

Spectrum of infection in hospitalized adult nephrotic syndrome patients

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World Journal of Biology Pharmacy and Health Sciences, 2026, 26(02), 200-208

Publication history: Received on 08 April 2026; revised on 16 May 2026; accepted on 18 May 2026

Article DOI: <https://doi.org/10.30574/wjbphs.2026.26.2.0246>

Abstract

Background: Patients with nephrotic syndrome are prone to infections due to immune dysfunction. This study evaluated the spectrum of infections and causative organisms.

Aim of Study: To see the pattern of different infection encountered in adult nephrotic syndrome along with antibiogram

Material & Methods: A prospective study was conducted on 50 nephrotic syndrome patients admitted to Chittagong Medical College Hospital over six months, excluding those on prior antibiotics. Infection types, organisms, and antibiotic sensitivity were analyzed.

Results: Out of 50 patients, 54% were male. Common symptoms included edema (100%), fever (38%), and dysuria (20%). Urinary tract infection (UTI) was most frequent (18%), followed by tuberculosis (6%), pneumonia (4%), skin and soft tissue infection (4%), peritonitis (4%), and bacteremia (2%). Focal segmental glomerulosclerosis was the most common histological type (32%). *Escherichia coli* was the predominant pathogen, showing sensitivity to multiple antibiotics, while *Klebsiella* was the second most common.

Conclusion: Overall, early detection, rational antibiotic use, and improved hygiene practices are crucial to reduce infection-related morbidity in nephrotic syndrome patients.

Keywords: UTI; Nephrotic syndrome; *E coli*; Infection

1. Introduction

The definition of nephrotic syndrome includes massive proteinuria, hypoproteinemia (serum albumin < 2.5gm/dl), generalized edema and hyperlipidemia (>250 mg/dl)¹. Arbitrarily nephrotic proteinuria is defined as a urinary protein excretion of greater than 3.5 gm/24 hour in adult.¹ Kidneys affected by nephrotic syndrome have small pores in the podocytes, large enough to permit proteinuria (and subsequently hypoalbuminemia, because some of the protein albumin has gone from the blood to the urine) but not large enough to allow cells through (hence no hematuria). By contrast, in nephritic syndrome, RBCs pass through the pores, causing hematuria.² Infection is the major complication of nephrotic syndrome. The incidence of infection in childhood nephrotic syndrome is high then adult nephritic syndrome, mostly seen in the developing countries. Common infections are urinary tract infection (UTI), respiratory

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tract infection(RTI), blood stream infection(BSI), skin and soft tissue infection(SSTI), peritonitis, tuberculosis and some other uncommon infections.^{3,4}Children in relapse have increased susceptibility to bacterial infections because of urinary losses of immunoglobulins and properdin factor B, defective cell-mediated immunity, their immunosuppressive therapy, malnutrition, and edema or ascites acting as a potential culture medium. Spontaneous bacterial peritonitis is a common infection, although sepsis, pneumonia, cellulitis, and urinary tract infections may also be seen.² An uncontrolled study found a reduction in the rate of bacterial infections after the intravenous administration of IgG.³There might have grave infection with minimal physical findings due to extensive use of corticosteroids or combination with other immunosuppressive agents.³ Infection were the chief cause of mortality with nephrotic syndrome in the pre- antibiotic era, and still account for a considerable morbidity.^{5,6}

There are several explanations for this increased risk, including

- Edema, which acts as good culture media for infection
- Urinary loss of factor B and D of the alternative complement pathway, which is crucial for the phagocytosis of encapsulated bacteria such as *S. pneumonia*
- Decreased serum immunoglobulin due to increased urinary loss and tubular catabolism of IG
- Impaired polymorph phagocytic function
- Decreased perfusion of spleen due to hypovolemia.
- Malnutrition
- Secondary effects of corticosteroids

Among all infection in adult nephrotic syndrome urinary tract infection is an important but often under diagnosed infection with nephrotic syndrome. Incidence of UTI in nephrotic syndrome is high⁴. UTI has also been reported to adversely influence the response of patient with nephrotic syndrome to corticosteroids. In addition to immunosuppression and other factors, the pressure on the collecting system by edematous pyramids causes narrowing and functional obstruction of the flow of urine that renders it more vulnerable for developing urinary tract infection.^{7,8}Most studies observed that UTI and lower respiratory tract infection were the most frequent infections and there was a relative low incidence of serious infection such as sepsis, peritonitis and meningitis in hospitalized nephrotic patients. Those findings are like the results from two retrospective studies. Gulati DM et al³ study found that the incidence of UTI was high (13.2%) and was the most common infection followed by tuberculosis (7.2%), peritonitis (5.1%), skin infection (3.2%), respiratory tract infection (3.1%), and sepsis (2.4%) respectively. In UTI *E. coli* was the most common etiological agent (61.2%) Mc Viar M et al⁴ showed incidence of UTI was 16% in their study. Many hospitals indoor beds are occupied by the patient of nephrotic syndrome. Repeated relapses are responsible for such burdens which are often caused by UTI, RTI and bacteremia.⁹ In our country some study on nephrotic syndrome is done, it has been shown that UTI is the commonest infection of nephrotic syndrome⁶. So, this study is planned to see the pattern of different infection encountered in adult nephrotic syndrome along with antibiogram which may help selecting appropriate antibiotic empirically to treat infection in nephrotic syndrome.

2. Material and methods

2.1. Type of study

Cross Sectional study

2.2. Place of study

Department of Nephrology and Department of Medicine Chittagong Medical College Hospital

2.3. Period of Study

Six months

2.4. Study population

All patients of nephrotic syndrome those was admitted in the CMCH and histopathological diagnosis performed

2.5. Sample size

A sample size of 50 consecutive nephrotic syndrome patients.

2.6. Selection criteria

2.6.1. Inclusion criteria

- Patients diagnosed as nephrotic syndrome and histopathological exam done
- Age above 18 years
- . Voluntarily given consent to participate in the study

2.6.2. Exclusion criteria

- Nephrotic syndrome with other co morbidity like malignancy, stroke, Acute kidney injury (AKI), chronic kidney disease (CKD) or urogenital anomalies.
- Subjects who are taking antibiotics before admission

2.7. Sampling technique

Purposive Sampling

2.8. Study procedure

Diagnosed cases of nephrotic syndrome patients were thoroughly informed about the aims, objectives and detail procedure of the study before examination. He/She was encouraged for voluntary participation and allowed freedom to withdraw from the study whenever she/he liked even after participation. From all eligible subjects after getting consent clinical history was taken and clinical examination was done to elicit findings related to nephrotic syndrome and its complication. Related investigations like urine examination, blood examination, chest X-ray, ascitic fluid study was done. 10cc venous blood was collected after proper sterilization after diagnosis of nephrotic syndrome. Fresh mid-stream clean catch urine was collected in a sterile container for different tests. Ascitic fluid when appropriate was also collected by maintaining proper procedure by researcher himself. Sputum for Gram stain, AFB stain and culture were performed, and MT was done in suspected cases. Blood sample, ascitic fluid and urine sample were cultured in appropriate media like Nutrient Agar, Blood Agar and Mac-konkey's Agar to see the growth pattern and anti-bio gram was done to see the sensitivity pattern if growth is positive. Kidney biopsy was done to confirm the adult nephrotic syndrome in the Nephrology ward in presence of the guide by a trained and expert nephrologist and histopathology done by expert histopathologist in the Department of Pathology of CMCH. All relevant data were noted in the pretested data sheet. The blood was collected by researcher himself. All relevant investigations were done in the biochemistry and clinical pathology departments and microbiology Departments of CMCH.

2.9. Collection of Urine Specimen

The specimen for urine culture was obtained carefully to prevent contamination by periurethral flora. A clean-catch midstream urine specimen was used. Early morning mid-stream urine specimens was collected into a sterile universal bottle after discarding of initial 50 ml although in case of adult 200 ml was advised. The collected specimen was sent to the laboratory where immediate processing was done, or it was stored at 4°C in the refrigerator until processing carried out within 12 hours of collection.

2.10. Data Analysis

The data were compiled, analyzed and then tabulated according to key variables. Data was analyzed using SPSS for Window's – 18 employing necessary statistical tools. Chi-square tests was performed to examine possible association between 2 categorical variables. The mean and standard deviations of the urinary profiles were computed. A p-value of < 0.05 at 95% CI will be considered significant.

3. Results

3.1. Sociodemographic Status(N=50)

Regarding gender analysis of 50 study patients 27(54%) were found male and 23(46%) were female. Male to female ratio was 1.17: 1. Among the 50 patients 12(24%) patients were in service, and 19(38%) were housewives. Among 50 patients 28(56%) were from upper middle class and 20(40%) were from lower middle class 2(4%) were from low socioeconomic group.

Table 1 Sociodemographic Status of the study patients(N=50)

Gender	Frequency	Percent
Male	27	54
Female	23	46
Total	50	100
Occupation		
Service	12	24.0
Farmer	2	4.0
Business	3	6.0
Housewife	19	38.0
Others	14	28.0
Total	50	100.0
Socioeconomic status*		
Low	2	4.0
Lower middle class	20	40.0
Upper middle class	28	56.0
Total	50	100.0

3.2. Clinical features of the study patients

Regarding analysis of clinical symptoms of patients the dominating clinical features were present and past history of body swelling (100%), others were fever (38%) dysuria (20%) and cough (10%).

Table 2 Clinical features of the patients of nephrotic syndrome(n=50)

Clinical Symptoms		Frequency	Percentage (%)
History body swelling	Yes	50	100.0
History of body swelling	Yes	50	100.0
Fever	Yes	19	38.0
	No	31	62.0
Dyspnoea	Yes	5	10.0
	No	45	90.0
Cough	Yes	5	10.0
	No	45	90.0
Hematuria	Yes	1	2.0
	No	49	98.0
Dysuria	Yes	10	20.0
	No	40	80.0
Abdominal pain	Yes	10	20.0
	No	40	80.0
Hemoptysis	Yes	2	4.0

	No	48	96.0
Anemia	Yes	2	4.0
	No	48	96.0

3.3. Findings of urine examination

Among the study patients reddish urine was found in 14% of patients, all patients had pus cell (100%), RBC was present in 30(60%) patients and urine culture was positive among 9(18%) patients.

Table 3 Urine study report

Urine findings		Frequency	Percent
Colour of urine	Cloudy	43	86.0
	Reddish	7	14.0
Pus cell	Present*	50	100.0
RBC	Present	30	60.0
	Absent	20	40.0
Urine culture	Positive	9	18.0
	Negative	41	82.0

*Present was defined >5 hpf

3.4. Pattern of infection

Among the study patients urine culture was positive among 9(18%), blood culture was positive among 1(2%), sputum culture was found positive in 2(4%), peritonitis was found in 2(4%), skin and soft tissue infection was found in 2(4%) and positive MT was found in 3(6%) of study patients.

Table 4 Infection screening report

Infection screening report		Frequency	Percent
Urine culture	Negative	41	82.0
	Positive#	9	18.0
Blood culture	Negative	49	98.0
	Positive#	1	2.0
Sputum culture	Negative	48	96.0
	Positive#	2	4.0
Ascetic fluid report*	Normal	48	96.0
	Positive#	2	4.0
Local inflammatory sign**	Present	2	4.0
	Absent	48	96.0
MT test***	Positive	3	6.0
	Normal	47	94.0
Sputum for AFB	Positive	3	6.0
	Negative	47	94.0

3.5. Pattern of sensitivity of *E coli* found in UTI

E. coli was sensitive Amikacin, Ceftriaxone, Ciprofloxacin, Cotrimoxazole, Gentamycin Imipenem and Netilmicin and resistant to Cephalexin, Carbenicillin, Cefotaxime and Doxycycline. Some drugs showed moderate sensitivity against this bacterium.

Table 5 Table showing antibiogram of *E coli* in UTI with Nephrotic syndrome (N=7)

Drugs	Sensitive	Moderately sensitive	Resistant
Amoxicillin + Clavulanic acid	4	3	0
Amikacin	4	1	2
Azithromycin	3	4	0
Cephalexin	2	1	4
Ceftriaxone	4	3	0
Cefuroxime	4	1	2
Ceftazidime	3	2	2
Carbenicillin	2	0	5
Ciprofloxacin	3	0	4
Cefotaxime	4	0	3
Cotrimoxazole	4	1	2
Doxycycline	3	0	4
Erythromycin	2	2	3
Gentamycin	3	2	2
Imipenem	7	0	0
Nalidixic Acid	2	4	1
Netilmicin	4	1	2
Nitrofurantoin	1	3	3

3.6. Pattern of sensitivity of *Klebsiella* found in UTI

The second common bacteria *Klebsiella* was found sensitive to Amikacin, Ceftriaxone, Ceftazidime, Ciprofloxacin, Gentamycin and Imipenem and antibiotics were found to resistant are . Amoxycillin Clavulanic acid, Azithromycin, Cephalexin, Carbenicillin, Cefotaxime, Cotrimoxazole, Doxycycline, Netilmicin, Nitrofurantoin.

Table 6 Table showing antibiogram of *Klebsiella* in UTI with Nephrotic syndrome.(n=2)

Drugs	Sensitive	Moderately sensitive	Resistant
Amoxicillin + Clavulanic acid	0	1	1
Amikacin	2	0	0
Azithromycin	0	1	1
Cephalexin	0	1	1
Ceftriaxone	1	1	0
Cefuroxime	2		0
Ceftazidime	1	0	1

Carbenicillin	2	0	0
Ciprofloxacin	1	1	
Cefotaxime	1	1	0
Cotrimoxazole	0	0	2
Doxycycline	1	1	0
Erythromycin	1	1	0
Gentamycin	1	0	1
Imipenem	2	0	0
Nalidixic Acid	1	0	1
Netilmicin	1	1	0
Nitrofurantoin	1	0	1

3.7. Pattern of infection with etiology of NS\

UTI was found in FSGS(3), MPGN(4) and MCGN(2) type of NS, SSTI was found in FSGS(1) and MCGN(1) types of NS, 2 cases of pneumonia were found in FSGS, one case of septicemia was found in lupus nephritis.

Table 7 Types of NS with infection pattern(n=50).

Types of NS	UTI	SSTI*	Pneumonia	TB	Peritonitis	Septicemia	Total(%)
FSGS	3	1	2				6(12%)
MPGN	4			2			6(12%)
MCGN	2	1			1		4(8%)
Lupus nephritis						1	1(2%)
MN					1		1(2%)
MC				1			1(2%)

*Skin and soft tissue infection

4. Discussion

Nephrotic syndrome, a recognized immunocompromised state, predisposes patients to a wide spectrum of infections, with urinary tract infection (UTI) being particularly common. In this six-month study conducted at a tertiary care hospital in Chittagong, 38% of patients developed infections, with UTI accounting for 18%, reinforcing its clinical significance. This prevalence is higher than that reported in the general population and aligns with findings from previous studies, highlighting nephrotic syndrome as an important risk factor for infection. The male predominance observed (male: female = 1.17:1) is consistent with earlier studies, though the purposive sampling technique may explain some demographic inconsistencies. While nephrotic syndrome is typically more common in children aged 2–6 years, inclusion of adult patients in this study reflects its broader clinical spectrum¹. Socioeconomic factors also appear influential, as most patients belonged to lower- to upper-middle-income groups, where hygiene and healthcare access may affect infection risk. Clinically, edema, oliguria, and facial puffiness were the most frequent presentations, with symptomatic infections observed in all affected cases. Those findings are consistent with the earlier study done by Hossain et al.¹⁰ The incidence of UTI were found higher in the present study than the study done in earlier time which may be due to poor socioeconomic status of the patients and improper personal hygiene. Alwadhi et al¹¹ found the higher incidence of various infection(88.2%) in relapse than that in first episode(70.6%) in their study. S Gulati et al¹² showed in their study that possibility of UTI may be a major role in relapse of nephrotic syndrome. It is documented that nephrotic syndrome is a immunocompromised condition and various infection may precipitate the relapse. The present study did not include the relapse cases but in initial attack also UTI was found as a common infection. FSGS, MPGN and MCGN were found three common types of adult nephrotic syndrome where infection were found more common in FSGS(12%) and MPGN(12%) This pattern regarding types of nephrotic syndrome were also found in other

studies.¹³ Microbiologically, *Escherichia coli* (77.7%) remained the predominant uropathogen, followed by *Klebsiella* (22.2%), mirroring patterns seen in the general population. However, the higher infection rate may be attributed to compromised immunity, poor hygiene, and prior antibiotic exposure.¹⁴⁻¹⁵ The antibiotic sensitivity pattern showed effectiveness of agents such as amikacin, ceftriaxone, ciprofloxacin, gentamicin, and imipenem, while resistance to commonly used antibiotics suggests rising antimicrobial resistance due to indiscriminate use.

5. Conclusion

Overall, early detection, rational antibiotic use, and improved hygiene practices are crucial to reduce infection-related morbidity in nephrotic syndrome patients.

Compliance with ethical standards

Acknowledgement

We Acknowledge the contribution of all the participant in this study.

Disclosure of conflict of interest

The author declares no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in this study.

Statement of Ethical Approval

Ethical Committee had approved this study

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