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SERVICES FOR SCIENCE AND EDUCATION

Perioperative Acute Renal Failure at Chu-Kara

Essohanam Mouzou
Université de Kara; département de médecine en spécialités médicales

ABSTRACT

The aim of this study was to take stock of perioperative acute renal failure (ARF) in intensive care at Kara University Hospital. This was a retrospective, descriptive and analytical study of the records of patients with renal failure in the surgical intensive care unit of Kara University Hospital from 1 January 2021 to 31 December 2023. The parameters studied were: epidemiological, diagnostic, therapeutic and evolutionary aspects. Results: 94 cases of ARF were studied, with a frequency of 2.11%. The average age of the patients was 45.65 ± 20.02 years. The most common age group was elderly patients aged 60 and over. The sex ratio was 4.7. The majority of patients were rural (71.30%). The most common type of ARF was functional ARF (76%), followed by obstructive ARF (18%). Digestive surgery was the most common in 60.63% of cases, followed by uronephrological surgery (19.1%) and traumatological surgery (11.7%). General anaesthesia was most common, accounting for 85.10% of cases. The average length of stay in intensive care was 4.25 ±6.42 days. Complications accounted for 40.42% of cases, dominated by infections and hyperkalaemia. Management was associated with a high mortality rate of 31.91%. Conclusion: Perioperative ARF was the result of a combination of numerous factors related to the patient's condition, delay in consultation, type of surgery, precarious haemodynamic events and perioperative infections. Management of perioperative acute renal failure is primarily preventive and aetiological.

Keywords: perioperative acute renal failure, CHU-Kara, Togo.

INTRODUCTION

Perioperative acute renal failure (ARF) is a common pathology involving a sudden decline in the kidney's ability to eliminate waste, regulate extracellular volume and maintain acid-base and electrolyte homeostasis from 5-7 days before to 7-12 days after surgery.[1,2]. It constantly leads to a rise in creatinine and more or less severe metabolic and hydroelectrolytic disorders[3]. This is a common situation in every country in the world, whatever their economic situation.[4]. In Europe, the incidence of perioperative AKI was estimated at 2.87% in France and 13.4% in Germany for abdominal surgery in 2015[5,6].

AKI has been shown to occur in the post-operative period after major surgery, with an incidence rate of 7.3% in Japan in 2018 after major non-cardiac surgery[7][.

In a US study of four tertiary teaching hospitals in patients undergoing major non-cardiac surgery in 2018, the incidence of postoperative AKI was 10.1%.[8][.

The incidence of postoperative ARF was 11.36% in Morocco in 2019[9][. Very recent studies (2023) in South Africa showed the overall incidence of AKI in patients who had undergone major surgery to be 11.2 % [1[10]. The incidence of post-operative AKI was 22.5% and 12% respectively in Nigeria and Ghana in 2018[4,11].

In a prospective study in Togo in 2008, it was 11% perioperatively[1[12]. In the northern region of Togo, no such study had been carried out. This prompted our work, the general objective of which was to take stock of perioperative renal failure in the intensive care unit at CHU-KARA; to determine the epidemiological profile of renal failure patients undergoing surgery; to identify the different aetiologies of perioperative renal failure patients; to identify prognostic factors; and to analyse the treatment received perioperatively.

MATERIALS AND METHOD

Study Framework

CHU Kara is 420 km from CHU Sylvanus Olympio in Lomé, the capital of Togo. It covers an area of 8,713 hectares.

Surgical Intensive Care Unit at Kara University Hospital:

The surgical intensive care unit was adjacent to the operating theatre to the east. This operating theatre was housed within the surgical department.

Human Resources:

The surgical intensive care unit had two wards with a capacity of twelve beds since 1 January 2023, compared with eight previously. As of 08 March 2023, it employed eight nurses (previously four) and four patient attendants; one intensive care anaesthetist since November 2019; and four anaesthetic paramedics since 2023, including a department supervisor.

Organisation of Activities in The Surgical Intensive Care Unit and Operating Theatre at Kara University Hospital:

From 7 a.m. to 5 p.m., the service was provided by two nurses, a patient attendant and a paramedical anaesthetist, who was on call for 24 hours, and from 5 p.m. to 7 a.m. by two nurses and a patient attendant. The ward supervisor also provided nursing care and deputised for the intensive care anaesthetist in his absence. The intensive care anaesthetist was responsible for medical visits seven days a week, with two counter-visits a day depending on his availability. He also provided anaesthetic consultations three days a week. He also taught at the Faculty of Medicine and at the paramedical schools for nurses and midwives in Kara and Dapaong, 220 km away.

Material Resources of the CHU-Kara Surgical Intensive Care Unit:

(a) Respiratory resuscitation equipment was modest.
- Upper airway release devices;
- Oxygenation or ventilation equipment
- Ventilation or oxygenation monitoring equipment

(b) Cardiovascular resuscitation equipment was also modest.
- Monitoring equipment,
- Cardiovascular care equipment and medicines.

Study Methods

Type and Period of Study:

This was a retrospective descriptive study of the records of patients with acute renal failure in the perioperative period in the surgical intensive care unit of the CHU Kara from 1er January 2021 to 31 December 2023, i.e. 36 months. This study was carried out from 10 July 2022 to 21 March 2024.

Population Studied:

Inclusion Criteria:

The complete records of patients of both sexes hospitalised in the surgical intensive care unit of Kara University Hospital during the study period who had undergone surgery and had presented with acute renal failure before, during and after surgery were included.

Exclusion Criteria:

Incomplete medical records of patients with renal failure were excluded from the study.

All patients who had undergone surgery without a stay in the surgical intensive care unit were excluded.

Non-inclusion Criteria:

Any patient with renal failure who had not undergone surgery was excluded.

Method of Data Collection:

Data Collection Equipment:

We collected the parameters studied from the medical records, therapeutic and anaesthetic charts, and registers of the intensive care unit. A survey form was used to collect the parameters studied. We asked the department supervisor about the organisation of the department, human resources, equipment and materials.

Data Collected:

We collected:

- socio-epidemiological data: age, sex, profession, origin, reason for admission, etc.;
- diagnostic data: associated pathologies, reason for surgery, physical and paraclinical signs (creatinine level, uraemia, etc.);
- pre-, intra- and postoperative care;
- Progression data: complications, mortality, factors contributing to mortality.

Data Compilation and Processing:

The data was analysed manually and entered and processed using Sphinx software. The document was entered using Microsoft Word Office 2016.

Ethical Aspects:

The study was carried out with the authorisation of the medical advisory committee and the director of the CHU-Kara. Patient anonymity was respected.

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RESULTS

Social and Demographic Data

Effectif:

During the study period, 5054 patients were hospitalised in the surgical intensive care unit of the Kara University Hospital, including 4452 operated patients, 94 of whom met the inclusion criteria, i.e. a frequency of 2.11%. Six (06) patient files were excluded from the study.

Age:

Table 1: Breakdown of patients by age.

Year	Workforce	%
< 20	10	10,60
[20 - 30[	12	12,80
[30 -40[	17	18,10
[40 - 50[	12	12,80
[50 - 60[	19	20,20
[60 - more	24	25,50
Total	94	100

The average age of the patients was 45.65 ± 20.02 years, with extremes of 1 and 90 years, and the median age was 47.5 years. Six of the children under 20 were under 18.

Gender:

Males predominated with 75.50% (71 patients). The sex ratio was 3.08.

Place of Origin:

Patients from urban areas accounted for 28.70% (27 patients) and 71.30% from rural areas (67 patients).

Patient Concerns:

Farmers 28%; craftsmen 16%; civil servants 11.7%; students/pupils 17%; housewives 11.7%; car drivers 5%; pensioners 9.6% and those with no occupation 1%.

Source of Patients by Hospital Department:

Visceral surgery 54%; urology 17%; traumatology 11%; gynaecology 6%; paediatric surgery 2%; neurosurgery 2% and stomatology 2%.

Diagnostic Data

Associated Pathologies (8.51%):

8.51% of patients had associated pathologies. Hypertension 6.38%; Diabetes 2 .12%; CKD 1.06%.

Surgery Prior to Renal Failure:

14 patients (14.89%) had undergone previous surgery.

6 hernia repairs; laparotomy, prostatectomy, salpingectomy, tibia fracture, caesarean section, cataract repair, surgery for acute generalised peritonitis, femur fracture 1 case each.

Types of Surgical Pathologies:

Neurosurgical Pathologies:

Narrowed lumbar canal and subdural haematoma 1 case.

Digestive Pathologies Surgical:

Table 2: Breakdown of patients by reason for visceral surgery.

	Workforce	%
Acute generalised peritonitis	41	43,62
Intestinal obstruction	3	3,19
Acute appendicitis	2	2,13
Inguinal hernia	2	2,13
Appendicular abscess	1	1,06
Parietal abscess	1	1,06
Tumour of the small intestine	1	1,06
Cholecystitis	1	1,06
Hydro pneumothorax	1	1,06
Abdominal evisceration	1	1,06
Total	54	57,43

Traumatological Conditions:

Polytrauma, Fournier gangrene, fracture of the 2 bones of the left forearm, fracture of the 2 femoral bones, fracture of the clavicle, open trauma of the right hip 1 case each. Gangrene 2 cases and fracture of the left femur 3 cases with 11.70% of traumatological pathologies (11 cases).

Uronephrological Pathologies:

They represented 17 cases (18.08%) with benign prostatic hypertrophy (7 cases); Fournier's gangrene 3 cases; renal lithiasis and tumour 2 cases each; acute obstructive pyelonephritis, nephrectomy and urethral stricture 1 case each.

Gynaecological and Obstetric Pathologies:

The preoperative pathologies were preeclampsia (2 cases), endometrial polyp, cervical neoplasia, anamniosis and post abortal peritonitis (1 case each).

Paediatric Surgical Pathologies:

Acute generalised peritonitis (1 case) and anal imperforation (1 case) were the preoperative surgical pathologies.

Stomatological Diseases:

Cervicofacial cellulitis accounted for 2 cases.

Renal failure according to Glasgow score

45 patients had a GCS of between 13 and 15; 5 between 9 and 12. There were no patients with a GCS of less than 8.

Renal Failure According to Haemodynamic Status:

Renal Failure According to Systolic Blood Pressure (PAS)= (93.61%):

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Table 3: Renal insufficiency according to SAP

	Workforce	%
< 90	13	13,83
[90; 120[	32	34,04
From 120 to 140	25	26,59
From 140 to 150	8	8,51
From 150 to 160	5	5,32
From 160 to 180	4	4,26
180 and more	1	1,06
Total	88	93 ,61

20.45% of patients had a PAS above 140 mm Hg, 64.77% had a normal PAS and 14.77% had a PAS below 90 mm Hg.

Renal Insufficiency According to Diastolic Blood Pressure (DBP):

Table 4: Distribution of kidney failure patients according to PAD

	Workforce	%
< 60	36	38,30%
[60 -80[	37	39,36%
[80 -85[	0	0,00%
[85 - 90[	1	1,06%
[90 -100[	10	10,64%
[100 - 110[	3	3,19%
[110 - more	1	1,06%
Total	88	93,61%

ARF According to Heart Rate (HR):

The variation in heart rate following acute renal failure was: normal in 67 cases (71.30%); tachycardia in 25 cases (26.60%) and bradycardia in 2 cases (2.10%).

ARF according to peripheral saturation (Spo2) and respiratory rate (RR).

ARF According to Peripheral Oxygen Saturation (SPO2):

A total of 93.24% of patients had an SPO2 above 90% in ambient air (AA) and 6.76% had an SPO2 below 90% in AA.

ARI by Respiratory Rate (RR):

The variation in respiratory rate following ARF was: less than 17 for 6.25% of cases; between 17 and 20 for 9.38% of cases and more than 20 for 84.38% of cases.

ARF According to 24-hour Diuresis:

Oliguria was present in 15% of cases, diuresis was preserved in 77.50% of cases and polyuria was present in 7.50% of cases.

Kidney Failure According to Biology (KDIGO Classification):

Three stages were identified: stage 1 (45%); stage 2 (18%) and stage 3 (37%).

ARF Following the Perioperative Period:
Three types of renal failure were found in the study: IRAF 76% of cases; IRAO 18% of cases and IRAP 6% of cases.

ARI According to Intraoperative Lesion in Neurosurgery:
Subdural haematoma and spinal cord compression were the intraoperative neurosurgical lesions in one case for each neurosurgical pathology.

ARF According to Intraoperative Lesions in Visceral Surgery (54 cases):
Acute generalised peritonitis (35 cases); volvulus of the colon, tumour of the last loop, acute appendicitis, inguinal hernia and rupture of the spleen (2 cases each); abdominal contusion, ileal perforation, traumatic rupture of the spleen, small bowel volvulus, ascites, parietal suppuration, small bowel tumour, cholestasis, vesicular gangrene, intestinal obstruction, flange obstruction, hydropneumothorax, abdominal evisceration and rectal tumour 1 case each were the digestive lesions found intraoperatively.

ARF According To Intraoperative Trauma Injuries (11 cases):
Fracture of the left femur (2 cases) and necrosis of the dorsal surface of the left foot (2 cases); Gangrene of the leg; fracture of the 2 bones of the left forearm; fracture of the 2 bones of the leg; fracture of the clavicle; fracture of the right femur; dry gangrene of the left foot and consolidated osteosynthesis of the femur 1 case each were the intraoperative trauma injuries.

ARF According to Intraoperative Lesions in Uronephrology (17 cases):
Renal calculi, bladder tumours, pyonephrosis, urethral strictures, acute obstructive pyelonephritis, perforated bladder tumours, obstructive renal failure (1 case each), Fournier's gangrene (3 cases) and benign prostatic hypertrophy (7 cases) were the most common intraoperative lesions in uronephrology.

Gynaecological and Obstetrical Injuries (6 Cases):
Preeclampsia 2 cases; anamnios, uterine necrosis, cervical neo, post abortal peritonitis one case each were intraoperative injuries in gynaecology and obstetrics.

ARF According to Intraoperative Lesions in Paediatric Surgery:
Intraoperative injuries in paediatric surgery were anal imperforation and acute generalised peritonitis.

ARI According to Intraoperative Lesions in Stomatology:
Intraoperative lesions in stomatology were cervico-facial cellulitis in 2 cases.

Treatment
Preoperative Treatment:
Eighty (80) patients received filling, 85% with crystalloids and 15% with colloids. 10.60% of patients (10 patients) received a blood transfusion.

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Table 5: Patients with renal insufficiency according to other drugs received preoperatively.

	Workforce	%
Antibiotics	51	46,80
Analgesics	44	54,25
PPI	13	13,83
Corticoids	3	03,19
Vasopressive amines	2	02,12
Phenobarbital	2	02,12
Insulin	2	02,12

*=proton pump inhibitor.

Surgical Treatment:

Table 6: Distribution of AKI according to surgical treatment

	Workforce	%
Laparotomy-wash-drainage	54	57,44
Osteosynthesis	7	07,44
Amputation	5	05,31
RTUP*	5	05,31
Fitting the J probe	4	04,25
Appendectomy	4	04 ,25
Herniorraphy	4	04,25
Colostomy	4	04,25
Splenectomy	3	03,19
Nephrectomy	3	03,19
Epiplasty	3	03,19
Pyelostomy	2	02,12
Hysterectomy	2	02,12
Caesarean section	2	02,12
Adenectomy	2	02,12
Ileostomy	2	02,12
Lumbotomy	1	01,06
Urethral dilatation	1	01,06
lumpectomy	1	01,06
Necrosectomy	1	01,06
Stripping	1	01,06
Parage-Suture	1	01,06
Laminectomy	1	01,06
Incision of the abscess	1	01,06
Trepanning	1	01,06
Chest drainage	1	01,06
Uretroscopy	1	01,06
Removal of osteosynthesis material	1	01,06

NB. One patient had undergone more than one surgical procedure.
*= Transurethral resection of the prostate.

Renal Insufficiency According to the Type of Anaesthesia:

General anaesthesia 87% of cases and spinal anaesthesia 13% of cases.

Renal Insufficiency According to Postoperative Treatment:

Table 7: Distribution of ARF according to treatment.

	Workforce	%
Analgesic	75	79,80
Anti-inflammatory	6	6,40
Antihypertensive	7	7,40
Infusion solution	71	75,50
Anti-malarial	3	3,20
PPI	20	21,30
Anticoagulant	8	8,50
Antibiotics	66	70,20
Transfusion	10	10,60
Anticoagulant	2	2,10
Diuretic	7	7,40
Vasopressive amines	7	7,40
Dopamine	2	2,10
Phenobarbital	2	2,10
Anxiolytic	1	1,10
Kayexalate	2	2,10
Bicarbonate	1	1,10
Insulin	2	2,10

*=proton pump inhibitor.

Patient Outcomes:

Patients transferred represented 41%, deaths 31.91% and discharges 21.09%.

IRA by Length of Hospitalization:

Table 8: Breakdown of patients by length of stay in hospital

days	Workforce	%
<2	20	21,30
[2- 4[	32	34,00
[4- 6[	9	9,60
[6- 8[	7	7,40
[8 -10[	2	2,10
[10 -12[	1	1,10
[12 -more	5	5,30
Total	94	100

The average length of hospitalisation was: 4.25 ±6.42 days with extremes of 1 and 50 days

Evolution

Post-Operative Complications:

Table 9: Distribution of patients according to postoperative complications

	Workforce	%
Septic shock	14	14,89
Hyperkalaemia	13	13,83
Pulmonary embolism	3	03,19
Hypovolaemic shock	3	03,19
Cardiogenic shock	2	02,12

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Uremic encephalopathy	1	1,10%
Anemia	1	1,10%
Pulmonary oedema	1	1,10%

complications, or 40.42% of cases, were recorded postoperatively.

Factors Associated with Death:

Trends by Age:

Table 10: Trends by patient age

year	Deceased	alive	Total (%)
< 18	1	5	6
[18- 30[	5	11	16
[30 - 40[	6	11	17
[40 - 50[	2	10	12
[50 -60[	6	13	19
[60 - more	10	14	24
Total	30	64	94

p=0.25519453: there was no correlation between age and patient outcome.

Trend by Gender:

Table 11: Trends by gender

year	Deceased	alive	Total (%)
Female	10	13	23
Male	20	51	71
Total	30	64	94

p =0.02592927; there was a correlation between outcome and patient gender.

Progression According to Associated Pathologies:

Table 12: Trends by associated pathologies

	Deceased	alive	Total (%)
HTA	3	3	6
Diabetes	1	1	2
Total	30	64	94

p =0.00201949; there was a correlation between outcome and associated pathologies.

Evolution According to Area of Origin:

Table 13: Trends by region of origin:

	Deceased	alive	Total
Rural area	23	44	67
Urban area	7	20	27
Total	30	64	94

p = 0.00706972 there was a correlation between outcome and the area from which patients came.

Changes According to Type of Surgery:

Table 14: Changes by type of surgery

	Deceased/% of	alive	Total
Urology	3(17,64)	14	17
Visceral surgery	20(37,03)	34	54
Traumatology	4(36,36)	7	11

Gynaecology	1(16,67)	5	6
Neurosurgery	0(0)	2	2
Paediatric surgery	0(0)	2	2
Stomatology	2(100)	0	2
Total	30	64	94

Progression According to Glasgow Score:

Table 15: Progression of ARF according to Glasgow score.

	Deceased/% of	alive	Total
[3-8]	0(0)	0	0
[9-12]	3(60)	2	5
[13-15]	14(31,11)	31	45
Total	30	64	94

P <0.001 there was a correlation between outcome and Glasgow score. Not all patients had benefited from Glasgow score assessment.

Adjustments by Type of ARI:

Table 16: Changes by type of ARI

	Deceased	Vivant	Total
IRAO	3	14	17
IRAP	0	2	2
IRAF	27	47	74
Total	30	64	94

p =1.7777: there was no correlation between outcome and type of AKI.

Progression According to 24-hour Diuresis:

Table 17: Changes according to 24-hour diuresis

	Deceased	alive	Total
Oliguria	3	3	6
preserved	11	20	31
Polyuria	0	3	3
Total	30	64	94

p =0.01096627 there was a correlation between progression and 24-hour diuresis

Evolution According to the KIDIGO Classification:

Table 18: Development according to the KIDIGO classification

	Deceased	alive	Total
Stage 1	7	35	42
Stage 2	7	10	17
Stage 3	16	19	35
Total	30	64	94

p =0.02 there was a correlation between progression and the KIDIGO score.

DISCUSSION

Methodological Aspects

During the study we recorded 100 cases of perioperative ARF. Six (06) cases met the inclusion criteria.

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The main methodological limitation is the diagnosis of acute renal failure (ARF) in the perioperative setting.

Creatinine was the biomarker traditionally used to assess renal function. However, it has certain limitations in intensive care, notably a delayed response in relation to actual kidney injury. Neutrophil Gelatinase-Associated Lipocalin (NGAL) and Kidney Injury Molecule-1 (KIM-1) are considered to be early biomarkers of AKI, being able to detect kidney injury earlier than creatinine according to Parikh and Han [[13,14].

Several studies have shown that NGAL levels increase rapidly after kidney injury and can predict the onset of ARF at an early stage. It can be measured in blood or urine, and rapid tests are available to facilitate its use in clinical practice. In Togo, however, biomarker measurement is not routine. The elements used for diagnosis are creatininaemia and hourly diuresis.

Six incomplete files were not included in the study. This finding is inherent in retrospective studies where records are incomplete and/or cannot be found because there were no staff responsible for archiving the records apart from the supervisor who was busy caring for patients. The medical staff alone were woefully inadequate for completing and updating medical records. This raises the problem of keeping medical records in health facilities. Computerisation of medical records in the various departments of the Kara University Hospital would prevent medical records from being lost.

Although creatinine levels were routinely included in the pre- and post-operative tests, not all patients were able to perform them, especially post-operatively, which reduced our sample size.

Despite these limitations, our study remains of interest. It is the first study of its kind at the CHU-Kara.

Epidemiological and Socio-demographic Aspects

Frequency:

The number of renal failure patients operated on was 94 for 445 2 patients operated on during the same study period with 2.11% of patients.

This frequency was very low in our context. This may be related to under-diagnosis of ARF due to the low socio-economic status of the population. Some intensive care patients had not been able to have creatinine levels measured (especially in the postoperative period), which was one of the routine paraclinical tests requested in intensive care.

These results are very low compared to those found by Rossouw et al[1[10] in South Africa in 2023, Kadam et al[115] in 2020 in England found 11.2% and 6.9 % respectively. Raji et al[111] in Nigeria in 2018 had a frequency of 22.5%, as did Benlamkadam S[[9] in 2019 in Morocco found 11.36%. This would be related to the size of their sample which was considerable.

Ouro-Bang'Na et al[112] in a 2008 study in Lomé found the frequency of renal lesions to be 11%. As Lomé is the capital of Togo, socio-economic realities were better than in the interior of

the country, where most of the patients in our context came from poorer rural areas. In Lomé, the capital of Togo, there would be more patients with kidney disease, given the eating habits.

The criteria for defining acute renal failure, the type of study, the recruitment method and the inclusion criteria could explain this difference in results.

The frequency of perioperative ARF varies enormously depending on the heterogeneity of the diagnostic criteria used in the populations studied and the type of surgery according to Benlamkadam et al.[9].

Age:

The average age of the patients was 45.65 ± 20.02 years, with extremes of 1 and 90 years (Table 1). The most common age group was elderly patients aged 60 and over, accounting for 25.50% of cases. According to Corinne et al[[16] many studies consider age over 60 years to be an important risk factor for postoperative acute renal failure.

Advanced age is a factor that favours AKI, given the effect of age on renal function and renal structures, and the impact of numerous chronic diseases whose incidence increases with age, according to Liangos et al. [117]. Our results are similar to those found by Rossouw et al[10] in South Africa with an average age of 49 and Benlamkadam S [9] in 2019 in Morocco with an average age of 52.5 years. This finding would be similar to all the data in the African literature, but would be very low compared with data from developed countries. In France and the United States, according to Grams et al [118].

The average age is thought to be linked to the fact that the African population is relatively young, and that there are other factors in the deterioration of kidney function in Africa, such as the uncontrolled use of anti-inflammatory drugs, adulterated medicines and herbal decoctions or infusions.

The most represented age group were elderly patients aged 60 and over (25.50%). This can be explained by the fact that life expectancy in Togo today has increased considerably. This increase can be explained by the progress made in modern medicine in recent years.

In all cases, all ages were involved. It is therefore important to ensure that all perioperative patients have good renal protection by maintaining a good mean arterial pressure and avoiding nephrotoxic drugs.

Gender of Patients:

The predominance of males was 75.5%, with a sex ratio of 4.7. Benlamkadam et al[9] also found in 2019 in Morocco a male predominance of 76.6%.

Grams et al[118] found similar values of 96.3% in the United States in 2017.

Ahoui et al[[19] found a predominance of women (60%); they had a greater number of patients from the gynaecology and obstetrics department. Consequently, there were more women in their sample.

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Male sex is thought to be a predisposing factor in perioperative ARF.

Origin of Patients:
Most of the patients (71.30%) came from rural areas, partly because the CHU-Kara was the referral hospital in the northern region, and partly because patients from rural areas were slow to consult, transiting through various lower-level centres before being referred to the CHU-Kara. As a result, they would already have complications linked to their pathologies, especially renal complications.

It would be a good idea to set up surgical units in rural areas and ensure that they are operational, and to raise the awareness of healthcare staff in outlying areas so that they can refer patients earlier if their level of care exceeds their level of service.

The most represented department was visceral surgery with 56.4% of patients with kidney failure. Our results are similar to the majority of studies carried out for non-cardiac surgery. Roussow et al[110] found a predominance of digestive pathologies with a rate of 21.9%. This low rate may be linked to the fact that they included plastic, vascular and other non-cardiac surgeries which were not included in our study. Digestive surgical pathologies have a high prevalence of ARF, ahead of uronephrological and traumatological pathologies.

Diagnostic Aspects
Associated Pathologies:
Associated pathologies accounted for 8.51 hypertension and diabetes. The two associated pathologies were recorded in our work, in reality with the pathologies found in the perioperative period. They are more frequent.

Rossouw et al [1[10] also found hypertension to be the main associated pathology, with a rate of 35.9 % .

Arterial hypertension was one of the diseases most frequently responsible for kidney damage. According to Chertow et al.[220].

Tomozawa et al[2[21] showed that hypertension leads to increased susceptibility to acute renal failure after liver resection surgery.

Diabetics are a high-risk group with an incidence of AKI of up to 7% in general surgery according to Mackenzie et al.[222].

Hypertension and diabetes predispose to perioperative ARF.

Preoperative ARF and Surgical Pathologies. (Table 2):
They were dominated by digestive pathologies. They included adult and paediatric pathologies and one obstetric case. In total there were 57 cases out of 94 patients (60.63%) who initially presented with preoperative haemodynamic changes due to acute renal failure and who had been subjected to surgical and anaesthetic aggression which aggravated the haemodynamic effects by reducing perfusion of the organs, in this case the kidneys. In traumatology, there was

also 1 case of polytrauma with a preoperative problem, as well as open fractures associating bleeding and delayed management.

ARF and Glasgow Score:
According to the neurological impairment, there were no severe comatose patients, although not all patients were evaluated neurologically. In our context, neurological impairment would be associated with high uraemia, shock and trauma aggravating ARF. This aggravation was not assessed in our context due to the retrospective nature of the study.

ARF and Haemodynamic Factors:
The preoperative shock rate was around 15% (14.77%), with almost 20% suffering from moderate hypertension, probably as a result of the reaction, and 65% having an essentially normal haemodynamic state. In 26.60% of cases, tachycardia was one of the reactive factors of hypotension and hypoperfusion. (tables 3 and 4)

Diuresis:
There was oliguria in 15% of cases and preserved diuresis in 77.5 % of cases. Probably related to insufficient vascular filling in digestive pathologies.

Our results are similar to those of Benlamkadam S [9] with 26.66% oliguria and 77.5% preserved diuresis.

While Brivet et al[223] found 52% oliguria and 48% preserved diuresis. This may be due to the fact that their study only included patients with severe renal failure.

Diuresis was an important diagnostic and prognostic factor: the occurrence of oliguria would undoubtedly increase the risk of death. This negative effect of oliguria has been demonstrated by numerous studies, according to Benlamkadam S[[9] and De Mendonça A et al [24] . This is thought to be linked to the lesions that cause oliguria in the kidneys as a result of hypoperfusion. In our context, 7.50% of polyuria was due to the removal of a postoperative obstructive ARF obstruction.

ARF and Peripheral Oxygen Saturation:
Few patients were desaturated on room air. This was related to shock and anaemia (6.76% of SPO2 < 90% in room air). Most patients hyperventilated preoperatively to compensate for these conditions. It was corrected by almost systematic oxygenation of patients with serious and complex pathologies during the perioperative period.

Biological Examination (KDIGO Classification):
In our context, there were three stages according to biology: stage 1 (45%), stage 2 (18%) and stage 3 (37%). This classification was dominated by the last two, signifying biological worsening in 55% of patients with hydroelectrolytic disorders.

Types of Perioperative AKI:
The most common type of ARF was functional ARF in 76% of cases. This can be explained by the fact that the most represented group of pathologies were digestive surgical pathologies which reduced perioperative haemodynamics, were accompanied by digestive surgical lesions

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with significant fluid loss (creation of a third sector) and by delays in management. Perioperative ARF is often of the functional type according to Matuszkiewicz-Rowińska J et al [25]. But IRAO 18% related to obstacles on the urinary tract had offered good prognosis after lifting according to Matuszkiewicz-Rowińska J et al [25]. This classification was crucial for specific treatment.

Treatment

Preoperative Treatment:

Eighty patients had received preoperative vascular filling for emergency pathologies and 10.60% blood transfusion for anaemic compensation, in line to some extent with the haemodynamic optimisation described by Himmelfarb J et al [26]. Other medications (table 5) included non-nephrotoxic antibiotics and analgesics with low renal toxicity. Antibiotics helped to reduce the inflammatory lesions of infectious pathologies in the majority of patients and therefore reduced the postoperative worsening of AKI according to Himmelfarb J et al [26].

Preoperatively, 10.6 0% of patients had received a blood transfusion. There was no correlation between outcome and blood transfusion (p =3.1383). In all cases, blood transfusion optimised kidney oxygenation, helping to reduce the worsening of perioperative ARF according to Himmelfarb J et al [26].

Eighty-five-point one percent (85.1%) had received crystalloid or colloid filling. There was a correlation between outcome and filling (p=0.0359).

According to Himmelfarb J et al [26], optimising renal perfusion pressure is the only proven therapeutic objective in humans for preventing perioperative renal failure.

Intraoperative Treatment:

Type of Anaesthesia:

General anaesthesia was the most commonly used anaesthetic in 87% of cases. Anaesthesia, whether general or spinal, always induces a degree of relative hypovolaemia through vasodilatation of the capacitative system. Anaesthetic drugs affect myocardial contractility to a greater or lesser extent. Preoperative fasting is also a factor to be taken into account for scheduled operations.

Our results are similar to those found by Raji et al[111] in Nigeria in 2018 (90.4%).

Intraoperative arterial hypotension of less than 20 mmHg below preoperative values for more than 60 minutes induces renal dysfunction in 15% of cases.[227].

Standard recommendations are to keep MAP at a value of at least 60 mm Hg, but in patients at risk (elderly, hypertension, diabetes, diffuse atheroma) this value is considered too low and it is better to aim for values of 70 mm Hg or more according to Tavernier[2[28]

Type of Surgery:

The most common type of surgery was digestive surgery in 57.44% of cases (table 6), followed by uronephrology and traumatology in 18.10% and 11.7 0% of cases respectively.

Our results are similar to those of Roussow et al[110] and Grams et al[118] who found a predominance of digestive pathologies in 21.9% and 27.7% of cases respectively.

Benlakadam S.[[9] in 2019 in Morocco had found that cardiovascular and urological surgery were both providers of perioperative ARF in the same rank in 30% of cases ahead of digestive surgery represented in 23.33% of cases.

Digestive surgery (table 6) is the main cause of perioperative ARF, ahead of uronephrological and traumatological surgery. In our context, the combination of 2 paediatric digestive cases and one obstetric digestive case reinforces and increases the frequency of ARF in digestive surgery. According to Matuszkiewicz-Rowińska J et al [25], surgical treatment in our context reduced postoperative ARF by removing the obstruction, treating the aetiology and reducing septic foci.

Post-operative Treatment:

Filling was carried out postoperatively in 75.50% of cases (Table 7). This is thought to be related to early postoperative death, financial difficulties of the parents, and oliguria in our context. The kidney is often described as an innocent bystander injured during systemic events. In a physiological situation, it has intrinsic means of regulating its blood flow. Control of renal circulation is based on the myogenic hypothesis, independent by definition of the autonomic nervous system, associated with the subtle balance of vasoconstrictor and vasodilator mediators[226]. Optimisation of renal perfusion pressure is the only proven therapeutic objective in humans to prevent postoperative AKI[226]. The other drug treatments (table 7) were analgesics, antibiotics and blood transfusion, which are generally not very toxic for the kidneys, especially antibiotics for the management of most of the infectious pathologies operated on, and to compensate for decompensated anaemia.

No extrarenal purification was envisaged in our context because no dialysis service was available, as recommended by Pickkers P et al [29].

Evolution (tables 9, 11, 12, 13, 14, 15, 17 and 18)

Patient Outcomes:

Sixty-two point zero nine per cent (62.09%) of patients had a favourable outcome and were transferred to specialist departments for post-operative follow-up. A further 31.91% died in intensive care.

Several factors influenced patient outcomes, including gender (p=0.0259), patient location (p=0.007), associated pathologies (p=0.002), KIDIGO classification (p=0.02), complications (p=0.05), vascular filling (p=0.0359) and diuresis (p=0.023).

Duration of Hospitalization:

The average length of stay in the surgical intensive care unit for patients with renal failure was : 4.25 ±6.42 days with extremes of 1 and 50 days (table 8).

Our results are similar to those of Benlamkadam S. [9] who found an average length of stay of 6 days, with extremes of 3 and 15 days. In our context, the extremes were enormous, perhaps linked to the characteristics of the perioperative patients and the complexity of the pathologies associated with the delay in management.

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Liotier J et al [30] showed that the occurrence of postoperative ARF prolonged the average length of hospital stay by 16 to 23 days.

Complications:
During hospitalisation, there were 40.42% complications, including 14.89% septic shock, 13.83% hyperkalaemia, 3.19% pulmonary embolism, and the same for hypovolaemic shock (table 9).

Septic shock was linked to the underlying pathologies responsible for perioperative ARF and to the frequent nosocomial infections that require scrupulous prevention.

Hyperkalaemia was related to impaired potassium elimination one of the complications found by Matuszkiewicz-Rowińska J [25] et al and managed symptomatically as described by Matuszkiewicz-Rowińska J et al [25].

Mortality:
The mortality rate was 31.91%. It was very high. The contributing factors were delays in treatment, advanced and complex pathologies, acute renal failure with associated complications, and financial difficulties for patients from rural areas. Most of the factors were found in the study by De Mendonça A [24].

Despite the progress made in perioperative resuscitation, mortality remains high. This can be explained in part by the high proportion of elderly and multi-tarred patients, as well as the complexity of the surgeries performed, according to Benlamkadam S. [9].

Ahoui et al[119] found 18.75% in Benin in 2016, almost half as much as in our context.

Benlamkadam S.[9] found in 2019 in Morocco 46.67%. In their study they also included patients operated on in cardiovascular surgery, which was not the case in our context.

This rate should give us cause for concern, so that we can work towards more comprehensive care and, above all, greater emphasis on prevention.

Factors Linked to Death:
There was no correlation between age and death in perioperative ARF, but there was an increase in death according to age in our context (table 10); according to De Mendonça A et [24] the mortality of ARF patients reached 50% according to advanced age, associated chronic pathologies, plus numerous aetiological factors associated with ARF.

Septic shock was the main factor linked to death in 64.28 cases, hyperkalaemia in 62.24% of cases and oliguria in 50% of cases.

According to Shiba et al[7]the incidence of postoperative ARF increased with the duration of oliguria. For Failal I et al [31] the prognosis depends on the initial aetiology and early management, whereas in our context management was always delayed.

There was a correlation between the progression of ARF and gender (table 11): males were more at risk and often consulted late because they often sought alternatives such as traditherapy, which only increased kidney damage with the use of products toxic to the kidneys. There was a correlation between AKI and associated pathologies (table 12). Chronic pathologies constitute a bed for renal lesions, as reaffirmed by De Mendonça A [24].

In table 13, the origin was an aggravating factor in ARI, with delayed consultation, insufficient financial means with little income (agricultural zone), and no health insurance. The population sought other alternatives, such as traditional therapy, which aggravated the renal condition. However, according to Brivet et al [23], the kidney must be sufficiently perfused and intoxication must be avoided.

The type of surgery (table 14) is an important factor in the initial loss of fluids and electrolytes in digestive surgery, and in the worsening of ARF if management is delayed.

Altered consciousness (table 15) is also an aggravating factor because it prevents oral intake of food and water, so dehydration and oliguria set in, creating the renal damage reported by Brivet et al [23].

There was no correlation between the progression of AKI and the type of AKI (table 16), but rather between the type of impairment, whether functional, obstructive or parenchymal.

Diuresis (table 17) correlated with the progression of ARF, and oliguria is a major predictor of high morbidity and mortality, as confirmed by Brivet and De Mendonça [23;24].

There was a correlation between the progression of AKI and the KIDIGO classification (table 18), with a very high mortality rate at stage 3. The higher the uraemia, the worse the patient's clinical condition.

CONCLUSION

The study on perioperative ARF revealed a frequency of 2.11%. Males, the elderly, patients from rural areas, farmers, craftsmen, pupils/students, housewives and civil servants were more affected; similarly, patients from hospital wards such as digestive surgery, uronephrology, traumatology, gynaecology and paediatrics were more associated with the study. Contributing factors were: male gender, advanced age, patients from rural areas, associated pathologies, digestive pathologies, ureteronephrological pathologies, delayed management, intraoperative hypoperfusion.

The prognostic factors were male sex, rural population, associated pathologies (hypertension and diabetes), KADIGO classification with stages 2 and 3, septic complications, oliguria and renal hypoperfusion.

On analysis of the treatment: pre-, intra- and postoperative filling was not optimised throughout the perioperative period, intraoperative hypotension was not compensated for; digestive, uronephrological and traumatological surgery had adversely affected postoperative outcome, as did systemic factors (oliguria and nephrotoxic drugs). Perioperative ARF was serious, with a very high mortality rate (31.91%) in our context. It is essential to prevent renal

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hypoperfusion in the pre-hospital, hospital, pre-, per- and postoperative setting; to manage the various pathologies early and, above all, to avoid nephrotoxic drugs or factors.

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