

RESEARCH ARTICLE

The First Steps of Renal Biopsy Puncture in Niger: Indications, Complications and Results

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Received: 28 June 2025 Accepted: 11 July 2025 Published: 17 July 2025

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Abstract

Objective: To study the technical aspects, indications and results of renal biopsy puncture in two hospitals in Niger.

Patients and Methods: We conducted a retrospective, multicenter study from January 2019 to December 2024, including 193 patients who underwent RBP in the nephrology departments of the Hôpital National Amirou Boubacar Diallo de Niamey (HNABD) and the Hôpital National de Zinder (HNZ). We assessed the socio-demographic, clinicobiological, histological and evolutionary characteristics of patients who underwent renal biopsy.

Results: The annual frequency was 38.6 RBP/year; the mean age of patients was 32.20 years. The sex ratio M/F was 2.02. Edematous syndrome was the most common clinical manifestation in 62.69% of cases; phytotherapy was the antecedent reported in 26.43%. Mean proteinuria was 3.49 ± 3.06 ; renal failure was found in 67.36% of cases; anemia in 54.92% of cases. The indication for PBR was nephrotic syndrome in 53.36% of cases, and the left kidney was the RBP site in 98.96% of cases. Glomerular damage accounted for 69.35% of cases, and tubulointerstitial damage for 21.79%. The most common postbiopsy complication was macroscopic hematuria in 09.84% of cases.

Conclusion: Renal biopsy is an essential procedure in the diagnosis of kidney disease, providing precise information on histological lesions and guiding therapeutic management.

Keywords: Renal Biopsy Puncture, Niger.

1. Introduction

Renal biopsy puncture (RBP) is a medical procedure involving the removal of a fragment of renal parenchyma for histopathological examination. It makes a considerable contribution to the diagnosis, therapeutic choice and prognostic evaluation of nephropathies. The procedure remains invasive, with various complications, mainly hemorrhagic. It provides

essential histological evidence for the management of nephropathies, particularly glomerular nephropathies. Immunolabeling and molecular biology studies have clarified the clinical and histological individualization of kidney diseases, opening up many new avenues for pathogenic understanding [1]. In developed countries, percutaneous renal biopsy is frequently used in the diagnosis and management of renal pathologies.

Citation: MOUSSA T. Zeinabou Maiga, BONKANO B. Djibrilla, MOUSSA D. Hassane, *et al.* The First Steps of Renal Biopsy Puncture in Niger: Indications, Complications and Results. Archives of Nephrology. 2025; 7(2):09-15.

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In France, in 2020, a total of 6,517 renal biopsies were recorded [2], 3705 in China in 2017 [3]. However, the practice of RBP in clinical nephrology is considerably lacking in many developing countries and particularly in sub-Saharan Africa [2]. A. Lemrabott et al had found an average of 222/An in Senegal [4], in Morocco in the city of Marrakech 423 RBP were performed over 3 years [5]. This low prevalence in sub-Saharan Africa could be explained by the lack of universal health coverage in many countries, and the non-existence of the technical facilities required for sampling and, above all, histological analysis [6].

In Niger, renal biopsy puncture has been performed since 2019, hence the need for this study to review the techniques, indications, complications and results of renal biopsy puncture in Niger.

2. Patients and Methods

This was a multicenter, retrospective study running from January 1, 2019 to December 31, 2024. All patients who underwent renal biopsy during this period in the two nephrology departments of the Hôpital National Amirou Boubacar Diallo de Niamey (HNABD) and the Hôpital National de Zinder (HNZ) were included in the study. Patients whose biopsy specimens were agglomerular were excluded from the study, representing 10 out of 193. The variables studied were: sex, age, origin; clinical aspects (personal medical history/comorbidities, clinical manifestations, blood pressure); paraclinical aspects (coagulation tests, 24h proteinuria, azotemia, creatinemia, blood count, serologies, ECBU, renal ultrasound); indication, site, complications and evolution following renal biopsy. All biopsies were performed under ultrasound guidance. Cores were harvested by percutaneous puncture using an automatic gun with silverman G16 and G18 needles under local anaesthesia. Fragments were fixed in formalin for light microscopy and AFA for immunofluorescence.

Table 1. Distribution of patients according to indication for PRB

Indication for PRB	Number	Percentage (%)
Nephrotic syndrome	103	53,36
Severe renal failure	44	22,79
Glomerular syndrome	18	9,33
Massive proteinuria	15	7,77
Lupus	7	4,66
Scabiosis	3	1,55
Hematuria	3	1,55
Total	193	100%

Most samples were sent to Kano (Nigeria) and a small portion to Dakar (Senegal). Data were recorded on a pre-designed survey form, then entered into Excel. Analysis was performed using Excel and Epi-info 7.2.4.0; Pearson Chi² test with statistical significance if $p < 0.05$. Informed consent was obtained from patients, and anonymity was preserved when filling in the survey forms and presenting the results.

3. Results

During our study period, 193 cases of RBP were performed in the two Nephrology and Dialysis departments (Amirou Boubacar Diallo National Hospital of Niamey and Zinder National Hospital). The annual frequency was 38.6 biopsies/year on average. 5.18% (n=10) of biopsies were inadequate. Males predominated, at 66.84% (n=129), with a M/F sex ratio of 2.02. The mean age of patients was 32.20 years, with a standard deviation of 15.36 years and extremes of 4 and 72 years. The most common age group was between 15 and 35, with a frequency of 52.33% (n=101). More than half the patients (67.88%, n=131) were from Zinder. 62.69% of patients (n=121) had an edematous syndrome. Toxic habits and a medical history of hypertension accounted for 26.43% (n=51) and 20.21% (n=39) respectively. Mean proteinuria was 3.49 ± 3.06 with extremes ranging from 0.06 to 22 g/24H. The majority of patients had right and left kidney sizes greater than 10 cm, with respective frequencies of 86.52% (n=167) and 89.64% (n=173). Mean azotemia was 17.58 mmol/l and mean creatinemia $438.54 \mu\text{mol/l}$. Nearly half the patients (45.08%, n=87) had a haemoglobin level of 12 g/dl or higher. 53.36% (n=103) of renal biopsies were indicated for nephrotic syndrome, and almost all patients (98.96%, n=191) had the left kidney as puncture site. Glomerular damage accounted for 69.35% of cases, tubulointerstitial damage for 21.79% and vascular damage for 5.45%. In this study, macroscopic hematuria was the complication in 09.32% of cases (n=18).

Table 2. Distribution of patients by lesion type histology

Type of Lesion	Number	Percentage (%)
LGM	40	21,85
NTIC	25	13,66
GNMP	23	12,56
HSF	22	12,02
Vascular nephropathy	9	4,91
Diabetic nephropathy	4	2,18
Lupus nephropathy	17	9,28
NTA	10	5,4
Diffuse glomerulosclerosis	11	6,01
GEM	5	2,73
NIA	5	2,73
Included lesions	5	2,73
RENAL AMYLOSIS	1	0,54
Nodular glomerulosclerosis	2	1,09
IgA nephropathy	3	1,63
MAT	1	0,54
Total	183	100,0

4. Discussion

In the course of this study, 193 cases of renal biopsy puncture were performed in the two nephrology departments of Amirou Boubacar Diallo Hospital in Niamey and Zinder National Hospital. The mean age of patients was 32.20 years, with extremes of 4 and 72 years. Our results are comparable to those of KALLOSSY O. in Mali in 2021 [7], Mhamedi S. et al. in Morocco in 2018 [1], Lemrabott A. et al. in Senegal in 2019 [8], who respectively found mean ages of 35.03; 38.16 and 33.8 years. These results could be explained by the increased prevalence of secondary causes, notably infectious and dysimmune, such as malaria and systemic lupus erythematosus, which affect this age group. This diagnostic procedure enables us to confirm kidney pathologies and guide therapeutic choices, particularly in the case of inflammatory or genetic nephropathies. What's more, this adult population's greater tolerance of the procedure means that renal disorders can be managed safely and effectively [9]. The frequency of renal biopsy was 38.6 per year in our study. This frequency is higher than that reported by Mhamedi S. et al. in Oujda, Morocco, in 2018 [1] and KALLOSSY O. in Mali in 2021 [7], who reported mean annual frequencies of 27 and 12 RBP/year respectively. However, our results are lower than those reported by Lemrabott A. et al. in Senegal in 2019, for whom the mean frequency was 222 RBP per year [8]. Renal biopsy is a common procedure in developed countries, often

used to diagnose kidney disease and guide treatment. In developing countries, on the other hand, this procedure remains less frequent, due to factors such as lack of medical infrastructure, high cost and limited access to trained specialists. Developed countries generally benefit from better-funded healthcare systems and greater availability of advanced medical technologies. This disparity in access to renal biopsy can lead to delays in the diagnosis and management of kidney disease in low- and middle-income countries. Efforts are needed to improve access to this procedure and reduce inequalities in renal disease management worldwide [10].

In this study, patients were predominantly male, with a M/F sex ratio of 2.02. These results are comparable to those of Lemrabott A. et al. in Senegal in 2019 [8], in whom the majority of patients were male with a sex ratio of 1.15. However, our results differ from those of Mhamedi S. et al. in Morocco in 2018 [1] and KALLOSSY O. in Mali in 2021 [7], who found a female predominance with sex ratios of 0.86 and 0.66 respectively. Our results could be explained by the fact that men have a higher incidence of chronic kidney disease (CKD) than women, leading to a higher frequency of renal biopsy punctures in male patients. The female hormone estrogen has a protective effect on the kidneys, reducing the progression of chronic kidney disease. This hormonal protection is less present in men, making them more susceptible to kidney disease. In addition, men have poor dietary

habits (excessive consumption of salt, phosphorus and protein) and tend to have a higher prevalence of risk factors such as hypertension and obesity, which are closely linked to the development and progression of kidney disease. The combination of these biological and behavioral factors can accelerate the decline in renal function, increasing the need for diagnostic procedures such as renal biopsy in men [11].

In this study, toxic habits and medical history were dominated by traditional herbal medicine in 26.43% of cases and hypertension in 20.21%. Our results differ from those found by Mhamedi S. et al. in Morocco in 2018 [1] and KALLOSSY O. in Mali in 2021 [7], who found hypertension to be the predominant comorbidity in proportions of 36% and 40% respectively. According to the WHO, in some developing countries, a large proportion of the population - up to 80% - relies on traditional medicine, particularly in rural areas. This is due to the availability and accessibility of these often less costly treatments, as well as the lack of access to modern medicine for these populations [12]. In Africa, herbal medicines are generally under-researched and poorly regulated, and some plants commonly used in traditional African medicine possess compounds that are potentially toxic to the kidneys. For example, a study carried out in Ivory Coast revealed that 44% of the plants studied had caused hypercreatinemia, and 26% renal parenchyma toxicity. These included Aloe vera, Aristolochia pistolochia and Artemisia absinthium, plants frequently used in our regions [12,13,14].

Edematous syndrome was the clinical sign found on admission in 62.69% of cases.

Our results are comparable to those of Mhamedi S. et al. in Morocco in 2018 [1] and KALLOSSY O. in Mali in 2021 [7], who also found oedematous syndrome as the clinical sign on admission in 60 and 57.1% of cases respectively. Our results could be explained by the fact that the oedematous syndrome is mainly linked to glomerular alterations responsible for a nephrotic syndrome. The latter is characterized by massive proteinuria, hypoalbuminemia and generalized edema. These manifestations result from increased glomerular permeability to plasma proteins and inappropriate sodium retention due to activation of the renin-angiotensin-aldosterone system. PBR can identify underlying glomerular causes such as minimal lesion glomerulonephritis or membranous glomerulopathy, facilitating accurate diagnosis and appropriate management [15].

In this study, 24-hour proteinuria was predominantly greater than 3g/24h in 49.76% of cases. This result is comparable to those of Mhamedi S. et al. in Morocco in 2018 [1]

Lemrabott A. et al. in Senegal in 2019 [8], and those of KALLOSSY O. in Mali in 2021 [7], who also found 24-hour proteinuria greater than 3g/d in 58; 78.3 and 68.6% of cases respectively. Proteinuria in excess of 3 g/24h is often observed in patients with severe renal pathologies, such as glomerular impairment including nephrotic syndrome, where there is an impairment of the glomerular filtration barrier, allowing plasma proteins to pass into the urine. This rise in proteinuria generally signals diffuse renal damage, and requires renal biopsy to confirm the diagnosis and assess the extent of damage [16].

In this study, kidney size was predominantly greater than 100 mm in 88.09% of cases, a result comparable to those of KALLOSSY O.

In Mali in 2021, who found kidney size greater than 100 mm in all patients[7]. Renal biopsy may be indicated even in the presence of normal-sized kidneys, as renal morphology does not always reflect underlying histological abnormalities. Glomerular pathologies such as minimal lesion glomerulonephritis or membranoproliferative nephropathy often present with normal kidney size, requiring a RBR to confirm the diagnosis. Furthermore, at an early stage, some chronic kidney diseases (CKD), such as lupus nephritis or diabetes, do not result in changes in renal size, but may already present significant microscopic lesions. PBR can also be used to assess functional abnormalities (proteinuria, hematuria) and guide management before macroscopic changes appear [17].

In our study, creatinemia was above normal in 67.36% of cases. These results are comparable to those of KALLOSSY O. in Mali in 2021, who found hypercreatinemia in 62.8% of cases [7]. Hypercreatininemia is a frequent indication for renal biopsy (RBP), as it reflects impaired renal function, mainly due to a reduction in glomerular filtration rate (GFR). This elevation may be caused by glomerular pathologies (glomerulonephritis, diabetic nephropathy), tubulointerstitial lesions (acute or chronic nephritis), or hemodynamic disorders (thrombotic microangiopathies). A RBP is often necessary to identify the underlying cause, differentiate etiologies and guide management. Hypercreatininemia is therefore a key sign, often present before visible renal morphological changes [18 ; 19].

In this study, the mean hemoglobin level was 11.37g/dl. This result is comparable to those of Mhamedi S. et al. in Morocco in 2018 [1] and those of KALLOSSY O. in Mali in 2021 [7], who respectively found mean hemoglobin levels of 11.98 and 11.62 g/dl. Patients admitted to nephrology requiring renal biopsy frequently suffer from anemia, a complication linked to renal dysfunction. Renal failure impairs the production of erythropoietin, a key hormone in the regulation of red blood cell production, leading to anemia. Furthermore, the systemic inflammation associated with certain kidney pathologies, such as glomerulonephritis, exacerbates this condition. Additional factors, such as chronic blood loss and iron deficiency, also contribute to anemia in these patients. Thus, the management of anemia is a crucial aspect of the treatment of kidney disease, particularly for those requiring renal biopsy to refine their diagnosis [20].

In this study, Nephrotic Syndrome was the most common indication for RBP in 53.36% of cases, followed by Severe Renal Failure in 22.28%. These results are comparable to those of Mhamedi S. et al. in 2018 [1], Ben. Salam M. et al. (2020) in Morocco [21] and Lemrabott A. et al. in Senegal in 2019 [8], who had also found that Nephrotic Syndrome was the most reported indication in proportions of 81; 41.8 and 78.3% of cases respectively. Nephrotic syndrome is one of the main indications for renal biopsy (RBP) due to the diversity of its primary glomerular causes (such as minimal lesion glomerulonephritis and segmental and focal glomerulosclerosis) and secondary causes (diabetes, lupus erythematosus, infections, sickle cell disease, etc.). RBP is crucial for establishing an accurate diagnosis, differentiating etiologies and guiding treatment. It can also be used to assess response to treatment, particularly in refractory forms. RBP remains essential for adapting management and improving clinical outcomes [22 ; 23].

Glomerular nephropathy (LGM, GNMP, HSF, NL, GSD, GEM, N.IgA) was the most common type of nephropathy diagnosed at PBR in 69.35% of cases. Our results are comparable to those of Mhamedi S. et al. in Morocco in 2018 [1] and KALLOSSY O. in Mali in 2021 [60], who respectively found glomerular involvement in 81% and 87% of cases. Glomerular nephropathy is a major cause of renal dysfunction and is frequently diagnosed by renal biopsy. This is due to their great etiological diversity and the importance of histopathological diagnosis in determining the origin of glomerular lesions, whether primary (such as minimal lesion glomerulonephritis,

membranous glomerulopathy, segmental and focal glomerulosclerosis) or secondary to systemic diseases such as systemic lupus erythematosus or diabetic nephropathy. RBP plays a crucial role in characterizing these pathologies, enabling us to determine the extent of glomerular lesions, such as podocyte pedicel fusion, glomerular sclerosis or immune complex deposition. This information is essential for selecting appropriate treatment and predicting patient prognosis [9; 24].

In this study, macroscopic hematuria was the most reported complication in 09.84% of cases, followed by microscopic hemorrhage in 03.11%, and malaise and hypotension in 00.52%. These results are comparable to those of Mhamedi S. et al. in Morocco in 2018 and KALLOSSY O. in Mali in 2021, who found macroscopic hematuria to occur in the majority of cases after RBP (3.1 and 11.3% respectively). These results could be explained by the fact that macroscopic hematuria after renal biopsy puncture results mainly from vascular lesions caused by the biopsy needle, due to the richly vascularized anatomy of the kidney. The main risk factors include the technique used, underlying coagulation disorders and proximity to the urinary tract. Although generally transient, this complication requires monitoring to avoid serious consequences. Adequate preparation prior to PBR and a controlled technique are essential to reduce the risks [26 ; 27 ; 28].

5. Conclusion

Renal biopsy is an essential procedure in the diagnosis of kidney disease, providing precise information on histological lesions and guiding therapeutic management. This examination is rarely performed in our country, and is often requested in young adult males admitted for nephrotic syndrome, often associated with toxic habits of phytotherapy. The main indication for RBP was nephrotic syndrome, and the procedure was commonly performed on the left kidney. Biopsy results mainly revealed glomerular nephropathy, and macroscopic hematuria was the most common complication.

Although renal puncture biopsy provides an accurate diagnosis, its prescription remains limited by a number of factors, including a shortage of specialists, a lack of modern equipment and limited access to nephropathology services in some regions.

More needs to be done. This will promote an overall improvement in the management of patients with kidney disease.

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