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Research Article

Contribution of Percutaneous Coronary Intervention in the Management of Acute Coronary Syndromes in Burkina Faso: Results from the Ouagadougou Myocardial Infarction Registry (RIO) and the Burkina Interventional Cardiology Registry (RE.C. I -Burkina).

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Abstract:

Aim: This study aimed to evaluate impact of percutaneous coronary intervention (PCI) in management and prognosis of acute coronary syndromes in Ouagadougou.

Methods: An analytic study compared data from two registries: the myocardial Infarction registry of Ouagadougou (RIO) before PCI and the Interventional Cardiology Registry of Burkina Faso (RE.C. I-Burkina) in the era of PCI. It included patients aged more than 18 years admitted for acute coronary syndromes (ACS) in Ouagadougou. Sociodemographic, clinical, therapeutic characteristics and outcomes of the patients of the two registries were analyzed.

Results: 343 patients were included. Patients of RE.C. I-Burkina registry were younger than them of RIO registry (p=0.011). ACS was dominated by STEMI in both registries. In RE.C. I-Burkina coronary lesions were multivessel in 74%. PCI was performed in 55,9% of patients who underwent coronary angiography with successful procedure in 92,1% of cases. In hospital mortality in the RE.C.I.-Burkina registry was lower than that in the RIO registry (5,9% vs 12.7%, p=0.011).

Conclusion: PCI improved coronary revascularization rate and hospital mortality from ACS in Burkina Faso. These results should be better by earlier cares and team improvement.

Key words: acute coronary syndromes; coronary angiography; percutaneous coronary intervention; prognosis; Burkina Faso

Abbreviations

RIO: myocardial Infarction Registry of Ouagadougou

PCI: Percutaneous Coronary Intervention

RE.C. I-Burkina: Interventional Cardiology REgistry of Burkina Faso

ACS: Acute Coronary Syndromes

STEMI: ST-segment Elevation Myocardial Infarction

NSTEMI: Non-ST-segment Elevation Myocardial Infarction

LAD: left anterior descending artery

LVEF: Left Ventricle Ejection Fraction

DAPT: Dual Anti-Platelet Therapy

ACEi/ARBs: Angiotensin-converting enzyme inhibitor/Angiotensin II receptor blockers LMWH: Low Molecular Weight Heparins

Introduction

Coronary artery disease is a public health problem. Each year, more than 7 million people worldwide are diagnosed with acute coronary syndrome (ACS) [1]. In Burkina Faso, the hospital incidence of ACS was 4.2% in 2018, with an in-hospital mortality rate of 8.7% and a one-month mortality rate of 16.2% [2]. The in-hospital mortality rate is 22.7% in ACS among patients aged 60 and over [3]. This high mortality is linked, among other things, to delayed treatment [4] and inadequate management in the absence of interventional cardiology. In Burkina Faso, interventional cardiology has been operational since 2022. Our study aimed to evaluate the impact of percutaneous coronary intervention (PCI) on the management and prognosis of patients with ACS in Ouagadougou.

Patients And Methods

This analytical study compared the characteristics and management of patients over 18 years of age hospitalized for ACS in Ouagadougou city, using data from two registries. The Ouagadougou Myocardial Infarction Registry (RIO) is a multicenter registry that retrospectively included patients hospitalized for ACS in three public hospitals and three private healthcare facilities in Ouagadougou from January 1, 2016, to December 31, 2020, prior to the introduction of interventional cardiology in Burkina Faso. The Burkina Faso Interventional Cardiology Registry (RE.C.I.-Burkina) is a single-center registry established at the Tengandogo University Hospital Center, the only public interventional cardiology hospital in Burkina Faso, which prospectively included patients who underwent coronary angiography and/or coronary angioplasty. In this study, preliminary data from the RE.C.I-Burkina registry concerning patients over 18 years of age hospitalized for ACS were considered for the period from March 1, 2022, to September 30, 2023. Sociodemographic characteristics, cardiovascular risk factors, type of ACS, treatments and hospital outcomes were compared between the two registries. Angiographic and PCI data were specified for patients from the RE.C.I-Burkina registry.

Patient's characteristics were described by their count and percentage for categorical variables. Quantitative variables were described by their means and standard deviations. To explore associations between categorical variables, the chi-square test was used to compare the proportions of the two registries. In the case of the association between continuous quantitative variables and categorical qualitative variables, we chose a test comparing means or any other analysis depending on the appropriate conditions. The analyses were performed using Rsutio software version 4.3.2, and a p-value < 0.05 was considered significant for a 95% confidence interval.

Results

A total of 343 patients were included, comprising 275 patients from the RIO registry and 68 patients from the RE.C. I-Burkina registry.

Sociodemographic characteristics

The mean age of patients was 60 ± 14.8 years (range 20–91) in the RIO registry and 55 ± 12.3 years (range 31–80) in the RE.C.I-Burkina registry ($p = 0.005$). There was no statistically significant difference in sex between patients in the two registries: 70.9% and 79.4% were male in the RIO and RE.C.I-Burkina registries, respectively ($p = 0.21$).

Craftsmen and laborers were more represented in the RIO registry (17%) than in the RE.C.I-Burkina registry (6%) ($p = 0.04$). Tradespeople were more represented among patients who underwent coronary angiography in RE.C.I-Burkina than in the RIO registry (15% vs 4%, $p = 0.003$). Housewives were relatively more numerous (26%) in the general population of patients with ACS than in the population of patients with access to coronary angiography (9%) ($p = 0.004$). Mine workers and non-governmental organization (NGO) employees had greater access to coronary angiography ($p = 0.02$). Table I summarizes the sociodemographic characteristics of patients in both registries.

Clinical Characteristics

The main cardiovascular risk factors found in patients were hypertension, diabetes mellitus, smoking, and dyslipidemia. There was no statistically significant difference between patients in the two registries about the other cardiovascular risk factors (see Table I).

ST-segment Elevation Myocardial Infarction (STEMI) was the most frequent in both registries, accounting for 64.4% in RIO and 66.2% in RE.C.I-Burkina. It was followed by Non-ST-segment Elevation Myocardial Infarction (NSTEMI) with elevated troponin and Unstable Angina, as shown in Table I. There was no statistically significant difference in the distribution of ACS types between the two registries ($p = 0.93$).

Paraclinical aspects

The left ventricular ejection fraction was less than 50% in 42.6% of patients in both regsitries. The mean hemoglobin level, mean creatinine level, and mean total cholesterol and LDL cholesterol levels were identical in the populations of the two registries, as shown in Table I. Coronary angiography was performed in only 3.3% of patients in the RIO registry (after medical evacuation out of the country) and in all 68 (100%) patients in the RE.C.I.-Burkina. In the RE.C.I.-Burkina patients who underwent coronary angiography, the radial approach was used in 61 (89.7%) patients and the femoral approach in seven (10.3%) cases. The 6F sheath was the most frequently used, in 75% of cases. Two (2.9%) procedures were performed before the 12th hour of pain onset. In 50 (73.5%) patients, at least one significant lesion was found on at least one vessel. The lesions were single-vessel (26%), two-vessel (34%), and three-vessel in 40% of cases. The left main coronary artery was affected in four (5.9%) patients. The left anterior descending artery (LAD) was the most frequently affected vessel (69.1%), followed by the right coronary artery (54.4%) and the circumflex artery (41.2%), as shown in Table II.

Table I: Ociodemographic and clinical characteristics of patients with acute coronary syndrome in the RIO and RE.C.I-Burkina registries in Ouagadougou

Sociodémographic and clinical Characteristics	RIO Registry Number=275 (%)	RECI-Burkina Number=68 (%)	p-value
Sociodemographic characteristics			
Male sex	195 (70.9)	54 (79.4)	0.21
Mean age (SD)	60 (14.8)	55 (12.2)	**0.005**
Occupation n (%)			
Craftsman / Worker	46 (17)	4 (6)	**0.04**
Merchant	11 (4)	10 (15)	**0.003**
Farmer	14 (5)	1 (2)	0.329
Housewives	72 (26)	6 (9)	**0.004**
Official	69 (25)	20 (29)	0.57
Military / Paramilitary	6 (2)	4 (6)	0.22
Minister of religion	6 (2)	3 (4)	0.54
Liberal profession	8 (8)	4 (6)	0.41
Retirees	8 (8)	6 (9)	0.06
Mines/NGO workers	6 (2)	6 (9)	**0,02**
Cardiovascular risk factors			
Age correlated with sex	221 (80,4)	52 (76,5)	0,59
High blood pressure	158 (57,5)	35 (51,5)	0,45
Diabetes	51 (18,6)	18 (26,5)	0,20
Dyslipidemia	32 (11,6)	5 (10,3)	0,42
Smoking	63 (23)	17 (25)	0,84
Type of ACS			
STEMI	177 (64,4)	45 (66,2)	
NSTEMI	71 (25,8)	16 (23,5)	0,93
Unstable Angina	27 (9,8)	7 (10,3)	
LVEF < 50%	92 (42,6)	29 (42,6)	**1**
Biology			
Mean hemoglobin (SD)	14,2 (9,8)	13,5 (1,7)	0,33
Mean creatinine (SD)	119 (96,1)	114 (92,4)	0,46
Mean total cholesterol (SD)	4,8 (1,6)	4,7 (1,6)	0,93
Mean LDL cholesterol (SD)	2,98 (1,3)	2,7 (1,3)	0,34

NGO: Non-governmental organization ACS: acute coronary syndromes. STEMI: ST-segment elevation acute Myocardial Infarction. NSTEMI: Non-ST-segment elevation. Myocardial Infacrtion LVEF: Left ventricular ejection fraction. SD = standard deviations.

Table II: Angiographic characteristics of 68 patients who underwent coronary angiography for acute coronary syndromes at Ouagadougou (RE.C.I-Burkina registry).

Angiographic charactéristics	Number (N=68)	Pourcentage (%)
Arterial access		
Radial	61	(89,7)
Femoral	7	(10,3)
Sheath		
5 French	17	(25,0)
6 French	51	(75,0)
Time to coronary angiography		
< 12th hour	2	2,9
≥ 12th hour	66	97,1
Significant coronary lesions (out of 50 lesions)	**50**	**73,5**
Left main coronary artery involvement	4	5,9
Left anterior descending artery involvement	47	69,1
Circumflex artery involvement	28	41,2
Right coronary artery involvement	37	54,4
Angiographically normal coronary arteries	**18**	**26,5**
Number of coronary arteries affected (out of 50 lesions)		

Single-vessel disease	13	26,0
Two-vessel disease	17	34,0
Three-vessel disease	20	40,0

Therapeutic aspects

Treatment with beta-blockers, statins, and renin-angiotensin-aldosterone system inhibitors was identical in both registries (see Table III). Low-molecular-weight heparins (LMWH) was more frequently used in patients in the RE.C.I-Burkina registry (94.1% vs 87.9%; p = 0.0004). Dual antiplatelet therapy was prescribed more frequently in RE.C.I-Burkina than in RIO (91.2% vs. 73.1%; p = 0.003). PCI was performed in 55.9% of patients in RE.C.I-Burkina and 3.3% of patients in the RIO registry (p < 0.0001). Thirty-four PCI procedures were performed with a drug-eluting stent, representing 89.5% of cases (see Table IV). PCI was performed ad hoc in 35 (92.1%) patients and electively in three cases (4.4%). The success rate after PCI was 92.1% (with TIMI flow 3). In 5.3% the result was incomplete (TIMI flow 2) and in 2.6% there was failure.

Table III: Compared medical treatment of acute coronary syndromes in the RIO and REC.I-Burkina registries.

Treatment	RIO Registry Number =275 (%)	RE.C. I-Burkina Number=68(%)	Chi-Square	p-value
Beta-blocker	214 (77.8)	55 (80.9)	0.14	0.70
Aspirin	228 (82.9)	66 (97.1)	7.80	**0.005**
Clopidogrel	225 (81.8)	63 (92.6)	3.98	**0.04**
DAPT	201 (73.1)	62 (91.2)	8.99	**0.003**
ACEi/ARBs	195 (70.9)	55 (80.9)	2.26	0.13
Statins	223 (81.1)	59 (86.8)	0.84	0.36
LMWH	201 (73.1)	64 (94.1)	12.6	**0.0004**
Thrombolysis*	26 (9.5)	1 (10)	3.75	0.05
Percutaneous coronary intervention	9 (3,3)	38 (55, 9)	18.42	< **0.0001**

*DAPT: Dual Anti-Platelet Therapy ACEi/ARBs: Angiotensin-converting enzyme inhibitor/Angiotensin II receptor blockers LMWH: low molecular weight heparins *Applicable only for STEMI.*

Table IV: Percutaneous coronary intervention data of 38 patients revascularized in the RE.CI-Burkina registry

Setting	Number N=38	Pourcentage (%)
Type of PCI		
Primary PCI	2	5,3
Time of PCI		
Ad 'hoc	5	92,1
Delayed	3	7,9
Nature of the lesions		
New lesion	36	94,7
Stent restenosis	2	5,3
Type of stent		
Drug Eluded Stent	34	89.5
Balloon only	4	10.5
PCI results		
Success (TIMI flow 3)	35	92.1
Incomplet success (TIMI Flow 2)	2	5,3
Failure (TIMI flow 1 or 0)	1	2.6

PCI = Percutaneous Corornary Intervention TIMI = Thrombolysis In Myocardial Infarction

In hospital Outcomes

Four in-hospital deaths were reported in RE.C.I-Burkina, representing a mortality rate of 5.9%, compared to 35 deaths (12.7%) in the RIO registry (p=0.011). Among the deaths in RE.C.I-Burkina, one occurred during angioplasty for a critical lesion of the ostial left main coronary artery, and the other three occurred following the angioplasty procedure during hospitalization, one due to sudden death (probably by ventricular tachycardia) and the other due to an ischemic stroke with hemorrhagic transformation.

Discussion

Sociodemographic Characteristics

The mean age of ACS patients in our study was 60 ± 14.8 years in the RIO registry and 55 ± 12.2 years in the RE.C.I-Burkina registry. This mean age is similar to that found in sub-Saharan African literature, which ranges from 55 to 61 years [5-8]. These results confirm the young age of coronary diseases patients in sub-Saharan Africa. In our study, patients who underwent coronary angiography were predominantly employed with an income sufficient to cover the cost of care. However, the unavailability of coronary angiography in Burkina Faso at the period of the RIO registry partly explains the low rate of access to angiography in this registry. The male predominance in our patients (70.9% in RIO and 78.8% in RE.C.I.-Burkina) corroborates data from the literature, which report a proportion of men in 3/4 to 2/3 of the populations as Toure et al. who reported a sex ratio of 2.33 [9].

Clinical Aspects

Hypertension was the most frequent modifiable risk factor in our study, at 57.5% in RIO and 51.5% in RE.C.I.-Burkina. Ndao et al. [8] and Diop et al. [10] reported a prevalence of hypertension of 47.3% and 59% in their respective series. Hypertension is a major risk factor for atherosclerotic disease. The prevalence of diabetes was 18.6% in RIO and 26.5% in RE.C.I.-Burkina. In the France-PCI registry, 27.8% of patients were diabetic [11]. The prevalence of smoking in our study was 23% and 25% respectively in RIO registry and RE.C.I-Burkina registry with no statistically significant difference. According to the clinical presentation, STEMI was the most frequent (64.4% of cases in the RIO registry and 66.2% in the RE.C.I-Burkina registry), followed by NSTEMI (25.8% and 23.5% in the two registries) and Unstable Angina (9.8% and 10.3%). According to N'Guetta et al. [7], STEMI accounted for 73% of ACS cases and 75.1% of patients who underwent PCI.

Coronary angiography data

In our study, 55.9% of patients who underwent coronary angiography received PCI. This proportion is higher than the 22% reported by N'Guetta at the beginning of this technique [7].

Radial approach was the most frequently used (91.9%). It is the preferred approach for coronary angiography and PCI because it is associated with a significantly lower rate of puncture site complications [12].

In 65 (95.6%) cases, coronary angiography was scheduled. It was performed as an emergency procedure in three cases (4.4%). In Côte d'Ivoire, 20.2% of patients with ACS underwent coronary angiography before the 12th hour of pain onset [7]. The low proportion of patients admitted for emergency coronary angiography in our series is due to several factors: delayed consultation, the patient pathway involving visits to several centers before admission to the Tengandogo University Hospital, financial constraints, and the reduced size of the intervention team, which consisted of only two interventional cardiologists during the study period.

In our series, coronary angiography revealed angiographically normal coronary arteries in 26.5% of cases. Our results are close to those of Diop in Senegal (32%) [10]. Toure et al. [9] and the France-PCI registry [11] reported 34% of angiographies without significant coronary lesions in all patients presenting for coronary angiography in their respective series.

In our study, the lesions were single-vessel in 26% of cases, two-vessel in 34% of cases, and three-vessel in 40%. The proportion of patients with three-vessel disease was greater than that found by N'Guetta (10.5% among STEMI and 17.7% among NSTEMI [7] and Touré et al. [9] with 25%. In the France-PCI registry, 48% of coronary lesions were multivessel [11].

Therapeutic data and percutaneous Coronary Intervention

In the RIO registry, the proportion of STEMI patients treated with fibrinolysis was 9.5%. This proportion was 10% in the RE.C.I-Burkina registry. This proportion is identical to that found in the REPACI registry in Côte d'Ivoire, which was 10.6%. This low fibrinolysis rate is due to excessively long admission times in our setting and the unavailability of thrombolytics and/or their high cost, as reported by other African authors [7,13].

PCI was performed in only 3.3% of patients in the RIO registry and in 55.9% of ACS patients in the RE.C.I-Burkina registry. It was performed with a drug-eluting stent in 94.1% of cases. The success rate of angioplasty in our study was 92.1%. This result is close to that of the initial series in several studies. Indeed, N'Guetta in Côte d'Ivoire reported an PCI success rate of 90.1% [7]. In Senegal, where coronary angiography has been performed for about ten years with a larger team, the angiographic success rate in ACS was 96.4% [8]. These results confirm the importance of the learning curve at the beginning of interventional cardiology. In fact, results improve with the experience of the teams and the availability of consumables specific to certain procedures. In addition to coronary angioplasty, the drug treatment of patients in the RE.C.I-Burkina registry is significantly improved, with a higher proportion of patients receiving dual antiplatelet therapy and heparin compared to the RIO registry.

In hospital outcomes

Hospital mortality in the RE.C.I-Burkina registry was 5.9% compared to 12.7% in RIO. Ndao et al. found a mortality rate of 2.7% in Senegal [8]. In Europe, with prehospital management and early admission to the cathlab, the hospital mortality rate for ACS after PCI with stenting is lower [11, 14, 15]. With prehospital management, the experience of interventional cardiology teams, and the increased number of procedures, interventions are becoming easier and safer. In the France-PCI registry, the hospital mortality rate for ACS varies from 1.1% for NSTEMI to 5.3% for STEMI [11].

The prognosis for coronary patients is multifactorial and does not depend exclusively on the performance of PCI [3, 15-17]. In our context, delays in care, pre-hospital management, and medical treatment are not always appropriate before PCI. Furthermore, deaths are not related to the PCI procedure in the majority of cases. Thus, among our patients who died in the hospital, one case was related to the procedure on a critical left main coronary artery ostial lesion, another to an ischemic stroke with hemorrhagic transformation two days after successful angioplasty in a female patient, and a sudden death, probably due to ventricular tachycardia, in a patient admitted with severe acute pulmonary edema due to extensive anterior necrosis from proximal left anterior descending artery occlusion that had been progressing for two days, and in a hypertensive and diabetic patient who had not been previously monitored.

Conclusion

Interventional cardiology is effective in Burkina Faso since 2022. The results of the first procedures are encouraging, with improved coronary revascularization rate and a reduction in hospital mortality from ACS. These results can be improved through early intervention, particularly pre-hospital care by the emergency medical services with thrombolysis, direct patient admission to the cathlab, training of interventional cardiologists, and improved financial accessibility. Long-term studies are needed to assess its lasting impact in Burkina Faso.

Study's. Limitations

The difference in data collection periods between the two registries may have influenced the discrepancies in certain treatments. The limited number of patients in the RE.C.I-Burkina registry restricts the scope of this study but provides a preliminary estimate of the contribution of angioplasty in Burkina Faso.

Conflicts Of Interest

The authors declare that they have no conflicts of interest related to this article.

Authors' Contributions

KAMBIRE Yibar, DABIRE Y. Eric, and YAMEOGO N. Valentin drafted the protocol, collected and analyzed the data, and wrote the article. All authors read, amended, and approved the protocol and the draft article.

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