

# Coronary Angioplasty in a Low Income Sub-Saharan Country: Situational Analysis

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## Abstract

**Introduction:** Coronary angioplasty is not widely conducted in sub-Saharan Africa in general and Senegal in particular. The objective of this work was to describe the indications, techniques, results and difficulties of coronary angioplasty in Senegal. **Patients and Methods:** We prospectively included all patients who underwent coronary angioplasty between July 2012 and November 2014. We evaluated the clinical characteristics, techniques used, and the peri-procedural complications. **Results:** 110 coronary angioplasties were performed at the cardiac catheterisation unit of the *Clinique du Golf* in Dakar. The average age of patients was  $60.41 \pm 10.93$  years. A male predominance was noted with a sex ratio of 6.3. Hypertension was found in 57% of patients. The principal indications for coronary angioplasty were for the management of acute coronary syndromes with or without ST elevation, in 29 and 39 patients respectively. The femoral artery was the puncture site in 104 patients. The lesions treated were type A/B1 or B2/C in 53 and 57 cases respectively. The success rates of coronary angioplasties and 30-day mortality were 91% and 0.9% respectively. **Conclusion:** In sub-Saharan Africa, Senegal in particular, the practice of coronary angioplasty is low. Indeed, many factors linked to socioeconomic status limit the development of coronary angioplasty in Senegal.

## Keywords

Coronary Angioplasty, Acute Coronary Syndrome, Interventional Cardiology

## 1. Background

Coronary angioplasty with stent implantation introduced by Sigwart *et al.* in

1986 remains the treatment of choice for coronary atherosclerosis in its various presentations. It is the most common interventional procedure in cardiology with more than 2 million coronary angioplasties done every year worldwide, half of which occur in the United States of America [1] [2]. Advanced equipments, techniques and drugs largely explain the good short and long term prognosis of patients undergoing coronary angioplasty [2]. These technological advancements and increased operators' experience have led to the treatment of increasingly more complex lesions, such as unprotected common trunk, chronic occlusions and bifurcation lesions. Despite its impact on the prognosis of coronary artery disease patients in the short and long term, coronary angioplasty is not widely done in sub-Saharan Africa in general and Senegal in particular. The objective of the present study was to describe the indications, techniques, results and difficulties of coronary angioplasty in Senegal.

## 2. Patients and Methods

The study was carried out at the cardiology department of *Hôpital Principal de Dakar* and at *Clinique du Golf*. These two health facilities are both in the Senegalese capital, Dakar.

We prospectively included all patients who underwent coronary angioplasty with or without stent implantation between July 2012 and November 2014. However, patients who underwent only coronary angiography were excluded from the study.

### 1) Clinical characteristics

We evaluated the patients' age, sex, modifiable cardiovascular risk factors, history of cardiovascular disease and family history of coronary artery disease.

We analyzed the indications for coronary angioplasty: acute coronary syndrome with or without ST segment elevation, stable angina or silent ischaemia.

### 2) Interventional procedure

We have also evaluated the following activities done during the procedure: the technique used, the characteristics of the lesion according to the ACC/AHA classification, TIMI flow grade, the catheter and guide wire used, the characteristics of the balloon and stent, the stent type (bare or active), the results of angioplasty (success, intermediate success or failure) and complications.

### 3) Statistical analysis

The parameters studied were entered onto a computerized questionnaire using Epi Info version 6.0. Statistical analysis was performed using with Statistical Package for the Social Sciences (SPSS) software version 14.0.1. Quantitative variables were expressed as mean  $\pm$  standard deviation and the qualitative variables were expressed as percentages.

## 3. Results

During the study period, 280 coronary angiographies and 110 coronary angioplasties were performed at the *Clinique du Golf* in Dakar.

### 1) Clinical characteristics

The average age of patients was  $60.41 \pm 10.93$  years. There was a male predominance with a sex ratio of 6.3 (95 males vs 15 females). Hypertension was the commonest cardiovascular risk factor found in 57% of patients. The prevalence of other risk factors are summarised in **Table 1**. 20 patients had a history of a myocardial infarction. Among the patients, 12 have had a coronary angioplasty done in Morocco or in France. A history of ischaemic stroke and a peripheral arterial occlusive disease of the lower limbs were found in 2 and 6 patients respectively.

The commonest indications for coronary angioplasty were for the management of acute coronary syndrome, with or without ST segment elevation respectively in 29 and 39 patients. Two patients had a primary angioplasty. The remaining patients were revascularized secondarily after thrombolysis through facilitated angioplasty or after detection of viability respectively in 15 and 12 cases. Other indications for coronary revascularization were effort angina in 38 cases and silent ischemia in 2 patients.

### 2) Interventional procedure

The femoral artery was the main site of puncture and was used in 104 patients. However, the radial artery was used in 6 patients. The lesions treated were type A/B1 or type B2/C in 53 and 57 cases respectively. A TIMI flow 0 during coronary angiography was present in 23 patients. Five patients had received coronary angioplasty for bifurcation lesion. **Table 2** list the materials and technique used during revascularization procedures. The success rate of coronary angioplasties was 91% (100/110 cases). The main factors of failure were chronic occlusion in 8 cases and calcifications in 2 cases.

The main complications found in our patients were moderate bleeding at the femoral puncture site without hemodynamic consequences but that required transfusion, and one case of acute stent thrombosis. The mortality rate at 30 days was 0.9% (1 patient).

**Table 1.** Clinical characteristics and indications for coronary angioplasty.

Clinical characteristics	Number	Percentage
Average age	$60.41 \pm 10.93$	
Diabetes	45	40.9%
Smoking	46	41.8%
Hypertension	63	57.2%
Dyslipidaemia	46	41.8%
Family history of coronary artery disease	10	9%
History of myocardial infarction	32	29%
History of coronary angioplasty	11	1%
ST elevation acute coronary syndrome	29	26.3%
Non-ST elevation acute coronary syndrome	39	35.4%
Stable angina/silent ischaemia	42	38%

**Table 2.** Techniques/equipment for coronary angioplasty.

Technique for coronary angioplasty	Number	Percentage
Femoral artery	104	94.5%
Radial artery	6	5.5%
Anterior interventricular artery	52	47.2%
Circumflex artery	28	25.4%
Right coronary artery	27	24.5%
Common trunk	3	2.7%
Bare stent	82	82.8%
Drug eluting stent	17	17.2%
Average length of stent	17.43 + 4.4 mm	
Average diameter of stent	2.9 + 0.2 mm	
Kissing balloon	3	2.7%
Volume of contrast	188.68 + 63.21 ml	
Success of angioplasty	100	91%

#### 4. Discussion

Coronary angioplasty is an interventional medical procedure widely practised around the world. There are annually more than 2 million angioplasties, with a success rate of 97%, a mortality rate of 0.5%, and a need for urgent coronary surgery of less than 0.5%. Advances in technology and equipments have allowed us to manage more complex lesions such as unprotected common trunk, chronic occlusions and bifurcation lesions. The risk of re-stenosis has been greatly reduced by the use of active stents [3].

However, the practice of coronary angioplasty is not widespread in sub-Saharan Africa. We describe the first set of coronary angioplasties done in Senegal. This practice is still at a low level, indeed in more than 2 years we have carried out only 110 such procedures or an average of 55 angioplasties per year. This low level of activity is correlated with an excess risk of peri-procedural complications. Ellis *et al.* [4] have shown a strong correlation between the number of patients treated annually by angioplasty and the cumulative risk of serious complications (myocardial infarction, emergency coronary artery bypass surgery, death). Interventional cardiologists treating less than 70 patients per year have an overall rate of serious complications of 9.3% and being 5.1% in the subgroup of patients treated for a single lesion (type A or B1 of the ACC/AHA classification). For those treating more than 270 patients a year, the rates are 2.9% and 1.7% respectively [4]. However, our success and mortality rates of respectively 91% and 0.9% are comparable to Aversano *et al.* (90.7% success, mortality 0.9%) in the United States of America [5]. The indication for coronary angioplasty in our study was mainly for the management of acute coronary syndromes with or without ST segment elevation in 62% of cases. In a study carried out in France, Mboup *et al.* found similar indication for angioplasty where 67.9% of in-

dications were for the management of acute coronary syndromes [6]. However, in our study primary angioplasty could be performed in only 2 patients. This low primary angioplasty activity is related to the long delay in the management of cases and low health insurance coverage in Senegal. Indeed, the average time to management of myocardial infarction in Dakar is  $53.2 \pm 21.3$  hours [7]. The absence of routine coronary artery bypass surgery in Dakar constitutes a real obstacle to care for the most frequent complex lesions such as unprotected common trunk, calcified lesions and bifurcations. Our activity is also limited by the limited availability of disposable equipments. Indeed no industry specializing in interventional cardiology is present in Senegal. A procedure may be postponed for several days due to unavailability of adequate equipment.

## 5. Conclusion

In sub-Saharan Africa, Senegal in particular, the practice of coronary angioplasty is low. The principal indication in our study was for the management of acute coronary syndromes with or without ST segment elevation. The success rate was high and complications were low. However, many factors linked to low socioeconomic status limit the development of coronary angioplasty in Senegal. The expansion of this activity requires an unwavering government support, the development of coronary surgery and establishment of pharmaceutical industry specializing in interventional cardiology.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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