

Pattern of infection in children presented with obstructive uropathy – a hospital based study.

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Abstract:

Background: Obstructive uropathy refers to the structural impedance to the flow of urine anywhere along the urinary tract which may result from congenital (anatomic) lesions or can be caused by trauma, neoplasia, calculi, inflammatory process or surgical procedure. It is responsible for about 4% of end-stage renal disease. Obstructive uropathy is invariably associated with some co-morbid conditions specially infection. **Objective:** This study was conducted in the department of pediatric nephrology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, Bangladesh with an objective to identify different pattern of infections in children with obstructive uropathy. **Methods:** A total of 55 patients of obstructive uropathy were enrolled. Thorough clinical and laboratory evaluation including hematological, biochemical, radiological and radio nucleotide imaging were done along with blood and urine culture. **Result:** Out of 55 cases, 42.27% of obstructive uropathy was detected between 1 to 5 years and 89.27% was infected. Among obstructive uropathy cases, majority had posterior urethral valve (PUV) (42.27%). Urinary tract infection was the commonest (60%) type of infections followed by septicemia and respiratory tract infection. **Conclusion:** Age between 1 to 5 years was the commonest age of children for hospital admission due to obstructive uropathy. Among various manifestations of obstructive uropathy, infections, mostly urinary tract infection was the commonest one.

Key Words: obstructive uropathy, infection, micro-organism.

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Introduction:

Obstructive uropathy is an important cause of chronic renal failure in children.¹ Obstruction is defined as an impediment to the urinary outflow which if not treated promptly, can cause progressive renal damage.¹ Urinary tract obstruction can result from congenital (anatomic) lesions or can be caused by trauma, neoplasia, calculi, inflammatory process or surgical procedure.² Each year about 2/1000 people in the United States of America (USA) are hospitalized for obstructive uropathy.³ The condition has a bimodal distribution. In childhood, it is mainly due to congenital anomalies of the urinary tract.³ Overall, obstructive uropathy is responsible for about 4% of end-stage renal disease.³ Children generally present

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with dribbling of urine, pain during micturition, fever, urinary tract infection, poor stream and palpable bladder and kidney.¹ Infection complicating obstruction may cause dysuria, pyuria, urinary urgency and frequency, referred kidney and ureteral pain, costovertebral angle tenderness, fever, and, occasionally, septicemia.³ Most obstruction can be corrected, but a delay in therapy can lead to irreversible renal damage. How long it takes for nephropathy to develop is variable depending on the underlying pathology, the presence or absence of Urinary Tract Infection (UTI), and the degree and duration of the obstruction. Prognosis is worse if UTI remains untreated.³

From March 1993 to December 1994, a study was conducted among a total of 304 children less than 5 years of age with their first documented symptomatic urinary

tract infection who presented consecutively to the emergency department of a paediatric hospital in Australia. Of those patients bacteraemia occurred in 6%, all of whom were under 6 months of age. *E. coli* was the causal organism in 84%.⁴ Using the US Healthcare Cost and Utilization Project Kids Inpatient Database, a sample size of 2832 children were studied. They identified that comorbid UTIs complicated 6.7% of congenital obstructive uropathy (COU), which increased mean hospital charges by \$7910 (\$4770-\$11,040) and length of hospital stay (LOS) by 2.66 days as compared to COU discharged without associated UTI. These children deserve special attention, not only to reduce hospital costs, but more importantly because these complicated UTIs may complicate other comorbid conditions such as chronic kidney disease that may accompany the CUO.⁵

Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka is a tertiary level hospital in Bangladesh which deals with referral cases from the whole country. Every year a number of obstructive uropathy cases presenting with features of different types of infections along with symptoms of urinary tract obstruction get admitted into this hospital. The objective of this study was to identify different patterns of infections with which children with obstructive uropathy presented in our tertiary care centre.

Methods:

It was a cross sectional study. A total of 55 children of various types of obstructive uropathy who got admitted in the Department of Pediatric Nephrology, BSMMU between July 2005 to November 2006 along with different types of infection were included in this study. Those who received oral and parenteral antibiotics prior to hospital admission were excluded.

After obtaining informed written consent, data were collected using standard questionnaires. The characteristics examination included age and sex of patients, presenting complaints like urinary incontinence, dribbling, straining, narrow stream, hematuria, presence of abdominal mass, abdominal pain, dysuria, respiratory distress, fever or not growing well. Patients were thoroughly examined. During examination, degree of pallor, respiratory rate and pattern, temperature, heart rate, blood pressure, edema, anthropometry and bed side urine test for albumin were looked for. Regarding systemic examination, urogenital system, cardiovascular system, respiratory system and vertebral spine were examined thoroughly. Complete blood count included hemoglobin percentage, total and differential counts of white blood corpuscles, peripheral blood film, urine for routine and microscopic examination were also done. Urine for culture and sensitivity with colony count, 24 hours urine for total protein, blood urea, serum creatinine, serum electrolyte were sent as a part of detailed evaluation. Glomerular filtration rate was estimated by Schwartz formula considering 0.45 in infant and 0.55 in children as the constant (K). Chest xray was done for patients with respiratory complains and suspected pneumonia cases.

Blood culture was done in blood agar, chocolate agar and Mac-conkeys agar media. Collection of urine specimen varied with age like midstream clean catch specimen, from bag applied to the perineum and temporary transurethral catheterization. Early morning urine sample was preferred. Urine culture was done in chromogenic media. In positive cases sensitivity pattern was also identified. Digital chest X-Ray and relevant renal imaging were performed. Ultrasonogram of KUB region was done by expert sonologists of the Institute of Nuclear medicine and Ultrasound of BSMMU by using Toshiba 2D machine. DTPA renogram was done to see total and

split renal function and here Tc99 isotope. For anatomical details, DMSA Scintigraphy by using commercially available kit with Tc99 isotope was used. For Micturating Cystourethrogram (MCU) and Intra Venous Urography (IVU) the dye Lopamiro was used. Radionuclide imaging was considered according to requirement on the basis of presenting complaints and physical findings of patients. Patients need for radio-imaging of renal tract were individualized and all modalities of imaging were not done for each and every patient. The characteristics were tabulated. Data were analyzed as percentage of the total and inference was drawn.

Result:

In this cross sectional study, a total of 55 patients of obstructive uropathy were enrolled. Out of 55 patients 47.27% were between 1 to 5 years age group. In our study 89.09% patients were male and only 10.91% patients were female and male female ratio was 8: 1. There was a variety of obstructions like Posterior urethral valve(PUV), Pelvi-ureteric junction(PUJ) obstruction, Vesico Ureteric Reflux(VUR), Bladder neck hypertrophy (BNH) etc. Highest incidence of Posterior urethral valve (27.27%) was seen followed by Posterior urethral valve along with Vesico Ureteric Reflux (18.18%), PUJ obstruction (16.36%) and VUR (12.72%) and also neurogenic bladder (Table 1). The presentation of obstructive uropathy varied depending upon underlying cause. The common presentations were incontinence, dribbling and narrow stream (87%), abdominal mass (71.23%), fever (81.03%) and not growing well (15.76%) along with other features (Table 2). Among all cases of obstructive uropathy, 60% patient had UTI during admission. 12.72% had septicemia, 3.63% with Respiratory Tract Infection (RTI) and 23.63% patients were free from infection (Table 3). E.coli was the

most common etiological agent (84.37%) for UTI cases followed by Klebsiella(12.50%) and streptococcus(3.12%) (Table 4). Cefixime had the highest sensitivity (100%) for Klebsiella. For Streptococcus, both cefixime and ceftriaxone showed the highest (100%) sensitivity. But E.coli, showed the maximum sensitivity for ceftriaxone(96.4%) followed by for cefradine(89.2%) and cefixime(85.7%) respectively (Table 5).

Table - I

Types of obstructive uropathy in studied patients (N:55)

Types of obstruction	No of cases	%
PUV	15/55	27.27
PUJ unilateral	5/55	9.0%
obstruction Bilateral	4/55	7.27%
VUR Unilateral	2/55	3.63%
Bilateral	5/55	9.0%
Bladder outlet obstruction		
BNH	3/55	5.45
Stricture Urethrae	1/55	1.81
Urethral diverticulum	1/55	1.81
Others		
PUV+VUR	10/55	18.18
PUV+ UB Diverticulum	4/55	7.27
PUV + BNH	2/55	3.63
nephrolithiasis	1/55	1.81
Congenital megaureter	1/55	1.81
BNH + VUR	1/55	1.81

NB: PUV- Posterior urethral valve, VUR- Vesico Ureteric Reflux, PUJ- Pelvi-Ureteric Junction Obstruction obstruction, BNH- Bladder neck hypertrophy, UB- Urinary bladder.

Table-II
Presenting features of the patients according to type of obstructive uropathy (n=55)

Types of obstruction	Incontinence/ Dribbling/ Straining/ Narrow stream	Abdominal mass	Hematuria	Dysuria/ Abdominal pain	Respiratory Distress	Fever	Not Growing well
PUV	10/15 (66.6%)	4/15 (26.7%)	0/15 (0%)	1/15 (6.7%)	0/15 (0%)	9/15 (60%)	3/15 (20%)
PUJ obstruction	4/9 (44.4%)	6/9 (66.7%)	0/9 (0%)	4/9 (44.4%)	0/9 (0%)	5/9 (55.5%)	1/9 (11.1%)
VUR	6/7 (85.7%)	0/7 (0%)	1/7 (14.2%)	0/7 (0%)	0/7 (0%)	3/7 (42.8%)	1/7 (14.2%)
BNH	2/3 (66.7%)	2/3 (66.7%)	0/3 (0%)	0/3 (0%)	0/3 (0%)	2/3 (66.7%)	0/3 (0%)
Stricture	1/1 (100%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)
Urethrae	1/55 (100%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	1/1 (100%)
Congenital megaureter	1/55 (100%)	1/1 (100%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	0/1 (0%)
Urethral diverticulum	1/55 (100%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	0/1 (0%)	1/1 (100%)	0/1 (0%)
Nephrolithiasis	1/55 (0%)	0/1 (0%)	0/1 (0%)	0/2 (0%)	1/2 (50%)	0/2 (0%)	0/2 (0%)
PUV + BNH	2/55 (50%)	2/10 (20%)	0/10 (0%)	1/10 (100%)	0/10 (0%)	8/10 (80%)	0/10 (0%)
PUV+VUR	8/10 (80%)	1/4 (25%)	1/4 (25%)	3/4 (75%)	1/4 (25%)	3/4 (75%)	1/4 (25%)
PUV+ UB	1/4 (25%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	0/1 (0%)	0/1 (0%)	1/1 (100%)
Diverticulum	4/55						
BNH + VUR	1/1 (100%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	0/1 (0%)	0/1 (0%)	1/1 (100%)

NB: PUV- Posterior urethral valve, VUR- Vesico Ureteric Reflux, PUJ- Pelvi-Ureteric Junction Obstruction obstruction, BNH- Bladder neck hypertrophy, UB- Urinary bladder.

Table-III
Type of infections in different types of obstructive uropathy (n=55)

Obstructive Uropathy	Total No of cases (n)	UTI	Septicemia	RTI	No infection
PUV	15	12/15 (80%)	1/15 (6.6%)	1/15 (6.6%)	1/15 (6.6%)
PUJ obstruction	9	1/9 (11%)	3/9 (33%)	0/9 (0%)	5/9 (55%)
VUR	7	6/7 (85.7%)	0	0	1/7 (14.2%)
BNH	3	1/3 (33.33%)	0	0	2/3 (66.66%)
Strictu re Urethrae	1	1/1 (100%)	0	0	0
Congenital megaureter	1	1/1 (100%)	0	0	0
Urethral diverticulum	1	0	0	0	1/1 (100%)
nephrolithiasis	1	1/1 (100%)	0	0	0
PUV + BNH	2	1/2 (50%)	1/2 (50%)	0	0
PUV+VUR	10	5/10 (50%)	2/10 (20%)	1/10 (10%)	2/10 (20%)
PUV+ UB Diverticulum	4	3/4 (75%)	0	0	1/4 (25%)
BNH + VUR	1	1/1 (100%)	0	0	0

NB: PUV- Posterior urethral valve, VUR- Vesico Ureteric Reflux, PUJ- Pelvi-Ureteric Junction Obstruction obstruction, BNH- Bladder neck hypertrophy, UB- Urinary bladder.

Table-IV

Micro organisms isolated in UTI cases in patients with obstructive uropathy (n=55)

Obstructive Uropathy	UTI Cases (n=33)	E.coli (n=28)	Streptococcus (n=1)	K lebsiella (n=4)
PUV	12	10 /12 (83.33%)	0	2/12 (16.66%)
VUR	6	5/6 (83.33%)	1/6 (16.66%)	0
PUJ obstruction	1	1/1 (100%)	0	0
BNH	1	1/1 (100%)	0	0
Stricture Urethrae	1	0	0	1/1 (100%)
Congenital megaureter	1	0	0	1/1 (100%)
nephrolithiasis	1	1/1 (100%)	0	0
PUV + BNH	1	1/1 (100%)	0	0
PUV+VUR	5	5/5 (100%)	0	0
PUV+ UB Diverticulum	3	3/3 (100%)	0	0
BNH + VUR	1	1/1 (100%)	0	0

NB: PUV- Posterior urethral valve, VUR- Vesico Ureteric Reflux, PUJ- Pelvi-Ureteric Junction Obstruction obstruction, BNH- Bladder neck hypertrophy, UB- Urinary bladder.

Table-V
A Microbial agents and their sensitivity pattern to antimicrobials (n=55)

Antimicrobials	E.coli		streptococcus		klebsiella	
	S	R	S	R	S	R
Cefradine	25/28 (89.25%)	3/28 (10.75%)	0	1(100%)	3/4 (75%)	1/4 (25%)
cefixime	24/28 (85.7%)	4/28 (14.3%)	1/1 (100%)	0	4/4 (100%)	0
Ceftriaxone	27/28 (96.40 %)	1/28 (3.6 %)	1/1 (0%)	0	2/4 (50%)	2/4 (50%)
Amikacin	0	28/28 (100 %)	0	1/1 (100 %)	2/4 (50%)	2/4 (50%)
Nitrofurantoin	0	28/28 (100 %)	0	1/1 (100 %)	2/4 (50 %)	2/4 (50 %)
Imipenem	25/28 (89.25%)	3/28 (10.7 5%)	1/1 (100 %)	0	0	4/4 (100 %)

NB:S- Sensitive , R - Resistant

Discussion:

Obstructive uropathy is one of the commonest cause of hospitalization of children. It refers to the structural impedance to the flow of urine anywhere along the urinary tract leading to 'hydronephrosis', which is the dilation of the renal pelvis and calyces.⁶ Dilatation of the renal pelvis can occur even in the absence of urinary obstruction; therefore, hydronephrosis and obstructive uropathy are not interchangeable or synonymous terms. The damage to renal parenchyma caused by these conditions often leads to 'obstructive nephropathy' contributing to a decrease in renal function.⁷ Unlike many other renal diseases, obstructive uropathy, if treated early, is a potentially curable form of kidney disease.⁸

Obstructive uropathy accounts for 16.5% of all preventive strategies need to be devised in the United States.^{9,10} Prenatal ultrasound in the antenatal period is the cornerstone of early detection^{11,12}

Very often, children with various forms of obstruction in urinary tract present with infection. But there are very few studies in this regard. This study tried to highlight different patterns of infections in a child with obstructive uropathy.

In this study, 55 children of both sexes from 8 months to 13 years with different types of obstructive uropathy were clinically, biochemically, hematologically and microbiologically evaluated. Radio-nucleotide analysis was also done to find out different types of obstruction, infection and extent of renal impairment. It was observed from this study that, most of the patients (47.27%) were between 1-5 years of age range (mean age 33 months), most of whom were male (89.09%). This result has similarity to another study conducted in department of pediatrics, Osaka Medical College, Japan which shows 21 reported patients of obstructive uropathy ranging from 0.4 to 3 years. The sex distribution showed a strong male predominance.¹¹ In BSMMU, the most common pattern

was posterior urethral valve (27.27%), but, in a study conducted in department of pediatrics, South Valley University, Egypt to screen for obstructive uropathy in rural Egyptian children showed the highest prevalence for mild pyelocaliectasis (antero posterior renal pelvic diameter 10-15 mm) followed by presence of urinary tract stones.¹⁰ Here the common presenting features of urinary tract obstruction was incontinence, dribbling, straining, narrow stream, abdominal mass, hematuria, abdominal pain, respiratory distress, fever and not growing well. Urinary tract infection was found to be the most frequent (60%) co-morbid condition, followed by septicemia (12.72%) and respiratory tract infection (3.63%). Obstruction anywhere in the urinary tract causes stasis of urine. This provides a favorable environment for bacterial proliferation, multiplication and development of symptomatic or asymptomatic UTI. In this study, UTI was considered to be present when the centrifuged urine contained more than 5 pus cells per high power field along with a positive urine culture for organism whether symptomatic or not. In a similar study regarding epidemiology of symptomatic UTI in children, VUR (19.9%) and PUV (27.6%) were found to be the common risk factors in children suffering from UTI.¹²

E. coli (84.37%) was isolated from most of the patients suffering from UTI where other patients had growth of streptococcus and klebsiella. Most of the infectious cases were sensitive to ceftriaxone, cefradine and cefixime followed by levofloxacin, amikacin and nitrofurantoin, probably due to haphazard and irrational use of antibiotics in the community.

As obstructive uropathy of any type is a cause of chronic sufferings, children become immune compromised. So risk of other types of infections increase as well. Besides UTI, some children were found to have sepsis as another co-morbidity. There are some case reports in this regard.¹³ Sepsis is a potentially fatal whole body inflammation caused by severe infection. Patients having clinical features of sepsis and a positive blood culture were included in this category.

Respiratory tract infection (RTI) included both upper and lower respiratory tract infections. Upper respiratory tract infections included tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media, influenza and common cold. Lower respiratory tract infection (pneumonia) was considered as more serious than the upper respiratory tract infections. In this study, patients were considered to have upper respiratory tract infection if symptoms and signs were suggestive, and lower respiratory tract infection if there was radiological finding. There is a review of acute bilateral obstructive uropathy among 3258 children who have various forms of upper respiratory tract infections and also pneumonia.¹⁴

It was observed from this cross sectional study that obstructive uropathy with their variable presentation commonly seek medical advice between 1 to 5 years. Among the various presentations infection is the commonest one which may lead to chronic kidney disease if not detected and treated.

Conclusion:

It is concluded from this study that age between 1 to 5 years is the commonest age of children for hospital admission due to obstructive uropathy. Posterior urethral valve in male child is the leading cause of obstructive uropathy. Among various manifestations of obstructive uropathy, infections, mostly urinary tract infection is the commonest one.

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