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Preliminary Study on Renal Ultrasound Biometry in Apparently Healthy 18 to 30-Year-Old Subjects with Normal Renal Function in Ouagadougou

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Abstract

Introduction: In our practice, renal measurements in patients with normal renal function usually appear to be lower compared to standards reported in reference literature. The standards are probably different in our context. Given the importance of renal biometrics in nephrological practice, we felt it necessary to carry out this preliminary study in order to identify an order of reference measurements appropriate to our context. **Methods:** This was a cross-sectional study that took place from 18 August to 04 November 2018 at the Yalgado Ouedrarogo University Hospital Center. The first 100 subjects aged between 18 and 30 years who met the following inclusion criteria were selected: to be black african Burkinabe and to have normal renal function. The height, width and thickness of each kidney were measured using ultrasound scanners. For statistical tests, a value of $p < 0.05$ was considered statistically significant. **Results:** The average age was 23.9 ± 6.1 years and the sex ratio was 2.2. Mean heights, widths and renal thicknesses were 94.5 ± 14.5, 38.7 ± 10.7 and 36.3 ± 10.3 mm, and 96.7 ± 16.7, 42.7 ± 16.7 and 36.8 ± 10.8 mm respectively for right and left kidneys. The distribution of the different renal dimensions in our sample followed a normal distribution. In the particular case of the right kidney, the probability that its height was

between 79.2 and 109.7 mm was 0.95 and the probability that it was less than 79.2 mm or greater than 109.7 mm was 0.05. Renal height was significantly higher in subjects with height greater than 1.70 m ($p \leq 0.02$). The left kidneys were on average significantly larger than the right kidneys ($p = 0.0001$). **Conclusions:** Our study is not extrapolable to the general population of Burkina Faso. It suggests, however, that the kidneys of the apparently healthy Burkinabe subject are smaller than what is reported in anatomy reference books. Our work, which is preliminary, should be deepened through a national survey. In the meantime, we should consider, in the nephrological assessment of the Burkinabe patient, the results of the renal biometrics we report.

Keywords

Black African, Burkina Faso, Renal Biometrics, Ultrasounds Scanner

1. Introduction

Ultrasonography is an imaging technique that relies on the use of ultrasound. Because of its safety and accessibility, it is the first-line for the exploration of renal parenchyma and vessels. It allows, in association with the laboratory tests, the early diagnosis of renal disease expressed by a morphological and/or structural abnormality of the kidneys.

The knowledge of renal biometry provides essential morphometric parameters. It reports changes in kidney size during renal disease helping doctors to make a diagnostic and therapeutic decision. This assumes a prior knowledge of normal kidney size. While studies have been done in western countries to evaluate normal kidney biometrics, estimating the height at 120 mm, the width at 60 mm, and the thickness at 30 mm; only a few studies in black Africa were devoted to this question [1]. As a Consequence, African healthcare centers are using western countries reference ranges, which are not always adapted to Black African. Indeed, the kidney size varies from one population to another, also depend on age, weight, height, sex, and origin [2]. A study done among adults in Benin, found the kidney size to be well below western countries numbers [3]. However, can these results be generalized to other black African populations?

In our practice, renal measurements in patients with normal kidney function usually appear to be lower compared to normal values reported in literature. The normal values are probably different in our context. Given the importance of renal biometrics in nephrology, we deemed necessary to carry out this preliminary study to identify normal reference values appropriated to our context.

2. Methods

We conducted a descriptive and analytical cross-sectional study between August

18 and November 04, 2018 in the imaging department of the Yalgado Ouedraogo University Hospital Center (CHU-YO).

The study population included students and individual accompanying patients aged 18 to 30 years. We chose a convenience sample. The selection of subjects was done using brochures in CHU-YO, and The Universities Ouaga I Pr Joseph KI-ZERBO and Saint Thomas Aquin. Empirically, the first 100 subjects meeting the inclusion criteria were selected.

The inclusion criteria were:

- be black and have at least a parent and grandparent Burkinabe.
- age between 18 and 30 years.
- be apparently in good health:
  - no past medical history of acute or chronic kidney disease, high blood pressure, clinically detectable heart or liver failure, diabetes mellitus, edema, hematuria, pyuria;
  - normal urine dipstick test for albumin, red blood cells, leukocytes, glucose, urinary density, nitrite;
  - a normal glomerular filtration rate (GFR), estimated by the the modification of diet in renal disease (MDRD);
  - even and symmetrical kidneys, with normal echogenicity and without structural abnormalities.

We did not include pregnant women in the study.

The data were collected using a standardized questionnaire, completed by the same interviewer at each interview with the subjects. The studied variables were renal biometrics, and socio-demographic, clinical and biological data (plasma urea, creatinine). A leaflet explaining the objectives of the study was given to the participants. For those who could not read, it was described to them in the language of their choice.

The data were collected anonymously. The obtained results were only shared with the subjects who wanted it. The brand of the ultrasound machine used was Toshiba™ or General Electric™. Each of the two reference radiologists weres performed at least two measurements per patient. The average of these measurements (expressed in millimeters) for each subject was used.

The length was measured on a longitudinal section through the long axis between the two poles. The width measurement was made on a cross-section, corresponding to the distance between the hilum and the lateral edge. The thickness was measured on a transverse section through the hilum between the anterior and posterior surfaces and perpendicular to the width.

In order to be operational, renal ultrasound biometrics were defined by the method of ultrasound measurement using the two conventional slices (longitudinal and transverse) to establish limits [3]. Classically, the normal size of the kidneys is 120 mm for the height, 60 mm for the width and 30 mm for the thickness. Renal hypotrophy is described when the height is less than 90 mm, the width less than 40 mm and the thickness less than 30 mm. Renal hypertrophy is defined by a height greater than 120 mm.

This study has been approved by the management of the university hospital center Yalgado Ouédraogo of Ouagadougou, in the absence of an institutional ethics committee. An information leaflet detailing the objectives has been proposed to the identified persons. For those who could not read, the instructions were clearly explained in the dialect of their choice. It was only after this stage that verbal consent was requested and acquired from study participants. We did not observe any cases of refusal to participate. The data was collected under the guise of anonymity and confidentiality. The results of the complementary examinations were immediately communicated and explained to the participants.

Data entry and analysis was done on a micro-computer with Epi-Info software. Quantitative variables were expressed as mean ± standard deviation and qualitative variables as numbers and percentages. The chi-square test was used to compare the qualitative variables for total numbers ≥ 5. For total numbers < 5, we used Fisher's exact test. The Student's t-test was used to compare the means. A p-value < 0.05 was considered statistically significant.

3. Results

The study concerned 100 individuals. The sex ratio was 2.2 and the average age of the patients was 23.9 ± 6.1 years. The overall mean serum creatinine was 110.7 ± 9.5 mL/min/1.73 m^2. The general complete data of patientsis shown in Table 1.

3.1. Renal Measurements by Ultrasound

Kidney measurements on ultrasound showed an average height of 94.5 ± 14.5 and 96.7 ± 16.7 mm for respectively the right and left kidneys. The synthesis of renal measurements on ultrasound is reported in Table 2.

3.2. Distribution of Renal Heights

The distribution of renal heights in our sample followed a normal distribution. Thus, the probability that the height of the right kidney be between 79.2 and 109.7 mm was 0.95 and the probability that the height of the right kidney be less than 79.2 mm or greater than 109.7 mm was 0.05 (Figure 1).

The probability that the height of a left kidney be between 81.5 and 111.8 mm was 0.95 and the probability that the height of a left kidney be less than 81.5 mm or greater than 111.8 mm was 0.05 (Figure 2).

3.3. Factors Associated with Kidney Height Socio-Demographic Factors

The socio-demographic factor significantly associated with renal height was the sex (Table 3). Thus, the renal height was significantly higher in male.

3.4. Lifestyle

In our study, there was no significant association between lifestyle and renal

Table 1. Socio-demographic, clinical and laboratory data of 10,018 to 30-year-old subjects with normal renal function in Ouagadougou.

Sex ratio: 2.2	**Body mass index in kg/m²**
Mean age: 23.9 ± 6.1 years	m ± SD overall: 22.6 ± 8.7
Residence	m ± SD men: 22.4 ± 6.9
Ouagadougou n (%): 95 (95)	m ± SD women: 23.2 ± 8.0
Other residence n (%): 5 (5)	**SBP in mmHg**
Profession	m ± overall SD: 117.3 ± 5.1
Student n (%): 65 (65)	m ± SD men: 118.0 ± 7.2
Pupil n (%): 19 (19)	m ± SD women: 115.8 ± 3.5
Official n (%): 16 (16)	**DBP in mm Hg**
Lifestyle	m ± SD overall: 74.6 ± 1.9
Tobacco* n (%): 14 (14)	m ± SD men: 76.2 ± 2.2
Alcohol** n (%): 36 (36)	m ± SD women: 71.0 ± 3.3
Sedentary n (%): 32 (32)	**Creatininemia in µmol/L**
Weight in kg	m± overall SD: 82.6 ± 2.5
m ± SD: 68.1 ± 24.9	m ± SD men: 86.3 ± 12.5
m ± SD men: 69.8 ± 23.2	m ± SD women: 74.3 ± 9.9
m ± SD women: 64.3 ± 24.7	**GFR (MDRD) in mL/min/1.73 m²**
Height in cm	m ± SD: 110.7 ± 9.5
m ± SD: 173.1 ± 21.9	m ± SD men: 124.3 ± 5.9
m ± SD men: 176.1 ± 18.9	m ± SD women: 109.4 ± 10.4
m ± SD women: 166.4 ± 14.6	

*: 3.5 packs-year on average. **: occasional consumption. DBP: diastolic blood pressure. GFR: glomerular filtration rate. m ± SD: mean ± standard deviation. MDRD: modification of diet in renal disease. SBP: systolic blood pressure.

Table 2. Height, width and thickness of right and left kidneys of 100 18 to 30-year-old subjects with normal renal function in Ouagadougou.

	Right Kidney	Left Kidney
Height		
m ± SD in mm	94.5 ± 14.5	96.7 ± 16.7
<90 mm n (%)	27 (27)	18 (18)
≥90 mm n (%)	73 (73)	82 (82)
Width		
m ± SD (extreme) in mm	38.7 ± 10.7	42.7 ± 16.7
<40 mm n (%)	55 (55)	26 (26)
≥40 mm n (%)	45 (45)	74 (74)
Thickness		
m ± SD (extreme) in mm	36.3 ± 10.3	36.8 ± 10.8
<30 mm n (%)	4 (4)	6 (6)
≥30 mm n (%)	96 (96)	94 (94)

m ± SD: mean ± standard deviation.

height (Table 4).

3.5. Anthropometric Data

In our study, the average kidney height for subjects less than 1.70 m and those

Table 3. Association between renal height and socio-demographic factors of 18 to 30-year-old subjects with normal renal function in Ouagadougou.

	Right kidney		Left kidney	
	Height m ± SD in mm	p	Height m ± SD in mm	p
Sex		0.009		0.008
Man	94.8 ± 14.8		96.8 ± 13.6	
Woman	93.6 ± 11.6		96.7 ± 6.7	
Age in years		NS		NS
<20	86.6 ± 6.6		93.0 ± 10.0	
[20 - 25]	95.6 ± 14.5		97.3 ± 17.3	
[25 - 30]	94.0 ± 14.0		96.5 ± 12.4	
≥30	88.0 ± 2.6		90.0 ± 3.0	
Residence		NS		NS
Ouagadougou	94.8 ± 14.7		96.7 ± 16.7	
Outside of ouagadougou	89.4 ± 6.7		96.8 ± 11.1	
Profession		NS		NS
Student	90.7 ± 8		94.8 ± 4.5	
Pupil	91.1 ± 3.6		42.3 ± 0.7	
Official	91 ± 6		94 ± 5.6	

m ± SD: mean ± standard deviation. NS: not significant.

Table 4. Association between kidney height, antecedents, and lifestyle of 18 to 30-year-old subjects with normal renal function in Ouagadougou.

	Right kidney		Left kidney	
	Height m ± SD in mm	p	Height m ± SD in mm	p
Smoker		NS		NS
Yes	95.3 ± 8.2		98.5 ± 15.5	
No	94.4 ± 14.3		96.5 ± 16. 4	
Chew Tobacco		NS		NS
Yes	104 ± 9		104.7 ± 9.6	
No	94.3 ± 14.2		96.5 ± 16.5	
Alcohol		NS		NS
Yes	98.7 ± 4.7		101.5 ± 11.5	
No	94.3 ± 14.3		96.5 ± 16.4	
Sedentary		NS		NS
Yes	93.4 ± 13.4		96.3 ± 9.2	
No	94.7 ± 14.6		96.7 ± 16.7	

m ± SD: mean ± standard deviation. NS: not significant.

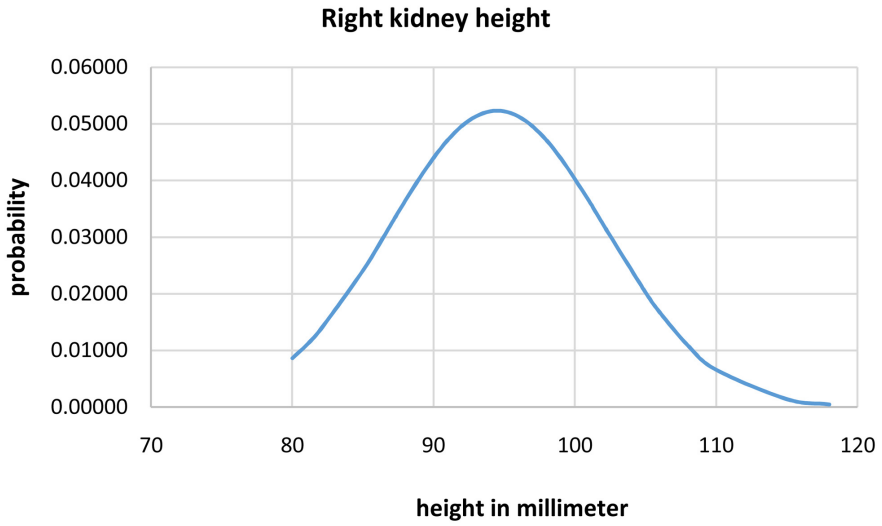

Figure 1. Gauss curve representing the distribution of subjects according to the height of the right kidney. Mean = 94.5; standard deviation = 14.5; n = 100. Horizontal axis: right kidney heignt in millimeter. Vertical axis: probability.

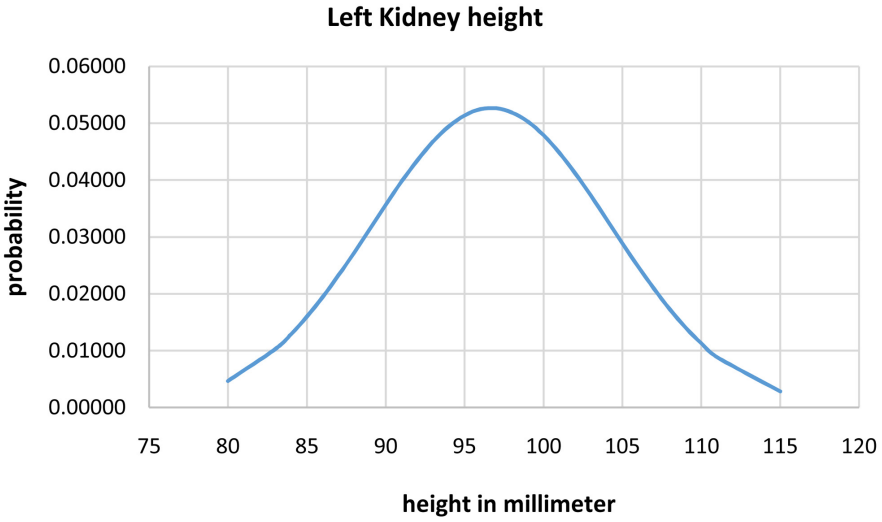

Figure 2. Gauss curve representing the distribution of subjects according to the height of the left kidney. Mean = 96.7; standard deviation = 16.7; n = 100. Horizontal axis: left kidney heignt in millimeters. Vertical axis: probability.

with a size greater than or equal to 1.70 m was respectively 91.4 ± 11.6 and 95.4 ± 15.5 mm for the right kidney and 92.9. ± 13.1 and 97.8 ± 15 mm for the left kidney. The kidney was significantly higher in height for subjects greater than or equal to 1.70 m both on the right ($p = 0.002$) and on the left ($p = 0.005$) (Table 5). Likewise, the height of the kidney of subjects with a BMI greater than or equal to 25 kg/m^2 was greater than that of subjects with a BMI less than 25 (Table 5).

3.6. Laboratory Factors

In subjects with serum creatinine less than 70 µmol/L had an average height of

Table 5. Association between kidney height and anthropometric data of 18 to 30-year-old subjects with normal renal function in Ouagadougou.

	Right kidney		Left kidney	
	Height m ± SD in mm	**p**	**Height m ± SD in mm**	**P**
Height		0.02		0.005
<1.70 m	91.4 ± 11.6		92.9 ± 13.1	
≥1.70 m	95.4 ± 15.5		97.8 ± 15	
Weight		NS		NS
<60 kg	91.2 ± 11.2		93.8 ± 13.7	
[60 - 80] kg	94.8 ± 14.8		97.1 ± 14.1	
≥80 kg	97.5 ± 9.5		98.8 ± 11.8	
Body mass index		0.04		0.02
<25 kg/m²	94.2 ± 14.3		96.1 ± 16.3	
≥25 kg/m²	95.5 ± 8.1		98.1 ± 10.9	

m ± SD: mean ± standard deviation. NS: not significant.

the right and left kidneys of 97 ± 8 and 98.7 ± 11.7 mm, respectively. For subjects with serum creatinine greater than or equal to 70 µmol/L, the mean kidney height was 94.3 ± 14.3 and 96.6 ± 13.6 mm, respectively. The differences observed were not significant.

3.7. Comparison of Renal Size Means

In average, the right kidney had a height of 94.5 ± 14.5 mm, a width of 38.7 ± 10.7 mm and a thickness of 36.3 ± 10.3 mm. Compared to the right kidney, the average size of which was 96.7 ± 16.7, 42.7 ± 16.7 and 36.8 ± 10.8 mm respectively for heigth, width and thickness, the left kidney was larger ($p = 0.0001$ for the three types of measurements).

4. Discussion

We used ultrasound for the kidneys measurements. This ultrasound technique has the advantage of being safe and financially accessible. It is a first-line imaging. When performed by an experienced operator, the ultrasound provides exciting results. However, CT scan is more accurate and easier to reproduce [4] but it is much more expensive. Our choice to use two ultrasound operators helps improve the accuracy.

We reported mean height of 94.5 ± 14.5 mm for the right kidney and 96.7 ± 16.7 mm for the left kidney, and even kidneys with 80 mm of height were compatible with normal kidney function. These sizes are smaller than the 120 mm appearing in classic anatomy books [1] described in Caucasian. Other African authors report means that, although slightly higher than ours, are well below 120 mm. Indeed, Ramilitiana *et al.* in Madagascar, Agboton *et al.* in Benin and Okoye *et al.* in Nigeria noted the mean of the height for the right and left

kidney between 98 to 106 mm [3] [5] [6]. In Mexico, Oyuela-Carrasco *et al*. [7] found a mean of 104.3 ± 6.5 mm for the right kidney and 105.8 ± 7.5 mm for the left kidney. In our study as well as in others, the right kidney was lower than the left, certainly because of the presence of the liver above the right kidney.

We did not find any significant association between kidney height and age, certainly due to the age homogeneity of our sample. We should know that the height varies depending on age. This has been well demonstrated in the study of Buchholz *et al*. [2] based on a population aged between 13 and 80 years. Thus, in their sample, the size of the kidney increased until the 3rd decade, remained stable throughout the middle age and then decreased. Like most studies [2] [3] [6] [8], we confirmed that male had a higher kidney size than female. The influence of the male sex hormones lead in general to a higher weight and height in man compared to woman. It is known the height of the kidney is proportional to these two anthropometric parameters [7] [9] [10]. Our study has moreover confirmed this association between these parameters and the renal height.

5. Limits of the Study

The results of our study could not be generalized to the national level because of our convenience sampling. Also, normal kidney function was determined by the estimation of GFR by the MDRD formula. Although this method is well-appropriated for the weights and ages in our study, the accurate measurement of the GFR with a standard method (however costly) would have given us the preliminary study, with exciting results th certainty. Despite these limitations, we have reached to the end of this at can serve as a basis for practitioners in our country.

6. Conclusion

Although our study cannot be generalized to the population of our country, suggests that the kidneys of the healthy Burkinabe are smaller than what is reported in anatomy books. Our study, which is preliminary, should be deepened through a national study. If this study confirms the present results, some questions may be asked. Indeed, if the GFR is proportional to a healthy kidney size, we can wonder if the Black Burkinabe (African by extension) does not have a lower GFR at birth. Could this contribute to a faster progression of chronic renal failure in such a population? Moreover, we should consider, in the nephrology assessment of Burkinabe patient, the results of the renal biometry that we report.

Conflicts of Interest

The authors do not declare any conflict of interest.

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Appendix

FICHE DE COLLECTE

I/IDENTITE

- Numéro d'identification: ……
- Age: ……
- Sexe: M /_/, F /_/
- Lieu de résidence: ……
- Profession: ……...
- Ville: ……
- Contact: ……

II/ ANTECEDENTS

➢ Personnels:

- Terme à la naissance: ……
- Gémellité: Oui /_/ Non /_/
- Complications à l'accouchement: Oui /_/ Non /_/ (si oui préciser……)
- Hématurie: Oui /_/ Non /_/
- Pyurie: Oui /_/ Non /_/
- Œdème de type rénal: Oui /_/ Non /_/
- Brûlures mictionnelles: Oui /_/ Non/_ /
- Infections ORL: Oui /_/ Non /_/
- HTA: Oui /_/ Non /_/ (si oui date de début…….)
- Maladie rénale: Oui /_/ Non /_/ (si oui date de début…….)
- Diabète: Oui /_/ Non /_/ (si oui date de début……)
- Hémoglobinopathie: Oui /_/ Non /_/ (si oui date de début…….)
- Cardiopathie: Oui /_/ Non /_/ (si oui date de début…….)

➢ Familiaux:

- HTA: Oui /_/ Non /_/
- Diabète: Oui /_/ Non /_/ (si oui quel type…….)
- Cardiopathie: Oui /_/ Non /_/
- Maladie rénale: Oui /_/ Non /_/
- Autres: ……

➢ Mode de vie:

- Tabac fumé: Oui /_/ Non /_/ (si oui combien de paquets années…….)
- Tabac chiqué: Oui /_/ Non /_/
- Alcool: Oui /_/ Non /_/ (si oui quelle quantité……..)
- Sédentarité: Oui /_/ Non /_/

➢ Autres Antécédents: …….

III/DONNEES CLINIQUES

- Etat général selon OMS: /_/

- Capable d'une activité identique à celle précédent la maladie, sans aucune restriction: 0.
- Activité physique diminuée mais ambulatoire et capable de mener un travail: 1.

- Ambulatoire et capable de prendre soin de soi, incapable de travailler. Alité moins de 50% de son temps: 2.
- Capables de seulement quelques soins personnels. Alité ou en chaise plus de 50% du temps: 3.
- Incapable de prendre soin de lui-même, alité ou en chaise en permanence: 4.

- Taille: ……
- Poids: …….
- Indice de masse corporelle: ……
- Bruits du cœur: ……
- Pression artérielle: ……
- Les mensurations du foie: ….....

IV/DONNEES BIOLOGIQUES

- la créatininémie: …….
- le débit de filtration glomérulaire selon MDRD: ……..

V/BIOMETRIE RENALE

REIN DROIT:

- Hauteur: ……

1 = (augmentée) > 120
2 = (normale) 85 - 120
3 = (diminuée) < 85

- Largeur: …….

1 = (augmentée) > 60
2 = (normale) 35 - 60
3 = (diminuée) < 35

- Epaisseur: …….

1 = (augmentée) > 52
2 = (normale) 28 - 52
3 = (diminuée) < 28

- Bonne différenciation cortico-médullaire: Oui /_/, Non /_/

REIN GAUCHE:

- Hauteur: ……

1 = (augmentée) > 120
2 = (normale) 85 - 120
3 = (diminuée) < 85

- Largeur: …….

1 = (augmentée) > 60
2 = (normale) 35 - 60
3 = (diminuée) < 35

- Epaisseur: …….

1 = (augmentée) > 52
2 = (normale) 28 - 52
3 = (diminuée) < 28

- Diamètre: …….

1 = (augmentée) > 77

2 = (normale) 49 - 77

3 = (diminuée) < 49

- Bonne différenciation cortico-médullaire: Oui /_/, Non /_/

Symétrie de la taille des reins: Oui /_/ Non /_/

COLLECTION SHEET

I/IDENTITY

- ID number: ……
- Age: ……
- Sex: M / _ /, F / _ /
- Place of residence: ……
- Profession: ……...
- City: ……
- Contact: ……

II/BACKGROUND

Personal:

- Term at birth: ……
- Twinning: Yes / _ / No / _ /
- Complications during childbirth: Yes / _ / No / _ / (if yes specify ……)
- Hematuria: Yes / _ / No / _ /
- Pyuria: Yes / _ / No / _ /
- Edema of renal type: Yes / _ / No / _ /
- Micturition burns: Yes / _ / No / _ /
- ENT infections: Yes / _ / No / _ /
- HBP: Yes / _ / No / _ / (if yes start date …….)
- Renal disease: Yes / _ / No / _ / (if yes start date …….)
- Diabetes: Yes / _ / No / _ / (if yes start date ……)
- Hemoglobinopathy: Yes / _ / No / _ / (if yes start date …….)
- Cardiopathy: Yes / _ / No / _ / (if yes start date …….)

Family:

- HBP: Yes / _ / No / _ /
- Diabetes: Yes / _ / No / _ / (if yes which type …….)
- Cardiopathy: Yes / _ / No / _ /
- Renal disease: Yes / _ / No / _ /
- Other: ……

Lifestyle:

- Smoked tobacco: Yes / _ / No / _ / (if yes how many packages years …….)
- Chewed tobacco: Yes / _ / No / _ /
- Alcohol: Yes / _ / No / _ / (if yes what quantity …… ..)
- Sedentary lifestyle: Yes / _ / No / _ /

Other History: …….

III/CLINICAL DATA

- General condition according to WHO: / _ /

- Capable of an activity identical to that preceding the disease, without any restriction: 0.
- Reduced but ambulatory physical activity capable of carrying out work: 1
- Ambulatory and able to take care of oneself, unable to work. Bedridden less than 50% of his/her time: 2.
- Capable of only some personal care. In bed or in a chair more than 50% of the time: 3.
- Unable to take care of himself, bedridden or in a chair permanently: 4.

- Cut: ……
- Weight: …….
- Body mass index: ……
- Noise of the heart: ……
- Arterial pressure: ……
- The liver measurements: ….....

IV/BIOLOGICAL DATA

- creatinine level: ……
- the glomerular filtration rate according to MDRD: ……..

V/RENAL BIOMETRY

RIGHT KIDNEY:

- Height: ……

1 = (increased) > 120

2 = (normal) 85 - 120

3 = (decreased) < 85

- Width: ……

1 = (increased) > 60

2 = (normal) 35 - 60

3 = (decreased) < 35

- Thickness: …….

1 = (increased) > 52

2 = (normal) 28 - 52

3 = (decreased) < 28

- Good cortico-medullary differentiation: Yes / _ /, No / _ /

LEFT KIDNEY:

- Height: ……

1 = (increased) > 120

2 = (normal) 85 - 120

3 = (decreased) < 85

- Width: ……

1 = (increased) > 60

2 = (normal) 35 - 60

3 = (decreased) < 35

- Thickness: …….

1 = (increased) > 52

2 = (normal) 28 - 52

3 = (decreased) < 28

- Diameter: …….

1 = (increased) > 77

2 = (normal) 49 - 77

3 = (decreased) < 49

- Good cortico-medullary differentiation: Yes / _ /, No / _ /

Symmetry of kidney size: Yes / _ / No / _ /