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Renal failure in cancer patients: results from the national cancer registry of Abidjan, Côte d'Ivoire

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ABSTRACT

Background: Renal failure (RF) is a risk factor for morbidity and mortality in cancer patients.
Objectives: To describe the profile of cancer patients with RF.
Patients and Methods: This is a retrospective descriptive study of RF in patients enrolled in the national cancer registry of Abidjan, during the period from January 2012 to December 2015. The diagnosis of RF was confirmed based on a measured glomerular filtration rate (GFR) < 60 mL/min obtained using the Modification in Diet of Renal Disease (MDRD) formula. A comparison of patients with (n = 131) or without (n = 136) RF, followed by a logistic regression analysis, made it possible to identify the risk factors for RF.
Results: The mean age was 54 ± 13.9 years in the group with RF versus 49 ± 14.8 years in the group without RF ($P = 0.003$). The etiologies of RF were urinary tract obstruction (41.2%), administration of platinum salts (19.8%) and water losses (12.2%). In multivariate analysis, age ($P = 0.009$), presence of hypertension ($P = 0.02$), uterine cancer ($P = 0.0001$) and prostate cancer ($P = 0.014$) were associated with the risk of RF in cancer patients. Factors such as male gender ($P = 0.007$), HIV infection ($P = 0.021$), GFR<15 mL/min ($P = 0.002$), and hemoglobin level <8 g/dL ($P = 0.041$) were associated with mortality in cancer patients with RF.
Conclusions: Late diagnosis leads to renal complications with an increased risk of mortality.

Implication for health policy/practice/research/medical education:
In our study, patients with renal failure (RF) were elder than those without RF. The main causes of RF were urinary tract obstruction, drugs and water losses. In multivariate analysis, age, hypertension, uterine cancers and prostate cancers were related to increase risk of kidney failure in cancer patients. In-hospital mortality was higher in the group with RF. In multivariate analysis, factors such as male gender, HIV infection, glomerular filtration rate (GFR)<15 mL/min, and hemoglobin <8 g/dL were associated with mortality in cancer patients with RF. In our context, late diagnosis leads to renal complications with an increased risk of mortality. It is essential to prevent it through early diagnosis and management.

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Original Article

1. Background

According to United Nations population evaluations (1), the African population between 2010 and 2030 is projected to increase by 60% (from 1.03 billion to 1.63 billion) and by 90% for those aged 60 and over (from 55 million to 103 million), the age at which malignancy occurs most commonly. Cancer is a growing problem in Africa due to population aging and growth as well as the high prevalence of cardiovascular risk factors (including tobacco use, alcohol consumption, obesity and physical inactivity) and certain infectious agents (2). Despite this growing burden, cancer continues to receive a relatively low public health priority in Africa, which is largely due to limited resources, but also to other public health problems, including communicable diseases such as HIV/AIDS, malaria and tuberculosis. In sub-Saharan Africa, diagnosis of cancer is made late (3), thus exposing patients to complications including

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renal diseases.

Renal failure (RF) is a serious complication of cancer and constitutes a source of morbidity and mortality. The prevalence of acute kidney injury (AKI) varies between 12% and 49% according to series (4). Of these patients, 9% to 32% require renal replacement therapy (5,6). RF can be pre-renal, intrinsic or post-renal. Intrinsic RF can result from prolonged renal hypoperfusion, exposure to nephrotoxic drugs or lesions of renal micro-arteries. Post-RF is the result of clinically significant urinary tract obstruction (7,8). Renal disease in cancer patients is a reality in daily practice. However, to the best of our knowledge, there is no information available on renal disease in cancer patients in Côte d'Ivoire.

2. Objectives

Our study aims to describe the profile of cancer patients with RF and enrolled in the national cancer registry of Abidjan.

3. Patients and Methods

3.1. Study type and population

This is a retrospective descriptive study conducted over the period from January 2012 to December 2015, which consisted in analyzing cancer patients with RF. Any patient with RF aged 16 years or older and enrolled in the national cancer registry of Abidjan was included. Patients with no serum creatinine level in their medical records were excluded. We then compared this group with another group of patients without RF also enrolled in the registry. Once the diagnosis of RF was made, patients were referred to the department of nephrology and internal medicine of Treichville teaching hospital for treatment and care.

3.2. Definitions

According to the K/DOQI guidelines (9), RF has been defined and classified based on an estimated glomerular filtration rate (GFR) calculated from serum creatinine level determined during follow-up. Our reference formula for GFR estimation was the simplified MDRD (Modification in Diet of Renal Disease) equation (10). All patients with GFR < 60 mL/min were included. Serum creatinine was measured with the Jaffé method.

Anemia is defined based on a hemoglobin level below 12 g/dL. It is considered severe for a hemoglobin level below 8 g/dL.

Diagnosis was made according to the American diabetes association (ADA) criteria (11) for diabetes mellitus and according to the "Eighth Joint National Committee" (JNC8) criteria (12) for high blood pressure.

Patients with cancer included those with a solid or hematopoietic malignancy.

RF is considered functional in the presence of a renal hypoperfusion factor (diarrhea, vomiting, low cardiac output) or signs of extracellular fluid loss and dehydration. It is considered obstructive in case of RF associated with a bilateral dilatation of pyelocaliceal cavities on ultrasound. Acute tubular necrosis was reported in case of AKI associated with proteinuria lower than 1 g/24 h with or without oliguria. Oliguria is defined as a diuresis of less than 500 mL/24 h. Diagnosis of acute glomerulonephritis (AGN) is confirmed in the presence of edema, high blood pressure and positive test for albuminuria with a decreased complement C3. Acute interstitial nephritis is reported in case of AKI with positive test for leukocyturia and preserved diuresis (1 to 2 L/d) or in case of IKA with preserved diuresis in a context of confirmed drug intake. Renal biopsy was not performed.

3.3. Variables

Serum creatinine and plasma urea were measured upon patient admission. For each patient included, we collected the following information using a standardized survey form; demographic data (age, gender, and occupation), comorbidities (diabetes mellitus, hypertension and HIV), characteristics of cancer (histological type and organ affected), causes of RF such as urinary tract obstruction, water losses, hemorrhage and nephrotoxic drug administration were analyzed.

Clinical data (reason for admission, blood pressure upon admission, temperature, level of consciousness, hydration status and diuresis), laboratory data (serum creatinine level, plasma urea concentration, calcium level, blood glucose level, hemoglobin level, leukocyte count and CBC, platelet counts, CBEU, blood culture, HIV serology and CD4 lymphocyte count), imaging data (renal ultrasound) and treatment data were also analyzed.

A regular serum creatinine measurement helped assess the progression of RF within 6 months following diagnosis of cancer. This progression was considered favorable if GFR was > 90 mL/min or when we observed an increase of at least 50% as compared with baseline GFR. The primary endpoint was RF and the secondary endpoint was mortality at 6 months.

3.4. Ethical issues

The research followed the tenets of the Declaration of Helsinki; in spite of its retrospective character,

this study was approved by the Ethical Committee of Treichville Teaching Hospital. The anonymity and confidentiality of the information collected were preserved by assigning an ID number to each patient's medical record.

3.5. Statistical analysis

Data were entered into an Excel database and then analyzed using the SPSS software version 22. A univariate analysis was performed. The proportions of qualitative variables were compared across patients with or without RF using the chi-square test or Fisher's exact test. With regard to quantitative variables, the means were compared using the analysis of variance (ANOVA) test. The relative quantitative variables were transformed into categorical variables according to pathological norms. Qualitative or categorical variables with $P < 0.05$ were included in a logistic regression model to highlight the association between these variables and RF in cancer patients. The association was quantified by the odds ratio (OR). The threshold of $P < 0.05$ was considered significant.

4. Results

Over the study period, we included 131 cancer patients with RF. This group was compared with another group of patients without RF (n = 136).

The mean age was 54 ± 13.9 years in the group with RF versus 49 ± 14.8 years in the group without RF (p = 0.003). We observed a female predominance in both groups (Table 1). The age groups of 55 to 65 years (30.5%), 35 to 45 years (20.6%) and 45 to 55 years (19.1%) were the most observed in the group with RF. Comorbidities such as hypertension (19.8%), HIV

Table 1. Characteristics of patients with or without renal failure

	With renal failure (n = 131)	Without renal failure (n = 136)	*P* value	OR (CI 95%)
Gender				
Male	29.8% (39/131)	36.8% (50/136)		
Female	70.2% (92/131)	63.2% (86/136)	0.14	1.17 (0.89-1.55)
Age (years)	54.6 ± 13.9	49.2 ± 14.8	0.003	
<35	6.1% (8/131)	16.9% (23/136)	0.005	0.49 (0.26-0.91)
35-45	20.6% (27/131)	19.1% (26/136)	0.43	1.04 (0.77-1.41)
45-55	19.1% (25/131)	27.2% (37/136)	0.07	0.78 (0.56-1.08)
55-65	30.5% (40/131)	25% (34/136)	0.19	1.14 (0.88-1.48)
65-75	13.7% (18/131)	7.4% (10/136)	0.06	1.36 (1-1.84)
≥ 75	9.9% (13/131)	4.4% (6/136)	0.06	1.43 (1.03-2)
Co-morbidities				
Hypertension	19.8% (26/131)	9.6% (13/136)	0.01	1.44 (1.11-1.88)
Diabetes	0.8% (1/131)	2.9% (4/136)	0.19	0.40 (0.07-2.33)
HIV	9.2% (12/131)	4.4% (6/136)	0.09	1.39 (0.98-1.98)
Hemoglobin (g/dL)				
>12	12.2% (16/131)	9.2% (13/136)	0.30	1.14 (0.80-1.62)
8-12	44.3% (58/131)	60.3% (82/136)	0.006	0.72 (0.56-0.92)
<8	41.2% (57/131)	30.1% (41/136)	0.016	1.32 (1.04-1.68)
Histology				
Adenocarcinoma	22.1% (29/131)	25.7% (35/136)	0.29	0.90 (0.66-1.22)
Carcinoma	45% (59/131)	34.6% (47/136)	0.05	1.24 (0.97-1.58)
Sarcoma	3.1% (4/131)	8.1% (11/136)	0.06	0.52 (0.22-1.23)
Organ				
Uterus	38.2% (50/131)	8.8% (12/136)	0.0001	2.04 (1.65-2.51)
Ovary	4.6% (4/131)	4.4% (6/136)	0.58	1.02 (0.57-1.82)
Breast	10.7% (14/131)	20.6% (28/136)	0.019	0.64 (0.41-0.96)
Prostate	9.2% (12/131)	1.5% (2/136)	0.004	1.82 (1.41-2.34)
Bladder	4.6% (6/131)	0.7% (1/136)	0.05	1.78 (1.28-2.47)
Liver	7.6% (10/131)	6.6% (9/136)	0.46	1.07 (0.69-1.68)
Stomach	3.1% (4/131)	8.8% (12/136)	0.04	0.49 (0.21-1.16)
Colon	2.3% (3/131)	5.1% (7/136)	0.18	0.60 (0.23-1.56)
Rectum	3.8% (5/131)	0.7% (1/136)	0.09	1.72 (1.18-2.52)
Pancreas	2.3% (3/131)	3.7% (5/136)	0.38	0.75 (0.30-1.87)
Limbs	0.8% (1/131)	9.6% (13/136)	0.001	0.13 (0.02-0.92)
Platinum salts	27.4% (36/131)	14.7% (20/136)	0.017	1.19 (1.02-1.58)
Mortality	13% (17/131)	4.4% (6/136)	0.011	1.58 (1.19-2.08)

infection (9.2%) and diabetes (0.8%) were reported in this group. The proportion of hypertension and HIV infection was higher in patients with RF as compared to those without RF (Table 1).

RF was in stage 3 in 43.5% of cases, in stage 4 in 22.9% and in stage 5 in 33.5% of cases. Anemia was observed in 87.8% of cases. Hemoglobin was < 8 g/dL in 41.2% of patients and its proportion was 28.1% in stage 3 patients, 40% in stage 4 patients and 65.9% in stage 5 patients ($P=0.001$). This proportion of hemoglobin < 8 g/dL was statistically greater in the group with RF (OR = 1.32, 95% CI = 1.04-1.68, $P=0.016$).

The causes of RF were urinary tract obstruction in 41.2% of cases, drugs in 19.8% and water losses in 12.2%. The proportion of obstructive RF was 22.8% in stage 3 patients, 33.3% in stage 4 patients and 70.5% in stage 5 patients (Table 2). Platinum salts were the only causes of drug-induced RF.

The main histological types were carcinoma (45%) and adenocarcinoma (22.1%). We did not observe any significant difference in histological type across both groups (Table 2).

The affected organs in the group with RF were the uterus (38.2%), breast (10.2%), prostate (9.2%) and liver (7.2%). In univariate analysis, factors such as hypertension (OR = 1.44, 95% CI = 1.11-1.88, $P=0.01$), hemoglobin <8 g / (95% CI = 95% = 1.04-1.68, $P=0.016$), cancers such as uterine cancers (OR = 2.04, 95% CI = 1.65-2.51, $P=0.0001$) and prostate cancers (OR = 1.82, 95% CI = 1.41-2.34, $P=0.004$), and the use of platinum salts OR = 1.19; 95% CI = 1.02-1.58, $P=0.017$) were associated with RF (Table 1). Uterine cancers were almost exclusively located in the cervix. In multivariate analysis, the 65-75 age range (OR = 3.07, 95% CI = 1.32-7.12, $P=0.009$), hypertension (OR = 2.34, CI 95 % = 1.14-4.78, $P=0.02$), uterine cancers (OR = 6.37, 95% CI = 3.20-9.71, $P=0.001$) and prostate cancers (OR = 6.75, 95% CI = 1.48-10.80, $P=0.014$) were associated with the risk of RF in cancer patients (Table 3).

The treatment received by patients was for the cause of RF. Hemodialysis was performed in 9 cases (6.8%), urinary diversion by percutaneous nephrostomy in 8 cases (6.1%) and bladder catheterization in 1 case.

In-hospital mortality was 13% in the group with RF versus 4.4% in the group without RF (OR = 1.58, 95% CI = 1.19-2.08, $P=0.01$). In univariate analysis, HIV infection (OR = 3.05, 95% CI = 1.17-7.89, $P=0.02$), GFR<15 mL/min (OR=3.25; 95% IC =1.50-7.05; $P=0.006$) and hemoglobin level <8 g/dL (OR = 2.61; 95% CI = 1.02-6.63; $P=0.03$) were associated with death among our patients (Table 4). In multivariate analysis, factors such as male gender (OR = 3.79; 95%

Table 2. Characteristics of patients according to glomerular filtration rate

	GFR<15 (n = 44)	GFR 15-30 (n = 30)	GFR 30-60 (n=57)	*P* value
Gender				
Male	18.1% (8/44)	23.3% (7/30)	42.1% (24/57)	
Female	81.8% (36/44)	76.7% (23/30)	57.9% (33/57)	0.023
Age (years)				
<35	4.5% (2/44)	6.7% (2/30)	7% (4/57)	0.86
35-45	22.7% (10/44)	26.7% (8/30)	15.8% (9/57)	0.44
45-55	20.5% (9/44)	23.3% (7/30)	15.8% (9/57)	0.66
55-65	25% (11/44)	26.7% (8/30)	36.8% (21/57)	0.38
65-75	11.4% (5/44)	13.3% (4/30)	15.8% (9/57)	0.82
≥ 75	15.9% (7/44)	3.3% (1/30)	8.8% (5/57)	0.19
Co-morbidities				
Hypertension	22.7% (10/44)	16.7% (5/30)	19.3% (11/57)	0.80
Diabetes	-	3.3% (1/30)	-	0.18
HIV	13.6% (6/44)	16.7% (5/30	1.8% (1/57)	0.03
Hemoglobin (g/dL)				
>12	6.8% (3/44)	10% (3/30)	17.5% (10/57)	0.24
8-12	27.3% (12/44)	50% (15/30)	54.4% (31/57)	0.019
<8	65.9% (29/44)	40% (12/30)	28.1% (16/57)	0.001
Etiologies				
Urinary tract obstruction	70.5% (31/44)	33.3% (10/30)	22.8% (13/57)	0.0001
Water losses	6.8% (3/44)	16.5% (5/30)	14% (8/57)	0.38
Drugs	11.4% (5/44)	30% (9/30)	21.1% (12/57)	0.13
Others	-	10% (3/30)	3.5% (2/57)	0.08
Mortality	20.5% (9/44)	10% (3/30)	8.8% (5/57)	0.19

Table 3. Risk factors for renal failure in multivariate analysis

Variables	*P* value	OR	95% CI	
			Lower	Greater
Female	0.22			
Age (years)				
55-65	0.48			
65-75	0.009	3.07	1.32	7.12
Hypertension	0.020	2.34	1.14	4.78
HIV	0.12	-	-	-
Carcinoma	0.08	-	-	-
Hemoglobin < 8 g/dL	0.059	-	-	-
Uterus	0.0001	6.37	3.20	9.71
Prostate	0.014	6.75	1.48	10.80
Bladder	0.086	6.48	3.48	14.57
Rectum	0.089	-	-	-
Liver	0.74	-	-	-
Platinum salts	0.066	-	-	-

IC = 1.44-9.99; *P*=0.007), HIV infection (OR = 3.72, 95% CI = 1.02-13.63; P=0.021), GFR<15 mL/min (OR = 4.88, 95% CI = 1.80-13.23, *P*=0.002), and hemoglobin <8 g/dL (OR = 3.02, 95% CI = 1.04-8.77, *P*=0.041) were associated with mortality in cancer patients with RF (Table 4). The proportion of subjects aged 65 years and older was higher among male patients than among female patients, as did the proportion of adenocarcinoma, liver cancer, rectal cancer and bladder cancer in our study (Table 5).

5. Discussion

According to the results of "GLOBOCAN 2012", 847 000 new cases of cancer (6% of the world total) and 591 000 deaths (7.2% of the world total) were reported in 54 African countries in 2012, with approximately three-quarters in the 47 countries of sub-Saharan Africa. The 4 most common cancers were, in order of frequency, breast, cervical, prostate and liver cancers (13). In Côte d'Ivoire, the most common cancers are breast cancer (25.7%), uterine cancer (24%), prostate cancer (15.8%) and liver cancer (15%) (14). This high proportion of breast and uterine

Table 4. Risk factors for death

	N	Death (%)	Univariate analysis Unadjusted OR (95% CI)	*P* value	Multivariate model Adjusted OR (95% CI)	*P* value
Gender						
Male	39	20.5	2.09 (0.87-5.03)	0.08	3.79 (1.44-9.99)	0.007
Female	92	9.7	0.47 (0.19-1.14)			
Age (years)						
<35	8	0	1.16 (1.08-1.24)	0.26		
35-45	27	18.5	1.6 (0.61-4.16)	0.33		
45-55	25	12	0.9 (0.28-2.92)	0.87		
55-65	40	10	0.70 (0.24-2.01)	0.50		
65-75	18	16.6	1.34 (0.42-4.22)	0.61		
≥ 75	13	15.3	1.21 (0.31-4.71)	0.78		
Co-morbidities						
Hypertension	26	7.6	0.53 (0.13-2.20)	0.37		
Diabetes	1	0	1.04 (1-1.08)	0.69		
HIV	12	33.3	3.05 (1.17-7.89)	0.02	3.72 (1.02-13.63)	0.021
GFR (mL/min)						
30-60	57	8.8	1.02 (0.39-2.63)	0.57		
15-30	30	10	1.18 (0.37-3.75)	0.49		
<15	44	20.5	3.25 (1.50-7.05)	0.006	4.88 (1.80-13.23)	0.002
Hemoglobin (g/dL)						
>12	16	0	2.40 (0.25-12.58)	0.09		
8-12	56	10.7	0.69 (0.24-2.01)	0.50		
<8	54	20.3	2.61 (1.02-6.63)	0.03	3.02 (1.04-8.77)	0.041
Organ						
Uterus	50	12	0.86 (0.30-2.51)	0.79		
Ovary	6	16.6	1.30 (0.20-8.25)	0.78		
Prostate	12	16.6	1.32 (0.34-5.10)	0.69		
Bladder	6	16.6	1.30 (0.20-8.25)	0.78		
Breast	14	7.1	0.52 (0.07-3.64)	0.49		
Liver	10	20	1.61 (0.42-6.08)	0.49		
Etiologies						
Urinary tract obstruction	54	14.8	1.26 (0.52-3.07)	0.60		
Platinum salts	26	3.8	0.25 (0.03-1.81)	0.12		0.08
Water losses	16	12.5	0.95 (0.24-3.80)	0.95		

Table 5. Patient characteristics according to gender

	Male (n = 39)	Female (n = 92)	P value	OR (95% CI)
Age (years)				
<35	10.3% (4/39)	4.3% (4/92)	0.18	1.75(0.83-3.71)
35-45	15.4% (6/39)	22.8% (21/92)	0.23	0.70(0.32-1.49)
45-55	10.3% (4/39)	22.8% (21/92)	0.07	0.48(0.19-1.23)
55-65	25.6% (10/39)	32.6% (30/92)	0.28	0.78(0.42-1.45)
65-75	23.1% (9/39)	9.9% (9/92)	0.04	1.88(1.08-3.28)
≥ 75	15.4% (6/39)	7.6% (7/92)	0.14	1.65(0.85-3.17)
Co-morbidities				
Hypertension	17.9% (7/39)	20.7% (19/92)	0.46	1.05(0.80-1.37)
Diabetes	0%	1.1% (1/92)	0.7	1.42(1.27-1.59)
HIV	2.6% (1/39)	12% (11/92)	0.07	1.34(1.09-1.66)
Hemoglobin <8 g/dL	35.9% (11/39)	46.7% (43/92)	0.17	1.13(0.91-1.42)
GFR <15 mL/min	20.5% (8/39)	39.1% (36/92)	0.02	0.51(0.25-1.01)
Histology				
Adenocarcinoma	41% (16/39)	14.1% (13/92)	0.001	2.44(1.50-3.98)
Carcinoma	23.1% (9/39)	54.3% (50/92)	0.001	0.36(0.18-0.70)
Sarcoma	2.6% (1/39)	3.3% (3/92)	0.65	1.07(0.60-1.90)
Organ				
Bladder	10.3% (4/39)	2.2% (2/92)	0.06	2.2.38(1.26-4.47)
Liver	17.9% (7/39)	3.3% (3/92)	0.008	2.64(1.6-4.37)
Stomach	7.7% (3/39)	1.1% (1/92)	0.07	2.64(1.41-4.96)
Colon	0%	3.3% (3/92)	0.34	1.43(1.28-1.61)
Rectum	10.3% (4/39)	1.1% (1/92)	0.027	2.88(1.71-4.84)
Pancreas	2.6% (1/39)	2.2% (2/92)	0.65	1.12(0.22-5.68)
Limbs				
Platinum salts	7.7% (3/39)	25% (23/92)	0.017	0.90(0.86-98)
Mortality	20.5% (8/39)	9.8% (9/92)	0.08	1.73(0.96-3.11)

cancers could be the reason for female predominance in our study population.

The risk of cancer as well as cardiovascular disease increases with older age. Patients with RF are older and more likely to have hypertension with a higher proportion of HIV infection (but not significant, $P = 0.09$). These factors contribute to renal dysfunction in our patients.

In the BIRMA study, anemia was more common in patients with GFR < 60 mL/min (15). In the context of cancer, it is difficult to distinguish the renal and extra-renal effects of anemia. Indeed, the incidence of anemia in cancer patients is high, but with great variability according to studies, ranging from 30% to 90% (16). Its pathogenesis is multifactorial. The functional iron deficiency due to insufficient iron incorporation into the erythroid precursor despite apparently adequate body iron stores is a major phenomenon (17). In addition, chronic inflammation leading to malignancy (18) and absolute iron deficiency resulting from bleeding (including cancer bleeding) may be responsible for anemia (19). Finally, the suppression of the bone marrow, either by infiltration of malignant cells (20), or myelosuppressive chemotherapy (21), as well as nutrient deficiencies (22) may be associated with anemia. Owing to the potentially multifactorial complexity of anemia, defining causes in cancer patients is not always simple, and conventional evaluation only has a limited value (23).

The affected organs are identical to those observed in the African literature (13,14). In the study by Rosa et al, the highest incidence of AKI was observed in patients with cervical, ovarian and prostate cancers (24). In the BIRMA study, age, gender, bone metastasis and a medical history of chemotherapy were associated with the risk of RF (15). According to some authors, hypovolemia (35%) and obstruction of the urinary tract (26%) were the main risk factors for RF (24). In our study, urinary tract obstruction was the main risk factor, followed by water losses. Late diagnosis leads to loco-regional invasion of cancer with ureteral trapping. In our context, the conjunction of ignorance, poverty and socio-cultural habits are the key factors for late diagnosis (3).

The use of platinum salts was the only cause of drug-induced RF in our study. Anti-cancer drugs can cause injuries to various segments of the nephron. Thus, bevacizumab and gemcitabine may cause vascular lesions, while platinum salts, methotrexate, cetuximab

and vincristine expose patients to tubulo-interstitial lesions (25).

RF was reported to be associated with reduced overall survival and increased mortality in cancer patients (26). In our study, advanced age, male gender, HIV infection, severity of RF and low hemoglobin level (<8 g/dL) were the risk factors for death. Younger patients experienced greater benefit from recent oncology advances than elderly patients. (27). Yokoi et al showed that locally advanced cervical cancer patients with adenocarcinoma histology experience significantly worse survival outcomes than those with carcinoma (28). About liver cancer, the proportion of new cases was 58 500 with 56 000 deaths estimated in 2012 (13). The main risk factors in operation for hepatic cancer on the African region are infections with the hepatitis viruses and aflatoxin (29,30). Colorectal cancer is the fifth most common malignancy in Africa according to estimates for 2012, with 41 000 new cases and around 29 000 deaths, and a slight dominance of cases in men (13). This large proportion of the elderly, adenocarcinoma, liver and rectum cancer could explain that the male gender is associated with death in our patients.

Anemia is largely related to the bleeding of pelvic cancers. It appears here as a factor of aggravation of these pelvic cancers.

Cancer is commonly associated with HIV in West-Africa (31). Kaposi's sarcoma, malignant non-Hodgkin's lymphoma, uterine, anogenital and liver cancers are all associated with HIV infection. In the vast majority of cases, patients were not known to be HIV-positive at the time of cancer diagnosis, and thus not treated with highly active antiretroviral therapy.

6. Conclusions

In our context, age, high blood pressure and pelvic cancers, especially uterine and prostate cancers, are risk factors for RF in cancer patients. The main etiologies of RF are urinary tract obstruction, water losses and the use of platinum salts. RF is associated with an increased risk of death in cancer patients. Male gender, HIV infection, RF severity and hemoglobin level < 8 g/dL are factors associated with death. The management of cancer patients with RF falls within the disciplines of oncologists, urologists and nephrologists. It is essential to prevent it through early diagnosis and management. This involves an evaluation of renal function using the formulas, especially the simplified MDRD formula. This will enable dosage adjustment during chemotherapy so as to reduce its renal toxicity. Besides, the combination of several nephrotoxic drugs should be avoided.

Limitations of the study

Our study has limitations that must be considered in interpreting the results. These are mostly the retrospective character of the study with missing data for the assessment of patient outcome at 6 months.

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Authors' contributions

KHY made a substantial contribution to the conception, design, analysis and interpretation of data. He was also involved in drafting the manuscript and revising it critically for important intellectual content. MT, NC, SPD and SDK collected data. YK and IA revised the manuscript critically for important intellectual content.

Conflicts of interest

The authors declare no conflict of interest.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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