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Prognostic Role of Pulse Pressure in the Acute Phase of Myocardial Infarction

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Abstract

Objective: Pulse pressure is a cardiovascular risk factor. The aim of our study was to assess the short and medium term prognosis of myocardial infarction in the African black having a high pulse pressure. Methods: We performed a comparative retrospective study of 200 patients hospitalized in the Cardiology Institute of Abidjan. The first group (100 patients) had a high pulse pressure (≥60 mmHg). The second (100 patients) had normal pulse pressure (≤60 mmHg). The primary outcome was mortality. Secondary endpoints were represented by hemodynamic complications, rhythmic and conduction disturbances. Both groups of patients were matched. The matching is performed by socio-demographic criteria, the seat of necrosis and cardiovascular risk factors. The authors explained the choice of 60 mmHg as references because in all their studies they have realized that it is from 60 mmHg pulse pressure morbid events that occur in prospective studies and retrospective studies in stiffness of the great arteries is responsible for all these events. Pulse pressure is in itself, an independent cardiovascular risk factor in systolic blood pressure, diastolic blood pressure when associated with myocardial infarction, it becomes from 60 mmHg poor prognostic factor especially in the acute phase. Results: The mean age was 54.46 ± 10.10 years for patients with normal pulse pressure and 52.32 ± 10.89 years in patients with high pulse pressure. Patients with elevated pulse pressure were twice as left ventricular failure (Chi^2 = 3.71; P = 0.048 = 2 OR 95% CI = 0.93 to 4.29). These patients had an ejection fraction and fractional shortening double bass (Chi^2 = 31.23 P = 0.00001, OR = 2.2 95% CI 0.8 to 17.4) 10 mmHg for increased pulse pressure we observed an average growth of 18% mortality rate. Mortality was three times higher in patients with elevated pulse pressure (Khi^2 = 15, 06 ddl = 1 P = 0.0001 OR = 3.34 95% CI 1.72 to 6.52). Conclusion: The high pulse pressure represented an independent poor prognostic factor in the acute phase of myocardial infarction in the black African.

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Keywords

Myocardial Infarction Pulsed, Pressure, African

1. Introduction

Pulse pressure also known as Differential Blood Pressure is currently considered as a risk factor independent of Systolic Blood Pressure, Diastolic Blood Pressure and Mean Arterial Pressure. It represents a factor independent of cardiovascular risk. The role of this factor is now well quantified in treated and apparently controlled hypertensive subjects and normotensive subjects [1]-[5].

High pulse pressure is both a cardiovascular risk factor and a factor of bad prognostic in the acute phase of myocardial infarction. This risk factor is well studied in Western Countries whereas in Africa in general and in Côte d'Ivoire in particular, few studies have been conducted to assess the prognostic role of pulse pressure in the acute phase of myocardial infarction.

It is in this context and in view of filling this apparent gap that we conducted this comparative study in order to assess pulse pressure as an independent risk factor of excess mortality rate and occurrence of complications in the acute phase of myocardial infarction in Black African subject.

2. Methodology

We conducted a retrospective comparative study related to two groups of patients admitted to the Institute of Cardiology of Abidjan for Acute Myocardial Infarction whose pain had been evolving since less than 24 hours from 2003 to 2007. The first group consisted of 100 patients who presented upon admission high pulse pressure simultaneously with myocardial infarction. The second group consisted of 100 patients hospitalized during the same period for myocardial infarction with normal pulse pressure. It was a case-control study (one case for each control subject) where cases were patients with high pulse pressure and control subjects patients with normal pulse pressure.

The matching of the two populations was conducted according to the age, gender, the site of necrosis and major cardiovascular risk factors (High Blood Pressure, tobacco, diabetes, obesity, hypercholesterolemia, hypertriglyceridemia). Endpoints in each group of population were potential hemodynamic, rhythmic, conductive complications as well as mortality in the acute phase of myocardial infarction.

The diagnosis of myocardial infarction was based on clinical criteria (acute coronary syndrome resistant to nitroglycerin) electrocardiographic (Pardee waves, Q wave), biological (cardiac enzymes elevation, troponin I elevation).

Pulse pressure was assessed upon admission to the emergency room and during hospitalization.

Furthermore, we calculated the average of different pulse pressures in each patient upon admission and during hospitalization.

Pulse pressure was calculated regardless of the reading method as the difference between Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) PP = SBP (140 mmHg) − DBP (80 mmHg) = 60 mmHg.

Pulse pressure was considered to be high when it exceeded 60 mmHg [6] [7].

All the patients of both groups were treated with sodium heparin using syringe pump, converting enzyme inhibitor, beta blocker, nitrates, antiplatelet drugs and statin. None of the patients received thrombolytic or angioplasty revascularization treatment .A this time in our cardiology center was practiced these treatments

Statistical analysis of data was carried out by means of the software Epi Info 6 version 6.04. The comparison of both populations was conducted thanks to the odds ratio calculation, confirmed by the Chi^2 test with a threshold of 5%. Numbers less than 5 were compared by means of the Fischer Test with a threshold of 5%. The survival curve was drawn according to the Kaplan-Meir procedure.

The limitations of our study: a retrospective study, there was bias, since some records were incomplete, the management was not optimal due to the lack of thrombolysis, the absence of coronary angiography.

3. Results

The mean age was 52.3 years for patients with high pulse pressure and 54.4 years for subjects with normal pulse

pressure. We observed a male predominance in both populations (68.5% vs 31.5%, P = 0.55). The average of pulse pressure was 60 mmHg in patients with high pulse pressure and 45 mmHg in those with normal pulse pressure.

Comparative Study

The frequency of patients who presented a complicated evolution during their hospitalization was significantly higher in the group of patients with high pulse pressure compared to those with normal pulse pressure.

As a matter of fact, patients with high pulse pressure were two times more at risk of developing left ventricular failure compared to those with normal pulse pressure (Chi^2 = 3.71, ddl = 1, P = 0.048, OR = 1.99, CI of 95% = 0.93 - 4.29).

The comparative study of rhythm disorders in both populations did not reveal a correlation between pulse pressure elevation in the acute phase of myocardial infarction and the occurrence of rhythm disorders. (Chi^2 = 0, ddl = 1, P = 0.72, OR = 1, CI of 95% = 0.54 - 2.35), the same applied to conduction disorders (Chi^2 = 2.26, ddl = 1, P = 0.133, OR = 0.532, CI of 95% = 0.172 - 1.648).

The echography of left ventricular ejection fraction revealed a statistically significant difference between patients with high pulse pressure and those with normal pulse pressure. Patients with high pulse pressure were three times more at risk of developing a Low Ejection Fraction (EF < 0.55) than those with normal pulse pressure. The same applied to shortening fraction. (Chi^2 = 23.63, ddl = 1, P = 0.0000012, CI of 95% = 0.28 - 7).

The collapse of the ejection fraction and shortening fraction in the acute phase of myocardial infarction was correlated with the increase in pulse pressure.

There were moreover a significant difference between patients with high pulse pressure and those with normal pulse pressure regarding complicated evolution. Pulse pressure elevation constituted a risk factor of occurrence of derogative events (complications and deaths) in the acute phase of myocardial infarction. (Chi^2 = 81.40, ddl = 1, P = 0.0000).

For an increase of 10 mmHg in pulse pressure, we observed an average rise of the mortality rate by 18%. Mortality was three times higher in patients with high pulse pressure than in patients with normal pulse pressure. (OR = 3.3, CI of 95% = 1.72 - 6.52).

After a two-month follow-up, survival experienced a decrease, sign of a rise in mortality between admission and the first week in both populations but particularly noticeable in patients with high pulse pressure. This decrease worsened after the third week of hospitalization in patients with high pulse pressure.

Excess death rate factors in hospitals are summarized in the table. They were mainly represented by a pulse pressure elevation beyond 60 mmHg, left ventricular failure; low ejection fraction was 50% [**Table 1**].

All the other factors such as: High Blood Pressure, Tobacco, Diabetes, Dyslipidemia, Stress Obesity, MI Territory were matched [**Table 2**].

Survival experienced a decrease, sign of a rise in mortality between admission and the first week in both populations but particularly noticeable in patients with high pulse pressure [**Figure 1**].

This accentuated decrease worsened after the third week of hospitalization in patients with high pulse pressure.

Table 1. Characteristic of the initial study populations.

Variables	High PP (N = 100)	Normal PP (N = 100)	OR	IC95%	Chi^2
Age	52.3	54.4		6.04	0.61
Sex M/F	62/38	75/25	0.544	3.91	0.068

Table 2. Survival summary of both populations.

	J0	J2	J4	J6	J8	J10	J12	J14	J16	J18	J20	J22	J24
Normal PP	99	94	92	92	88	87	87	87	86	85	85	85	
High PP	97	83	75	73	66	62	60	58	56	56	53	49	46

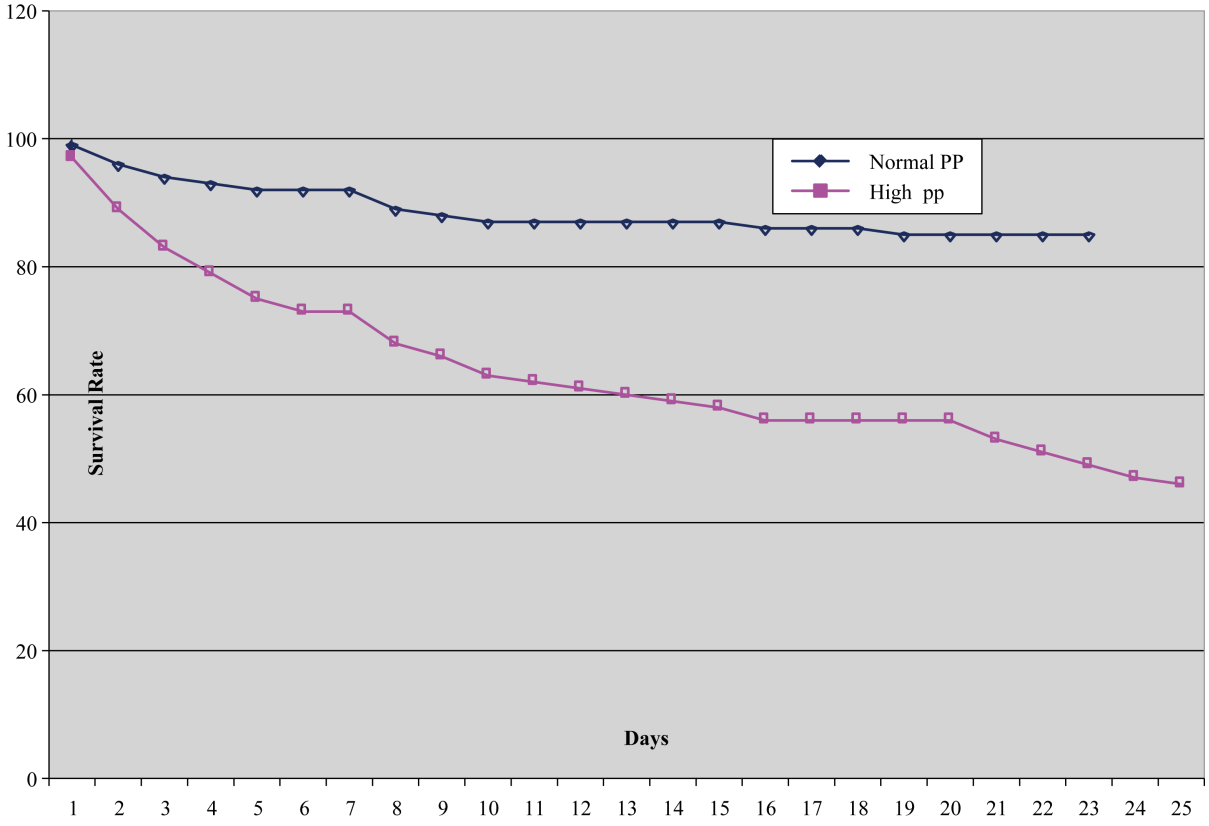

Figure 1. Survival curve.

4. Discussion

Epidemiologycally, the mean age of the first population with high pulse pressure was 52.3 years. There were mainly male subjects (70%). The mean age of the second population of patients was 54.4 years. 67% of them were male. Fewer studies have been carried out on pulse pressure in Black Africa in order to allow for a comparative approach of our results. Studies conducted in France revealed that the mean age of patients with high pulse pressure was 55 years [8] [9]. Moreover, these studies showed that pulse pressure was a major risk factor that needed to be considered in the acute phase of myocardial infarction.

Pulse Pressure depends on three hemodynamic factors: left ventricular ejection rate, aortic parietal stiffness degree and pressure waves. Ventricular ejection causes a disturbance of the aortic wall triggering a propagation of the pressure wave along the arterial tree. As the wave moves in territories with more and more reduced diameter and increasingly rigid wall, it follows a deformation of the pressure curve along the arterial tree [10]. This mechanism could account for the occurrence of complications with as a result the rise of mortality in the acute phase of myocardial infarction. Patients with high pulse pressure were two times more at risk of developing an unfavorable evolution than those with normal pulse pressure (OR = 2). High pulse pressure appears as a bad prognostic factor in the acute phase of myocardial infarction.

The prognostic role of Pulse Pressure on cardiovascular affections is well defined. In our study, patients with high pulse pressure were two times more prone to left ventricular failure in the acute phase of myocardial infarction than those with normal pulse pressure. As well, an increase of 10 mmHg in the pulse pressure was correlated to an increase of 26.6% of complications. Our results were in line with the results of Chae *et al.* [11] who revealed that an increase of 10 mmHg in the pulse pressure goes along with an increase of left ventricular failure in the acute phase of myocardial infarction by 14%. Vaccarino *et al.* showed in a recent study that an increase in the pulse pressure by 10 mmHg was associated with an increase of heart failure risk by 32% [12]. High pulse pressure is moreover a determining factor in the occurrence of hemodynamic complications in the acute phase of myocardial infarction in Black African subjects [13] [14].

In myocardial infarction, rhythm disorders are part of early complications. Are those atrial or ventricular heart rates related in one way or the other to the rise of the pulse pressure in the acute phase of myocardial infarction? This theme is nearly not dealt with in the literature and results do not underline significant difference between subjects with high pulse pressure and subjects with normal pulse pressure regarding rhythm disorders. Is it however possible to assert that no link exist between the level of pulse pressure and the occurrence of heart rhythm disorders? More objective answers could be obtained in future works with more systematic stress on cardiac rhythm disorders in the acute phase of myocardial infarction.

With regards to conduction disorders we did not observe statistically significant difference between cases and control subjects. *I.e*. patients with high pulse pressure are not more at risk of developing conduction disorders than those with normal pulse pressure in the acute phase of myocardial infarction.

Fewer data exist in Africa relating to the impact of pulse pressure on mortality in the acute phase of myocardial infarction unlike in the Western world, where many studies have been conducted. From our stand we stressed that an increase by 10 mmHg of pulse pressure had as consequence an average increase of the mortality rate by 18% [15]-[17].

Pernenkil *et al*. showed that a rise in the pulse pressure during myocardial infarction correlated with an annual mortality of 9% [18] [19]. Domanski *et al*. assessed the role of pulse pressure in terms of cardiovascular risk factor in a population concluded that pulse pressure was an independent predictor of cardiovascular mortality, coronary diseases and total mortality [20]. Thus according to the same authors an increase of pulse pressure by 10 mmHg was associated with an increase of cardiovascular death rate by 26%. Madhavan and coll. underlined that pulse pressure only and not diastolic blood pressure and systolic blood pressure, was a predictive of myocardial infarction [21]. As a matter of fact the relative risk of coronary events in patients with their pulse pressure exceeding 63 mmHg was higher compared to hypertensive patients with a pulse pressure under 47 mmHg.

The implication of pulse pressure in cardiovascular morbidity and mortality was also proved in a population of patients who presented myocardial infarction followed by a heart failure. A recent analysis of the results of the study of Danchin [6] showed that the risk of complication and cardiovascular mortality was positively correlated to the amplitude of pulse pressure recorded in the acute phase and after myocardial infarction. Benetos and coll. revealed that cardiovascular mortality was positively correlated to the level of pulse pressure, after adjustment to the age, to the level of mean pressure and to other risk factors [7] [22]. According to the same study, pulse pressure was a significant determining factor of coronary mortality. In a former analysis, it was observed that a pulse pressure exceeding 65 mmHg could be accompanied by a frank elevation of coronary cardiovascular risk, even if absolute values of systolic blood pressure and diastolic blood pressure did not exceed the higher normal limit [20]. For example, a patient with a blood pressure reading of 138/68 mmHg (pulse pressure = 70 mmHg) with a coronary risk higher than 50% compared to a patient with a blood pressure reading of 125/78 mmHg (pulse pressure reading of 47 mmHg). We obtained results in line with this mortality rate for a pulse pressure higher than 60 mmHg.

Patients with high pulse pressure died two times more than those with normal pulse pressure in the immediate phase of myocardial infarction. Regarding myocardial constants some authors of whom Konin *et al*. revealed that one of the mortality causes of myocardial infarction in the acute phase is the collapse of ejection fraction and shortening fraction [23] [24]. Bouraoui revealed also that one of the immediate death causes in the acute phase of myocardial infarction is left ventricular dysfunction [25]. In our study, patients with high pulse pressure developed two times low ejection fraction and shortening fraction than those with normal pulse pressure.

5. Conclusion

This hospital-based case-control study aiming at assessing the prognostic role of pulse pressure in the acute phase of myocardial infarction enabled us to underline the following facts: Pulse pressure elevation is a factor of bad prognostic because it increases significantly hemodynamic complications, the incidence of left ventricular dysfunction and mortality in the acute phase of myocardial infarction.

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