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Benign Nephroangiosclerosis at the Zinder National Hospital: Clinical Presentation and Paraclinical Aspects

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Abstract

Introduction: The aim of our study was to examine the clinical and paraclinical characteristics of benign nephroangiosclerosis (BNA) in the Nephrology department of the National Hospital of Zinder.

Patients and method: This is a cross-sectional study with a descriptive aim that involved 152 patient files who had undergone a kidney biopsy (KB) over a period of 4 years from November 1, 2019 to November 1, 2023 at the Nephrology department of the Zinder National Hospital. The processing and analysis of the data collected were carried out using Excel and Epi Info software version 7.2.5.0.

Results: During the study period, 152 patients underwent kidney biopsy, 31% of whom (n=47) were hypertensive. The hospital prevalence of NAS represented 9% (n=13) of all kidney biopsies. The mean age was 44.69 ± 10.66 years with extremes of 28 and 63 years. The sex ratio was 5.5 in favor of men. Two out of three patients had 24-hour proteinuria between 1 and 3g. In total, 61% (n= 8) of the patients in our sample were in the last stage of kidney failure. The main indication for kidney biopsy, unexplained kidney failure, was therefore the most frequent indication representing 53.85% (n= 7).

Conclusion: This work demonstrates that benign NAS is a reality at the Zinder National Hospital. This disease is more common in young people with cardiovascular risk factors, whose diagnosis is most often made at the last stage of kidney failure. Its progression is insidious and potentially fatal, which is why detecting and controlling high blood pressure at the initial stage will reduce the morbidity and mortality of NAS in our context of limited resources.

Keywords: Nephroangiosclerosis; Kidney Biopsy; National Hospital of Zinder.

Introduction

Nephroangiosclerosis (NAS) is the generic term defining any modification of a kidney compartment related to insufficiently or poorly managed high blood pressure (HYPERTENSION) [1]. The prevalence of hypertension varies from 10 to 15% for the general population in the world and is more marked in Africa, in the order of 23 to 27% [2,3]. Indeed, there is a correlation between increased blood pressure (BP) and the risk of end-stage kidney disease (ESRD) [4]. The diagnosis of NAS with certainty in theory is based on the histological results of the kidney biopsy. However, in practice, it is most of the time presumptive, hence the risk of erroneous and overestimated

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diagnosis which is based on the clinic. The prevalence of NAS is variously assessed depending on the use or not of KBP. Based on clinical presumption in the United States, more than 20% of dialysis appointments are attributable to NAS amputation. Indeed, there are few data on NAS based on kidney biopsy results in sub-Saharan Africa. In Niger, no study has been conducted on this topic so far. Therefore, this study was proposed to fill this research gap.

Patients and Methods

Study framework. Zinder National Hospital / Niger

Type and period of the study

This cross-sectional (longitudinal) study with a descriptive aim was carried out over a period of 4 years, from November 1, 2019 to November 1, 2023.

Study population

The study included all hypertensive patients who received KBP during the study period.

Inclusion criteria

All hypertensive patients whose KBP demonstrated SIN.

inclusion criteria: . Patients whose KBP results do not show SIN.

Data collection method

Data were collected from the KBP registry, we also extracted data from patients whose KBP showed NAS among the hypertensive population. The biopsy cores were sent to Kano (Nigeria) by land. Kano is about 250 km from Zinder.

In this retrospective study, data from the KBP registry of Zinder National Hospital were reviewed of all adult patients with long-standing hypertension who had indications and consented for KBP and underwent the procedure over a 4-year period from November 1, 2019 to October 31 , 2023. All biopsy cores were sent to Kano, Nigeria by land. Kano which is approximately 250 km from Zinder where there are qualified histopathologists with a well-equipped laboratory.

Samples were transported in a fixative that allowed good preservation of proteins and nucleic acids and offered quality morphological analysis. Samples were then processed by optical microscopy as well as immunofluorescence.

The extracted data include sociodemographic and clinical characteristics of the patients as well as the histological reports obtained

Procedures for fixing and transporting removed fragments

For optical microscopy. The sample was placed in a straight line either on a compress, but most often on the back of the operator's gloved hand and then immediately immersed in the fixative: AFA (Alcohol/ Formalin /Acetic Acid). It allowed both good preservation of proteins and nucleic acids and offered a quality morphological analysis.

For immunofluorescence (IF): The reference technique was the study on frozen sections. Several aspects were studied, the quality of the sample, the histological techniques used and finally the histological results themselves. The histological results were recorded in detail: glomeruli (cellular states, topography, proliferations, deposits, state of the glomerular basement membrane), interstitial tissue, tubules, vascular state, Congo red staining to look for amyloid deposits and presence or absence of immunoglobulins (Ig).

Variables used

Sociodemographic data, clinical and paraclinical parameters as well as histological results.

Data analysis

The collected data were entered and analyzed using Excel and Epi Info™ 7.2.5.0 software. Quantitative variables were expressed as mean or median. Proportions were summer expressed in percentage.

Ethical considerations. An anonymous database was created from the KBP register and patients' medical records. No information will identify the patients included in this study. Research authorization was obtained from the Faculty of Health Sciences of André Salifou University and the General Management of the National Hospital of Zinder.

Results

Among the 47 hypertensive patients who benefited from KBP, 13 met the inclusion criterion, i.e. a frequency of NAS of 9% of all KBPs performed. The mean age of our patients was 44.69 ± 10.66 years with extremes of 28 and 63 years. The most affected age group was 35 to 59 years, i.e. in 69% of cases (n = 9). A male predominance was found with a male/ female ratio of 5.5. Unexplained kidney failure was the main indication for PBR in our patients, i.e. 53.85% (n = 7).

More than two-thirds (n = 9) of patients had systolic -diastolic HYPERTENSION .

Classification according to severity of hypertension in patients with NAS.

Grade III was the most represented grade with a frequency of 53.85% (n=7).

Male patients and age were the most represented cardiovascular risk factors in 61% (n=8) and 22% (n=3) of cases, respectively. The majority of patients had an increase in serum creatinine (value greater than 120 µmol/l), i.e. 11 out of 13 patients. The mean serum creatinine was 673.70 ±583.2634 µmol/l with extremes of 65.81 and 2110.64 µmol/l.

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Table 1: Distribution of patients with NAS by KBP indication

GRP indication	Frequency (*n*)	Percentage (%)
Unexplained kidney failure	7	53.85
Lupus	1	7.69
Glomerular syndrome	4	30.77
Nephrotic syndrome	1	7.69
Total	13	100

Table 2: Distribution of hypertensive patients with NAS according to serum creatinine value before KBP .

Creatinemia	Frequency (n)	Percentage (%)
<120	2	15.38
[120-299]	1	7.7
[300-500]	4	30.77
≥500	6	46.15
Total	13	100

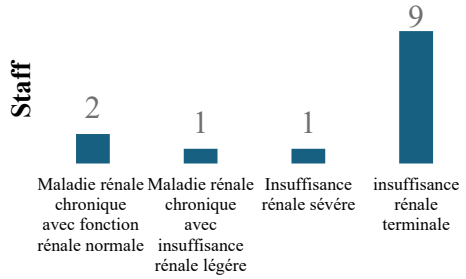

Figure 1: Distribution of patients according to the stage of IRC in patients with NAS

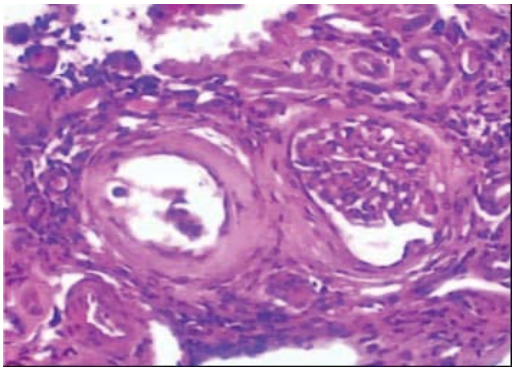

Figure 2: Image of a glomerulus characterizing NAS in a patient at HNZ in 2024

Discussion

Prevalence of NAS

During the study period, 152 KBPs were performed at the Nephrology and Hemodialysis Department of the HNZ. Among them, 47 were hypertensive, 13 of whom met our inclusion criteria, i.e. a SIN frequency of 9% across all KBPs. We found the same results as those observed by other African authors: Omboudou E et al [5] in Mali in 2023 with 9.2% and N'DAH et al [6] in Ivory Coast in 2022 with 10.61%. In Europe, Robles NR et al in Spain with 9.4% [7]. Furthermore, other studies had found a lower prevalence than ours. Indeed, Benzouina et al [8] in Morocco in 2021 and Sensu S et al [9] in China in 2019 had NAS prevalence rates of 2.6% and 2% respectively. This could be explained by the fact that there was a low proportion of the hypertensive population on all KBP in their studies. On the other hand, other studies have found higher prevalences than ours: M. Beaufils [10] in the United States in 2005, more than 20% of SIN. DIAWARA et al [11] in Senegal reports that NAS represents 52.32% of MCR in Thiès between January 1, 2013 and December 31, 2017. S.KA et al [12] in Togo 17.6% of SIN on all IRC, Ouattara B et al [13] 25.3% of SIN making it the first etiology of IRC in Ivory Coast. These high frequencies of NAS could be explained by the fact that all of these frequencies cited above were determined on the basis of a diagnosis of NAS based on presumptive clinical criteria.

Sociodemographic aspects

Age. In our study the mean age was 44.69 ± 10.66 years with extremes of 28 and 63 years. Patients in the 35-50 age group represented 69.23%. In the studies carried out by Omboudou E et al in Mali [5] Robles NR et al. [7] in Spain in 2010 the mean ages were respectively 43.45 ± 13.47 years, 66.6 ± 12.1 years. N'DAH et al [6] in a study on Kidney Biopsy in sub-Saharan Africa in 2022, the dominant group was that of 19-59 years. This could be explained by the fact that the majority of our patients were young, an age at which many patients delay consultations, as well as by non-compliance with medical treatment for high blood pressure, which can lead to rapid deterioration of kidney function.

Sex. The sex ratio was 5.5 in favor of men in our study, i.e. a male frequency of 85%. This predominance of NAS for the male sex was also found in the studies of Omboudou E et al [5] in Mali in 2023, Robles NR et al [7] in Spain in 2010, Lemrabott A et al [14] in Senegal in 2018, N'DAH et al. [15] in Ivory Coast where the sex ratios were respectively 1.27; 1.33; 1.07 and 2.8. On the other hand, OMOTOSO B [16] in Nigeria in 2016 in his study had found a female predominance with a sex ratio of 0.42.

Clinical data

Cardiovascular risk factors

HYPERTENSION exists in all our patients. Omotoso B [16] in Nigeria in 2016 in his study found male gender in 29.8% of cases and smoking in 5.7% of cases. While in our study, as in those of Lemrabott A et al [14] in 2018, Mbarki et al [17] in Morocco in 2016 and Robles NR et al [7] in 2010, male gender predominated. Indeed, HYPERTENSION is not only more common in male patients, but also kidney

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lesions are more common in men during the evolution of HYPERTENSION. HBP in a context of unexplained AFR is a common reason for requesting KBP. Indeed, hypertensive patients represented 31% of KBP requests in our study. We found the same results as those found in the study by Diallo A et al. [18] in Ivory Coast (36% HBP in his study). On the other hand, Mbarki H et al. [17] in Morocco in 2016 found a higher frequency of approximately 43.3%. M. Ben Salem et al. [19] in Tunisia in 2018 found a lower frequency than ours, i.e. 21%. These higher and lower frequencies could be linked not only to the difference in size of our enchantments but also to the duration of the period of our studies which differs. In our study, the typology of HYPERTENSION in terms of frequency was systolic -diastolic (69.25%) systolic (23.08%) and diastolic (7.69%). In his study Omboudou E et al. [5] in Mali found 82.45%; 13.16% and 4.39% respectively for systolic -diastolic hypertension , systolic hypertension and diastolic hypertension. Systolic -diastolic HYPERTENSION presents more severity in patients in terms of kidney complications. HBP was grade III in 53.85% of our patients. Grade III hypertension was reported by Omboudou E et al [5] in 2023 and Lemrabott A et al [14] in Senegal respectively in 51.62% and 39%. This is explained by the fact that so-called severe grade III hypertension is the type most associated with kidney comorbidities than the others.

Stage of discovery of NAS. In our series, 61% of our patients were at the CKD stage. In his study Omboudou E et al [5] in Mali had found a predominance of terminal CKD in 92.8% of patients. This high prevalence of CKD in NAS could be explained by the fact that NAS is a disease of remarkable clinical discretion and completely asymptomatic for many years in most patients [20].

Paraclinical aspects

Serum creatinine

The mean creatinine level was 673.70 ± 583.2634 µmol/l with extremes of 65.81 and 2110.64 µmol/l, our result is significantly lower than that of Omboudou E et al [5] who found a mean creatinine level of 1392.04 ± 697.205 umol /l with extremes of 170 and 3399 umol /l. On the other hand, our result is higher than those of OMOTOSO B [16] and Lemrabott A et al [14] who found respectively a mean serum creatinine of 88.05 ± 30.57 µm/L and 66.4 ± 63.04 mg/L. This high mean serum creatinine in our study and that of Omboudou E et al in Mali could be explained by the delay in consultation of patients in our services. Most of the time, this delay is due to the low socio-economic level of patients and the fact that they first resort to non-specific and indigenous treatments.

24-hour proteinuria

More than two-thirds of our patients had 24-hour proteinuria of less than 1.5 g, or 69% of cases. The mean 24-hour proteinuria is 1.688 ± 0.8524 with extremes of 0.310 and 3.20 g. This high frequency of mean 24-hour proteinuria is almost similar to that of Diallo et al. [81=18] in Côte d'Ivoire who reported 65%. It is significantly lower than that of Diangolé et al. [21] in Niger in 2023 and Mhamedi et al. [22] in Morocco in 2018 who reported 49% and 37% respectively. This difference in data could be explained by the fact that the last two results are obtained on all KBPs (excluding or not) while our result concerns the excluding population.

Indications for KBP

The diagnostic contribution of kidney biopsies is now indisputable for the diagnosis of certainty, treatment and monitoring of kidney pathologies. Thus, in our study, unexplained kidney failure followed by glomerular syndrome are the most represented indications with a rate of 53.85% and 30.77% respectively. Nephrotic syndrome represents 7.26%. In their studies Diangolé et al. in Niger report nephrotic syndrome (50.0%), unexplained kidney failure (27.5%), Mhamedi et al in Morocco, the indications for KBP were dominated by nephrotic syndrome (60%), all ages combined, M. Ben Salem et al in Tunisia, nephrotic syndrome was the most frequent indication (41.8%) and N'DAH et al report a predominance of nephrotic syndrome in 64.2% in a study on KBP in sub-Saharan Africa. [21,15,19,22]. This predominance of nephrotic syndrome could be due to the fact that the results of the four aforementioned studies concerned all KBPs of all pathologies combined, or that our results concerned KBPs on the NAS population.

Results of histopathological analyses

The quality of biopsies is essential. It depends on many factors such as the experience of the team performing the biopsy, but also on the equipment used [23]. The means of identifying biopsies was ultrasound. Other means of identification exist (under CT scan for patients with anatomical variations) but these were not used in our study. The analysis of biopsy fragments requires being able to observe all the elements of the kidney parenchyma and a minimum number of glomeruli. A dozen glomeruli can be considered a satisfactory number. For certain diseases, a single glomerulus can be used to suggest the diagnosis. In the literature, the rate of adequate sampling is 99% and the rate of severe complications is less than 0.1%. [24,23]. In our series, the mean number of glomeruli was 11.09 ± 6.53 glomeruli per KBP with extremes of 2 and 24 glomeruli. This result is lower than those of Ousmane k et al. [325] in Mali in 2021, Asgarali E et al. [23] in France in 2020 who reported an average number of glomeruli of 15.4 and 15.7 respectively. On the other hand, Majid et al in Niger in 2023 reported a result lower than ours of the order of 9.3 glomeruli per KBP [124].

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Limitations of the study.

During our study, we were confronted with certain limitations mainly related to the small size of our sample itself in connection with the unavailability of an anatomopathology service in the Zinder region but also to the low socio-economic level of our patients thus limiting the realization of these KBP.

Conclusion

Despite the unavailability of an anatomopathology department in our context and also the low socio-economic level of our patients, the practice of KBP is a reality at the National Hospital of Zinder. This allowed us to make the diagnosis of certainty of NAS with a prevalence of 9% of all KBP. In Niger, where access to KBP remains limited for a large part of the population, it will be crucial to reduce the prevalence and progression of NAS to the ETC stage by improving prevention strategies and effective control of HYPERTENSION which remains a major public health problem in the world. Studies with larger numbers than ours could help to better understand the epidemiological characteristics of NAS.

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