

Clinical characteristics and causes of pediatric hematuria in a tertiary care centre

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Abstract:

Background: Hematuria is defined as presence of >5 RBCs/HPF in uncentrifuged urine.

A good clinical examination and urine microscopy distinguishes glomerular from non-glomerular etiology.

The causes vary from UTI with quick recovery to severe glomerulonephritis with rapid decline in kidney function. Hence, it's crucial to determine the underlying disease for a better outcome.

Materials and Methods: This is a prospective observational study, conducted between March 2021 and June 2022 which enrolled children aged 3 months to 14 years with gross hematuria and data was collected according to a predesigned proforma. General information, detailed history regarding antecedent or current illnesses, infections, urinary complaints drug intake, living conditions of the family, kind of diet consumed was documented. Microscopic analysis of urine was done along with other relevant basic investigations for final diagnosis. Specific treatment was started and children were followed up regularly for confirming the persistence or resolution of hematuria.

Results: Of the 40 children enrolled, glomerular hematuria was seen in 60%. Post-infectious glomerulonephritis otherwise known as infection related glomerulonephritis IRGN was the commonest etiology. Renal calculi, UTI and hypercalcuria were common among non-glomerular hematuria. At follow up, microscopic hematuria persisted. The median time to resolution of gross as well as microscopic hematuria was longer in glomerular etiologies.

Conclusion: In summary, hematuria can be a distressing symptom and the only clear manifestation of an underlying renal disease. A methodical approach to assessment of hematuria leads the Pediatrician to make a suitable diagnosis. Beginning specific therapies and immediate recognition of complications and quick referral to the Nephrologist when needed are key steps in management of pediatric hematuria.

Key Word: Hematuria, outcome, UTI urinary tract infection, IRGN Infection related glomerulonephritis

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I. Introduction

Hematuria originated from the Greek words haima meaning blood and ouron meaning (urine) to refer to the presence of blood in the urine. Hematuria is defined as the persistent presence of more than 5 red blood cells per high power field. It can be grossly visible (macrohematuria) or only seen under a microscope (microhematuria). Microhematuria is often asymptomatic and has a prevalence of 4–5% in routine clinical practice¹. Macroscopic hematuria consists of bright-red urine, or cola-colored. Even 1 millilitre (ml) of blood in a litre of urine is enough to cause red urine.² The incidence of gross hematuria is 1.3 per 1000 children³ and prevalence of microscopic hematuria varies from 0.15–2%⁴. The American Academy of Pediatrics (AAP) does not recommend annual screening urinalysis, hence hematuria comes to attention when gross hematuria occurs or while evaluating for urinary symptoms⁵. The differential diagnosis of gross hematuria includes agents that can change urine color (foods, dyes, medications), red diaper syndrome (gastroenteritis due to *Serratia marcescens*), hemoglobinuria, myoglobinuria, upper urinary tract involvement like glomerular, vascular, interstitial causes, lower urinary tract involvement like cyst, stone, obstruction, infection (viral, bacterial, parasite), trauma and malignancy⁶.

Clinical presentation and urinalysis can distinguish glomerular from non-glomerular hematuria. Urinalysis by flow cytometry is a novel method for confirmation of hematuria and other urinary morphological

components ⁷ Drug induced hematuria, especially secondary to use of analgesics needs to be recognized in routine clinical practice. Rarer causes of hematuria may need more detailed evaluation with a renal biopsy, electron microscopy, urine biochemical testing and imaging. Swift referral to a pediatric nephrologist is directed in situations with non-resolution of hematuria before 2 weeks of commencement of glomerulonephritis, renal biopsy is needed, when there is persistent microscopic hematuria and need for detailed urine biochemistry testing or imaging modalities.

II. Material And Methods

This prospective observational study, conducted between March 2021 and June 2022 in Department of Pediatrics in Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinavutpalli, Andhra Pradesh, enrolled children aged 3 months to 14 years with gross hematuria. A total of 40 children with gross hematuria were in this study.

Study Design: Prospective open label observational study

Study Location: This was a tertiary care teaching hospital-based study done in Department of Pediatrics in Dr. Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation, Chinavutpalli, Andhra Pradesh.

Study Duration: March 2021 to June 2022

Sample size: 40 patients.

Inclusion criteria:

1. All children aged 3 months to 14 years with gross hematuria

Exclusion criteria:

1. Infants less than 3 months of age
2. Parents who don't want to participate in the study

Procedure methodology

After written informed consent was obtained, a well-designed questionnaire was used to collect the data of the recruited patients retrospectively. The questionnaire included socio-demographic characteristics, General information, detailed history regarding antecedent or current illnesses, infections, urinary complaints, drug intake, lifestyle habits and kind of diet consumed was documented. Microscopic analysis of urine was done along with other relevant basic investigations for final diagnosis. Specific treatment was started and children were followed up regularly for confirming the persistence or resolution of hematuria.

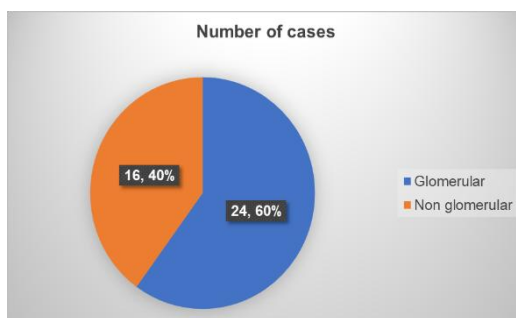
Statistical analysis

Data was analyzed using SPSS 21.0 software for analyses. Continuous variables were compared by independent t test, and categorical variables were compared by chi-square test. Time to event was compared by Cox-regression survival analysis. P value <0.05 was considered significant.

III. Result

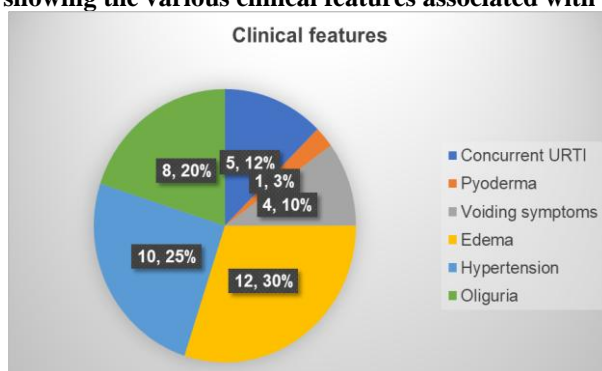
Amongst the 40 children enrolled, 24 children (60%) were of glomerular cause and 16 children had hematuria due to non-glomerular etiology

Graph 1 Pie chart showing the number of cases with glomerular and non-glomerular hematuria



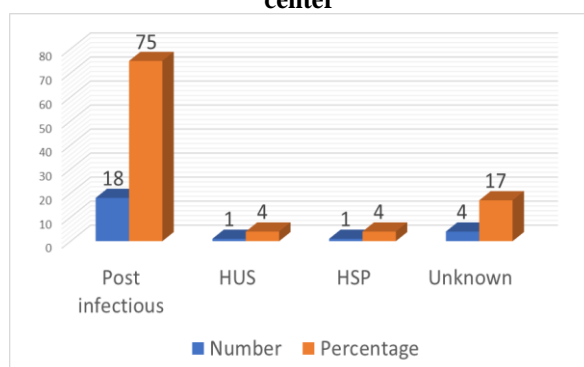
The various clinical features associated with pediatric hematuria were concurrent URTI, pyoderma, voiding symptoms, hypertension, oliguria.

Graph 2 Pie chart showing the various clinical features associated with pediatric hematuria



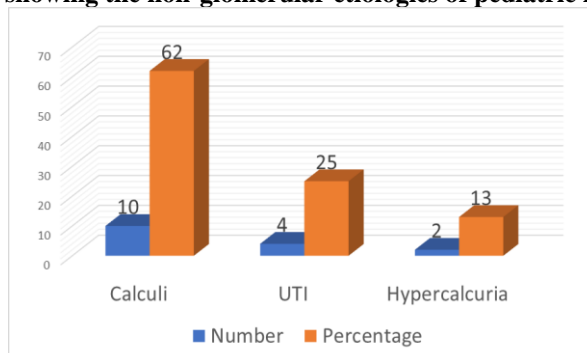
Out of the 40 subjects, URTI was seen in 5 children (12%), pyoderma was quite uncommon seen in 1 child (3%), voiding symptoms were seen in 4 children (10%), edema was observed in 12 children (30%) and hypertension was seen in 10 of them (25%) and oliguria was seen in 8 children amounting to 20%.

Graph 3 Bar diagram showing the glomerular etiologies of pediatric hematuria commonly seen in our center



Post-infectious glomerulonephritis (PIGN) was seen in 18 cases out of 40, being the commonest etiology of glomerular hematuria in our study accounting for 75%. The other etiologies were HUS hemolytic uremic syndrome, HSP Henoch Schonlein purpura 1 case each contributing to 4% and 4 cases (17%) whose cause couldn't be ascertained.

Graph 4 Bar diagram showing the non-glomerular etiologies of pediatric hematuria in our centre



Amongst the 40 cases presenting with gross hematuria considering the non-glomerular causes, renal calculi were seen in 10 cases (62%) of those with non-glomerular etiology followed by UTI in 4 cases (25%) and hypercalcuria in 2 patients (13%)

IV. Discussion

The present study is a prospective observational study in which etiology and clinical features of pediatric hematuria was evaluated. We prospectively enrolled and studied 40 children with macroscopic hematuria over 1.25 years and found glomerular causes to be more common. This was different when compared

to the study done by Youn T et al. and Bergstein J et al.^{8,9} The stark differences in etiology could be attributed to a dissimilar topographical and cultural background. Our analysis showed that infection related glomerulonephritis IRGN was the leading diagnosis in children with gross hematuria of glomerular origin.

In contrast to our study, IgA nephropathy is the commonest cause of glomerular hematuria in the study done by Hogg RJ, Silva FG, et al.¹⁰. This was also akin to the findings of predominant Ig A nephropathy amongst glomerular hematuria as studied by Moreno JA, Martín-Cleary et al.¹¹ unlike our study where IRGN constituted the vast majority. Though the incidence of IRGN has fallen in developed countries, it is still one of the most common renal disorders in children in developing countries. In our study about 1/3rd of the children presented as RPGN rapidly progressive glomerulonephritis. This number of RPGN cases are higher than studies done by Bhalla K, Gupta A, et al.¹²

As per the study done by Phadke KD, Vijayakumar M, et al. the number of children with hematuria presenting as RPGN was comparatively lesser than the findings of our study¹³

Amongst the children with AKI acute kidney injury in our study the recovery rate (80%) was higher, compared to prevailing works as shown by Askenazi DJ, Feig DI, et al.¹⁴

It was found in our study that 20% of children with glomerular etiology had persistence of hematuria and 25% of them had hypertension on follow up. Studies done by Sinha A et al., Moreno et al., and Balasubramanian R et al., show upto 35% children having persistent urinary abnormalities, hypertension at follow up^{11,15,16}

We found in our study that amongst the non-glomerular causes renal calculi, UTI were common and hematuria resolved after the underlying cause was treated.

After a median (IQR) follow up of 8 (6,14.2) months, microscopic hematuria persisted in cases with glomerular hematuria. The median time to resolution of gross as well as microscopic hematuria tended to be longer in glomerular etiologies

V. Conclusion

Hematuria can be a distressing symptom and the only clear manifestation of an underlying renal disease. A detailed history and clinical examination focused towards classifying glomerular and non-glomerular etiology is vital. A methodical approach to assessment of macroscopic and microscopic hematuria leads the Pediatrician to make a suitable diagnosis. Children presenting with gross hematuria need complete evaluation and risk classification, as glomerular causes account for a major proportion, especially in developing countries. Beginning specific therapies based on the underlying illness, immediate recognition of complications and quick referral to the Nephrologist when needed are key steps in the management of a child with hematuria.

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