SAS Journal of Medicine
Abbreviated Key Title: SAS J Med
ISSN 2454-5112
Journal homepage: https://saspublishers.com

OPEN ACCESS

Medicine

Assessment of Renal Function in the Elderly

Pr Djibril SY[1,6*], Traoré Djenebou[1,6], Bréhima Berthe[7], Togo Mamadou[2], Diarra Aoua[1], Sékou Landouré[1], Keïta Kaly[1], Traoré Abdramane[3], Tolo Nagou[3], Camara Boua Daoud[4], Saliou Mahamadou[2], Dao Karim[2], Koné Nouhoum[1], Sy Seydou[5], Goïta Issa Souleymane[6], Sanogo A[7], Sandji Oumar[6], Traoré Abdel Kader[1,6], Soukho Assétou Kaya[1,6]

[1]Department of Internal Medicine at the Point G University Hospital Bamako, Mali
[2]Department of Internal Medicine at Gabriel Touré University Hospital, Mali
[3]Department of Medicine at the BSS University Hospital in Kati, Mali
[4]Department of Medicine, Hospital Nianankoro Fomba, Segou, Mali
[5]Department of Nephrology at the Point G University Hospital, Bamako, Mali
[6]Faculty of Medicine and Odontostomatology (FMOS), Bamako, Mali
[7]Army Medical and Surgical Centre, Bamako, Mali

DOI: 10.36347/sasjm.2023.v09i08.012 | **Received:** 06.07.2023 | **Accepted:** 11.08.2023 | **Published:** 19.08.2023

***Corresponding author:** Pr Djibril SY
Department of Internal Medicine at the Point G University Hospital Bamako, Mali

Abstract **Original Research Article**

Introduction*:** Over the age of 40, kidney function decreases with age, with a decrease in glomerular filtration (DFG) flow in the range of 0.5 to 1 ml/mn per year. ***Purpose*:** To study the épidémio-clinical and paraclinical profile of the kidney function of the elderly. ***Methods and Material: Cross-sectional study with prospective collection and retrospective data on the files of subjects aged 65 or over from 01 January 2017 to 30 May 2018. ***Results*:** Forty-four (44) files met the inclusion criteria out of 196, representing a hospital frequency of 21%. The sex ratio was 2.4. Medical history was represented by HTA (56.1%), diabetes 14.6%. The reasons for admission were: abdominal pain (22%), disorders of consciousness (22%) and edema syndrome (10%). Creatininemia was high (75.6%). The association hypocalcemia and hyperphosphatemia in 12.5%. Anemia was normocytic normocyticnormochrome (53%). On ultrasound a good differentiation of renal cortico-medullary (80.5%), kidneys of normal size (87.8%) and urinary tract dilation (4.9%). Kidney failure was acute (80.5%) chronic (19.5%). Dehydration accounted for 41% of the causes, followed by hypertensive kidney disease (9.75%). ***Conclusion*:** Kidney function changes with age. Cardiovascular risk factors should be prevented early and corrected as best they can be to prevent them from acting later.

Keywords: Kidney function assessment, elderly, internal medicine, Point G Hospital.

INTRODUCTION

According to the WHO, an elderly person is any person aged 65 or over [1].

Over the age of 40, renal function declines with age, with a fall in glomerular filtration rate (GFR) of around 0.5 to 1 ml/min per year [2].

These age-related physiological and renal changes are associated with multiple medication use and the chronic diseases inherent in this population [3]; they must therefore be taken into account when prescribing renally-eliminated drugs because of the theoretical risk of accumulation [4].

Renal insufficiency (RI) corresponds to an alteration in the functioning of the kidneys, which no longer filter the blood correctly and no longer carry out their endocrine functions [5].

Chronic kidney disease (CKD) is defined by a single criterion: a reduction in glomerular filtration rate (GFR) of less than 60ml/min for 1.73m2, persisting for 3 months or more [6].

In Ivory Coast, CKD is the second leading cause of death in the internal medicine department of the Treichville University Hospital [7] and 4 to 20% of deaths at the Yalgado Ouédraogo National Hospital in Burkina Faso [8].

Acute renal failure (ARF) is the rapid fall in glomerular filtration rate. It follows an acute renal attack of variable intensity that is usually reversible [9].

In Mali, according to a study conducted by Farota in 2009 on AKI, the 60-83 age group was dominant (50%) [10]. A number of studies have been devoted to renal failure, but few have focused specifically on the elderly, which explains this study.

PATIENTS AND METHODS

We conducted a cross-sectional study with prospective and retrospective data collection, from 01 January 2016 to 30 May 2018. It included patients aged at least 65 years hospitalised in the internal medicine department of the Point G University Hospital during the study period.

All patients with at least one creatinine level measurement and an estimated glomerular filtration rate (GFR) < 60ml/min according to one of the following formulae were included: Cockcroft-Gault, MDRD or CKD-EPI and an abdomino-pelvic ultrasound.

Data were collected exhaustively by reading all the files in order to collect the variables.

We collected sociodemographic, clinical, paraclinical, etiological and therapeutic data. The sources used were the hospital register and the patients' hospital records. An individual survey form was prepared in advance. Variables were initially stored on survey forms and then entered into an SPSS version 22.0 epidemiological analysis tool. Arithmetic means were calculated with a risk of α-1.96 and $p<0.05$.

RESULTS

From 1 January 2016 to 31 May 2018, a period of 29 months, 877 patients were hospitalised in the internal medicine department, including 196 patients aged at least 65 years, a frequency of 22.34%. Forty-one (41) of the patients fulfilled the inclusion criteria, i.e. 21% of the geriatric population and 4.7% of all hospitalisations.

Table I: Distribution of patients by age group

Age group	Number	Fréquency
[65-75[	26	63,4%
[75-80]	8	19,5%
>80	7	17,1%
Total	**41**	**100,0%**

Males represented 70.7% of cases, with a sex ratio of 2.4. The mean age was 74.02±7.98 years, with extremes of 65 and 94 years.

The reasons for admission were abdominal pain and disorders of the conscience in 22% of cases each.

Table II: Distribution of patients by reason for hospitalisation

Reasons for hospitalisation	Numbers (n=41)	Frequency
Abdominal pain	9	22%
Disturbances of consciousness	9	22%
Edema syndrome	4	10%
Cough	3	7%
Blood sugar imbalance	2	5%
Polyarthralgia	2	5%
Vertigo	2	5%
Jaundice	2	5%
Other	8	16%
Total	**41**	**100%**

The medical history found was hypertension in 56.1% of cases. Arterial hypertension was observed on admission in 43.9% of patients.

Table III: Distribution of patients according to medical history

Medical history	Number n=41	Frequency
Hypertension	23	56,1%
Diabetes	6	14,6%
Hypertension + Diabetes	5	12,2%
Cardiomyopathy	2	4 ,87%
Chronic renal failure	2	4,87%
Blindness	1	2,43%
Urinary symptoms	1	2,43%
Oedema syndrome	1	2,43%
Macroscopic haematuria	1	2,43%
Recurrent anaemia	1	2,43%
No previous history	16	39%

Functional signs were represented by dyspnea in 53.65%, consciousness disorders in 48.78% and urinary symptoms in 39.02%.

Physical signs were represented by pallor in 46.34% of cases, followed by the presence of a persistent skin fold in 41.46%. Creatinine levels were high in 75.6% of patients, between 150 and 300 µmol/L in 29.3% of cases, and less than 100 µmol/L in 26.8% of cases. The mean creatinine level was 213.51 ± 181.77 µmol /L, with extremes of 45 and 984 µmol /L. Blood urea was elevated in 100% of patients and uric acid in 66.66%. We also observed 66.66% hypocalcaemia, 50% hyperphosphataemia and 6.25% hyperkalaemia. We observed a hypocalcaemia/hyperphosphataemia association in 2 patients with (p =0.486).

Table IV: Frequency of physical signs

Physical signs	Number	Frequency
Pallor	19	46,34%
Persistent skin folds	17	41,46%
Edematous syndrome	12	29,26%
Arthralgia	11	27%
Amyotrophy	8	19,51%
Ascites	6	14,63%
Jaundice	5	12,2%
Crepitating rales	5	12,2%
Jugular turgidity	4	9,75%
hepatomegaly	2	5%
Pericardial friction	2	5%
Hydrocele	2	5%
Babinski sign	2	5%
Others	7	17,07%

Anaemia was present in 92.7% of patients, it was normocytic normochromic in 53% and microcytic hypochromic in 29%.

Table V: Distibution of patients according to anemia

Anemia	Number	Fréquency %
Haemoglobin level		
Normal	3	7,3
Anaemia	38	92.7
Type of anaemia		
Normocytic normochromic	20	53
Hypochromic microcytic	11	29
Normocytic hypochromic	3	8
Macrocytic	3	8
Normochromic microcytic	1	3

NB: Three (3) patients had no anaemia

We observed leukocyturia in 31% of cases, and haematuria associated with leukocyturia in 6% of cases in 16 patients who underwent ECBU. Uroculture was negative in 63% of patients, isolating Escherichia Coli in 25%. A minimal 24-hour proteinuria was observed in 60% of patients.

According to Cockcroft-Gault, the mean GFR was 37.48 ± 13.81 mL/min with extremes of 10 and 58 mL/min; it was between 30-60 mL/min in 75% of cases.

According to Cockcroft-Gault formula, in the 11 patients with creatinine levels < 100 µmol/L, the GFR was between 30 and 60 mL/min in 10 (p =0.001).

According to MDRD formula, the mean GFR was 54.11 + or - 34.34 ml/min with extremes of 5 and 155 ml/min, and the GFR was >60 ml/min in 41.5% of cases.

According to CKD -EPI. The mean GFR was 46.32 + or - 29.29 ml/min with extremes of 4 and 115 ml/min. It was greater than 60 ml/min. In the 10 patients with normal creatinine, 9 had a GFR >60 ml/min (p =0.012); moreover, in the 11 patients with creatinine <100, the GFR was >60 ml/min (p = 0.010). In 80.5% of cases, the kidneys showed good cortico-medullary differentiation on ultrasound. In 87.8% of cases, the kidneys were of normal size on ultrasound. The excretory tracts were dilated on ultrasound in 4.9% of cases.

Table VI: Distribution of patients according to creatinine levels

Creatininemia	Number	Fréquency %
Normal	10	24,4
High	31	75,6
Total	**41**	**100**

Table VII: Distribution of patients according to creatinine classification

Creatinine classification	Number	Fréquency %
<100	11	26,8
100-150	9	22,0
150-300	12	29,3
300-600	7	17,1
600-800	1	2,4
>800	1	2,4
Total	**41**	**100**

Table VIII: Distribution of patients according to DFG

DFG	Number	Fréquency %
DFG Cockcroft-Gault		
30-60 ml/mn	18	75
15-30 ml/mn	3	12,5
10-15 ml/mn	2	8,3
<10ml/mn	1	4.2
DFG MDRD		
>60 ml /mn	17	41,5
30-60 ml/mn	12	29,3
15-30 ml/mn	8	19,5
10-15 ml/mn	2	4,9
<10ml/mn	2	4,9
DFG CKD -EPI		
>60 ml/mn	14	34,1
30-60 ml/mn	12	29,3
15-30 ml/mn	8	19,5
10-15 ml/mn	5	12,2
<10 ml/mn	2	4,9

Among 100% of patients with good cortico-medullary differentiation, the kidneys were of normal size. In 62.5% of patients with cortico-medullary dedifferentiation, the kidneys were reduced in size (p=0.00001).

Table IX: Distribution of patients according to ultrasound findings of the kidneys

Kidney ultrasound	Number	Fréquency
Cortico-medullary differentiation		
Good cortico-medullary differentiation	33	80,5
Poor cortico-medullary differentiation	8	19,5
Kidney size		
Normal	36	87,8
Decreased	5	12,2

Renal failure was acute and functional in 75.6% of cases and CKD in 19.5%. Fluid loss was the etiology in 41% of cases. Vascular nephropathy was present in 9.75% of cases and diabetic renal disease in 4.87%.

Table X: Distribution of patients by etiology of renal failure

Type of renal failure	Etiology	Number	Fréquency
Functional ARF	Fluid loss (dehydration)	17	41%
	Edematous syndrome / Chronic hepatopahy	5	12%
	Heart failure	2	5%
	Anaemia	2	5%

Type of renal failure	Etiology	Number	Fréquency
	No apparent cause	3	7%
	ACE inhibitors+ Edematous syndrome	1	2%
	Haemorrhagic shock	1	2%
Obstructive ARF	Cervical cancer	1	2%
	Prostate adenoma	1	2%
CKD	Diabetic kidney disease	2	4,87%
	Vascular nephropathy	4	9,75%
	No apparent cause	2	4,87%
	Total	**41**	**100%**

DISCUSSION

Methodology Limitations:

The study suffered from a number of shortcomings: the retrospective nature of the study made it difficult to use the medical records; the high cost of additional blood, urine and morphological tests made it difficult to carry out the requested analyses; some biological tests were not feasible at the Point-G laboratory. For the majority of patients, we were unable to calculate the GFR according to Cockcroft-Gault (CG) due to the difficulty in measuring the weight of these patients, who were often admitted in a bedridden state. Limitations in the means of para-clinical investigation have not allowed us to search for precise etiological factors.

Frequency:

This was a study of 196 patients aged at least 65 years hospitalised in the internal medicine department of the Point G University Hospital. Of these, 41 met the inclusion criteria, i.e. 21% of the geriatric population.

Acute renal failure was observed in 80.5% of cases; this result is higher than that reported by FAROTA [10], who found a frequency of 50% in the 60-83 age group.

Chronic renal failure was present in 19.5% of cases. This result is higher than that obtained by AMEKOUDI [11] who found a frequency of 10.3% in the 60-80 age group. On the other hand, this result is lower than that of Diallo [12], whose study focused solely on CKD in subjects aged over 60 years; she found a frequency of 32.32%.

***Socio-Demographic Data*:**

The [65-75] age group represented 63.4%. The mean age was 74.02 + or - 7.98 years with extremes of 65 and 94 years. Diallo [12] in 2009 reported an mean age of 68.17 + or - 6.6 years with extremes of 60 and 89 years. Males constituted 70.7% of cases, with a sex ratio of 2.4 (M/F), similar to Carbonnel [13] who found a sex ratio of 1.5 (M/F). Diallo [12] also found a sex ratio of 1.95.

This male predominance has also been confirmed by several studies of CKD in the general population in Mali and Africa [10, 14-19]. Some researchers have postulated that renal function declines more rapidly in men because they accumulate more of the classic risk factors and have a lifestyle that is more risky. These factors play a definite role, but do not fully explain the difference. The main hypothesis is that oestrogens have a renoprotective effect partly due to their antifibrotic properties, their vasodilatory effect and their stimulation of tubular proliferation [20].

Cardiovascular Risk Factors and History:

The medical history found was represented by hypertension in 56.1% of cases. This result is similar to that of Diallo [12] who found a medical history of hypertension in 56.6% of cases.

However, this result was higher than that of Farota [10] who found hypertension in 42.3% of cases. This can probably be explained by the fact that the frequency of this pathology increases with age, because Diallo's study, like ours, concerned only the geriatric population, unlike Farota's, which looked at all age groups. Cardiovascular risk factors were represented by hypertension in 56.1% of cases. This result is lower than that of AMEKOUDI [11], who found hypertension to be the cardiovascular risk factor in 75.6% of cases.

Clinical Data:

The reasons for admission were abdominal pain (22%), consciousness disorders (22%) followed by oedematous syndrome (10%).

However, according to Diallo [12], the two most frequently cited reasons for hospitalisation were renal failure and renal failure + hypertension (69.8% and 11.3% respectively). His study was conducted in a nephrology department where patients were admitted directly for renal failure, and we know that hypertension is one of the main causes of CKD. However, in our series, impairment of renal function was either discovered during the management of a pathology other than renal failure, or patients were admitted for internal medicine-related symptoms occurring in the setting of CKD. This could explain the difference between our admission reasons.

According to Farota [10] altered consciousness represented 50% of the reasons for admission. This result is higher than that of our study because the investigation took place in an intensive care unit where patients are very often admitted with consciousness disorders.

Functional signs were represented by dyspnea in 53.65% of cases. This is higher than that reported by Farota [10] in whom dyspnea represented 42.3% of functional signs.

The presence of persistent dehydration skin folds, indicating water loss, represented 41.46% of physical signs. This result is superior to that of Farota [10], who found skin folds in 25% of cases, indicating extracellular dehydration.

Our study population consisted exclusively of elderly subjects in whom persistent skin folds of dehydration could often be confused with skin ageing folds, which could explain this disparity between our results.

Biological Data:

Creatinine levels were elevated in 75.6% of cases, normal in 24.4%, between 150 and 300 µmol/l in 29.3% and less than 100 µmol/l in 26.8%. Mean creatinine was 213.51 + or - 181.77 with extreme values of 45 and 984 µmol/l.

This result is higher than that of Carbonnel [13] who found a mean creatinine level of 103.69 + or - 61.63 µmol/l, which could be explained by the difference between our methodology.

According to Cockcroft-Gault, GFR was between 30-60 ml/min in 75% of cases, with a mean GFR of 37.48 + or - 13.81 ml/min, with extremes of 10 and 58 ml/min.

According to MDRD, the GFR was >60 ml/min in 41.5% of cases with a mean GFR of 54.11 + or - 34.34 ml/min with extremes of 5 and 155 ml/min. This result is similar to that of Carbonnel [13] who found a mean GFR of 49.93 + or - 16.44 ml/min according to MDRD and a mean GFR of 42.14 + or - 17.11 ml/min according to CG.

Pedone [21] found that CG estimation of GFR tended to give lower results than MDRD.

In 34.1% of cases the GFR was greater than 60 ml/min according to CKD-EPI and the mean GFR was 46.32 + or - 29.29 ml/min with extremes of 4 and 115 ml/min. Among the 11 patients whose creatinine was < 100 umol/l, 10 had a GFR between 30 and 60 ml/min according to the Cockcroft-Gault formula with a p-value =0.001; among the 11, a GFR > 60 ml/min according to MDRD with a p-value =0.000; a GFR > 60 ml/min according to the CKD-EPI formula with a p-value = 0.010. There is therefore a statistically significant link between creatinine levels and the stage of renal failure according to the CKD-EPI, CG and MDRD formulae.

In the 17 patients whose GFR was >60 ml/min with MDRD, we observed a GFR between 30-60 ml/min when calculated with Cockcroft-Gault. p value = 0.000, so there is a statistically significant link between GFR according to Cockcroft and Gault and GFR according to MDRD.

Among the 14 patients who had a GFR > 60 ml/min according to CKD-EPI, 13 had a GFR between 30 and 60 ml/min according to CG with a p value = 0.007, so there is a statistically significant relationship between the GFR values according to CG and CKD-EPI.

Among the 14 patients who had a GFR >60 ml/min according to CKD-EPI, 13 also had a GFR >60 ml/min according to MDRD with a p-value = 0.000, so there was a statistically significant association between GFR values according to MDRD and CKD-EPI.

Blood urea was elevated in 100% of patients who completed the blood urea assay.

Hypocalcaemia was observed in 66.66% of patients who completed the assay. Phosphocalcic disorders appear early in renal failure (GFR<50ml/min). None of the patients tested for vitamin D, so our study does not allow us to link hypocalcaemia only to renal failure, as several etiological factors are present, including advanced age and the high frequency of cirrhosis in the internal medicine department.

Phosphataemia was elevated in 50% of patients who had undergone the test. The association between hypocalcaemia and hyperphosphataemia was observed in 2 patients with a p value of =0.486, so there was no statistically significant link between the value of the calcaemia and the level of phosphataemia.

Hyperkalaemia was observed in 6.25% of cases; this result is lower than that of Diallo [12] who found hyperkalaemia in 38% of cases. Potassium excretion capacity is maintained as long as aldosterone secretion and urine output are sufficient. In chronic renal failure, as long as creatinine clearance is above 10 ml/min, potassium elimination capacity (renal and digestive) remains sufficient to compensate for potassium intake. In acute renal failure, hyperkalaemia occurs due to a decrease in distal tubular flow, which reduces potassium secretion [22].

Hyponatremia was observed in 40.62% of cases, which is lower than that of Diallo [12], who found a frequency of 55.1% for hyponatremia. Anemia was present in 92.7% of patients, which is similar to that of Diallo [12], who found anemia in 96.2% of cases.

Of the 38 cases of anaemia identified, normochromic normocytic anaemia was present in 53% of cases and hypochromic microcytic anaemia in 29%. This result is similar to that of Diallo [12] who found normochromic normocytic anaemia in 54.9% of cases and hypochromic microcytic anaemia in 29.4% of cases. However, it is lower than that of AMEKOUDI [11] who

found a frequency of 60.3% for normocytic normochromic anaemia (typical of CKD) and 37.9% for microcytic anaemia. AMEKOUDI's study covers all age groups, whereas Diallo's study, like ours, focuses only on the geriatric population.

Among 16 patients who underwent cytobacterioligical urine exam, leucocyturia was observed in 31% of cases, haematuria associated with leucocyturia in 6% of cases. The uroculture was negative in 63% of cases, and Escherichia Coli was isolated in 25% of cases. However, this result is lower than that of Diallo [12] who observed leucocyturia in 60.4% of cases, haematuria associated with leucocyturia in 15.1% of cases, the uroculture was positive in 62.3% and Escherichia Coli was isolated in 54.5% of cases. This difference may be explained by the small number of patients who underwent UEC.

The 24-hour proteinuria was minor in 60% of cases; this result is higher than that of Diallo [12] who showed minor proteinuria in 56.6% of cases.This could be explained by the small number of patients who had 24-hour proteinuria in our sample (5 patients/41).In 2 cases, this proteinuria occurred in the context of a urinary tract infection. Proteinuria may be observed in cases of urinary tract infection without any renal involvement, hence the importance of monitoring this proteinuria after sterilisation of the urinary tract infection site.

Morphological Aspects:

Renal ultrasound revealed good cortico-medullary differentiation in 80.5% of cases, normal kidney size in 87.8% of cases and dilated urinary excretory tracts in 4.9% of cases. Hypertrophy of the prostate was observed in 48% of cases, with 31% of cases of homogeneous hypertrophy. 100% of patients with good cortico-medullary differentiation had normal kidney size. For 62.5% of patients with cortico-medullary dedifferentiation, the kidneys were reduced in size. p value = 0.000, so there is a statistically significant link between kidney size and cortico-medullary differentiation on ultrasound.

Etiological Aspects:

Renal failure was acute and functional in 75.6% of cases. Dehydration was the etiology in 41% of cases, with CKD accounting for 19.5% of cases, including 9.75% of vascular nephropathy. This result is lower than that of Diallo [12], who found 49.1% of vascular nephropathy.

CONCLUSION

Renal function must be assessed on a daily basis with advancing age. Cardiovascular risk factors must be prevented at a very early stage and corrected as far as possible to avoid these factors having an impact later in life in terms of very significant co-morbidities.

REFERENCES

1. Duquesne, F. (2011). Vulnérabilité de la personne âgée. *Urg*, 277-291.
2. Fesler, P., & Ribstein, J. (2009). Alteration modérée de la fonction rénale et risque cardiovasculaire. *Rev Med Intern*, *30*, 585–91.
3. Commereuc, M., Rondeau, E., & Ridel, C. (2014). Insuffisance rénale aiguë chez la personne âgée : aspects diagnostiques et thérapeutiques. *Presse Med*, *43*, 341-47.
4. Pautas, E., Monti, A., & LePetit corps, H. (2015). Thérapeutique gériatrie. *Rev Prat*, *65*, 1131-33.
5. Andro, M., Estivin, S., Comps, E., & Gentric, A. (2011). Evaluation de la fonction rénale au-delà de 80 ans : formule de Cockcroft et Gault ou Modification of diet in rénal disease. *Rev Med Intern*, *32*, 698-702.
6. Adaptation posologique des médicaments à la fonction rénale, OMEDIT (Observatoire du Médicament, des Dispositifs Médicaux et de l'Innovation Thérapeutique), Haute – Normandie Version Septembre 2013. http://www.soc-nephrologie.org/ICAR/lettre.htm
7. Diallo, A. D., Niamkey, E., & Yao, B. (1997). L`insuffisance rénale chronique en Cote d`Ivoire : Etude de 800 cas hospitaliers. *Bull Soc Pathol Exot*, *90*, 346-8.
8. Sakande, J., Sawadogo, M., William, C. N. E., Saizonou, S. E., Kabre, E., & Sawadogo, M. (2006). Profil biologique de l`IRC (CHN-Yo). *Biol Clinique*, *43*, 3-8.
9. Boffa, J. J., & Cartery, C. (2015). Insuffisance rénale chronique ou maladie rénale chronique. *EMC-Traité de médecine Akos*, *10*(2), 1-8.
10. Farota, A. (2008). Insuffisance Rénale Aiguë en Réanimation Facteur Etiologique et Pronostic Etude Rétrospective dans le service de réanimation du CHU du Point G. Thes Med, Bamako, n°580.
11. Amekoudi, E. M. (2012). Profil epidemio-clinique de l'insuffisance rénale chronique dans le service de néphrologie et d'hémodialyse du CHU du Point G. Thes Med, Bamako, N°91.
12. Diallo, N. (2009). Prévalence de l'insuffisance rénale chronique chez les sujets âgés dans le service de néphrologie et d'hémodialyse du CHU du Point G. Thes Med, Bamako, n°324.
13. Carbonnel, C., Seux, V., Pauly, V., Oddoze, C., Roubicek, C., Larue, J. R., ... & Retornaz, F. (2008). Quelle méthode d'évaluation de la fonction rénale utiliser chez le sujet âgé hospitalisé en unité de court séjour gériatrique? Comparaison de quatre méthodes. *La Revue de médecine interne*, *29*(5), 364-369.
14. Sabi, K. A., Gnionsahe, D. A., & Amedegnato, D. (2011). Insuffisance rénale chronique au Togo: aspects cliniques, paracliniques et étiologiques. *Med Trop*, *71*, 74-76.
15. Djanka, B. (2004). Epidémiologie de l'insuffisance rénale chronique dans le service de néphrologie du Point G. Thes Med, Bamako, n°01.

16. Sow, H. (1998). Insuffisance rénale chronique : aspects cliniques préventifs et prise en charge à l'hôpital National du Point G. Thes Med, Bamako, N°21.
17. Dia, K. (1996). Insuffisance rénale chronique en milieu hospitalier dakarois : étude epidemio-clinique. Thes Med, Dakar, N°62.
18. Somboro, B. (2004). Prévalence de la pathologie athéromateuse chez l'insuffisant rénal chronique et / ou hypertendu. Thes Med, Bamako, N°11.
19. Cisse, I. (1990). Aspect épidémiologique de l'IRC dans le service de médecine interne de l'Hôpital du Point G. Thes Med, Bamako, N° 27.
20. Mehier, P., Burnier, M., & Pruijm, M. P. D. (2017). Inégalité homme-femme face aux maladies rénales chroniques: mythe ou réalité? *Rev Med Suisse*, *13*, 473-6.
21. Pedone, C., Corsonello, A., & Incalzi, R. A. (2006). The GIFA Investigators. Estimating renal function in older people: a comparison of three formulas. *Age and Ageing*, *35*, 121-6.
22. Bock, A. (2012). Le problème calcium-phosphore de l'insuffisance rénale. *Forum Med Suisse*, *12*, 406-9.