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Pattern of Renal Diseases in Children Presented to King Abdulaziz University Hospital

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Abstract. The pattern of renal diseases in children presented to the tertiary pediatric nephrology center at King Abdulaziz University Hospital was reviewed respectively over the period of 8 years (2005–2012). A total of 850 children were seen. Male: female ratio is 2:1. Median (range) age at presentation was 9 (0.01-16) years. Fifty-five percent were Saudi and 45% were from various nationalities. Underlying etiology was congenital or inherited disease in 55.5% of the children. Glomerular diseases were the most common in acquired causes while obstructive uropathy was the most common in congenital causes. Non-neurogenic neurogenic bladder was the most common underlying diagnosis of children with urological abnormalities (28%), followed by posterior urethral valve (26%). Nephrotic syndrome was the most common of glomerular diseases with 31% with steroid resistant nephrotic syndrome. Renal impairment was present in 315 children with low glomerular filtration rate; chronic kidney disease stage 2 in 88, stage 3 in 84, stage 4 in 35 and stage 5 in 108. In conclusion, childhood congenital or inherited renal diseases were the majority. Non-neurogenic neurogenic bladder was the most common urological abnormality and nephrotic syndrome was the most common glomerular disease with high percentage of steroid resistant nephrotic syndrome. A considerable percentage presented with advanced chronic kidney disease.

Keywords: Chronic kidney disease, Pattern, University hospital, KSA.

Introduction

Understanding the pattern and the epidemiology of childhood renal diseases is very important to prevent chronic kidney disease (CKD) and

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delay its progression. The data available from developing countries, about childhood CKD is limited[1]. Nephrology is a growing pediatric subspecialty in the Kingdom of Saudi Arabia[2]. However data available about childhood renal diseases and epidemiology of CKD is limited and largely presents single center experience[3-5]. Furthermore, most of the studies cover glomerular diseases[4-7] and CKD[8-10], while there is lack of overview studies to evaluate epidemiology of other childhood renal diseases[3].

King Abdulaziz University Hospital (KAUH) is a tertiary center in the western province and it is located in a city which is very near to the holy city, Makkah. The demographic background of children followed up at KAUH might be different from other areas of KSA, and this could be reflected in the pattern of childhood renal diseases presented to this institution.

In this study, evaluation of the pattern of renal diseases in children presented to KAUH is done and the outcome is reported.

Patients and Methods

Retrospective review of all renal cases presented to the pediatric nephrology unit at KAUH over 8 years was conducted. Cases of acute kidney injury (AKI) caused by pre-renal failure or mild acute tubular necrosis were not included in this study. However, severe cases of AKI, which needed further follow up, were included.

All electronic and medical records of children presented with kidney diseases between January 2005 and December 2012 were reviewed. Demographic data, clinical data and outcome were recorded to all children.

Glomerular filtration rate (GFR) was calculated by Schwartz formula[11] to classify stages of CKD according to the guidelines of National Kidney Foundation Kidney Disease Outcomes Quality Initiative[12].

Results

A total of 850 children were presented to the pediatric nephrology unit at KAUH; 652 (61.8%) were boys and 324 (38.2%) were girls. Male: female ratio was 2:1. Median (range) age at presentation was 9

(0.01-16) years, mean (SD) of 8.8(4.96) years. Fifty-five percent (468 children) were Saudi and 45% (382 children) were from various nationalities. Non Saudi children were from different ethnic backgrounds: 183 (21.5%) from Arabic origin (118 Yemeni, 32 Palestinians, 27 Egyptians and 6 Syrians), 86 (10.1%) from African origin (29 Chadians, 24 Somalis, 24 Sudanese, 5 Ethiopians and 4 Nigerians), 104 (12.4%) from Asian origin (48 Pakistanis, 23 Indians 20 Burmese, 11 Afghanis and 2 Filipinos) and 9 children (1.05%) from mixed or other backgrounds.

Underlying etiology was congenital or inherited disease in 55.5% (473 children). Consanguinity was positive in 134 (28.5%), negative in 24 (5%) and unknown in 314 (66.5%) of cases with congenital or inherited diseases (Table 1).

Table1. The underlying diagnosis of different diagnostic categories.

Etiology of Renal Disease	Frequency	Percentage
Glomerular		
Steroid sensitive nephrotic syndrome	67	7.9%
Steroid dependant nephrotic syndrome	88	10.3%
Steroid resistant nephrotic syndrome	78	9.2%
Congenital and infantile nephrotic syndrome	18	2.1%
Chronic glomerulonephritis	43	5.1%
Post infectious glomerulonephritis	47	5.5%
Diabetic nephropathy	2	0.2%
Hematuria	11	1.3%
Urological = Obstructive		
Posterior urethral valve	71	8.4%
Neurogenic bladder	109	12.8%
Primary vesicoureteric reflux	28	3.3%
Pelviureteric junction obstruction	29	3.4%
Obstructive uropathy with dysplasia	31	3.6%
Cystic dysplastic		
Multicystic dysplastic kidney	29	3.4%
Polycystic kidney disease	21	2.5%
Nephronophthisis	4	0.4%
Simple renal cysts	4	0.4%
Congenital hypodysplastic kidney	13	1.5%
Absent kidney	5	0.5%
Ectopic kidney	6	0.6%
Tubular		
Renal tubular acidosis	34	4%
Barter's syndrome	6	0.7%
Nephrocalcinosis	6	0.7%
FHHNC*	7	0.8%

Table1. (*Continuation)* The underlying diagnosis of different diagnostic categories.

Etiology of Renal Disease	Frequency	Percentage
Miscellaneous		
Pyelonephritis	8	0.9%
Chronic renal failure of unknown etiology	27	3%
Hypertension	18	2.8%
Nocturnal enuresis	14	1.6%
Renal artery stenosis	4	0.4%
Pheochromocytoma	2	0.2%
***AKI**†*		
Acute tubular necrosis	14	1.6%

**FHHNC = Familial hypomagnesaemia hypercalciurea and nephrocalcinosis syndrome; †AKI = Acute kidney injury*

Glomerular diseases were the most common in acquired causes while obstructive uroptahy was the most common in congenital causes as shown in Fig. 1.

Nephrotic syndrome (NS) was the most common of glomerular diseases as it was the presentation of 251 patients. Seventy-eight (31%) children had steroid-resistant nephrotic syndrome (SRNS); 135 (62%) have steroid sensitive nephrotic syndrome (SSNS), with 88 (35%) with steroid-dependent nephrotic syndrome (SDNS), and 18 (7%) patients had congenital nephrotic syndromes (NPHS1) (Fig. 2).

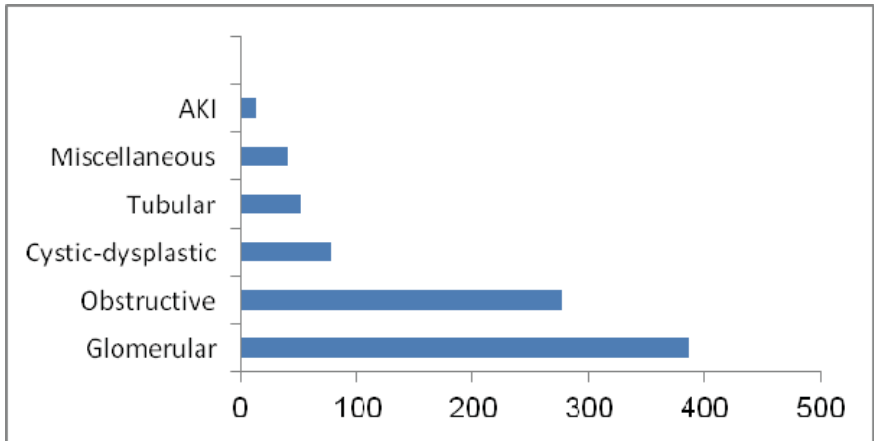

Fig. 1. Underlying diagnosis are categorized into glomerular diseases, obstructive uropathy, cystic-dysplastic, tubular diseases, acute kidney injury, and miscellaneous causes. (AKI = Acute kidney injury).

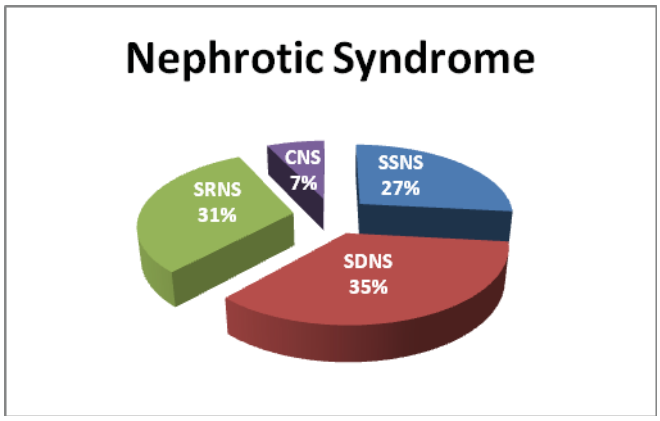

Fig. 2. **The clinical course of nephrotic syndrome shows the following: 27% had steroid sensitive NS with 35% had steroid dependent course, 31% had steroid resistant NS and 7% had congenital NS.**

Post infection glomerulonephritis (GN) was the diagnosis in 47 patients (5.5%) who presented with frank hematuria or severe AKI.

Non-neurogenic neurogenic bladder (NNNB) was the most common diagnosis of obstructive uropathy cases followed by posterior urethral valve (PUV). Neurogenic bladder associated with spinal lesion was the diagnosis of 11.5% children as shown in Fig. 3.

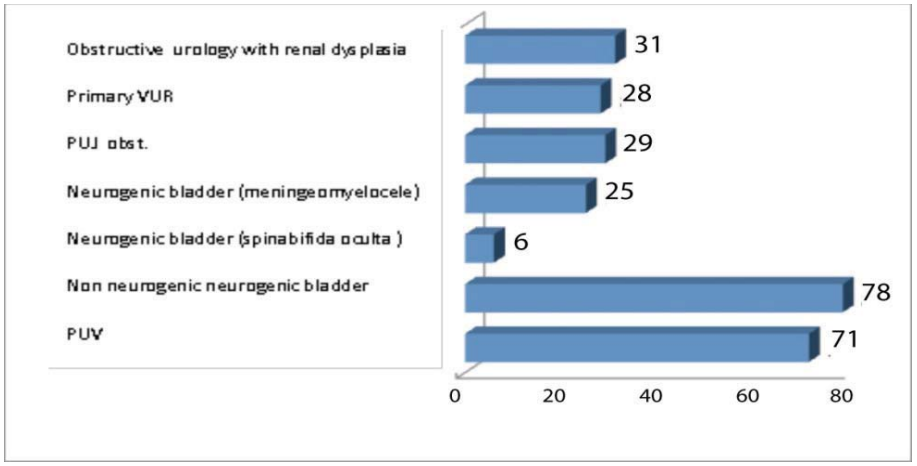

Fig. 3. **The underlying diagnosis of obstructive uropathy are as follows: The most common is (40.6%) neurogenic bladder, 26.4% Posterior urethral valve (PUV), 10.8% pelviureteric junction obstruction (PUJO), 10.4% primary vesicoureteric reflux (VUR) and 11.5 % obstructive uropathy with renal dysplasia.**

Different tubular disorders were the diagnosis in 51 patients[6]. Renal tubular acidosis was diagnosed in 33 children, Barter's syndrome in 5 children, familial hypomagnesaemia hypercalciuria and nephrocalcinosis syndrome (FHHNC) in 7 children and nephrocalcinosis in 6 subjects.

Outcome

Ten percent of the cohort (86 children) suffered from recurrent pyelonephritis and 21% (178 subjects) had hypertension.

Renal impairment was present in 315 children with low GFR (37%); CKD stage 2 in 88 children, stage 3 in 84 children, stage 4 in 35 children and stage 5 in 108 subjects (12.7%).

Renal replacement therapy (RRT) was offered to 73 children only. Thirty two children received regular hemodialysis (three sessions per week), 26 received automated peritoneal dialysis and 15 children had kidney transplantation in another center.

At the end of the study period, 566 (67%) children were still followed up at our unit; 138 (16%) children were lost to follow up; 79 (9%) children were transferred either back to their referring hospital or to adult nephrology service and 67 (8%) children were dead.

Discussion

In this study, the observation that hereditary and genetics childhood renal diseases are more common than acquired causes is similar to previous reports. It is estimated that 70% of the cases of kidney diseases in childhood are congenital with a likely genetic basis[13]. It was reported that congenital renal anomalies are the main underlying cause of CKD and end stage renal failure in children both in KSA[9-11] and in other countries. In a recent report from North American Pediatric Renal Transplant Cooperative Study (NAPRTCS), congenital causes including congenital anomalies of the kidney and urinary tract (48%) and hereditary nephropathies (10%), were the most common causes of CKD[14]. Similar results were reported by other European registries[15-16].

There was a large percentage of the cohort with neurogenic bladder either caused by spinal cord lesion or NNNB. It was interesting that NNNB was the most common urological abnormally in the cohort. Non-neurogenic neurogenic bladder covers a wide spectrum of lower urinary

tract and bowel dysfunctions, observed in the absence of a neurological background or lower urinary tract malformation. Non-neurogenic neurogenic bladder (NNNB) is characterized by the association of a severe impairment of the upper urinary tract with a dysfunctional elimination syndrome[17]. Neurogenic bladder caused by spinal lesion or NNNB is an important cause of end stage renal failure (ESRF) in KSA[9,18,19]. A study from our institution revealed that neurogenic bladder was the underlying cause in 19.6% of CKD in children, and of those 13.6% were associated with neural tube defects[18]. Neurogenic bladder is still an important cause of CKD in Turkey as it is the underlying cause of 15% of the cases[20] and it is the most common cause of CKD in Syria[21]. Therefore, neurogenic bladder is an important cause of CKD in developing countries. This is most likely caused by the limited awareness of the importance of bladder management in children with spina bifida among pediatricians, which led to a considerable delay in commencing clean intermittent catheterization in the affected children[2,22].

Similar to other reports, the study shows a higher predominance of males, which reflects the higher incidence of congenital disorders, including obstructive uropathy, renal dysplasia, and prune belly syndrome, in boys versus girls[14,15].

Nephrotic syndrome was the most common presentation of glomerular diseases. Nephrotic syndrome (NS) is reported to be more common in Asian children than in Caucasian children[23]. Similarly, it is thought to be more common in Arab children. However, no epidemiological data are available to confirm this observation. Similar to previous reports, a higher percentage of congenital and infantile NS compared to other countries[2,9] was observed. This could be explained by high consanguinity rate in Saudi population[24]. The high percentage of SRNS could be explained by the fact that KAUH is a tertiary center for pediatric nephrology in the Western province. Post-infectious was observed in only 5.5%, which is online with previous reports that post-streptococcal GN is declining in KSA, as it was reported as the underlying cause of 2.7-2.9% of adults GN[25] and 4 % of Pediatrics GN[26].

Tubular diseases represented 6% of the cohort, which is a high percentage compared to Western registries. However, in countries where

consanguinity is common tubular and other hereditary disorders, such as cystinosis, and primary hyperoxaluria, were reported to be high[27,28].

A considerable percentage was presented with CKD and low GFR and 12.7% were stage 5 CKD or ESRF. This could be explained by late referrals and unavailability for optimal care for many children from the beginning of the disease. This is true particularly for the unique demographic population we are serving. It is also similar to the findings of other developing countries, such as India, where data from a major tertiary hospital revealed that approximately 12% of patients presented to pediatric nephrology service over a 7-year period, had moderate to severe CKD (CCr < 50 mL/min per 1.73 m^2), and one quarter had already developed ESRD, highlighting the late diagnosis and referral pattern[29]. Similarly, data from a major Iranian hospital, collected over 7 years, reported that 11% of pediatric nephrology admissions were due to severe CKD (CCr < 30 mL/min per 1.73 m^2), and one half of the patients advanced to ESRD[28].

The study shows a high mortality rate of 8%, reflecting the need for improvement in the care of those disadvantaged children. This should include early detection and referrals, optimum treatment and availability of RRT for all children. Currently, we cannot offer RRT to all children because of limited resources.

Mortality rates remain significantly lower in pediatric patients with ESRD compared with their adult counterparts. Nevertheless, an assessment of the causes of death reflects the excess risk of cardiac and vascular diseases, and the high prevalence of left ventricular hypertrophy and dyslipidemia among children treated with renal replacement therapy[30]. Furthermore, the outcome of children with severe CKD is highly dependent upon the economy and availability of health care resources[31].

Conclusion

In this study, the pattern and the outcome of renal diseases in children presented to KAUH is discussed. There is a high mortality of 8%, indicating the need for more work on prevention and early detection of CKD in children.

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References

[1] **Harambat J, van Stralen KJ, Kim JJ, Tizard EJ.** Epidemiology of chronic kidney disease in children. *Pediatr Nephrol* 2012; **27**(3): 363-373.

[2] Kari JA. Pediatric renal diseases in the Kingdom of Saudi Arabia. *World J Pediatr* 2012; **8**: 217-221.

[3] **Abdurrahman MB, Elidrissy AT.** Childhood renal disorders in Saudi Arabia. *Pediatr Nephrol* 1988; **2**(3): 368-372.

[4] **Kari JA, Halawani M, Mokhtar G, Jalalah SM, Anshasi W.** Pattern of steroid resistant nephrotic syndrome in children living in the kingdom of Saudi Arabia: a single center study. *Saudi J Kidney Dis Transpl* 2009; **20**(5): 854-857.

[5] **al-Rasheed SA, al-Mugeiren MM, al-Salloum AA, al-Sohaibani MO.** Childhood renal diseases in Saudi Arabia. A clinicopathological study of 167 cases. *Int Urol Nephrol* 1996; **28**(5): 607-613.

[6] **Abdullah LS.** Histopathological pattern of pediatric renal diseases: a study from a university hospital in western Saudi Arabia. *Saudi J Kidney Dis Transpl* 2012; **23**: 377-384.

[7] **Jalalah SM, Jamal AA.** Childhood primary glomerular diseases in the western region of Saudi Arabia. *Saudi J Kidney Dis Transpl* 2009; **20**(4): 608-612.

[8] **Al-Ghwery S, Al-Asmari A.** Chronic Renal Failure among Children in Riyadh Military Hospital, Riyadh, Saudi Arabia. *Saudi J Kidney Dis Transpl* 2004; **15**(1): 75-78.

[9] **Kari JA.** Chronic renal failure in children in the Western area of Saudi Arabia. *Saudi J Kidney Dis Transpl* 2006; **17**(1): 19-24.

[10] **Al HN.** Chronic renal failure in children in Asir region of Saudi Arabia. *Saudi J Kidney Dis Transpl* 1997; **8**(3): 294-297.

[11] **Schwartz GJ, Munoz A, Schneider MF, Mak RH, Kaskel F, Warady BA, Furth SL.** New equations to estimate GFR in children with CKD. *J Am Soc Nephrol* 2009; **20**: 629-637.

[12] **Hogg RJ, Furth S, Lemley KV, Portman R, Schwartz GJ, Coresh J, Balk E, Lau J, Levin A, Kausz AT, Eknoyan G, Levey AS.** National Kidney Foundation's Kidney Disease Outcomes Quality Initiative clinical practice guidelines for chronic kidney disease in children and adolescents: evaluation, classification, and stratification. *Pediatrics* 2003; **111**(6 Pt 1): 1416-1421.

[13] **Bockenhauer D, Medlar AJ, Ashton E, Kleta R, Lench N.** Genetic testing in renal disease. *Pediatr Nephrol* 2012; **5**(6): 873-883.

[14] **NAPRTCS, Abdullah LS.** 2008. North American Pediatric Renal Trials and Collaborative Studies.

[15] **Ardissino G, Dacco V, Testa S, Bonaudo R, Claris-Appiani A, Taioli E, Marra G, Edefonti A, Sereni F.** Epidemiology of chronic renal failure in children: data from the ItalKid project. *Pediatrics* 2003; **111**(4 Pt 1): e382-e387.

[16] **Mong Hiep TT, Ismaili K, Collart F, Van Damme-Lombaerts R, Godefroid N, Ghuysen MS, Van HK, Raes A, Janssen F, Robert A.** Clinical characteristics and outcomes of children with stage 3-5 chronic kidney disease. *Pediatr Nephrol* 2010; **25**(5): 935-940.

[17] **Leclair MD, Heloury Y.** Non-neurogenic elimination disorders in children. *J Pediatr Urol* 2010; **6**(4): 338-345.

[18] **Kari JA.** Neuropathic bladder as a cause of chronic renal failure in children in developing countries. *Pediatr Nephrol* 2006; **21**(4): 517-520.

[19] **Neel KF, Salem MA, Soliman SM, Al-Hazmi H, Gomha AB, Khatab AA.** Acceptance and compliance of clean intermittent catheterization among Saudi patients. *Saudi Med J* 2008; **29**(7): 1014-1017.

[20] **Bek K, Akman S, Bilge I, Topaloglu R, Caliskan S, Peru H, Cengiz N, Soylemezoglu O.** Chronic kidney disease in children in Turkey. *Pediatr Nephrol* 2009; **24**(4): 797-806.

[21] **Saeed MB.** The major causes of chronic renal insufficiency in Syrian children: a one-year, single-center experience. *Saudi J Kidney Dis Transpl* 2005; **16**(1): 84-88.

[22] **Proesmans W.** The neurogenic bladder: introducing four contributions. *Pediatr Nephrol* 2008; **23**(4): 537-540.

[23] **Sharples PM, Poulton J, White RH.** Steroid responsive nephrotic syndrome is more common in Asians. *Arch Dis Child* 1985; **60**(11): 1014-1017.

[24] **Al-Abdulkareem AA, Ballal SG.** Consanguineous marriage in an urban area of Saudi Arabia: rates and adverse health effects on the offspring. *J Community Health* 1998; **23**(1): 75-83.

[25] **Mitwalli AH.** Glomerulonephritis in Saudi Arabia: a review. *Saudi J Kidney Dis Transpl* 2000; **11**(4): 567-576.

[26] **Al-Sabban E.** Spectrum of glomerular disease among children in Saudi Arabia. *Saudi J Kidney Dis Transpl* 1997; **8**(3): 285-288.

[27] **Hamed RM.** The spectrum of chronic renal failure among Jordanian children. *J Nephrol* 2002; **15**(2): 130-135.

[28] **Madani K, Otoukesh H, Rastegar A, Van WS.** Chronic renal failure in Iranian children. *Pediatr Nephrol* 2001; **16**(2): 140-144.

[29] **Hari P, Singla IK, Mantan M, Kanitkar M, Batra B, Bagga A.** Chronic renal failure in children. *Indian Pediatr* 2003; **40**(11): 1035-1042.

[30] **Mitsnefes MM, Daniels SR, Schwartz SM, Meyer RA, Khoury P, Strife CF.** Severe left ventricular hypertrophy in pediatric dialysis: prevalence and predictors. *Pediatr Nephrol* 2000; **14**(10-11): 898-902.

[31] **De Vecchi AF, Dratwa M, Wiedemann ME.** Healthcare systems and end-stage renal disease (ESRD) therapies--an international review: costs and reimbursement/funding of ESRD therapies. *Nephrol Dial Transplant* 1999; **14**(Suppl 6): 31-41.

نمط أمراض الكلى في الأطفال الذين يراجعون مستشفى جامعة الملك عبدالعزيز

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المستخلص. تمت دراسة نمط أمراض الكلى في الأطفال الذين راجعوا وحدة أمراض الكلى لدى الأطفال في مستشفى جامعة الملك عبد العزيز (KAUH) خلال ثمانية أعوام على التوالي (٢٠٠٥-٢٠١٢) ، حيث تمت متابعة ٨٥٠ طفلا وكانت نسبة الذكور: نسبة الإناث هي ١:٢، و متوسط العمر للمتقدمين ٩ سنوات (٠,٠١ حتى ١٦عام) بنسبة ٥٥٪ سعوديين و ٤٥٪ من جنسيات مختلفة. وقد شكلت الأسباب الخلقية الوراثية ٥٥,٥٪ من المسببات بين الأطفال. كما أن الأمراض الكبيبية هي الأكثر شيوعاً بين الأسباب المكتسبة. بينما اعتبر الاعتلال البولي الانسدادي الأكثر شيوعاً في الأسباب الخلقية، وكانت المثانة العصبية هي السائدة في الأطفال الذين يعانون من تشوهات المسالك البولية بنسبة ٢٨٪، ويليها صمام الإحليل الخلفي بنسبة ٢٦٪. ولكن المتلازمة الكلوية (NS) هي أكثر الأمراض الكبيبية شيوعًا. كما أن نسبة المتلازمة الكلوية المقاومة (المعاندة) للستيرويد هي ٣١٪. وقد ظهر القصور الكلوي في ٣١٥ طفلاً مع انخفاض معدل الترشيح الكبيبي :٨٨ طفلاً في المرحلة الثانية من المرض الكلوي المزمن، ٨٤ طفلاً في المرحلة ٣، ٣٥ طفلاً في المرحلة ٤ و ١٠٨ طفلا في المرحلة ٥. وفي

الختام، يمكن القول أن المسببات الخلقية الوراثية للأمراض الكلوية كانت هي السائدة. والمثانة العصبية من أكثر الأسباب شيوعًا في تشوهات المسالك البولية. وبالإضافة إلى ذلك فإن المتلازمة الكلوية هي السائدة بين الأمراض الكبيبية مع نسبة عالية من المتلازمة الكلوية المقاومة (المعاندة) للستيرويد. كما لوحظ وجود نسبة كبيرة من الأمراض الكلوية المزمنة في مراحلها المتقدمة.