Original Article

Clinicopathological Spectrum of Renal Biopsies in Children

Sqn Ldr AK Garg[*], Col M Kanitkar[+], Wg Cdr V Venkateshwar[#]

Abstract

Background: Renal biopsy has revolutionized the study of glomerular diseases. A retrospective analysis of 104 consecutive renal biopsies performed in children at a tertiary care referral centre over five years is presented.
Methods : All the biopsies were performed non-ultrasound guided by a single consultant nephrologist. Trucut needles were used in the initial few years and a Magnum biopsy gun (Bard) over subsequent three years. There were 66 boys and 38 girls.
Result: A male predominance occurred in the older and younger patients. The male: female ratio was 2.2:1, 1:1, and 2.7:1 for the age groups below five years, 5-10 years and above 10 years respectively. All patients tolerated the biopsy well and success rate was 94%. There were minimal complications in the form of post biopsy haematuria (33.3%). Haematuria was mild in most of the cases and settled down within 24 hours. None required transfusion. However, 60% patients had mild discomfort in the form of local pain. There was no mortality, infection or renal loss. The most common indication for a kidney biopsy was nephrotic syndrome. Out of 104 biopsies, 85 were in children with nephrotic syndrome. The commonest primary renal pathology was mesangial proliferative glomerulonephritis (38%), minimal change disease (19%), focal segmental glomerulosclerosis (15%) and membranoproliferative glomerulonephritis (7%).
Conclusion: Renal biopsy is a safe procedure in experienced hands and the commonest indication for a biopsy in children remains nephrotic syndrome.

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Key Words : Nephrotic syndrome; Biopsy gun; Haematuria; Mesangial proliferative glomerulonephritis; Minimal change disease

Introduction

Since its first introduction in 1951, renal biopsy has revolutionized the study of glomerular diseases [1]. With the help of light and electron microscopy and immunofluorescent examination of renal tissues, the renal pathologist has been able to classify glomerulonephrites, to describe their clinico-pathological correlation, natural history and to study their pathogenesis [2]. The clinicians utilize the information for the diagnosis and monitoring of treatment of their patients. The pattern of glomerular diseases may differ in different population groups. We undertook a retrospective review of renal biopsies in children with an aim of analyzing the clinico-pathological spectrum, the complications and the success rate.

A spring-loaded, automated, cutting-needle biopsy "gun" was developed in the early 1980's [3]. It was quickly adopted for renal biopsies because of its ease of use, decreased risk of renal laceration and lessened pain reported by patients [4]. The use of the biopsy gun, in combination with advanced imaging techniques, primarily ultrasound (USG), has led to an increase in safety and yield [5-9].

Material and Methods

This was a retrospective study of children who underwent percutaneous renal biopsy at a tertiary care paediatric nephrology referral unit over five years. All the biopsies were performed by single consultant nephrologist and were non-USG guided. Disposable Trucut needles were used in initial few years, however over the past three years a Magnum™ automatic biopsy gun (Bard®) with disposable needles was used. The case records of these patients were reviewed to collect demographic data, clinical features, indications of renal biopsy and pathological diagnosis. Complications during the procedure were analysed.

All renal biopsies were routinely processed in a standard technique for light microscopy, electron microscopy and immunofluorescence study. Renal tissue was considered adequate for diagnosis if it contained more than four glomeruli. They were reported by the pathologists of our institution as per World Health Organisation (WHO) classification [10].

Clinical features were recorded according to a set of predetermined criteria as follows: gross haematuria was defined as urine grossly red with red blood cells (RBC) and microscopic haematuria as the presence of >5 RBC per high power field. Proteinuria was defined as morning urine albustix 2+ or more, or protein excretion rate of more than 4 mg/m^2/hour. Nephrotic syndrome was defined as massive proteinuria

[*]Graded Specialist (Paediatrics), 7 AF Hospital, Kanpur. [+]Professor & Head, [#]Reader (Dept of Paediatrics), AFMC, Pune-40.
Received : 07.05.09; Accepted : 05.05.10 E-mail : mkanitkar15@gmail.com

of > 40 mg/m^2/hour, spot protein-creatinine ratio >2, presence of edema and serum albumin concentration of <2.5 g/dl. Nephritic-nephrotic syndrome was defined as nephrotic syndrome with the presence of atypical features such as hypertension, persistent microscopic or gross haematuria, impaired renal function, low complement C_3. Suspected nephritis was considered in the presence of the above features but a normal serum albumin level of >2.5 g/dl. Renal insufficiency was defined as glomerular filtration rate of < 90 ml/minute/1.73 m^2 and further classified using the chronic kidney disease (CKD) staging. Steroid resistance was defined as persisting proteinuria despite four weeks of prednisolone at dose of 2 mg/kg/day. Steroid dependence was defined as relapse of nephrotic syndrome on alternate day prednisolone or within two weeks of stopping prednisolone therapy. Henoch-Schonlein purpura was diagnosed when two or more of the following were present: vasculitic purpura, abdominal pain or gastrointestinal bleeding, joint pain and urinary abnormalities. Systemic lupus erythematosus (SLE) was diagnosed by the criteria of American College of Rheumatology (ACR).

The investigations carried out on each patient prior to a renal biopsy included the haemoglobin (Hb), prothrombin time (PT), activated partial thromboplastin time (APTT), platelet count and renal function test. Biopsy was done in the paediatric ward under local anaesthesia and sedation with midazolam and ketamine.

Results

From January 2003 to December 2008, a total of 104 children underwent renal biopsy at this centre. Their age at biopsy ranged from 12 months to 15 years, with 45 patients below five years of age, 37 patients between 5-10 years and 22 patients above 10 years. There were 66 boys and 38 girls. A strong male predominance occurred in the older and younger patients. The male: female ratio was 2.2: 1, 1:1, and 2.7:1 for the age groups below five years, 5-10 years, and above 10 years respectively (Table 1).

Table 1

Age and gender distribution of children undergoing renal biopsy (n=104)

Age (years)	Sex		Total (%)
	Female	Male	
1-5	14	31	45 (43.5)
6-10	18	19	37 (35.5)
>10	6	16	22 (21)

The most common indication for renal biopsy was nephrotic syndrome with either atypical presentation or steroid resistance. Out of 104 biopsies, 85 were in children with nephrotic syndrome. Among other indications seven had persistent haematuria and four had lupus.

As shown in Table 2, the commonest primary renal pathology were mesangial proliferative glomerulonephritis (MesPGN-38%) and minimal change disease (MCD-18.2%) while the tissue was inadequate in 5.7% cases.

When the indication for a biopsy was other than nephrotic syndrome, the biopsy revealed MesPGN in five (26%) cases, Lupus in four (21%) cases and cresentric glomerulonephritis and ESRD in two (10.5%) cases each.

Clinical indication and pattern of renal pathology in nephrotic children

A total of 85 children with nephrotic syndrome were biopsied. Of these, 51 patients were biopsied at onset because of atypical presentation, namely age of onset <1 year (eight cases), presence of nephritic-nephrotic features (11 cases) and initial steroid resistance (32 cases). The remaining 34 patients were biopsied at a later stage of their illness. The majority had either MesPGN (41%) or MCNS (22%) as depicted in Table 3.

Efficacy and adequacy of renal biopsy

The sample was adequate in majority of the 104 biopsies undertaken with inadequate tissue in only six samples. In 49% samples the yield was between 5-10 glomeruli and in 45% glomeruli were >10.

Table 2

Correlation of histopathology with indications for biopsy (n=104)

Pathology	MesPGN	MCNS	MPGN	FSGS	DPGN	ESRD	Lupus	Inadequate	Others*	Total
Indication										
Haematuria	03							02	02	07
ARF						01			02	03
Hypertension	02							01		03
Lupus							04			04
CKD									01	01
Proteinuria	-		-	-		01	-			01
Nephrotic	35	19	07	15	03	-	-	03	03	85
Total	40	19	07	15	03	02	04	06	08	104
(%)	(38)	(18.2)	(6.7)	(14.4)	(2.8)	(1.9)	(3.8)	(5.7)	(7.6)	(100)

*Others: IgA nephropathy-01; Cresentic GN-02; Oxalate nephropathy-01; Chronic pylonephritis-01; Interstial nephritis-03.

ESRD: end stage renal disease; MesPGN: mesangial proliferative glomerulonephritis; MCNS: minimal change nephritic syndrome; MPGN: membranoproliferative glomerulonephritis; FSGS: focal segmental glomeruloscleritis; DPGN:diffuse proliferative glomerulonephritis; ARF: acute renal failure; CKD: chronic kidney disease