ORIGINAL RESEARCH

Demographic, Clinical and Etiological profile of patients with Paediatric Haematuria; A Prospective observational study

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Abstract

Background: Haematuria is a scary symptom for both parents and treating paediatrician. Although red urine is quite common but diseases producing haematuria have quite unique set of presentations and requires relevant investigations to detect particular etiology.

Aim : We planned to evaluate the demographic, clinical and etiological profile of patients admitted with haematuria(both gross and microscopic) in children from 1mo to 14 yrs in a tertiary care hospital attached to a medical college.

Methods: This prospective observational study was conducted at a tertiary care paediatrics center attached to a medical college in eastern India. All patients ,1 mo to 14yr presenting with haematuria are included for observation.

Result: The study revealed majority of the population had gross haematuria (N= 51, 69.8%) and rest of the children were found with microscopic haematuria (N= 22, 30.1%). Glomerular cause (n-40, 54.79%)was more prevalent in comparison to non glomerular cause(n-33, 45.29%). Most common etiology amongst glomerular haematuria was PIGN(n-13, 17.8% of total) and UTI (n-16, 21.9% of total) was found to be the most common etiology in non-glomerular causes. In both gross and microscopic type glomerular etiology was found to be the most common cause followed by UTI in both, renal calculus was found to be the 3rd most common cause in gross haematuria. 17(23.3%) cases presented with recurrent haematuria. Renal calculus was the most common etiology found in recurrent haematuria cases.

Conclusion-Majority of children admitted with haematuria are of gross type, with glomerular pathology was found to be the major cause for which a planned follow up is the need of the hour. Amongst glomerular causes Post infectious glomerulonephritis and amongst non glomerular cause UTI(E. Coli) was the major cause of haematuria in our set up, which signifies infection being an important issue in our part of the world. Renal calculus found as 3rd MC cause of gross haematuria, also most common cause of recurrent haematuria.

Key words: haematuria, etiology, glomerular, non glomerular, gross , microscopic

Introduction

Presence of even a very small amount of blood in urine can make it red which is a matter of concern for the parents of a child as well as the paediatrician. Clinically, this condition known as haematuria(gross or microscopic) which should be evaluated to rule out any serious underlying renal ailments with grave prognosis. In a general paediatric setup, Ingelfinger etal., in the year 1977, reported an incidence of 1.3 gross haematuria/1,000 visits [1]. Similarly, in another study, Vehaskari et al., (1979) reported an incidence of 4.1% of microscopic haematuria in eight to 15 years old school going children [2] as also described by cho et al in 2011[13] Besides, Dodge etal., (1976), in another study reported the prevalence rate of haematuria vary with age, sex, and definition of haematuria [3].The prevalence and clinico-etiologic profile of both micro and macroscopic haematuria are reported by many authors [1-5]. However, the studies are sporadic, old, and there is a paucity of systematic paediatric haematuria reports in eastern Indian population. Hence, the objective of this single centric, prospective, and

observational investigation was to study the clinico-etiological, pathological, and demographic profile of paediatric haematuria patients (1 month to 14 years old) in an eastern Indian tertiary care setting.

Study Design and Method

This study was approved by institutional ethics committee (ECR/84/Inst/OR/2013/RR-20) and conducted during Jan 2019- Jan 2020. The children aged between one month to 14 years presenting with bothgross or microscopic haematuria (urine RBCs > 5 hp f) were enrolled in this study post inform consent execution. Children with haematuria following urinary tract/kidney surgery, post-catheterization, or associated perineal/genital inflammation, post-renal biopsy, and infants less than 1 month of age and more than 14 yrs age were excluded from this study.

Clinical features indicating glomerular aetiology include oliguria, cola-coloured/smoky urine, oedema, arthritis, rash, with or without history of pyoderma/sore throat or recurrent pharyngitis episodes. Similarly, children presented with urine sediment, fresh blood/clots in the urine, red or pink coloured urine, pus, abdominal pain, and painful micturition, fever, voiding symptoms or family history of renal stones were most likely to have non-glomerular haematuria or haematuria originating from lower urinary tract. Microscopic urine analysis showing>20% dysmorphic RBC and RBC casts, along with moderate proteinuria (dipstick method ≥2+) was considered glomerular haematuria [6,7]. Haematuria was differentiated from haemoglobinuria and myoglobinuria, where in the latter case, the urine was red without any RBCs microscopically. Besides, drugs like rifampicin, alkaptonuria, ingestion of beet root make the urine red. Hence, these causes which makes the urine red but not haematuria were ruled out in this study.

Eventually the categorization of haematuria was done based on patient history, clinical examination, microscopic urine analysis.The sample preparation for microscopic analysis was done as per the standard protocol, briefly, the urine sample were centrifuged at 2000 RPM for five minutes. The supernatant was decanted, the sediments were resuspended in 0.5 ml of urine and examined under light microscope at 20x(14). Similarly, in case of haemoglobinuria the supernatant after centrifugation remained red and urine dipstick found to be positive in spite of no RBCs in the urine. Further, investigation of the aetiology and the management was done as per the departmental protocol and standard guidelines [7].

Data collection and Statistical Analysis: The data were collected prospectively against a questionnaire on a Microsoft excel spreadsheet and the clinical workup of all included patients were done by the researcher. The statistical analysis was performed using SPSS version 21 for windows (SPSS, Inc, Chicago). The results were presented descriptively (mean ± SD and n%) to describe the baseline characteristics and Clinico-etiological features and incidence.

Result: In this study, out of 73 paediatric haematuria patients, 68.5% were males and 31.5% were females. The mean age, height, and weight of the participants were 6.5±3.6 years, 111.2 ±22.6 kg, and 20.15 ± 9.1cm respectively (Table 1).

Table1: Baseline characteristics and Clinical presentation

Baseline & Clinical presentation	**Mean±SD**	
Age	6.5±3.6	
Weight	20.15 ± 9.1	
Height	111.2 ±22.6	
Sex	M **(N, %)**	F **(N, %)**
	50, 68.5	23, 31.5
Clinical presentation	**(N, %)**	
Fever	39 (53.5)	
Edema	43 (58.9)	
Abdominal pain	36 (49.3)	
Oliguria	40 (54.8)	

Frequency and urgency	10 (13.7)
Dysuria	13 (17.8)
Hypertension	28 (38.4)
Jaundice	8 (11)
Recurrent Hematuria	17 (23.3)

Majority of the patients presented with fever (53.5%), oedema (58.9%), abdominal pain(49.3), oliguria (54.8%), and hypertension (38.4). Fever, pain abdomen, dysuria were more common in non glomerular ones while glomerular etiology commonly presented with oliguria, edema, hypertension along with haematuria. Out of 73 patients 17 (23.3%) had recurrent haematuria and renal calculus was found to be the common cause of glomerular haematuria. Rest all clinical presentations are enumerated in the table 1.The study revealed majority of the population had gross haematuria (N= 53, 72.60%) and rest of the children were found with microscopic haematuria (N= 20, 27.39%).In both gross and microscopic type glomerular etiology was found to be the most common cause followed by UTI in both, renal calculus was found to be the 3rd most common cause in gross haematuria. 17(23.3%) cases presented with recurrent hematuria. Renal calculus was the most common etiology found in recurrent haematuria cases.Routine pathological investigations were done in all cases. The mean haemoglobin was 9.95 ± 1.67mg/dl which indicates mild anaemia in the study population. The median platelet count was found to be 2.79 lacs/cmm with a minimum of 0.13 to maximum of 5.94lacs/cmm. This indicates non-haematogenous nature of the disease. Serum electrolytes were within the normal range (Table 2). The rest all parameters are presented in table 2.

Table 2. Microscopic Investigation

Pathology parameters	Mean	Median (Range)
Hb/mg	9.95 ± 1.67	-
TLC/mm^3	13174.11 ± 54	-
PLT lacs/ cmm	-	2.5 (0.13-5.94)
Serum Sodium mEq/L	141.29 ± 7.03	-
Serum potassiummEq/L	4.23 ± 0.67	-
Serum Urea mg/dL	-	39.50 (11-262)
Serum creatininemg/dL	-	0.80 (0.31-6.24)
Serum Calcium mg/dL	1.01±.057	-
Serum C3	-	39 (16-180)
Serum C4	-	17 (5-36)
	N (%)	
Dysmorphic RBC	25 (34.2)	
AKI	27 (37)	
Urine c/s	12 (16.6)	
E.Coli	8 (11)	
Enterobacter	1 (1.4)	

Enterococcus	1 (1.4)
Klebsiella	1 (1.4)
Proteus	1 (1.4)

Based on clinical features, urine analysis, biochemical investigation, imaging, and biopsy, glomerular cause was more prevalent in this study population (N=40, 54.79%) compared to non-glomerular causes (N=33, 45.29). Among glomerular haematuria 13 cases(17.8%) were diagnosed as post infectious glomerulonephritis (PIGN). The next prevalent underlying causes of glomerular haematuria in this study population were Sickle cell disease (SCD), Henoch-Schönlein purpura (HSP) nephritis and C1q glomerulonephropathy with the percentage of 5.5, 3.42 and 3.42 correspondingly. The rest all parameters are depicted in table 3.

Table3: Etiology of haematuria (Glomerular/non glomerular)

Glomerular (n,%) N= 40		**Non-Glomerular (n, %) N= 33**	
PIGN	13, 17.8	UTI	16, 21.9
FRNS	1, 1.4	Nephrolithiasis	8, 11
SRNS	2, 2.7	hydroureteronephrosis	2, 2.7
IgA Nephropathy	1, 1.4	Snake bite	4, 5.5
SLE nephritis	2, 2.7	Sepsis	2, 2.7
C1q glomerulonephropathy	3, 4.1	Malaria	5, 6.8
HSP nephritis	3, 4.1	ITP	1, 1.4
Good pasture syndrome	1, 1.4	PIGMENT Nephropathy	1, 1.4
IgM nephropathy	1, 1.4	Rhabdomyosarcoma uterus	1, 1.4
Sickle cell disease	4, 5.5		
Alport syndrome	1, 1.4		
CKD	1, 1.4		

Similarly, in non-glomerular causes, urinary tract infection (UTI)was the primary cause found in 16 (21.9%) patients and nephrolithiasis (in eight patients,11%) was the second leading cause of non-glomerular haematuria in our studied population. The urine c/s revealed predominantly E. coli (11%) as most common organism causing UTI followed by Enterobacter, enterococcus, klebsiella, and proteus as the causative organisms. Besides, malaria and snakebite were presented with gross haematuria in 6.8% and 5.5% children correspondingly. One unusual cases of a girl child had rhabdomyosarcoma of uterus presented with haematuria and abdominal mass in this study.(Table 4)

Table 4: Etiology of gross and microscopic haematuria

Etiology	**Gross haematuria (n, %), total-51**	**Microscopic (n, %), total 22**
PIGN	13	nil
UTI	10	6
Renal calculus	**7**	1
Snake bite	4	Nil

Sickle cell ds	4	Nil
Malaria	4	1
Sepsis	2	Nil
SLE nephritis	1	1
HSP nephritis	1	2
Good pasteure syndrome	1	Nil
IgA nephropathy	1	1
Alport syndrome	1	Nil
AIHA	1	Nil
ITP	1	Nil
Rhabdomyoma of uterus	1	Nil
FRNS	NIL	**5**
CKD	NIL	1
SRNS	NIL	2
IgM nephropathy	Nil	1
Pigment nephropathy	Nil	1

Discussion

The term haematuria is combination of two Greek words *haima* (blood) and *ouron* (urine) that together represent the presence of blood in the urine. In this condition, when the blood in the urine is visible to the naked eye it is called as macroscopic haematuria/gross haematuria or frank haematuria. Similarly, when red blood cells (RBCs) >5/μL of urine are seen under microscope are called microscopic haematuria [2]. Haematuria in paediatric patients is an indicative of diverse underlying aetiologies of varying pathologic implications. Hence, it is pivotal for the physician to identify the disease, initiate accurate diagnostic work up and in case of requirement to quickly refer the patient for subspecialty care.In this study, out of 73 cases 17 (23.3%) had recurrent haematuria, that implies most of the cases were new and give a clue that PIGN and UTI could be the major cause. Only one case had family history who was diagnosed with Alport syndrome. The prevalence of gross haematuria was more prevalent in males (n=38, 77.6%) compared to females (15, 65.2%) which is similar to findings observed in a study done by Kirtisudha mishra et al[15] Like wise in case of microscopic haematuria, the incidence was more in male (11, 22.4%) versus females (8, 34.8%) in contrast to other studies where they found a female preponderance[16]. In our study, was most prevalent in school going children aged between 5-10 years similarly as that of others report [1-3]. The gross haematuria of glomerular origin is more prevalent in this study unlike previous reports in where non-glomerular cause was predominant [7,8]. But Indian studies done by Mishra K et al [15] shows glomerular etiology(mc-PIGN) as major cause. These studies[7,8] were conducted in different geographical location and in other ethnic groups compared to our study where majority of the studied population belonged to low socio-economic group. It is most likely possible in a developing country, delayed disease presentation or reference to a speciality clinical setting results in late diagnosis. Oedema and oliguria along with cola colored urine are the most common presenting features of PIGN which was most prevalent cause of gross haematuria of glomerular origin This finding contracts the previously published reports where IgA nephropathy reported to have contributed significantly to macroscopic haematuria [8-11].this findings suggest PIGN is still a major problem in developing countries like us similar to other articles[17, 18] Fever, symptoms of frequency, urgency, dysuria are common among non-glomerular (13.7%) causes of haematuria, which proves UTI as the commonest cause in non-glomerular causes in our study in contrast to other studies[19] where most common cause was idiopathic hypercalciuria. Besides, other

predominant clinical presentation found in our study were Oliguria (N=40, 54.8%), Oedema (N=43, 58.9%), abdominal pain (N=36, 49.3%) and hypertension (N=28, 38.4%). Cola or burgundy colored urine along with recent history of URTI or pyoderma, hypertension, oedema or oliguria are suggestive of acute post-streptococcal glomerulonephritis (APSGN). Similar clinical findings are found in other studies[15].As per a 2007 Korean study, five million children studying in schools were subjected to systematic urine analysis to identify chronic renal ailment in its early stage [13]. However, we lack such investigation at school level and end up with delayed presentation and poor prognosis.

Conclusion

This prospective investigation revealed that gross haematuria was predominant compared to the microscopic haematuria. Incidence was more in boys compared to girls. Glomerular etiology was found to be the most common cause in both gross and microscopic forms of hematuria patients. In glomerular haematuria and in non-glomerular haematuria PIGN and UTI are most prevalent aetiology respectively with renal calculus being quite common in non-glomerular cases as well as a cause of recurrent hematuria. Children presenting any form of haematuria need thorough investigation and risk stratification for early detection and improved prognosis. A thorough investigation, treatment and follow up protocol is the need of the hour in view of glomerular aetiology as major cause and delayed diagnosis and management may lead to increase in chronic renal disease.

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