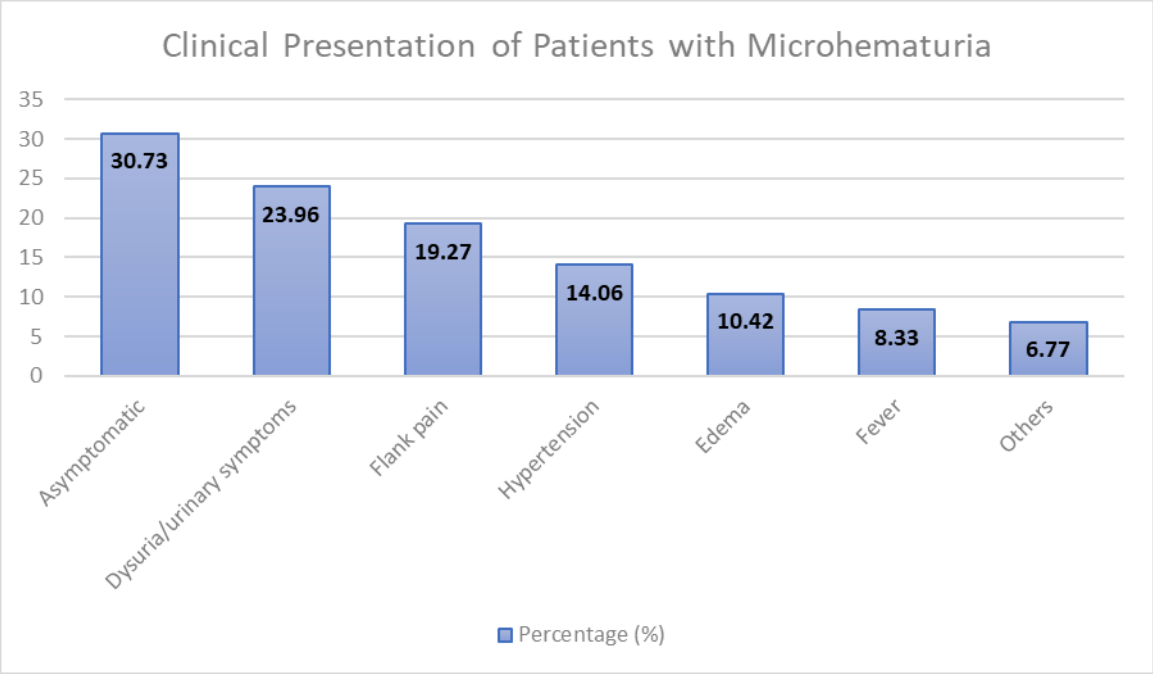

Figure 1: Clinical Presentation of Patients with Microhematuria

In urine microscopy, dysmorphic red blood cells were identified in 29.17% of cases. The presence of dysmorphic RBCs, especially in association with RBC casts observed in 14.58% of samples, indicates a glomerular source of hematuria. These findings demonstrate the usefulness of urine microscopy in distinguishing glomerular from non-glomerular causes of hematuria.

Table 2: Urine Microscopy Findings

Urine microscopy findings	Number of cases (n=192)	Percentage (%)
RBCs ≥3/HPF only	67	34.89
Dysmorphic RBCs	56	29.17
Isomorphic RBCs	71	36.98
RBC casts	28	14.58
WBCs / pus cells	52	27.08
Crystals	32	16.67
Micro-organisms	26	13.54
Epithelial cells	35	18.23

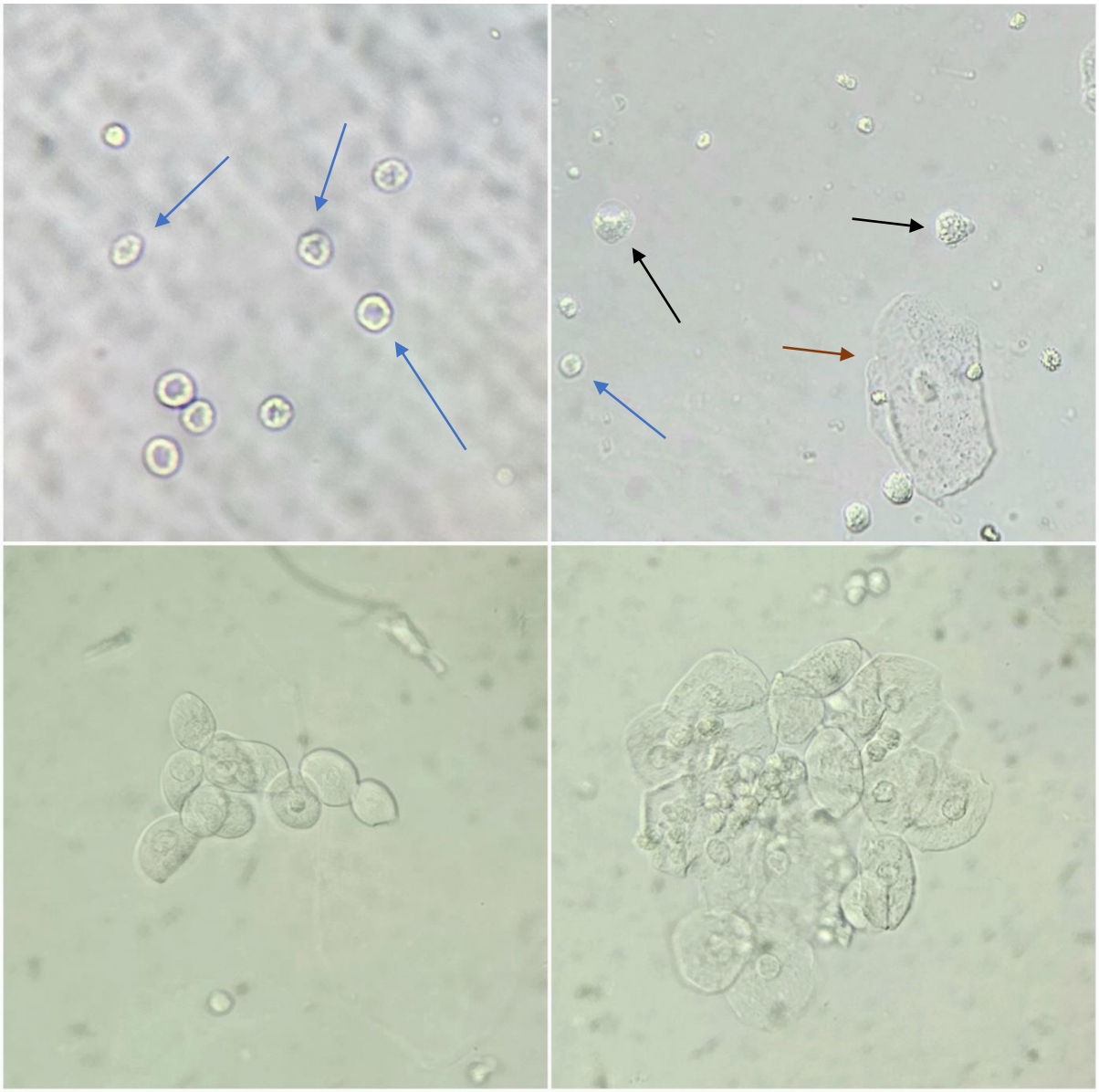

Figure 2: Urine microscopy findings. 2A- RBCs (Blue arrow); 2B- Squamous epithelial cell (Brown arrow) and WBCs (Black arrow); 2C- Transitional epithelial cells; 2D- Mixed cell cast

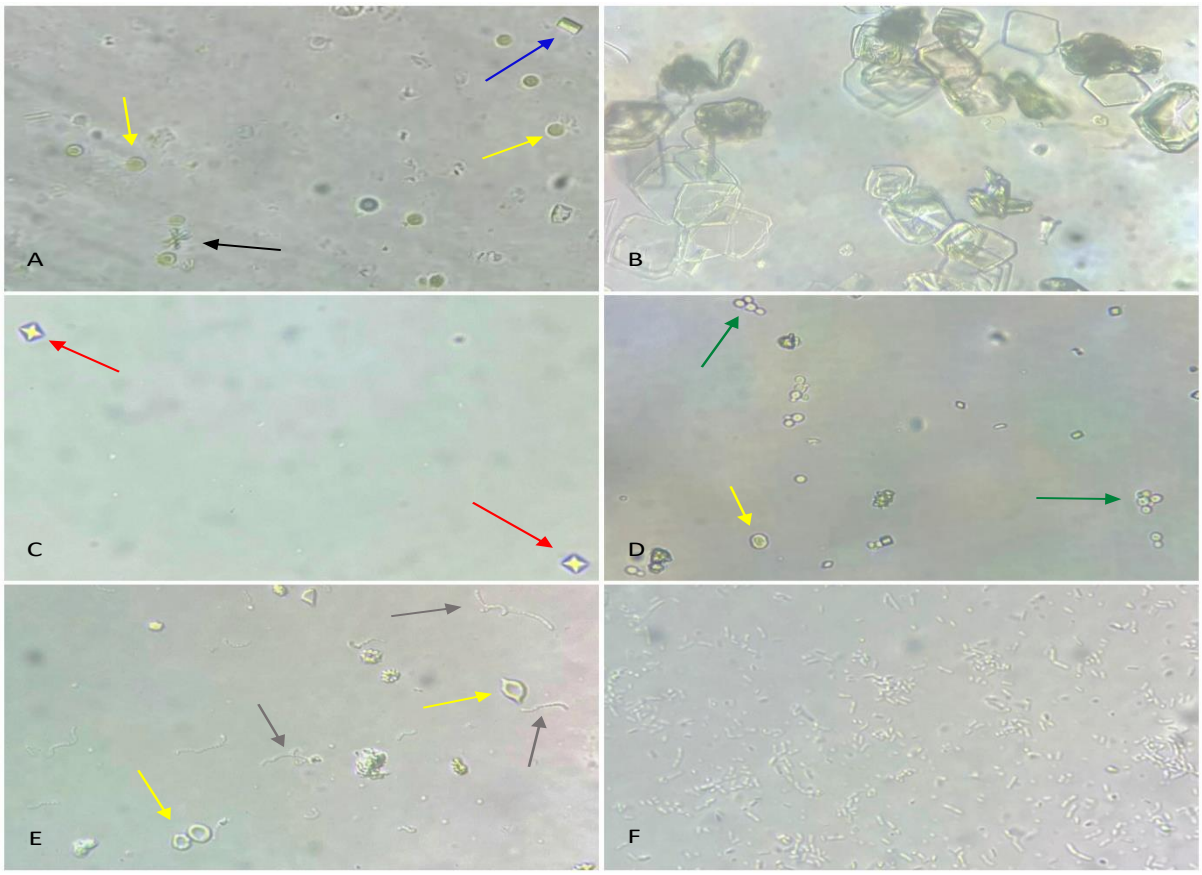

Figure 3: Crystals and micro-organisms in urine microscopy. 3A- Triple phosphate crystal (Blue arrow) and Calcium phosphate crystal (Black arrow); 3B- Uric acid crystals; 3C- Calcium oxalate crystals (Red arrow); 3D- Budding yeast cells (Green arrow); 3E- Cocci in chains (Grey arrow); 3F- Bacilli. (RBCs are indicated by yellow arrows)

The etiological causes of microhematuria showed lower urinary tract pathology as the most common cause (34.37%). This was followed by glomerular causes (29.17%) and non-glomerular renal pathologies (25%). Drug induced microhematuria was seen in 6.77% cases. Other causes included 4.69%.

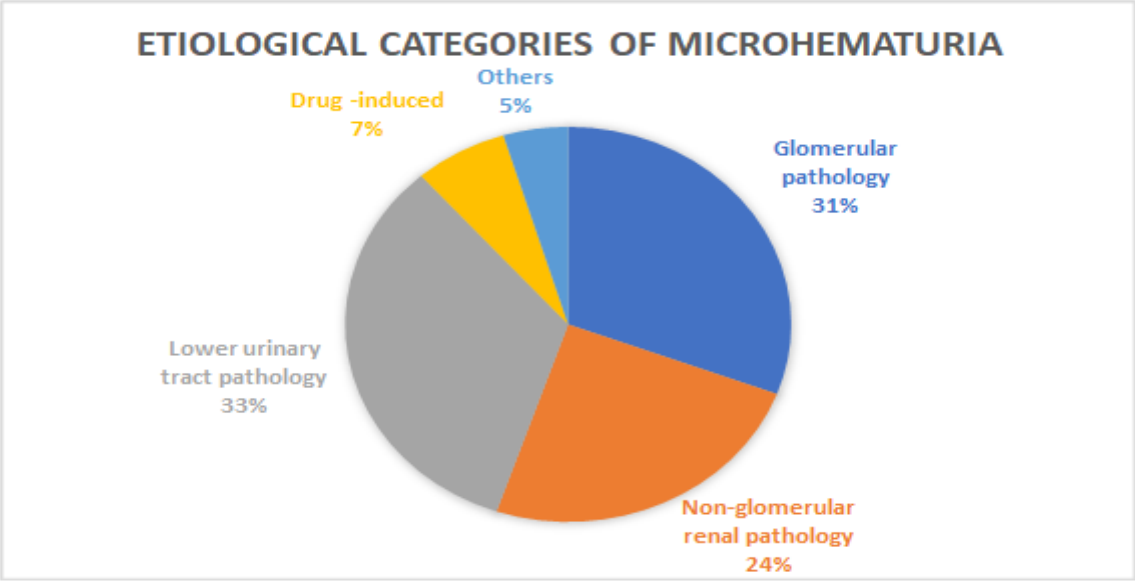

Figure 4: Etiological categories of Microhematuria

Table 3: Distribution of Etiological Causes of Microhematuria

Etiology	Number of cases (n=192)	Percentage (%)
Nephritic syndrome	38	19.79
Nephrotic syndrome	21	10.94
Urolithiasis	41	21.35
Renal cysts	10	5.21
Renal tumors	5	2.60
Pyelonephritis	9	4.69
Papillary necrosis	1	0.53
Lower urinary tract infections (Cystitis, prostatitis)	27	14.06
Benign Prostatic Hypertrophy	12	6.25
Bladder or ureteric malignancy	6	3.13
Anticoagulants (e.g.: Heparin, Warfarin)	8	4.17
Chemotherapy (e.g.: Cyclophosphamide)	5	2.60
Trauma/Instrumentation	4	2.08
Menstrual contamination	2	1.04
Snake bite-associated AKI	3	1.56

Various RBC morphologies were also studied. It is mainly categorised into 2, namely Isomorphic RBCs and Dysmorphic RBCs (Acanthocytes). The correlation of RBC morphology with etiology showed that dysmorphic RBCs were predominantly associated with glomerular causes. Among 48 (81.36%) of glomerular causes, dysmorphic RBCs were seen, whereas isomorphic RBCs, crenated RBCs, fragmented RBCs and ghost cells were seen in other pathologies (Figure 5).

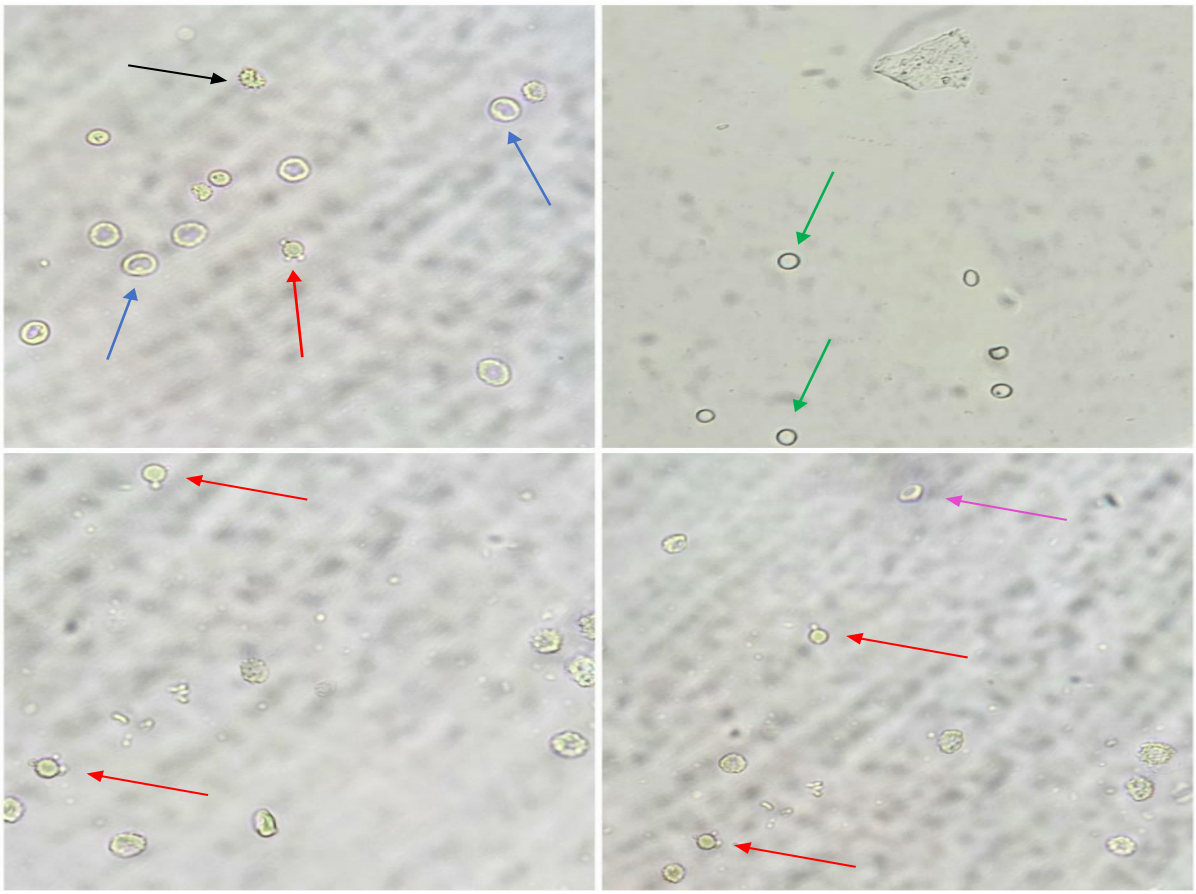

Figure 5: RBC morphologies in urine microscopy. Isomorphic RBCs (Discocytes) (Blue arrow), Dysmorphic RBC (Acanthocyte) (Red arrow), Crenated RBC (Black arrow), Ghost cells (Green arrow), Knizocytes (Pink arrow)

Table 4: Correlation of RBC Morphology with etiology

Predominant RBC morphology in urine microscopy	Glomerular Pathology (n=59)	Other pathologies (n=133)
Dysmorphic RBCs	48 (81.36%)	8 (6.02%)
Isomorphic RBCs	9 (15.25%)	62 (46.61%)
Mixed or others	2 (3.39%)	63 (47.37%)

On studying the Diagnostic Utility of Dysmorphic RBCs for Glomerular Hematuria, it was found that urine microscopy demonstrated high sensitivity and specificity in differentiating glomerular from non-glomerular hematuria (Table 5)

Table 5: Diagnostic Utility of Dysmorphic RBCs for Glomerular Hematuria

Parameter	Value
Sensitivity	81.36%
Specificity	93.98%
Positive predictive value	85.71%
Negative predictive value	91.91%

RBC casts were observed in 28 cases, among which 26 (92.86%) were of glomerular pathologies. The chi-square statistic is 59.4413. The p-value is <0.00001 (Significant at p <0.05). Thus, the presence of RBC casts showed a statistically significant association with glomerular disease.

DISCUSSION

Microhematuria is a frequent finding in routine urine microscopy. It is one of the earliest indicators of a significant renal or urological disease. In the current study, microhematuria was detected in 10.98% of urine samples. The reported occurrence of microhematuria in various populations ranges from 2% to 31%, depending on the screening methods, age group and the diagnostic criteria utilised. [6,7,8] This finding highlights the significant occurrence of microhematuria in routine clinical practice.

In this study, peak incidence was observed in 41-50 years of age. This finding is in accordance with multiple studies that show an age-related increase in both glomerular and urological pathologies such as urolithiasis, malignancies, benign prostatic enlargement and infections.[9,10] In the current study, there is a male predominance (M: F = 1.59:1) of microscopic hematuria, which goes hand in hand with the epidemiological data showing higher rates of urolithiasis, prostatic disorders and occupational exposures in men. [11]

In our study, hematuria was detected incidentally in 30.73% of cases. This means that nearly one-third of the patients were asymptomatic, which is a noteworthy observation that supports prior studies, which showed microscopic hematuria might be the only early manifestation of glomerular pathology or occult urological diseases. [12] In contrast, a study by Vivante et al. showed that 0.1%-0.5% were diagnosed to have persistent asymptomatic isolated microscopic hematuria, of which 0.7% developed End Stage Renal Disease (ESRD). In the same study, the prevalence of persistent asymptomatic isolated microscopic hematuria was 0.3% among adolescents and young adults. Among participants with hematuria, there was early detection of ESRD, which helped in early therapeutic interventions with the potential of slowing progression to ESRD.[13]

Among the symptomatic cases, dysuria and flank pain were the most common presenting complaints in the present study. In a study by Paul Froom et al., predominant chief complaints were fever (8.74%) and weakness (14.99%). Urinary retention, anemia, abdominal pain and nonspecific pain were other symptoms. [14] While microscopic hematuria itself is usually symptomless, any accompanying clinical features should prompt consideration of the underlying

etiology driving the presentation rather than the microscopic hematuria alone.

Urine microscopy detected RBCs and their morphologies, WBCs, Casts and Crystals. According to the guidelines from the European Confederation of Laboratory Medicine (ECLM), the basic level for anyone examining urine samples consists of description and identification of erythrocytes, leukocytes, epithelial cells, hyaline/non-hyaline casts, bacteria, Trichomonas, spermatozoa, artefacts (hairs/fibers etc.), lipid droplets and crystals.[15, 16]

In this study, lower urinary tract pathology (33.33%) was the leading etiological category of microhematuria, followed by glomerular (30.73%) and non-glomerular renal pathologies (24.48%). Urolithiasis is the single most common cause, followed by nephritic syndrome and lower urinary tract infections. Similar observations were documented in various studies. [17,18,19] A thorough medication history in evaluation is important, as drug-induced microhematuria, though less frequent, is not uncommon. [20] This is because the urinary bladder is vulnerable to the adverse effects of drugs, particularly due to anticoagulants and cyclophosphamide, because of the frequent excretion of drug metabolites in the urine.[21]

Different RBC morphologies were evaluated during urine microscopy in this study. Dysmorphic RBCs were present in 29.17% cases. While evaluating the underlying etiology, it was found that the dysmorphic RBCs were the predominant morphology observed in 81,36% of glomerular pathologies. In a study by Birch et al., Dysmorphic erythrocytes were present in 86 of 87 patients who were later shown to have glomerulonephritis; all 30 patients with non-glomerular lesions had isomorphic erythrocytes in the urine, and ten patients yielded a mixed morphologic pattern suggestive of dual pathology, which was confirmed in four patients. [22] The majority of dysmorphic red blood cells, including echinocytes, anulocytes, ghost cells, schizocytes, stomatocytes, codocytes, and knizocytes, were shown to be uncharacteristic of glomerular haemorrhage and also occurred in glomerular or nonglomerular disease. On the other hand, the RBC morphological defect associated with glomerular disease was a ring form with vesicle-shaped protrusions known as acanthocytes. [23] The findings of the present study are in accordance with multiple studies, which showed dysmorphic RBCs, particularly acanthocytes, are reliable markers of glomerular bleeding.[22,23,24]

In the current study, dysmorphic RBCs in urine microscopy proved to have a good diagnostic utility for detecting glomerular pathology, as it showed high sensitivity (81.36%) and high specificity (93.98%). In accordance with the above finding, a study by Györy et al. showed sensitivity was 88%, specificity 83%, accuracy 86%, positive predictive value 93%, and negative predictive value 71%. [25] Urine microscopy, when performed meticulously, can accurately localise the source of bleeding before advanced imaging, histopathological or serological testing.

RBC casts were observed in 14.58% of samples. A statistically significant association between RBC casts and glomerular pathology ($p < 0.00001$) was observed, with 92.86% of RBC cast–positive cases belonging to glomerular etiologies. RBC casts continue to be one of the most useful findings in urine microscopy, as they are commonly recognised as a pathognomonic indicator for glomerulonephritis.[26,27, 28]

CONCLUSION

The present study reinforces the fact that urine microscopy is indispensable for the detection of hematuria, which is usually missed if it is not gross. There is a strong correlation between dysmorphic RBCs and RBC casts with glomerular pathology. This can be demonstrated using cost-effective microscopy, which helps differentiate it from non-glomerular pathology with high diagnostic accuracy. This establishes the fact that urine microscopy is not a mere screening

tool but a powerful diagnostic modality. Incorporating urine microscopy into routine evaluation protocols can significantly increase early detection of underlying renal and urological diseases. In resource-limited settings, where advanced diagnostics may not be immediately available, a simple urine microscopy can provide critical insights into the origin of hematuria and guide appropriate further investigation. Thus, helps in appropriate timely management.

Declaration by Authors

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REFERENCES

1. Leslie SW, Hamawy K, Saleem MO. Gross and Microscopic Hematuria. 2025 Nov 30. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan–. PMID: 30480952.
2. Barocas DA, Lotan Y, Matulewicz RS, Raman JD, Westerman ME, Kirkby E, Pak LJ, Souter L. Updates to microhematuria: AUA/SUFU guideline (2025). Journal of Urology. 2025 Mar 13:10-97.
3. Saha MK, Massicotte-Azarniouch D, Reynolds ML, Mottl AK, Falk RJ, Jennette JC, Derebail VK. Glomerular Hematuria and the Utility of Urine Microscopy: A Review. Am J Kidney Dis. 2022 Sep;80(3):383-392. doi: 10.1053/j.ajkd.2022.02.022. Epub 2022 Jun 29. PMID: 35777984.
4. Bolenz C, Schröppel B, Eisenhardt A, Schmitz-Dräger BJ, Grimm MO. The Investigation of Hematuria. Dtsch Arztebl Int. 2018 Nov 30;115(48):801-807. doi: 10.3238/arztebl.2018.0801. PMID: 30642428; PMCID: PMC6365675.
5. Barocas DA, Boorjian SA, Alvarez RD, Downs TM, Gross CP, Hamilton BD, Kobashi KC, Lipman RR, Lotan Y, Ng CK, Nielsen ME, Peterson AC, Raman JD, Smith-Bindman R, Souter LH. Microhematuria: AUA/SUFU Guideline. J Urol. 2020 Oct;204(4):778-786. doi: 10.1097/JU.0000000000001297. Epub 2020 Jul 23. PMID: 32698717.
6. Grossfeld GD, Litwin MS, Wolf JS Jr, Hricak H, Shuler CL, Agerter DC, Carroll PR. Evaluation of asymptomatic microscopic hematuria in adults: the American Urological Association best practice policy--part II: patient evaluation, cytology, voided markers, imaging, cystoscopy, nephrology evaluation, and follow-up. Urology. 2001 Apr;57(4):604-10. doi: 10.1016/s0090-4295(01)00920-7. PMID: 11306357.
7. Khadra MH, Pickard RS, Charlton M, Powell PH, Neal DE. A prospective analysis of 1,930 patients with hematuria to evaluate current diagnostic practice. J Urol. 2000 Feb;163(2):524-7. PMID: 10647670.
8. Mohr DN, Offord KP, Owen RA, Melton LJ 3rd. Asymptomatic microhematuria and urologic disease. A population-based study. JAMA. 1986 Jul 11;256(2):224-9. PMID: 3723707.
9. Mariani AJ, Mariani MC, Macchioni C, Stams UK, Hariharan A, Moriera A. The significance of adult hematuria: 1,000 hematuria evaluations including a risk-benefit and cost-effectiveness analysis. J Urol. 1989 Feb;141(2):350-5. doi: 10.1016/s0022-5347(17)40763-4. PMID: 2492350.
10. Davis R, Jones JS, Barocas DA, Castle EP, Lang EK, Leveillee RJ, Messing EM, Miller SD, Peterson AC, Turk TM, Weitzel W; American Urological Association. Diagnosis, evaluation and follow-up of asymptomatic microhematuria (AMH) in adults: AUA guideline. J Urol. 2012 Dec;188(6 Suppl):2473-81. doi: 10.1016/j.juro.2012.09.078. Epub 2012 Oct 24. PMID: 23098784.
11. Messing EM, Young TB, Hunt VB, Newton MA, Bram LL, Vaillancourt A, Hisgen WJ, Greenberg EB, Kuglitsch ME, Wegenke JD. Hematuria home screening: repeat testing results. J Urol. 1995 Jul;154(1):57-61. doi: 10.1016/s0022-5347(01)67224-0. PMID: 7776456.
12. Vivante A, Afek A, Frenkel-Nir Y, Tzur D, Farfel A, Golan E, Chaiter Y, Shohat T, Skorecki K, Calderon-Margalit R. Persistent asymptomatic isolated microscopic hematuria in Israeli adolescents and young adults and risk for end-stage renal disease. JAMA. 2011 Aug 17;306(7):729-36. doi: 10.1001/jama.2011.1141. PMID: 21846854.
13. Grossfeld GD, Wolf JS Jr, Litwan MS, Hricak H, Shuler CL, Agerter DC, Carroll

PR. Asymptomatic microscopic hematuria in adults: summary of the AUA best practice policy recommendations. Am Fam Physician. 2001 Mar 15;63(6):1145-54. PMID: 11277551.
14. Paul Froom, Zvi Shimoni, Nathan Dusseldorp, Jochanan Benbassat, Asymptomatic Microscopic Hematuria in Inpatient Nonsurgical Adults, *American Journal of Clinical Pathology*, Volume 159, Issue 3, March 2023, Pages 221–224
15. European Confederation of Laboratory Medicine. European urinalysis guidelines. Scand J Clin Lab Invest Suppl. 2000; 231:1-86. PMID: 12647764.
16. Andersen H, Daae LN, Wien TN. Urine microscopy–an important diagnostic tool. Tidsskrift for Den norske legeforening. 2014 Sep 30.
17. Sutton JM. Evaluation of hematuria in adults. JAMA. 1990 May 9;263(18):2475-80. PMID: 2184261.
18. Edwards TJ, Dickinson AJ, Natale S, Gosling J, McGrath JS. A prospective analysis of the diagnostic yield resulting from the attendance of 4020 patients at a protocol-driven haematuria clinic. BJU Int. 2006 Feb;97(2):301-5; discussion 305. doi: 10.1111/j.1464-410X.2006.05976. x. PMID: 16430634.
19. Loo RK, Lieberman SF, Slezak JM, Landa HM, Mariani AJ, Nicolaisen G, Aspera AM, Jacobsen SJ. Stratifying risk of urinary tract malignant tumors in patients with asymptomatic microscopic hematuria. Mayo Clin Proc. 2013 Feb;88(2):129-38. doi: 10.1016/j.mayocp.2012.10.004. Epub 2013 Jan 9. PMID: 23312369.
20. Bennett AH. Cyclophosphamide and hemorrhagic cystitis. J Urol. 1974 May;111(5):603-6. doi: 10.1016/s0022-5347(17)60025-9. PMID: 4856785.
21. Drake MJ, Nixon PM, Crew JP. Drug-induced bladder and urinary disorders. Incidence, prevention and management. Drug Saf. 1998 Jul;19(1):45-55. doi: 10.2165/00002018-199819010-00004. PMID: 9673857.
22. Birch DF, Fairley KF, Whitworth JA, Forbes I, Fairley JK, Cheshire GR, Ryan GB. Urinary erythrocyte morphology in the diagnosis of glomerular hematuria. Clin Nephrol. 1983 Aug;20(2):78-84. PMID: 6616978.
23. Köhler H, Wandel E, Brunck B. Acanthocyturia--a characteristic marker for glomerular bleeding. Kidney Int. 1991 Jul;40(1):115-20. doi: 10.1038/ki.1991.188. PMID: 1921146.
24. Birch DF, Fairley KF. Haematuria: glomerular or non-glomerular? Lancet. 1979 Oct 20;2(8147):845-6. doi: 10.1016/s0140-6736(79)92191-3. PMID: 90933.
25. György AZ, Hadfield C, Lauer CS. Value of urine microscopy in predicting histological changes in the kidney: double blind comparison. Br Med J (Clin Res Ed). 1984 Mar 17;288(6420):819-22. doi: 10.1136/bmj.288.6420.819. PMID: 6423097; PMCID: PMC1441658.
26. Fogazzi GB, Garigali G. The clinical art and science of urine microscopy. Curr Opin Nephrol Hypertens. 2003 Nov;12(6):625-32. doi: 10.1097/00041552-200311000-00009. PMID: 14564200.
27. Perazella MA. The urine sediment as a biomarker of kidney disease. Am J Kidney Dis. 2015 Nov;66(5):748-55. doi: 10.1053/j.ajkd.2015.02.342. Epub 2015 May 2. PMID: 25943719.
28. Simerville JA, Maxted WC, Pahira JJ. Urinalysis: a comprehensive review. Am Fam Physician. 2005 Mar 15;71(6):1153-62. Erratum in: Am Fam Physician. 2006 Oct 1;74(7):1096. PMID: 15791892.

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