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Impact of the Angioplasty Procedure in Cohort of the Patients Older than 80 Years with Anemia: An Observational Study

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Abstract

Introduction: Cardiovascular diseases are the leading causes of death in the population. According to data from the World Health Organization of 2017, of the 21.7 million deaths from these diseases, more than ten million occur due to atherosclerotic coronary disease. In this context, anemia is a frequent problem among patients with acute myocardial infarction and ST elevation. Although there are advantages with this procedure, restenosis continues to be one of the main limiters of therapeutic success, especially in patients older than 80 years and with anemia.

Objective: Therefore, the present study aimed to conduct a retrospective longitudinal and observational study on the impact of angioplasty procedure in patients older than 80 years and with anemia.

Methods: A total of 185 participants were submitted to eligibility analysis, followed by STROBE (Strengthening the Reporting of Observational Studies in Epidemiology), The present study followed a retrospective longitudinal and observational model on the analysis of the profile of patients who underwent angioplasty at Brazil. The predictors were anemia and older patients.

Results: The multivariate analysis showed that anemic patients older than 80 years who underwent angioplasty died, with a significance level of 33.97% in the female group and 34.40% in the male group, with a total of 68.40 % of deaths in statistical terms. The Graph matrix-Plot model showing the results of the regression analysis between continuous predictors and response, with $p<0.05$ as significant. All the results showed $p<0.05$ because the presence of the predictor "anemia" negatively influenced the angioplasty procedure in the patients.

Conclusion: The present study showed that patients with anemia showed a significant increase in life risk with death occurring after an angioplasty procedure.

Keywords: Cardiovascular disease; Atherosclerosis; Angioplasty; Older patients; Anemia; Life risk

Introduction

Cardiovascular diseases are the leading causes of death in the population. According to data from the World Health Organization of 2017, of the 21.7 million deaths from these diseases, more than ten million occur due to atherosclerotic coronary disease (ACD) [1]. ACD is the most common cause of mortality in developed countries [1]. Comparing Brazilian patients with stable ACD from 40 to 75 years per 1,000 inhabitants with those from European countries, it is noted that Brazil (58.4%) is surpassed only by England (59.0%) and Spain (81.5%). In Brazil, it is responsible for large numbers of deaths and health care expenditures [2].

In this context, anemia is a frequent problem among patients with acute myocardial infarction and ST-elevation [3,4]. As myocardial ischemia occurs along with the reduction of oxygen in anemic patients, the infarct area can be increased. Lower levels of hemoglobin have been consistently associated with adverse cardiovascular outcomes in patients with congestive heart failure, and in patients undergoing percutaneous coronary intervention. Thus, hemoglobin (Hb) reference values for the definition of anemia are still largely based on 1968 WHO Scientific Group report, which established a cutoff value<13 g/dL for adult males and<12 g/dL for non-pregnant adult women [4].

Furthermore, the coronary diseases (CD) resulting from occlusion or narrowing of the coronary arteries due to the formation of atherosclerotic plaques [5-8]. The CDs, responsible for about 7.4 million deaths per year in Brazil, are associated with a set of risk factors, including advanced age, gender, smoking, obesity, hypertension, diabetes, genetic factors, hypercholesterolemia and sedentary lifestyle [9-13].

The pathophysiological manifestation of CD involves coronary insufficiency, characterized by the imbalance between supply and consumption of oxygen at the myocyte level [14-17]. Thus, the goal of treatment of stable angina depends on increased myocardial oxygen supply and reduced demand, which are closely related to contractility, left ventricular parietal stress, myocardial mass, and heart rate and post-load variations determined by blood pressure [18-21].

Within the therapeutic arsenal for the treatment of acute myocardial

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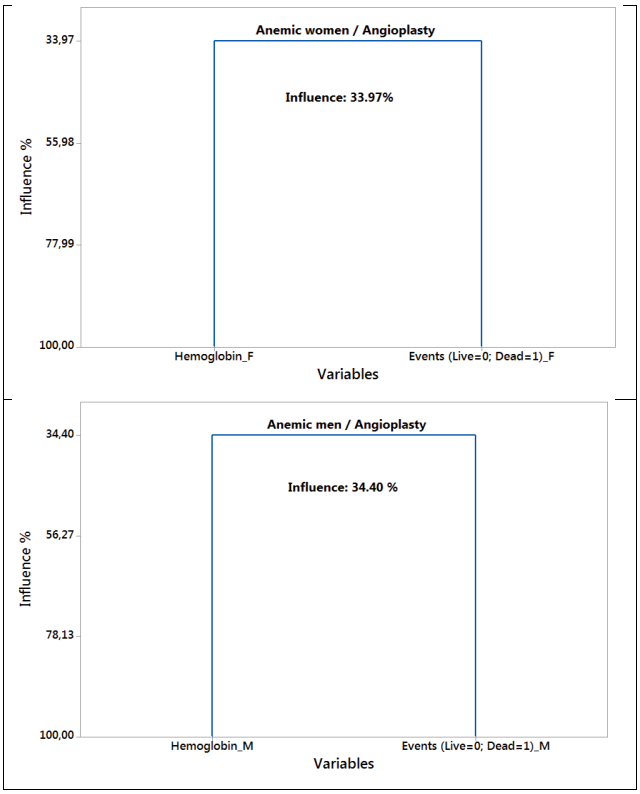

Figure 1: Multivariate analysis (Dendogram) showing the level of influence in percentage of anemic patients (women and men) who underwent angioplasty.

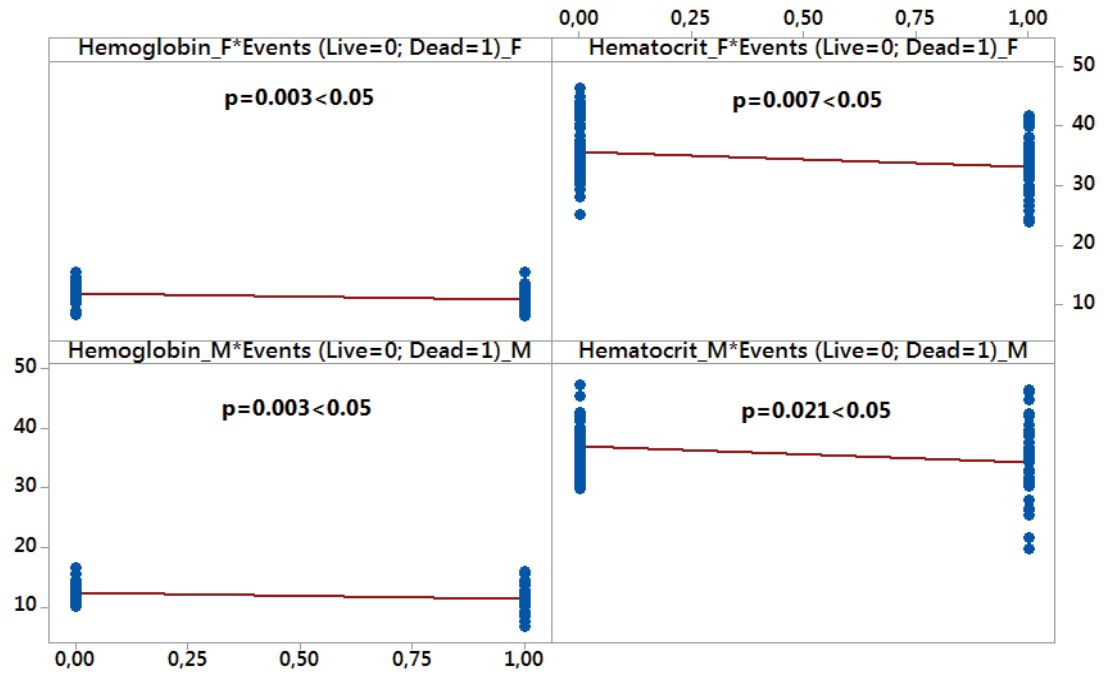

Figure 2: Graph matrix-Plot model showing the results of the regression analysis between continuous predictors and response, with p<0.05 significative.

infarction with ST segment elevation to the electrocardiogram, primary percutaneous coronary intervention is the most important reperfusion strategy [22-23]. However, its accomplishment within the deadlines defined in the evidence of the studies is a great challenge [24].

The diagnosis of CD is based on the association of clinical history and complementary examinations, since the majority of patients with CD present normal physical examination. Thus, complete anamnesis and evaluation of personal and family history are fundamental [25].

The treatment of acute myocardial infarction with ST-segment elevation is consolidated in the trinomial thrombolysis chemistry-primary angioplasty-salvage angioplasty [4,25]. Depending on the place of care and local conduct, these strategies work and lead to huge reductions in deaths and myocardial damage [26]. It is essential that the health system is organized to establish the best local strategy to obtain this enormous benefit of opening the artery responsible for the occluded infarct in the shortest time. The most used procedure for the treatment of coronary lesions is the angioplasty with stent implantation [27].

Although there are advantages with this procedure, restenosis continues to be one of the main limiters of therapeutic success, especially in patients older than 80 years and with anemia [1]. It is known that inflammation, with accumulation of activated mononuclear cells, may contribute to the development of restenosis [4]. Primary angioplasty is the use of the balloon catheter with or without coronary stent implantation and without prior thrombolytic use, to mechanically restore the anterograde coronary flow.

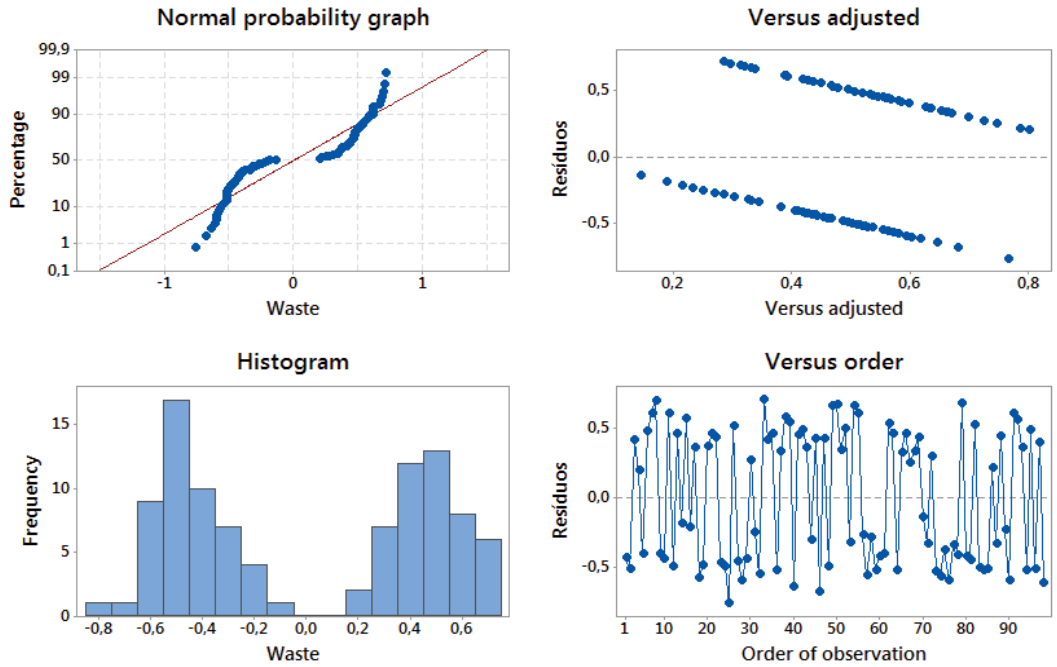

Figure 3: Representative graphs showing the results of the Durbin-Watson residual analysis (dw=2.51). There was a dependency relationship.

Continuous Predictors	Values
Gender	Male: 46.9 %
	Female: 52.5 %
Age (Mean ± St. Dev)	Male: 83.3 ± 4.1
	Female: 83.7 ± 3.8
SAH	Male: 75.86%
	Female: 86.21%
DM	Male: 28.3%
	Female: 43.63%
Tabagism	Male: 20.68 %
	Female: 9.19 %
Weight (Mean ± St. Dev)	Male: 70.5 ± 11.7
	Female: 64.2 ± 12.3
BMI (Mean ± St. Dev)	Male: 25.0 ± 3.4
	Female: 25.6 ± 4.7
Hemoglobin (Mean ± St. Dev)	Male: 11.9 ± 1.8
	Female: 11.4 ± 1.5
Hematocrit (Mean ± St. Dev)	Male: 35.9 ± 5.2
	Female: 34.5 ± 4.6
Total Events (Live or Dead) Female	Live: 51.02 %
	Dead: 48.98 %
Total Events (Live or Dead) Male	Live: 60.91 %
	Dead: 39.08 %
Statistical Total Deaths	68.40%

Table 1: Demographic data of continuous predictors, with sample size, n=185 patients (Female: n=98; Male: n=87).

Therefore, the present study aimed to conduct a retrospective longitudinal and observational study on the impact of angioplasty procedure in patients older than 80 years and with anemia.

Methods

Participants

A total of 185 participants (Female: n=98; Male: n=87) were submitted to eligibility analysis, followed by the rules STROBE (Strengthening the Reporting of Observational studies in Epidemiology), https://www.strobe-statement.org/index.php?id=strobe-home.

Study design

The present study followed a retrospective longitudinal and observational study on the analysis of the profile of patients who underwent angioplasty at Brazil. The predictors were: Cardiovascular disease, Atherosclerosis, Angioplasty, Older patients, Anemia, Life risk.

Statistical analysis

Statistical analysis of the data was performed and interpreted by the author of the present study. For data analysis a database was built in the Microsoft Excel spreadsheet which was exported to the Minitab 18 statistical program. A common descriptive statistical analysis and Anderson-Darling normality test were performed for all variables and controls, with reference $p>0.10$ as "normal". As there were continuous and categorical predictors (Hemoglobin/Hematocrit) and the response predictors (Live or Dead), linear regression and residual Durbin-Watson analysis were applied. For all linear regression tests, alpha level lower than 0.05 was adopted as significant. For Durbin-Watson residue analysis, the reference significance level was 0.05, adopting as acceptable range of independence $1.46<dw<1.63$ (according to the Durbin-Watson standard table, $dU<dw<4-dU$), with two explanatory variables for sample size of n =185.

Results

Based on the Table 1, found the profile of the data demographic, Gender (Male: 46.9 %, Female: 52.5 %); Age (Male: 83.3 ± 4.1, Female: 83.7 ± 3.8); SAH (Male: 75.86%, Female: 86.21%); DM (Male: 28.3%, Female: 43.63%); Tabagism (Male: 20.68 %, Female: 9.19 %); Weight (Male: 70.5 ± 11.7, Female: 64.2 ± 12.3); BMI (Male: 25.0 ± 3.4, Female: 25.6 ± 4.7); Hemoglobin (Male: 11.9 ± 1.8, Female: 11.4 ± 1.5); Hematocrit (Male: 35.9 ± 5.2, Female: 34.5 ± 4.6); Events (Female: Live: 51.02 %, Dead: 48.98 %); Events (Male: Live: 60.91 % Dead: 39.08 %).

In Figure 1, multivariate analysis showed that anemic patients older than 80 years who underwent angioplasty died, with a significance level of 33.97% in the female group and 34.40% in the male group, with a total of 68.40% % of deaths in statistical terms (Figure 1).

The above result was confirmed by the regression analysis presented in Figure 2. The Graph matrix-Plot model showing the results of the regression analysis between continuous predictors and response, with $p<0.05$ significative. All results showed $p<0.05$ between the match Hemoglobin vs Event (Dead) and Hematocrit vs Event (Dead), i.e. the presence of the predictor "anemia" negatively influenced the angioplasty procedure in patients.

To confirm these findings, Figure 3 presents the Durbin-Watson residual analysis generic results, and this analysis showed that the value $dw = 2.51$ did not fall within the acceptable range of independence of $1.75<dw<2.41$ (according to the Durbin -Watson standard table, $dU<dw<4-dU$) with two explanatory variables and a sample size of n = 185. Therefore, there was relationship of dependence (significance) between the data analyzed. Thus, the results are confirmed by Figure 3, where the residues appear to follow a straight line. There is evidence of discrepant points or unidentified variables; the residues appear to be randomly scattered around zero. There is evidence of non-constant variance, absent terms, discrepant points or influential points; the histogram does not follow a normal curve; the residues appear to be randomly scattered around zero. There is evidence that the error is correlated with each other (Figure 3).

Discussion

The present study showed that the angioplasty procedure may be risky in patients older than 80 years, since there was a death in 48.98% in the women and in 39.08% in the men in the total, and the iron anemia was responsible for 33.97% in the group of women and 34.40% in the men group, according to the statistical result.

The presence of anemia in patients older than 80 years presented in the present study is an important predictor for knowing and preventing the occurrence of death. Thus, one study evaluated the immediate and long-term results of coronary angioplasty and stent implantation in patients older than 80 years, being a high-risk group, considering the severity of the concomitant pathology and extent of coronary atherosclerosis [1]. A retrospective analysis of data from 167 patients over 80 years of age (mean age 81.43 ± 2.14 years) undergoing percutaneous coronary intervention from 2006 to 2013 was performed. There were only 16 (9.6%) patients with chronic anemia. Coronary angioplasty and stent implantation are an effective method of treating coronary atherosclerosis in patients older than 80 years with an acceptable rate of major adverse cardiac events. However, the low presence of patients with anemia made the procedure more successful [1].

In addition, another recent study showed that the estimated prevalence of anemia at admission in the context of an acute coronary syndrome (ACS) is between 10% and 43% of patients, depending on the specific population under investigation. In addition, up to 57% of ACS patients may develop hospital anemia (HA) [3]. Both anemias at admission and HA are associated with poorer short- and long-term mortality, although different mechanisms contribute to its prognostic impact. Baseline anemia can usually be traced back to a preexisting disease that should be specifically investigated and corrected whenever possible. HA is associated with clinical features, medical therapy, and interventional procedures, all of which elicit an adaptive cardiovascular response that may potentially worsen myocardial ischemia. The intrinsic fragility of anemic patients may limit aggressive medical and interventional therapy due to increased risk of bleeding, and may independently contribute to a worse outcome [3].

However, primary angioplasty for ST-segment elevation of ACS should not be delayed due to preexisting anemia. Thus, delaying revascularization to allow the rapid diagnosis of anemia is generally feasible and justified in ACS without ST-segment elevation [3]. In addition to identifying and treating the underlying causes of anemia, the only means readily available to reverse anemia is red blood cell transfusion. The appropriate transfusion threshold is still being debated, although solid evidence suggests red blood cell transfusion for patients with Hb level<8 g / dL and considering it in selected cases with Hb levels between 8 and 10 g/dL. No evidence supports the use of iron supplements and erythropoiesis-stimulating agents in the context of ACS [3].

In addition, another study showed that over time the risk of the

incidence of restenosis in patients with angioplasty increases in such a way that patients' survival decreases drastically after one year, mainly due to the presence of anemia. To determine the role of effective factors in the incidence of restenosis, a prospective intervention study [4] is recommended.

In addition, in 2011 we investigated the 21-month intrahospital and long-term outcomes in patients with and without anemia at admission who underwent primary angioplasty for acute myocardial infarction with ST-segment elevation. A total of 2509 patients (616 patients with anemia at admission) were treated with primary angioplasty due. The mean age of the patients in the anemic group was higher than the non-anemic group (61.5 ± 11.4 vs. 54.8 ± 11.4, P<0.001) [5]. Death rates, major cardiac events, and severe heart failure were significantly greater in anemic patients during the hospitalization period. In addition, the frequency of death was also higher in anemic patients when compared to non-anemic patients after a mean follow-up of 21 months (p<0.001) [5].

Thus, according to this 2011 study, patients with anemia at admission initially have high-risk profiles in relation to their worst clinical outcomes during and 21 months after hospitalization. According to the suggestion of evidence-based medicine, we conclude that the etiology of anemia should be meticulously investigated, and tissue oxygenation should be provided with appropriate treatment [5]. It is not uncommon for patients who present with ACS without ST elevation to have no electrocardiographic or laboratory abnormalities. In view of this, adequate assessment of the probability of atherosclerotic disease is fundamental [2]. The presence of one or more risk factors for coronary atherosclerotic disease, considerably increases the possibility of being the patient with an acute myocardial ischemic disease. Older age, male gender, family history of coronary disease, diabetes, hyperlipidemia, hypertension, smoking, chronic renal failure, previous infarction or atherosclerotic or carotid disease are widely known risk factors [5].

The initial diagnosis of sudden *cardiac* arrest (SCA) with supra ST is temporally confounded with its treatment. Due to the severity and drama of the disease, diagnosis and treatment go hand in hand, with no loss of time [11-14]. The central symptom of SCA with supra ST is chest pain that lasts for more than 20 minutes, which does not subside with rest, nor with the use of nitrates [15,16]. As in cases of ACS without supra ST, the pain is usually in oppression, it can radiate to one or both arms, jaw or nape. Also, in these cases there are those who present atypical symptoms, usually elderly, women or diabetics [17]. According to Palmiero et al. [28], the primary prevention of cardiovascular events in the elderly is a relevant problem due to the lack of evidence for safe and effective therapy.

Conclusion

Life expectancy has increased dramatically in the last two decades, the proportion of individuals 80 and older has grown rapidly in Europe and the United States. Therefore, it is important to implement the estimation of cardiovascular risk factors in the elderly for the patients' quality of life and to prolong their healthy life expectancy by choosing the best treatment for each patient, sharing the choice with himself whenever possible, always remembering elderly patients usually have multiple comorbidities that require a high number of medications, thus reducing the potential benefits of cardiovascular disease prevention.

The present study showed that patients older than 80 years with anemia showed a significant increase in life risk with death occurring after an angioplasty procedure.

Declaration of Potential Conflict of Interest

The authors declare no conflict of interest.

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