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Original Research Article

Assessment of seven year long results of kidney biopsy

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ABSTRACT

Background: Kidney biopsy is a standard kidney biopsy tissue analysis to look at histopathological diagnosis of various kidney diseases. Previous studies have shown kidney biopsy findings mostly in pediatric population, and there is no much data on impact of various sized biopsy guns on biopsy outcome. This study includes all age group and describes impact of usage of various sized biopsy guns on biopsy outcome.
Methods: A retrospective study was done on all patients who underwent kidney biopsy over 7 years.
Results: Among total number of 386 patients, 55.2% were males. The commonest indication for biopsy was nephrotic syndrome. The commonest histopathological pattern was Lupus nephritis. Renal failure (RF) was found in 157 (40.7%) of which it improved in 78 (20.2%). Amongst RF patients, the commonest was IgA nephropathy. Change of needle size from 18G to 16G showed increased morbidity in the form of complications but also increased diagnostic yield. Biopsy related complications were noted in 0.8%-1.8%.
Conclusions: The commonest indication for kidney biopsy was nephrotic syndrome. The commonest histopathological pattern was Lupus nephritis. Amongst RF patients, the commonest entity was IgA nephropathy. Change of needle size from thinner to thicker showed increased complications but also increased diagnostic yield too.

Keywords: Hypertension, Kidney, Nephrotic syndrome, Renal failure

INTRODUCTION

Kidney biopsy has become the most essential modality in evaluation of histopathology of kidney disease, planning treatment and knowing prognosis of disease. There is huge difference in epidemiology of renal histopathology all over the world, due to differences in race, socioeconomic status and frequency of performing kidney biopsy especially in developing countries.1 Indications for kidney biopsy enumerated in literature varies from asymptomatic urinary abnormalities to proteinuria and renal failure, though commonest indications for kidney biopsy are nephrotic syndrome followed by renal failure.[2,3,4,5,6] Though change of biopsy needle size from smaller to bigger do not increase morbidity but increases biopsy diagnostic yield, but it has been noted to have certain major and minor complications too.[7] Previous studies have shown kidney biopsy findings mostly in pediatric population, and there is no much data on impact of various sized biopsy guns on biopsy outcome. This study includes all age groups, describes impact of various sized guns on biopsy outcome including complications.

METHODS

A retrospective study of 386 patients who underwent kidney biopsy was done at tertiary Nephrology center between 2011 to 2018. Patients below 15years age,

between 16-65 years, above 66 years were termed as children, adults and elderly respectively. Acute renal failure (ARF) was defined as rapid deterioration of renal function with increase in serum creatinine by 50% from baseline. Chronic renal failure was defined as persistent serum creatinine >1.5 mg/dl. Nephrotic syndrome was defined as proteinuria >3 grams per day in adults, >40 mg/m² in a 24 hour urine collection in children. Nephritic syndrome was defined as combination of hematuria, hypertension, oliguria, edema and altered serum creatinine. Asymptomatic urinary abnormalities was defined as proteinuria <3.5 g/day, and/or hematuria >3 RBC with no hypertension.

Data retrieval

Informed written consent for kidney biopsy was obtained from both patient and family members after explaining about procedure. Bleeding parameters, platelet count were checked prior to biopsy. Following local anaesthesia with 1% lidocaine, under ultrasound guidance kidney biopsies were done. Biopsies were done with preferably 18 gauge Bard biopsy Gun, and 20 gauge or 16 gauge guns were also used too. 2 cores of tissue were taken in formalin and normal saline for light microscopy and immunofluorescence studies respectively in all cases. Following biopsy, patient was made to lie down in supine position with bed rest for at least for next 24 hours, monitoring for hematuria and vitals. Hematocrit and ultrasound study were done post biopsy in case of suspected bleeding complications. Patients without any complications were discharged after 24-48 hours.

Pathological study

These biopsies were done using Bard kidney biopsy Gun. Specimens were studied with Light microscopy after Hematoxylin and Eosin (H&E), Peracetic acid (PAS) staining, immunofluorescence using antisera against C3,C1q, IgG, IgM, IgA and if required, with Electron microscopy in indicated cases. Biopsies of transplant kidney were also studied.

Statistical analysis

Results on continuous measurements were presented on Mean±SD (Min-Max) and results on categorical measurements were presented in Number (%).

Significance was assessed at 5% level of significance. Chi-square/Fisher Exact test was used to find the significance of study parameters on categorical scale between two or more groups. Significant figures were: suggestive significance (P value: $0.05<P<0.10$), moderately significant (P value: $0.01<P\leq0.05$), strongly significant (P value: $P\leq0.01$). The Statistical software namely SPSS 18.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel were used to generate graphs, tables etc.

RESULTS

Gender and age distribution

In this study, out of 386 patients, 213 (55.2 %) were males and 178 (44.8%) were females. Male to female ratio was 1.23:1. At the time of diagnosis, age of the patients ranged between 9 to 78 years, with mean age of patients being 32.55±14.58 years.

Premorbid illness

In this study, Diabetes mellitus, Hypertension , NSAID, Infection, snake bite were found in 18(4.7%), 57 (14.8%), 6 (1.6%), 6 (1.6%), 3 (0.5%) patients respectively.

Indication of renal biopsy

The commonest indication for kidney biopsy was nephrotic syndrome in 258 (66.8%) patients followed by renal failure in 157 (40.7%) patients.

Histopathological pattern

Histopathological pattern according to frequency

It was found that primary glomerular disease (232) 57.4% was more common than secondary glomerular disease (103) 26.6%, followed by tubulo-interstitial diseases in 28 (7.3%). The commonest histopathological pattern was Lupus nephritis seen in 75(19.4%) cases, followed by Focal segmental glomerulosclerosis(FSGS) in 64(16.6%) cases (Table 1).

Histopathological pattern according to age group

The commonest histopathological pattern in age groups 1-20 years, 21-40 years, 41-60 years, >60 years were MCD in 21 (23.9%), Lupus nephritis in 47 (23.7%), FSGS in 22 (28.6%) and Membranous nephropathy in 7 (30.4%) cases respectively (Table 2).

Histopathological pattern according to gender

Lupus nephritis in 56 (32.4%) patients and FSGS in 40 (14.1%) were commonest histopathological entities in females and males respectively.

Histopathological pattern in diabetes mellitus patients

Amongst diabetes mellitus patients, the commonest histopathological entity was membranous nephropathy in 10 (55.6%) patients followed by diabetic nephropathy in 7 (38.9%) patients (Table 3).

Table 1: Kidney biopsy findings.

	Kidney biopsy findings	No. of patients (n=386)	%
Tubulo-interstitial disease: 28 (7.3%)	ATN	5	1.3
	AIN	5	1.3
	CIN	6	1.6
	ATN+AIN	12	3.1
Primary Glomerular disease: 222 (57.4%)	IgA Nephropathy	39	10.1
	MCD	56	14.5
	FSGS	64	16.6
	MN	43	11.1
	MPGN	14	3.6
	Mesangioproliferative GN	4	1.0
	C3 GN	2	0.5
Secondary Glomerular disease: 103 (26.6%)	PIGN	10	2.6
	Lupus nephritis	75	19.4
	Amyloid	8	2.1
	Cast Nephro	2	0.5
	DM Nephropathy	7	1.8
	HUS/TMA	1	0.3
Others	Renal Transplant	24	6.2
	Crescentric	22	5.7
	CGS	7	1.8

Table 2: Kidney biopsy findings according to age groups

Kidney biopsy findings	Age in years				Total (n=386)	P value
	1-20 years (n=88)	21-40 years (n=198)	40-60 years (n=77)	>60 years (n=23)		
ATN	0(0%)	4(2%)	1(1.3%)	0(0%)	5(1.3%)	0.518
AIN	0(0%)	5(2.5%)	0(0%)	0(0%)	5(1.3%)	0.186
CIN	0(0%)	2(1%)	3(3.9%)	1(4.3%)	6(1.6%)	0.127
ATN+AIN	1(1.1%)	8(4%)	2(2.6%)	1(4.3%)	12(3.1%)	0.595
Lupus nephritis	18(20.5%)	47(23.7%)	9(11.7%)	1(4.3%)	75(19.4%)	0.034*
MCD	21(23.9%)	26(13.1%)	5(6.5%)	4(17.4%)	56(14.5%)	0.014*
FSGS	21(23.9%)	18(9.1%)	22(28.6%)	3(13%)	64(16.6%)	<0.001**
MN	7(8%)	20(10.1%)	9(11.7%)	7(30.4%)	43(11.1%)	0.020*
MPGN	2(2.3%)	8(4%)	3(3.9%)	1(4.3%)	14(3.6%)	0.894
Mesangioproliferative GN	0(0%)	3(1.5%)	1(1.3%)	0(0%)	4(1%)	0.647
PIGN	2(2.3%)	4(2%)	3(3.9%)	1(4.3%)	10(2.6%)	0.779
IgA Nephropathy	10(11.4%)	24(12.1%)	5(6.5%)	0(0%)	39(10.1%)	0.193
Amyloid	0(0%)	2(1%)	4(5.2%)	2(8.7%)	8(2.1%)	0.009**
Cast Nephro	0(0%)	0(0%)	2(2.6%)	0(0%)	2(0.5%)	0.045*
Crescentric	6(6.8%)	12(6.1%)	3(3.9%)	1(4.3%)	22(5.7%)	0.85
CGS	1(1.1%)	5(2.5%)	1(1.3%)	0(0%)	7(1.8%)	0.679
DM Nephropathy	0(0%)	3(1.5%)	3(3.9%)	1(4.3%)	7(1.8%)	0.219
C3 GN	1(1.1%)	1(0.5%)	0(0%)	0(0%)	2(0.5%)	0.759
Renal Transplant	1(1.1%)	20(10.1%)	3(3.9%)	0(0%)	24(6.2%)	0.010**
HUS/TMA	0(0%)	1(0.5%)	0(0%)	0(0%)	1(0.3%)	0.813

Chi-Square/Fisher Exact Test

Histopathological pattern in hypertension patients

Amongst hypertensives who underwent biopsy, the commonest histopathological entity was IgA nephropathy, FSGS in 15 (26.3%) and 6 (10.5%) patients respectively.

Histopathological pattern in renal failure patients

Renal failure was found in 157 (40.7%) cases. Mean serum creatinine was 2.86mg/dl. It improved in 78 (20.2%) cases, indicating them as acute kidney injury (AKI). Amongst renal failure patients, the common

entities were IgA nephropathy and renal transplant recipients in 24 (15.3%) and 20 (12.7%) patients respectively. In AKI group, the common histopathological entities seen were that of transplant kidneys and ATN+ acute interstitial nephritis (AIN) in 17 (21.8%) and 12 (15.4%) patients respectively.

Table 3: Kidney biopsy findings in diabetes mellitus patients

Kidney biopsy findings	DM		Total (n=386)	P value
	No (n=368)	Yes (n=18)		
ATN	4(1.1%)	1(5.6%)	5(1.3%)	0.827
AIN	5(1.4%)	0(0%)	5(1.3%)	0.261
CIN	6(1.6%)	0(0%)	6(1.6%)	0.569
ATN+AIN	12(3.3%)	0(0%)	12(3.1%)	0.823
Lupus nephritis	75(20.4%)	0(0%)	75(19.4%)	<0.001**
MCD	55(14.9%)	1(5.6%)	56(14.5%)	0.977
FSGS	63(17.1%)	1(5.6%)	64(16.6%)	0.197
MN	33(9%)	10(55.6%)	43(11.1%)	0.041*
MPGN	14(3.8%)	0(0%)	14(3.6%)	0.345
Mesangioproliferative GN	4(1.1%)	0(0%)	4(1%)	0.423
PIGN	9(2.4%)	1(5.6%)	10(2.6%)	0.110
IgA Nephropathy	39(10.6%)	0(0%)	39(10.1%)	0.615

Chi-Square/Fisher Exact Test

Histopathological pattern in renal transplantation patients

In 24 (62%) renal transplant patients who underwent kidney biopsy, most common histopathological pattern was ATN in 10 (41.6%) followed by acute cellular rejection (ACR), ACR+ATN, AIN+ATN in 3 (12.4%), 3 (12.4%), 2 (8%) patients respectively.

Impact of biopsy instrument size

Kidney biopsy guns were used with different gauzes with 18G, 16G, 20G in 362 (93.8%), 8 (2.1%) and 15 (3.5%) respectively.

Mean number of glomeruli obtained was 10±0.1. Mean number of glomeruli obtained for 18G, 16G, 20G were 10, 12, 8.3 glomeruli respectively.

Further, among biopsy related events studied, inadequate samples, need of rebiopsy, perirenal hematomas, traumatic hematuria, infection, need of blood transfusion were noted in 2 (0.5%), 4 (1%), 7 (1.8%), 7 (1.8%), 1 (0.3%), 1 (0.3%) (Table 4).

When 18G needle was used, then inadequate biopsy yield, need of rebiopsy, perirenal hematoma, traumatic hematuria, were noted in 1 (0.2%), 1 (0.2%), 2 (0.5%), 2 (0.5%) cases respectively. When 16G needle was used, then perirenal hematoma, traumatic hematuria, infection, need of blood transfusion, surgical exploration of biopsied kidney were noted in 5 (1%), 5 (1%), 1 (0.2%), 1 (0.2%), 1 (0.2%) cases respectively. When 20G needle was used, then inadequate biopsy, need of rebiopsy were noted 1 (0.2%), 3 (0.7%) cases respectively. Change of needle size from 18G to 16G showed increased morbidity in the form of complications but also increased diagnostic yield. Among the cases who had bleeding, one patient had renal transplantation and one patient had thalassemia trait.

Table 4: Complications of kidney biopsy

	No. of patients (n=386)	%
Inadequate sample	2	0.5
Rebiopsy	4	1.0
Electron microscopy need	0	0.0
Biopsy complications	0	0.0
Peri-renal hematomas	7	1.8
Traumatic Hematuria	7	1.8
Arterio-venous fistula	0	0.0
Infection	1	0.3
Need of blood transfusions	1	0.3
Surgery	0	0.0
Angiogram+embolization	0	0.0
Nephrectomy	0	0.0
Death due to biopsy	0	0.0

DISCUSSION

This study gives results of about 386 patients who underwent kidney biopsies. Our hospital is a tertiary referral centre in this region.

Gender and age distribution

In this study, males were predominantly found. This finding are comparable to findings of studies done by Rasim M. Khamass et al, Rychlík I et al, Lee SA et al, Chang JH et al, Imtiaz S et al, Miller M et al, Rabbani

MA et al, Toledo K et al though the Rychilk et al, Lee SA et al, Miller M et al, Toledo K et al studies were comprised of pediatric group of population.[8,5,6,9,1,4,10,7]

In contrast, a study done in pediatric population by Ozkaym N et al, showed 54% were girls unlike seen on this study.[3]

Like in this study, Rabbani MA et al study showed mean age was 36±17.9 years and male to female ratio was 1.67:1.10.

Indication of renal biopsy

Like in this study, commonest indications for kidney biopsy were nephrotic syndrome followed by renal failure in 35.4% and 16% respectively (Lopez-Gomez JM et al study), nephrotic syndrome in 33%, 57.4%, 39.3% pediatric population (Ozkaym N et al study, Miller M et al study, Rychlík I et al study) respectively and unlike like asymptomatic urinary abnormalities predominantly in the form of hematuria in 35.9% (Lee SA et al study).[2-6]

Histopathological pattern

Histopathological pattern according to frequency and concordant to this study

It was found that primary glomerular disease (232) 57.4% was more common than secondary glomerular disease (103) 26.6%, followed by tubulo-interstitial diseases in 28 (7.3%). This was in comparison with Rychlík I study, Imtiaz S et al, Ozkaym N et al, Rabbani MA et al studies.[5,1,3,10]

The commonest histopathological pattern was Lupus nephritis seen in 75 (19.4%) cases, followed by Focal segmental glomerulosclerosis (FSGS) in 64 (16.6%) cases.

Histopathological pattern discordant

In contrast to findings to this study, Rychlík I study showed among primary GNs, the most frequent diagnoses were: IgA nephropathy (IgAN) 34.5%, minimal change disease (MCD) 12.4%. Among secondary GNs, systemic lupus erythematosus (SLE) represented 23.0%, followed by necrotizing vasculitis (NV) 15.5%.[5]

In contrast to this study, MCD, FSGS, IgA nephropathy, MCD, FSGS were most common histopathological entity in Khamass RM et al, Saca E et al, Rychlík I et al, Imtiaz S et al, Ozkaym N et al studies respectively.[8,11,5,1,3]

This variation compared to our study may be related to absence of lack of immunofluorescence, electron microscope facilities (Khamass RM et al) and also like in other studies (Khamass RM et al, Hazza I et al), which were done in pediatric group of population.

Histopathological pattern according to age group

Like in this study, Rychlík I study showed among children, the most common were IgAN (19.2%), MCD (17.6%), while among the elderly the most common were MGN (11.0%), NV (10.7%). The most common in patients with nephrotic proteinuria were MCD (50.5%) among children, but IgAN (24.6%) in adults aged 16-60 years and MGN (16.8%) among the elderly.[5]

Histopathological pattern in diabetes mellitus patients

Unlike to this study where membranous nephropathy was commonest entity, in Rychlík I study, diabetic glomerulosclerosis was found in 42.4% and non-diabetic renal diseases in 47.5% (IgAN in 17.5%, MGN and NAS in 11.1% and NV in 9.5%).[5]

Comparison of histopathological pattern in renal failure patients with other studies

In this study, renal failure was found in 157(40.7%) cases, like in Rychlík I et al study.[5]

In this study, mean serum creatinine was 2.86 mg/dl, comparable to K. Toledo et al study.[7] In another study done in pediatrics population by Miller M et al, renal failure was found in 3.2%.[4]

In this study amongst renal failure patients, the commonest were IgA nephropathy and renal transplant recipients in 24 (15.3%) and 20 (12.7%) patients respectively.

Like in this study, Rychlík I study showed IgAN (21.3%) and FSGS (8.3%) were the most common diagnoses among patients with mild renal insufficiency.[5]

Unlike this study, the incidence of biopsy-confirmed acute renal failure according to cause were Vasculitis (23.3%), AIN (11.3%) and crescentic glomerulonephritis (10.1%) in Lopez-Gomez JM et al study.[2]

It improved in 78 (20.2%) cases, indicating them as acute kidney injury. It is comparable to AKI incidence of 16.2% seen in Lopez-Gomez JM et al study.[2]

Histopathological pattern in renal transplantation patients

Like in this study, Rabbani MA et al study showed that in 11 patients who underwent graft biopsy, 5 patients had ATN, 3 had ACR, and 3 had CAD.[10]

Impact of biopsy instrument size

Like in this study, Toledo K et al study showed that mean number of glomeruli obtained was 9.94±0.036.[7]

Change of needle size from 18G to 16G showed increased complications but also increased diagnostic yield. Among patients who had bleeding, one patient had renal transplantation and one patient had thalassemia trait.

Like in this study, Arora K et al study showed greater amount of renal tissue, glomeruli was obtained when 16G needle was used than when 18G needle was used though greater pain was experienced when 16G needle was used.[12] Like in this study, Ozkaym N et al , Rychlík I et al studies, macroscopic hematuria was found in 2%, 3% respectively.[3,5]

Like in this study, Toledo K et al study showed minor complications (defined as hemoglobin drop post biopsy of >1g% but without need of blood transfusion) in 13.2%. Major complications were noted in 0.75% defined as requirement of blood transfusion, nephrectomy, embolization for major bleeding. Change of needle size from 18G to 16G did not increase morbidity but increased diagnostic yield.[7]

CONCLUSION

Pattern of kidney diseases are different compared to data published from different regions which can be explained by confounding factors including genetic or environmental factors, race, frequency of infective episodes, renal biopsy rate, referral centre bias and availability, histopathology laboratory service availability. Ours included even transplant biopsies unlike many studies quoted here in discussion. The commonest indication for kidney biopsy was nephrotic syndrome. The commonest histopathological pattern was Lupus nephritis. Commonest histopathological pattern in younger, adolescent, adult and elderly age groups were minimal change disease (MCD), lupus nephritis, FSGS and membranous nephropathy respectively. Lupus nephritis and FSGS were commonest histopathological entities in females and males respectively. Amongst diabetes mellitus, hypertensive patients, the commonest histopathological entity were membranous nephropathy, IgA nephropathy respectively. Amongst RF patients, the commonest entity was IgA nephropathy. In renal transplant patients, most common histopathological pattern was acute tubular necrosis (ATN). Among biopsy related events, the frequency of inadequate samples, need of rebiopsy, perirenal hematomas, traumatic hematuria, infection, need of blood transfusion, were noted ranging from 0.8%-1.8%. Change of needle size from thinner to thicker size showed increased morbidity in the form of complications but at the same time increased diagnostic yield too.

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