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CLINICAL RESEARCH

Optimizing the management of acute coronary syndromes in sub-Saharan Africa: A statement from the AFRICARDIO 2015 Consensus Team

Optimiser la prise en charge des syndromes coronaires aigus en Afrique subsaharienne : consensus du groupe AFRICARDIO 2015

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Abbreviations: ACS, acute coronary syndrome; ECG, electrocardiogram; EMS, emergency medical service; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction.

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Summary
Background. — Whereas the coronary artery disease death rate has declined in high-income countries, the incidence of acute coronary syndromes (ACS) is increasing in sub-Saharan Africa, where their management remains a challenge.
Aim. — To propose a consensus statement to optimize management of ACS in sub-Saharan Africa on the basis of realistic considerations.
Methods. — The AFRICARDIO-2 conference (Yamoussoukro, May 2015) reviewed the ongoing features of ACS in 10 sub-Saharan countries (Benin, Burkina-Faso, Congo-Brazzaville, Guinea, Ivory Coast, Mali, Mauritania, Niger, Senegal, Togo), and analysed whether improvements in strategies and policies may be expected using readily available healthcare facilities.
Results. — The outcome of patients with ACS is affected by clearly identified factors, including: delay to reaching first medical contact, achieving effective hospital transportation, increased time from symptom onset to reperfusion therapy, limited primary emergency facilities (especially in rural areas) and emergency medical service (EMS) prehospital management, and hence limited numbers of patients eligible for myocardial reperfusion (thrombolytic therapy and/or percutaneous coronary intervention [PCI]). With only five catheterization laboratories in the 10 participating countries, PCI rates are very low. However, in recent years, catheterization laboratories have been built in referral cardiology departments in large African towns (Abidjan and Dakar). Improvements in patient care and outcomes should target limited but selected objectives: increasing awareness and recognition of ACS symptoms; education of rural-based healthcare professionals; and developing and managing a network between first-line healthcare facilities in rural areas or small cities, emergency rooms in larger towns, the EMS, hospital-based cardiology departments and catheterization laboratories.
Conclusion. — Faced with the increasing prevalence of ACS in sub-Saharan Africa, healthcare policies should be developed to overcome the multiple shortcomings blunting optimal management. European and/or North American management guidelines should be adapted to African specificities. Our consensus statement aims to optimize patient management on the basis of realistic considerations, given the healthcare facilities, organizations and few cardiology teams that are available.

MOTS CLÉS
Syndromes coronaire aigu ;

Résumé
Contexte. — Alors que la mortalité liée à la maladie coronaire a diminué dans les pays industrialisés, son incidence augmente en Afrique subsaharienne où le traitement des syndromes coronaires aigus (SCA) reste problématique.

Infarctus du myocarde ; Afrique subsaharienne

Objectif. — Proposer un consensus de prise en charge des SCA en Afrique subsaharienne prenant en compte les réalités locales.
Méthodes. — La conférence AFRICARDIO-2 sur la maladie coronaire en Afrique subsaharienne (Yamousoukro, mai 2015) a revu les aspects évolutifs des SCA observés dans 10 pays (Bénin, Burkina-Faso, Congo-Brazzaville, Guinée, Côte d'Ivoire, Mali, Mauritanie, Niger, Sénégal, Togo), et analysé les stratégies susceptibles d'améliorer leur pronostic sur la base des moyens disponibles actuellement.
Résultats. — Le pronostic des patients atteints de SCA est impacté par des facteurs identifiés, comprenant le délai avant premier contact médical, transport vers l'hôpital, délai entre premier symptôme et revascularisation, nombre de services d'urgences limité, en particulier en milieu rural, absence d'urgences pré-hospitalières, et, de fait, faible proportion de malades éligibles pour une revascularisation (fibrinolyse ou interventionnelle). Avec 5 unités de cardiologie interventionnelle pour les 10 pays concernés, les taux de revascularisation interventionnelle sont très bas. Néanmoins, des unités de cardiologie interventionnelle ont vu le jour récemment dans des grandes villes comme Abidjan et Dakar. Les améliorations à attendre doivent cibler des objectifs immédiats simples mais précis : éducation de la population, formation des acteurs de santé en milieu rural, structuration des réseaux de prise en charge entre premier recours, urgences, antennes pré-hospitalières, services de cardiologie et de cardiologie interventionnelle.
Conclusion. — Compte tenu de l'augmentation des SCA en Afrique et de la faible adaptation des recommandations européennes ou nord-américaines, le consensus de prise en charge a été proposé pour optimiser la prise en charge en fonction des moyens matériels et humains disponibles actuellement.

Background

Whereas the rate of death from cardiovascular diseases has declined markedly in high-income countries in recent decades, the incidence is increasing in low-income and middle-income countries. The shift to non-communicable diseases in sub-Saharan Africa is progressing consistently, driven by changes in lifestyle, increased prevalence of cardiovascular risk factors, improved access to care, quality and affordability of health care and population ageing [1—3]. The World Health Organization estimated that in 2005, ischaemic heart disease caused approximately 361,000 deaths in the African region, and current projections suggest that this number will nearly double by 2030 [1,4].

The main cardiovascular risk factors fuelling ischaemic heart disease epidemiology in Africa are similar to those identified in the other regions of the world, apart from high cholesterol concentrations, to which fewer myocardial infarctions are attributable [1,5]. The ischaemic heart disease-attributable fraction of in-patients with heart failure in African cardiology departments increased 4—6-fold between 2007 and 2014, accounting for 8.1% of patients in the THESUS study [6] and 12% in South Africa [2]. Over the past two decades, the hospital prevalence of acute coronary syndromes (ACS) in the cardiology departments in Dakar has increased from 5% to 12%, concomitantly [7].

While the management and outcomes of patients with ACS have been studied extensively in the developed world, limited data are available from sub-Saharan Africa. Indeed, sub-Saharan African countries have limited access to a prehospital emergency medical service (EMS) and expensive therapies, such as fibrinolytic drugs (especially the newer ones) and stents, balloon catheters and accessory devices required to perform percutaneous coronary interventions (PCI). Also, few interventional cardiology facilities and catheterization laboratories are readily available across sub-Saharan Africa. Faced with these shortcomings, the European and/or North American guidelines on the management of patients with ACS are less applicable in most instances.

Optimization of the management of ACS in sub-Saharan Africa remains a challenging issue. As current data are derived almost exclusively from developed world populations, there is a need to establish registries in African countries, to increase awareness of the ACS burden and to establish appropriate preventive and management strategies. However, most prospective cohort studies of cardiovascular disease in sub-Saharan Africa have focused on cardiovascular risk factors and heart failure [7,8], with fewer studies specifically devoted to ACS, apart from the ACCESS South African sub-study, which included a large number of patients [9].

The AFRICARDIO-2 conference on coronary artery disease in sub-Saharan Africa (6—8 May 2015, Yamoussoukro, Ivory Coast) reviewed the ongoing features of ACS in 10 sub-Saharan countries (Benin, Burkina-Faso, Congo [Brazzaville], Guinea, Ivory Coast, Mali, Mauritania, Niger, Senegal and Togo). We looked at current trends in ACS in sub-Saharan Africa, and whether improvements in strategies and policies relevant to the clinical management and care of ACS patients may be expected, using readily available healthcare organizations.

ACS in sub-Saharan countries

Among the 665 patients included in 2006 in a multicentre study of cardiovascular emergencies in sub-Saharan Africa, ACS accounted for only 6.1% of patients [10]. This study did not, however, specifically address the management of ACS, which has emerged gradually over subsequent years. Several studies from West and Central Africa, the results of which were reported at the annual cardiology meetings in Abidjan (Ivory Coast), Dakar (Senegal) and Yaounde (Cameroon), and at the meetings of the Working Group on Tropical Cardiology of the French Society of Cardiology, have shown an increased occurrence of ACS. These contributions were analysed at the AFRICARDIO-2 conference, and an overview is provided in Table 1.

The outcomes of patients with ACS in sub-Saharan Africa are affected by factors that have been clearly identified across the reported studies, including delay from symptom onset to reperfusion therapy, limited numbers of primary emergency facilities, especially in rural areas, limited EMS prehospital management and transportation to the hospital, and hence limited numbers of patients eligible for myocardial reperfusion (thrombolytic therapy and/or PCI).

Time from symptom onset to receipt of reperfusion therapy

Current guidelines on the management of ST-segment elevation myocardial infarction (STEMI) emphasize the importance of the components of delays and the ideal time intervals for intervention [11]. Delay to treatment for ACS is a major contributor to the morbidity and mortality associated with STEMI [12,13]. Time intervals include time from symptom onset to decision to seek medical attention, time to reach first medical contact, and time from first medical contact to receipt of reperfusion treatment. In Western countries, transportation to the hospital accounts for only a very small part of the prehospital delay, and optimally timed treatment for STEMI is mainly limited by the patient's delay in seeking care [13]. Reaching a first medical contact and achieving effective hospital transportation generate delays that are severely prolonged in sub-Saharan Africa. In some instances, the delay in reaching the hospital may be as long as 6—10 days, including 2 days to reach the first medical facility, with an additional 6 days to reach the cardiology department [14]. The delay before reaching hospital has decreased in large cities, such as Dakar, where it has dropped from 53 hours in 2007 to 37 hours in 2015 [15] and to 14.5 hours among younger patients referred to the Dakar Coronary Care Unit [16]. However, while delays from symptom onset to receipt of therapy have substantially decreased in large urban and suburban areas, such as Dakar or Abidjan, delays exceeding 12 hours remain rather common, precluding, in turn, an effective revascularization attempt in most instances.

Transportation of patients to the hospital involves the available rural and urban public transport and private cars [14,17]. The EMS, developed by private initiatives, mostly in large cities, is rarely available or used. As might be expected, residence in rural areas, long travel distances and travelling home in response to symptoms are all associated with longer delays.

The EMS that has been developed in a few large towns has contributed to substantial improvements in the management of patients with an ACS. Since SOS Médecin-Sénégal was created 13 years ago in Dakar, 74 patients have been treated with a fibrinolytic agent for STEMI in the city and its suburban area. While the mean delay to thrombolysis was 156 minutes, this comprised 105 minutes before calling, and only 14 minutes for the EMS arrival [18]. Whether patients with an ACS were treated with prehospital thrombolysis before the SOS Médecins-Sénégal EMS was created is unknown, but is unlikely. Few data are available on prehospital therapies delivered in primary care facilities; none is mentioned in the studies reported by our team (Table 1). Among the subset of patients from South Africa included in the ACCESS registry, only 43% of patients received aspirin before hospitalization, 1.6% received clopidogrel and 3% received unfractionated or low-molecular-weight heparin [9].

Fibrinolytic therapy

Only a small proportion of African patients presenting with STEMI are eligible for thrombolysis; this results from the aforementioned delays that preclude any effective fibrinolytic therapy. Also, in too many instances, the cost of drugs is taken into account. For example, the current cost of treatment with the so-called ''cheap'' streptokinase reaches 160,000 FCFA (€ 246), while the guaranteed interprofessional minimum wage is 48,000 FCFA per month (€ 73 per month). Nevertheless, substantial improvements have been achieved in some large urban areas, such as Dakar and Abidjan. From 2007 to 2015, the proportion of STEMIs for which thrombolysis was administered increased from 11.3% to 31% in Dakar [14,15,17,19,20]. Meanwhile, streptokinase — the only thrombolytic drug used until 2007 — has been replaced in 20% of patients by newer agents, such as tenecteplase or recombinant tissue plasminogen activator [15]. Among patients treated by a prehospital EMS, such as SOS Médecins-Senegal, streptokinase accounted for 43% of treatments, tenecteplase for 41% and recombinant tissue plasminogen activator for 16% [18].

Percutaneous coronary intervention

As a result of the extreme scarcity of interventional cardiology facilities in sub-Saharan Africa, with only five catheterization laboratories in the 10 countries participating in this consensus statement, PCI rates are very low and are considerably lower than in middle- and high-income countries. However, in recent years, catheter laboratories have been built in referral cardiology departments in large African towns (Abidjan and Dakar). Among the 716 coronary catheterizations performed since 2010 in the Abidjan Institute of Cardiology, 76% were done in patients with an ACS, and 66% were for a STEMI. Primary PCI was performed in 30% of patients, and rescue PCI was performed in an additional 6% [21]. In Dakar, PCI has been performed at a similarly increasing rate since January 2015, when a new catheterization laboratory was launched in the Aristide Le Dantec Hospital; the number of PCIs increased from 101 by 2014,

Table 1 Published data on acute coronary syndrome management in sub-Saharan countries and in South Africa.

Country	Author, year [reference]	Patients (*n*)	Age (years)	Men (%)	Delay from symptom onset to therapy	EMS transportation to hospital	EF (%)	HF or shock (%)	Thrombolysis (%)	PCI (%)	Hospital mortality (%)
Benin	Vehounkpe, 2007 [17]	80	56	75				25	0	0	ND
Burkina-Faso	Samadoulogou, 2007 [17]	65		58		0		23			
Burkina-Faso	Yameogo et al., 2012 [14]	43	56.5	88	9.6 days	0 (private car, public transport)		16	4	0	11.6
Congo-Brazzaville	Ikama, 2007 [17]	55	65.5				36.5	25	0		
Congo-Brazzaville	Ondze-Kafata, 2013 [20]		66.3	49.6							
Guinea Conackry	Balde, 2013 [20]	127	(41)		14.5 hours						
Ivory Coast	N'Guetta, 2013 [20]	716 coronary catheterizations; 501 ACS (200 STEMI)	54.5	80					3.7	11.2	6.7
Mali	Diarra, 2007 [17]	162		80							
Mauritania	Ba, 2013 [19]	37	58.1	75				22			21.6
Niger	Toure, 2013 [20]	98		71							
Senegal	Diao, 2007 [17]	59	57	85	53 hours		39.5	20	11.5		15
Senegal	Sarr, 2015 [15]	100	55	73	37 hours			25	31		14
Senegal	Sarr, 2013[a] [16]	21[a]	34	85	14.5 hours			LVD: 37.5	44		14
South Africa	ACCESS investigators, 2011 [9]	642	58	76	3.6 hours (STEMI)	EMS 30-min drive			36 (STEMI)	53 (+14 CABG)	6.7 (1 year)

ACS: acute coronary syndrome; CABG: coronary artery bypass graft; EF: ejection fraction; EMS: emergency medical service; HF: heart failure; LVD: left ventricular dysfunction; ND: not declared; PCI: percutaneous coronary intervention; STEMI: ST-segment elevation myocardial infarction.

[a] Patients aged < 40 years.

to 116 from January to April 2015. A stand-alone PCI programme has also been developed in Lagos, Nigeria, which also mainly targets patients with acute myocardial infarction or unstable angina (81%) [22].

Accordingly, one should consider PCI for STEMI as an achievable challenge in large African cities, provided door-to-balloon times can be rationally shortened. Such an approach has been successfully developed in South African towns, where coronary angiography is performed in 93% of patients with acute myocardial infarction [9]. Conversely, when delays are prolonged and exceed mandated primary PCI times, pharmacoinvasive strategies combining prehospital thrombolysis and subsequent transportation to the hospital should be organized [23]. Such an approach would more appropriately apply to patients living in rural areas and/or for whom a long journey without medical transportation is expected.

Post-ACS management and follow-up

Current guidelines on the treatment of ACS emphasize long-term management and follow-up after the acute and subacute phases [11,24]. Exercise-based rehabilitation is recommended, but only a few centres in our team's area have developed cardiac rehabilitation facilities. In most instances, educational programmes and specifically targeted continuing medical education were conducted in close partnership with the Working Group on Cardiac Rehabilitation of the French Society of Cardiology. A first rehabilitation programme was initiated in Libreville, Gabon, in 2014. Following the first conference in cardiac rehabilitation held in Dakar, November 2015, another rehabilitation programme is expected to start in Dakar by 2016.

Smoking cessation programmes and counselling to control cardiovascular risk factors are performed in referral cardiology centres, but patients' subsequent adherence to secondary prevention seems lower than in middle- and high-income countries. Of the 56% of patients who were smokers when they experienced an ACS in South Africa, only 31.4% had stopped smoking 6—9 months later. Concomitantly, the proportion of patients taking their medications dropped by 8.9% for aspirin, 10.1% for statins, 6.2% for beta-blockers and 17.9% for angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers [25]. A survey of patient adherence to therapy after an ACS was performed in Dakar, Senegal: among 105 patients discharged from the cardiology department, lifestyle and diet recommendations were followed by 56% of patients, drugs were used appropriately by 42%, and 65% of patients attended appointments for follow-up visits [26]. The cost of medication was the major limiting factor for adherence to therapy. Expenditure related to appropriate pharmacological therapy after ACS reached € 205 per month (€ 132 using generically manufactured drugs).

Consensus statement for areas of priority

Given the absence of significant healthcare facilities capable of providing appropriate acute care for patients with ACS, the low general practitioner-to-population ratio across Africa and the extremely low numbers of cardiologists, to improve patient care and outcome emphasis should be placed on limited but selected objectives (Table 2):

- increase awareness of and education about ACS symptoms to improve recognition, by both patients and first-line emergency healthcare providers or paramedics in rural areas;
- train rural-based healthcare professionals in preventive cardiology and the diagnosis of cardiovascular emergencies;
- first-line healthcare facilities in rural areas should have high numbers of general practitioners or experienced paramedics who are trained to provide health counselling and emergency care; they should be aware of the importance of reducing delays in managing patients with a suspected diagnosis of STEMI, thereby fast-tracking patients to receive appropriate electrocardiographic examinations and treatment in a first-line referral infirmary;
- first-line healthcare facilities or infirmaries in small cities or covering rural community areas should be equipped with an electrocardiogram (ECG) and be served by a physician trained in minimal ECG interpretation; transmission of the ECG to the referral cardiology department by mail, fax or mobile phone should be available suitable for appropriate analysis if required; early antithrombotic therapy with 250 mg intravenous aspirin and 300 mg oral clopidogrel should be administered after a diagnosis of ACS has been confirmed or is strongly suspected;
- emergency rooms in larger towns or small cities should be able to make the decision to start fibrinolytic therapy associated with heparin; a fibrinolytic drug — at least streptokinase — and unfractionated or low-molecular-weight heparin should be available in the hospital pharmacy; fibrinolytic therapy is recommended within 12 hours of symptom onset in STEMI patients without contraindications;
- as recommended in high-income countries [14], optimal treatment should be based on the implementation of predefined networks between primary care facilities in rural areas, first-line medical facilities in towns and small cities, and cardiology referral centres in large cities;
- co-operation between hospital-based cardiology departments, catheterization laboratories and the EMS should be clearly defined, including when prehospital fibrinolytic therapy by the EMS and hospital-based PCI is affordable;
- clear definitions of geographical areas of responsibility have to be defined;
- an efficient, pre-established transportation system for medical emergencies should connect the different healthcare structures;
- referral of the patient to the most appropriate structure should be decided by telephone call, using the pre-established list of the healthcare network's facilities;
- large city-based cardiology and/or PCI facilities and teams should be organized in networks with primary and secondary care facilities, as well as with the EMS; as onset of symptoms to thrombolysis or to balloon time has become a performance measure, and is the focus of national quality-improvement initiatives, further management strategies should have a special focus on EMS and medical transportation to the first-line medical facility and subsequent referral to the cardiology department;

Table 2 Acute coronary syndrome — shortcomings to overcome.

	Time to decision to seek medical attention	Time to first call	Arrival at medical unit	Starting therapy	Referral to cardiology department
Rural area	Public education; paramedic knowledge and recognition of ACS	Public and paramedic education	Organized network with EMS and/or ambulance system; ECG if available	Aspirin; clopidogrel; treatment of pain	Organized network; ideally, clinical and ECG results transmitted if delay-compatible
First-line healthcare facilities or infirmaries	Public education; paramedic knowledge and recognition of ACS	Public and paramedic education	ECG available	ECG-ascertained: aspirin; clopidogrel; anticoagulants (LMWH, UFH); optimum treatment of pain; thrombolysis and defibrillation ability	ECG transfer to referral centre (mail, fax, mobile phone); organized patient transfer (network with EMS and first-line facilities)
EMS			ECG available; organized network with first-line healthcare and referral centres	ECG-ascertained: aspirin; clopidogrel; anticoagulants (LMWH, UFH); optimum treatment of pain; thrombolysis and defibrillation ability	ECG transfer to referral centre (mail, fax, mobile phone); organized patient transfer (network with EMS and first-line facilities)
Cardiology department	Nationwide public education programmes; paramedics' training and educational programmes CME for first-line GPs, EMS physicians and cardiologists	Develop and manage the ACS/CAD network	Thrombolysis; primary PCI	Direct cathlab admission; structured team (not just a single PCI-capable cardiologist); primary PCI available 24/7; ACS registry; ICU-coupled cathlab; start rehabilitation programme	

ACS: acute coronary syndrome; CAD: coronary artery disease; cathlab: catheterization laboratory; CME: continuing medical education; ECG: electrocardiogram; EMS: emergency medical service; GP: general practitioner; ICU: intensive care unit; LMWH: low-molecular-weight heparin; UFH: unfractionated heparin.

- given the excessively long delays that preclude revascularization attempts in too many instances, one would expect that a network approach will result in a substantial reduction in delays, as well as in the appropriate selection of either a pharmacoinvasive rescue PCI-coupled approach or a PCI-alone approach in some instances, mainly in patients from large cities [27—30];
- optimizing primary PCI approaches in large equipped cities should be coupled to enhanced prehospital urban and suburban EMS policies to reduce time-to-balloon delays in patients eligible for primary PCI;
- patients with ACS should be listed in a referral centre-based registry.

Conclusion

In light of the increasing prevalence of coronary artery disease and ACS in sub-Saharan Africa, healthcare policies should be developed to overcome the multiple shortcomings blunting optimal management. European and/or North American guidelines on the management of patients with ACS should be adapted to African specificities. The present consensus statement has been proposed in order to optimize the management of patients on the basis of realistic considerations, given the healthcare facilities, organizations and few cardiology teams that are available.

Disclosure of interest

The authors declare that they have no competing interest.

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