

# A Hospital Study on Pediatric Kidney Diseases: The Potential Role of Clinical Pharmacists

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**Abstract:** In a hospital study, a group of pediatric patients with renal disorders were investigated for the purpose of identification of the possible risk factors, types of renal disorders found, medications used and the possible role of clinical pharmacists in prevention and therapy of the disease. Total of 75 patients were selected and biochemical parameters were determined. The highest renal disease incidences were found between 4-8 years of age and the hospitalization days ranged between 2-30 days. Sixty percent of the patients had acute glomerular nephritis (AGN), sixteen percent had nephrotic syndrome (NS), and eight percent had Henoch - Schönlein nephritis (HS). Fiftythree percent of the studied subjects had previous history of a disease and this might be the most risky factor contributing to the development of kidney disorders. The number of drug types used per patient ranged from 1 to 5 and the frequency order of drugs used is as follows; antibiotics>antihypertensives> vasodilators> corticosteroids> antitussives> insulin preparations. The multi drug therapy was found to be common. The possible adverse effects, and drug interaction control, dosage adjustment, patient education and drug monitoring necessities points out the need of the pharmacists to be in contact with the patient and to be a member of the health care team to help in planning and carrying out successful therapeutic procedure.

**Key Words :** Pediatric disorder, renal risk factors, clinical pharmacy, drug utilization review, hospital pharmacy practice.

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## Introduction

The revolution of clinical pharmacy has been under the way since 1965<sup>1</sup>. Current idea is that pharmacists should be educated to have complete authority on drug products, their efficacy and their safe use by patients<sup>2-7</sup>.

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**Türkiye'de Pediatrik Böbrek Hastalıkları ile İlgili Bir Hastane Çalışması: Klinik Eczacının Olası Rolü**

**Özet:** Bir hastanede yapılan bu çalışmada renal bozukluğu olan bir grup pediatrik hasta incelenmiş ve muhtemel risk faktörlerinin, renal bozukluk tiplerinin, kullanılan ilaçların belirlenmesi ve bu hastalıkların tedavisinde ve önlenmesinde klinik eczacının olası rolü araştırılmıştır. Medikal kayıt verileri toplanmış ve biyokimyasal parametreler tayin edilmiştir. 75 hasta incelenmiştir. En yüksek hastalık insidansının 4-8 yaşları arasında olduğu görülmüştür. Bu hastaların hastanede kalış süreleri 2-30 gün arasında olup % 60'nın akut glomerulonefritli (ANG), % 16'sının nefrotik sendromlu (NS), % 8'inin ise "Henoch-schönlein" nefritli (HS) olduğu görülmüştür. % 53'ünün geçmişte hastalık hikayesinin olması böbrek bozukluklarının gelişmesinde bunun en önemli risk faktörü olabileceği görüşüne varılmıştır. Her hastanın kullandığı ilaç sayısının 1-5 arasında değiştiği tespit edilmiştir. İlaçların kullanım sıklığının antibiyotikler>antihipertansifler; vazodilatörler;kortikosteroidler>analjezik ve antipiretikler> vitaminler> antasitler> tüberküloz atıklar> antitussivler>insulin preparatları olarak sıralandığı görülmüştür. Bu çalışmada birden çok ilaçla yapılan tedavinin oldukça yaygın olduğu görülmüştür. Muhtemel ters etkiler, ilaç etkileşmelerinin kontrolü, doz ayarlanması, hasta eğitimi ve ilaçların izlenmesi gerekliliğinden dolayı eczacının başarılı bir terapötik plan yapılmasında, tedavinin gerçekleşmesinde büyük rolü olduğu ve hasta ve diğer sağlık personeli ile devamlı temas halinde olmasının gerektiği sonucuna varılmıştır.

**Anahtar Kelimeler:** Pediatrik böbrek hastalıkları, böbrek risk faktörleri, klinik farmasi, ilaç tüketiminin incelenmesi, hastane eczacılığı uygulamaları.

In the literature there are many studies showing how the pharmacy services can reduce drug related problems. 12,000 deaths and 15,000 hospitalizations due to adverse drug reactions were reported to

Food and Drug administration (FDA) in 1987 and it is concluded that drug related morbidity and mortality are often preventable by pharmaceutical services that they can reduce the number of adverse drug reactions, the length of hospitalizations and cost of the care<sup>8</sup>. Another report pointed out that of 293 admissions to inpatient services, 15.4% were drug related. To decrease this public health problem a patient educational program was suggested<sup>9</sup>. Clinical pharmacy services should include pharmaceutical, educational and therapeutic aspects<sup>10</sup>. In another study, it was indicated that out of 1651 patients, 5.88 % were admitted to the hospital because of drug-induced illnesses. Half of the cases appeared potentially avoidable<sup>11</sup>. Clinical pharmacists interactions with the prescribers showed reduced overall drug costs and 83% of the antibiotic related problems were identified by the pharmacists<sup>12</sup>. In an investigation done in U.S.A., it was shown that assignment of pharmacist in the patient-care area yielded a 1.5 day shorter length of stay, 1293\$ lower average total cost per admission (ICA), and 155 \$ lower average pharmacy cost per admission (DCA) than under unit dose system<sup>13</sup>.

Incidences of irreversible renal diseases have been increasing and between 50 to 75 people per million each year have kidney diseases of such severity that they require chronic dialysis, renal transplantations or they die from end-stage renal failure<sup>14</sup>. Reports on pediatric kidney disorders occupy an important place in the literature. Renal disfunction in children caused by lead toxicity<sup>15,16</sup>, genetic factors involving the urinary system organ anomalies<sup>17</sup>, and *E. coli* infection<sup>18</sup>, were some of the interesting reports on pediatric kidney disorders.

Due to limited information available in the literature concerning pediatric kidney disorders in Turkey, the following study was conducted to investigate the types of pediatric kidney disorders, drugs used and possible role of clinical pharmacist in the prevention and treatment of these disorders.

## Materials and Methods

### Subjects:

Seventyfive inpatients with renal disorders were randomly selected in the pediatric department of

one of the large hospitals in Istanbul. The full data base, final diagnosis and medication prescribed for each patient were examined. The diagnosis and medication prescribed for each patient were examined. The diagnosis reached by the specialist in the hospital for different kidney diseases was used to show the nature of the disorder and its distribution between the subject patients. Diseases diagnosed were acute glomerulonephritis (AGN), nephrotic syndrome (NS), Henoch-schönlein nephritis (HS), AGN+HS, AGN + carditis, HS + gastrointestinal bleeding, AGN + tuberculosis.

### Drugs prescribed:

The nature and number of medicaments prescribed to each patient were recorded. The classes of drugs prescribed were antibiotics, antihypertensives, diuretics, vasodilators, corticosteroids, analgesic-antipyretics, vitamins, antacids, tuberculostatics, antitussives and insulin preparations. Several drugs together were prescribed to some of the patients at a time.

### Laboratory analysis:

Blood urea nitrogen (BUN), serum creatinin, uric acid, glucose, total protein, albumin, triglyceride, cholesterol, sodium, potassium, chloride, calcium, magnesium and inorganic phosphate (PI) were assayed using Abbot spectrum EPX and ISE model autoanalyzer. The percent of patients with normal and abnormal values were evaluated with respect to normal reference values<sup>19</sup>.

## Results and Discussion

The age and sex distribution of the patients involved in this study is shown in Fig. 1. The age range of patients was 1 to 14 years. The highest incidences of the disorders were found between 4-8 years old children. This value was in accordance with the literature<sup>20-22</sup>. The males had higher incidence of the disorder than the females. Out of 75 patients examined, 45 were males.

Fig 2. shows the percentage of types of kidney diseases diagnosed. Sixty percent of the patients examined were diagnosed as acute glomerulonephritis (AGN), sixteen percent as nephrotics syndrome (NS), eight percent as Henoch-Schönlein nephritis (HS), and twelve percent of the patients had more

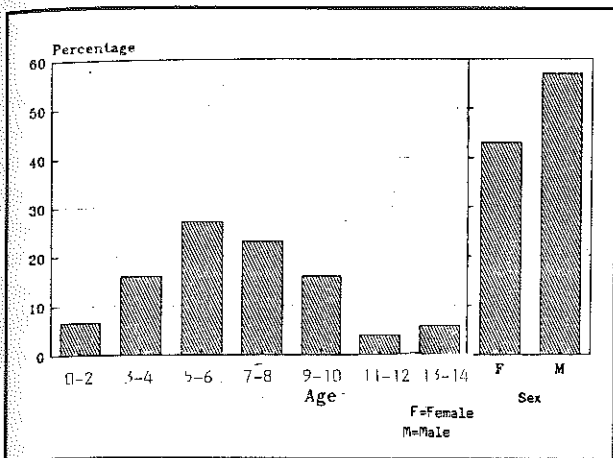


Figure 1. The distribution of patients according to age and sex (Total of 75 patients)

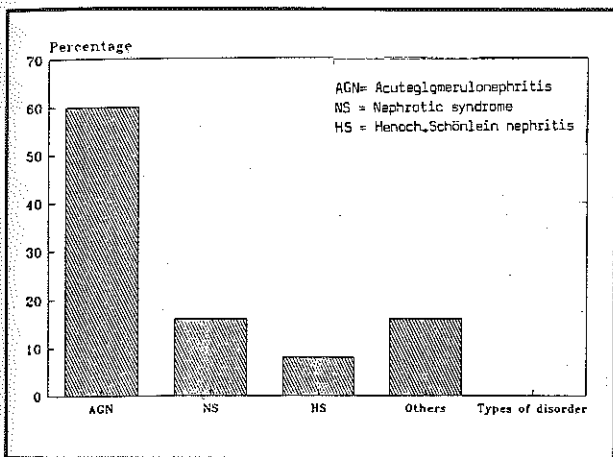


Figure 2. Distribution of renal disorder type

than one diseased state and these included AGN + carditis, AGN + diabetes, HS + gastrointestinal bleeding, AGN + tuberculosis. Acute glomerulonephritis was the most frequent disease seen in children among glomerular diseases and the highest incidence was observed between 2 to 9 years of age. The ratio of incidences between males and females were found as 2:3. In the U.S.A., the incidence of minimal lesion of nephrotic syndrome was found to be 2 in 100,000 and the disease was mostly seen between 2-7 years of age. It is also reported that in Henoch-schönlein purpurae the incidence of nephropathy was 25-50 % where about 2-3% of these patients further developed chronic nephropathy. Henoch-Schönlein nephropathy was seen in males more than in females and mostly seen between ages of 6-7 years<sup>20-21</sup>.

Fig. 3 depicts the number of medicaments prescribed for the patients under study. The number of drug types used per patient ranged from 1 to 5. 43 % of

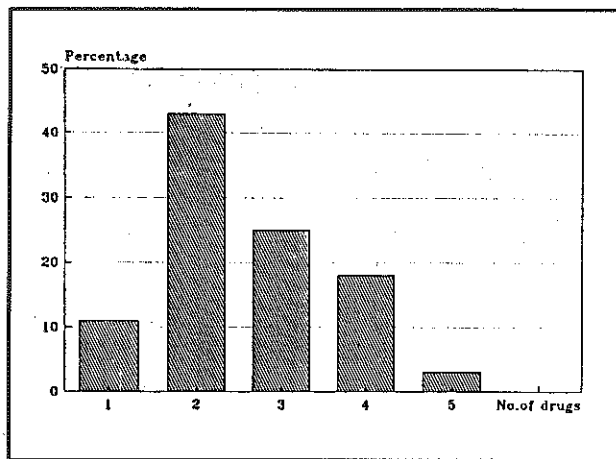


Figure 3. The distribution of the number of drugs used per patient.

the patients received two medications. The different classes of drugs prescribed are shown in fig 4. The frequency order of the drugs used were as follows: Antibiotics > antihypertensives and diuretics > vasodilators > corticosteroids > analgesic and antipyretics > vitamins > antacids > tuberculostatics > antitussives > insulin preparations. Monitoring of the drugs especially in kidney diseases is important. Keller compared the adverse effect profiles of different substances such as penicillins, tetracyclins, sulfonamides and quinolons and suggested that patients with severe blood, kidney or

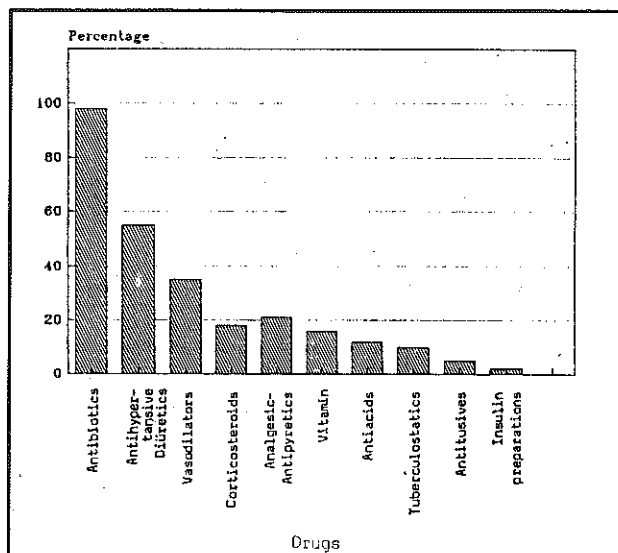


Figure 4. The distribution of different drugs administered to the patients.

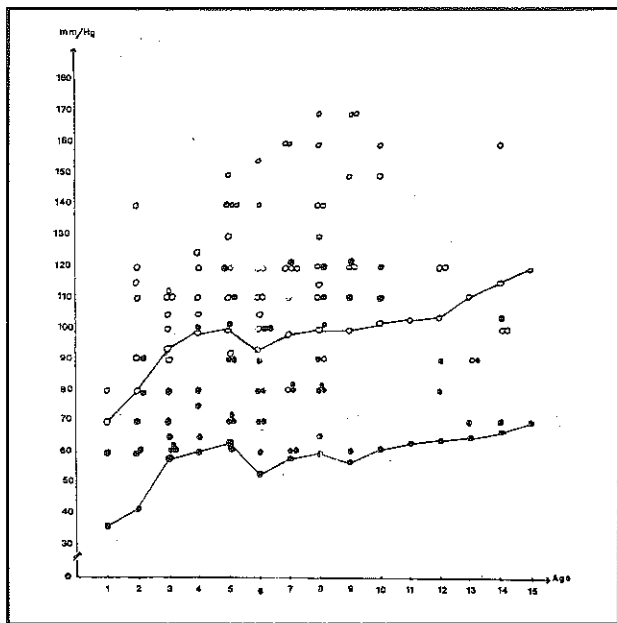


Figure 5. Blood pressure seen in different patients. (○ : cystolic) (● : diastolic)  
 ○ — ○ : Normal cystolic blood pressure level  
 ● — ● : Normal diastolic blood pressure level

liver diseases should not be treated with sulfonamides and the dose of penicillins and ofloxacin should be monitored in patients with renal insufficiency<sup>23</sup>. Up to 5 drugs were prescribed for some patients in this study and this indicates the presence of a polypharmacy. Drug interaction and possible side effects of drugs on kidney or other organs are quite possible in multidrug therapy. This fact points out again the need of a professional who can help in preventing drug interactions and toxicity through contact with both patient and physician. The pharmacist is that person who is best prepared to fulfill this job.

The patient characteristics that may have contributed to the development of kidney diseases are shown in Table I. The most important risk factor might be previous diseased states of the patient. 53 % of studied subjects had previous disease history especially infectious diseases where the incidence was 40 %. In the literature there are many reports on the effect of previously exposed infection diseases, systemic diseases and hereditary factors in developing kidney disorders<sup>20,22,24,25</sup>. Diabetes mellitus was reported to be a risk factor for diabetic nephropathy, urinary tract infections, renal papillary necrosis and different forms of glomerulonephritis and it is suggested that urinary albumin, glomerular filtration and blood pressure should be monitored in diabetic children as well as in chil-

dren of families with hereditary nephropathies<sup>26,27</sup>.

Patient complaints and main signs of symptoms are seen in Table II. In most of the cases, more than one symptom were present. Hypertension was seen in most of the cases. The blood pressure in children between the ages of 1-15 with different kidney disorders are shown in Fig 5. Acute increase in blood pressure was reported in the literature with many kidney disorders like acute glomerulonephritis, Henoch-Schönlein nephritis, acute renal failure and nephrotic syndrome. Our observations were in accordance with the literature<sup>20,28,29</sup>. Fig. 6 shows the hospitalization days that they ranged between 2 to 30 days. 18.7 % of the patients stayed 7 days in average in the hospital.

Table 1: Patient characteristics according to the disease history report

	Percentage of patients
<b>I. Vaccination</b>	
a) Regular vaccination	38.7
b) Irregular vaccination	24.0
c) No information available	37.3
<b>II. Previous disease states</b>	
a) Fevered disease	25.0
b) Upper respiratory tract infection	10.0
c) Urinary system infection	5.0
d) Others (diabetes, liver, tuberculosis, rheumatism)	13.0
e) No previous specific disease state	47.0
<b>III. Heredity conditions</b>	
a) Marriage with relatives	
b) Kidney disorder in the family	6.0
c) Diabetic patient in the family	6.0
d) Patient with tuberculosis in the family	4.0
e) Patient with hypertension in the family	4.0
f) Other diseases in the family (lung, liver etc)	13.4
g) No family history	56.6

Table II: Distribution of the patients' complaints according to the medical history.

Complaints of the patients	Percentage of patients
- Edema in the body	99
- Hypertension	90
- Dark urine	90
- Fever	75
- Oligouria	60
- Stomach ache	55
- Vomiting	55
- Others (nausea, coughing, loss of appetite, weakness, throat ache, diarrhea etc.)	15

Table III : Percentage of the patients with abnormal levels of the tested serum biochemical parameters.

Parameter (Normal range)	Acute Glomerulo- nephritis	Nephrotic Syndrome	Henoch-Schönlein Nephritis
	Abnormal Values (%)	Abnormal Values (%)	Abnormal Values (%)
BUN (5-18 mg/dl)	71.40	70.00	35.00
Creatinin (0.3-0.7 mg/dL)	4.65	18.20	5.00
Uric acid (2.0-5.5 mg/dL)	12.50	0	5.00
Total protein (6.0-8.0 g/dL)	48.10	70.00	15.00
Albumin (3.5-5.0 g/dL)	63.00	62.50	55.00
Cholesterol (120-200 mg/dL)	4.50	70.00	30.00
Triglyceride (30-108 mg/dL)	10.50	60.00	20.00
Glucose (60-100 mg/dL)	9.10	0	70.00
Na+ (130-145 mEq/L)	11.40	16.70	0
K+ (3.4-4.7 mEq/L)	15.60	16.70	0
Cl- (98-106 mEq/L)	17.40	66.70	55.00
Ca+2 (8.8-10.8 mg/dL)	47.80	62.50	50.00
Mg+2 (1.56-1.18 mEq/L)	37.50	-	50.00
Pi (4.5-5.5 mg/dL)	63.60	66.70	55.00

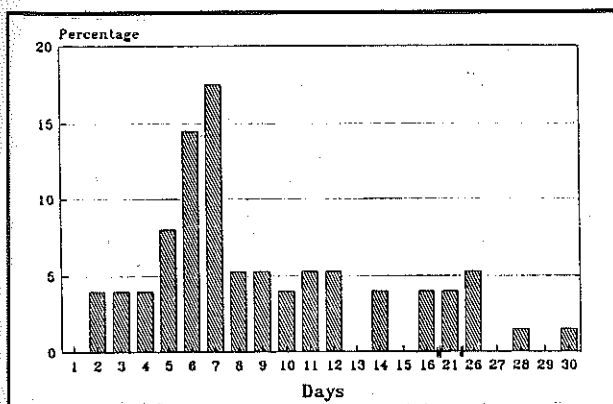


Figure 6. The distribution of the patients' hospitalization days.

Table III shows the percentage of patients with levels of abnormal levels of the specific biochemical parameters used in diagnosis and monitoring of different kidney disorders. Over 50 % of the AGN patients had abnormal levels of BUN, serum albumin and Pi. Over 50 % of the NS patients had abnormal levels of BUN, total serum protein, albumin, cholesterol, triglyseride, Cl<sup>-</sup>, Ca<sup>++</sup> and Pi. About and over 50 % of the HSN patients had abnormal values of serum albumin, glucose, K<sup>+</sup>, Cl<sup>-</sup>, Ca<sup>++</sup> Mg<sup>++</sup> and Pi. Since renal excretion of uric acid was found to be higher in children than adults, serum and uniryany acid was found to be higher in children than adults, serum and urinary uric acid monitoring was recommended in chil-

dren<sup>30</sup>. Also protein to creatinine ratio in urine was proposed as a biochemical parameter in measuring the extend of proteinuria<sup>31</sup>. Our results are in accordance with the literature<sup>20,32,33</sup>.

It was demonstrated that 88 % of consultations initiated by the pharmacists in pediatric units resulted in changes in therapy ways showing the ability of pharmacists in providing influential drug information to the attending pediatricians<sup>34</sup>. In the treatments of renal transplantation and hemodialysis patients the patient education, the dosage individualization follow up through pharmacokinetic studies and pharmacoeconomic evaluation done by clinical pharmacists highly improved the effectiveness of therapeutic treatment<sup>35,36</sup>.

The results of this study indicated the possible risk factors of kidney diseases and the most common kidney disease in Turkey in pediatric patients were between ages of 1-14 years. In addition, this study shows, the complexity of multidisease and multi-drug therapy and this indicated the need for the pharmacist as a participant in the health care team for preparation and follow up of a successful therapeutic procedure. Pharmacist can play an important role in patient education, drug therapeutic monitoring using clinical biochemistry and clinical pharmacokinetics and providing drug information to the health care team.

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