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Original Articles

Bed bath for infarcted patients: crossover of the hydrothermal control 40°C versus 42.5°C

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ABSTRACT

Aim: To compare the results of the water used to bath infarcted patients in bed under oxy-hemodynamic variables. **Method:** This research uses a 2X2 crossover of the interventions: bed bath with constant water temperature at 40°C (BB1) and 42.5°C (BB2) in 20 patients who had acute myocardial infarction (AMI). Dependent variables are: pulse oximetry, heart rate (HR) and axillary temperature (Axt). The inferential statistics will be used in an analysis of the variations found repeated throughout the sample, as well as the Bonferroni test, with a level of significance of 5%. **Results:** The SpO_2 and Axt were higher after BB2 ($p<0.05$) when compared with BB1. BB2 reduced HR by 1% ($p=0.01$). **Discussion:** The individual bath with controlled water temperature is capable of minimizing the oxy-hemodynamic impact. **Conclusion:** The bath with water temperature at 42.5ºC was shown to be more favorable than at 40°C with regard to SpO_2, HR and Axt in infarcted patients.

Descriptors: Baths; Myocardial Infarction; Evidence-Based Nursing; Body Temperature Regulation; Heart Rate; Nursing Care.

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INTRODUCTION

Cardiovascular disease is one of the main global causes of mortality. According to the American Heart Association (AHA), it was responsible for 17.3 million deaths in 2015. It is estimated that by 2030 the number will reach 23.6 million. With regard to ischemic heart disease, in particular acute myocardial infarct (AMI), the mortality rate in Brazil in 2015 reached 11.8%? , with the state of Rio de Janeiro presenting an average rate 27% higher than the Brazilian national average [1,2].

In a myocardial necrosis event, oxygen is impeded from reaching the cardiac muscle due to the obstruction. Therefore, strategies are essential to reduce the demand of the myocardial muscle to consume oxygen[1]. In this case, bed rest is an adopted practice during hospitalization of the infarcted patient, in order to reduce the body's additional expenditure of energy. Hence, among other basic necessities, a bath during the resting period must be performed by the nursing team in the bed.

Bed bath is a nursing intervention which is intended to promote hygiene, thermic regulation, microbiotic reduction, satisfaction, comfort and convenience. To perform the procedure effectively and safely, it is necessary that professionals are trained to identify and minimize potential disturbances, as changing position in bed, changes in water and environment temperature and the clinical deconditioning itself can impact on the hemodynamic response presented by the patient [1].

A bed bath involves differences between the environment, water and patient temperatures. The balance of body temperature is affected by the effort the cardiovascular system exerts in heat exchange among the internal body tissues, organs and the skin. These exchanges aim to maintain the internal temperature in a certain narrow range of temperature in a variety of conditions, having a direct relationship on the input of oxygen in the whole organic system. It is known that large temperature changes can influence hemodynamic responses, due to the risk of destabilization of physiological variables[1,2].

The scientific literature, although incipient, shows some evidence regarding the oxy-hemodynamic repercussions of bed bath in patients in critical condition. Water temperature of between 37°C and 40°C was found to be a factor in maintaining hemodynamic stability[5]. In a clinical study performed with critical patients, bed bath with water temperature set at a constant temperature of 40°C was shown to be more favorable for stabilizing pulse oximetry (SpO_2) when compared with bed bath of varying and unstable water temperature[1].

With regards to the quantity and quality of scientific research related to bed baths, there are some perceived gaps, which point to the urgent necessity for studies that shed light on the questions that are fundamental to a more systematized and sustainable nursing assistance, in order that nurses are able to identify and use effective prophylactic techniques against energy waste related to thermogenesis and its impact on health. Hence, the objective is to prevent a potential increase in demand for oxygen during the procedure and to guide assisting professionals to optimize their practice.

Based on the thermal implications that influence important effects on oxygen supply and demand, this research aims to compare the results of bed bath water temperature on the infarcted patient, according to SpO_2, heart rate (HR) and axillary temperature (Axt).

METHOD

This is a clinical essay of 2x2 crossover type, produced inside a coronary unit of a college

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hospital located in the municipality of Niterói, Brazil, during the year of 2011. The patients included were from both genders, above 18 years old, hospitalized due to an AMI, classified by the TISS-28 assisting complexity scale under score equal or higher to 20 points, which corresponds to classes II, III and IV of the scale. The criteria of exclusion were: patients in their first 12 hours after a convulsion episode and/or surgical procedure. The sample was chosen for convenience, composed of 20 individuals, based on the calculation of sizing for discrete variables of finite populations.

The crossover was set for two interventions: bed bath with hydrothermal control at 40ºC (BB1) and bed bath with hydrothermal control at 42.5ºC (BB2). To maintain a constant bath water temperature, the researchers used a heating plate with a thermostat. The dependent variables analysed were heart rate (HR), plethysmography of SpO_2 and Axt, recorded at three moments: pre-bath (15 minutes before), during bath (every 2 minutes) and after-bath (15 minutes after). The data were collected by a trained researcher and the bath was performed by the local service team.

The participants were taken to BB1 and, after a 24-hour washout, to BB2. The inexistence of carryover was independently observed during the moments before bath, between the two interventions and as seen in the variables SpO_2 (p=0.79), HR (p=0.91) and Axt (p= 0.08).

The demographic data were analyzed by descriptive statistics. After detecting the normality of data, by using the Shapiro-Wilk test, the definition of the effect of baths 1 and 2 upon the dependent variables was done by applying the analysis of variance (ANOVA) of repeated events and a t-paired test. When interaction between the factors was observed, the researchers used the multiple analysis test of Bonferroni. Prior to the test, a level of significance of 5% was adopted.

This research followed the standards set by Resolution #466/12, of the Brazilian National Health Council, with further approval by the Committee of Ethics in Research.

RESULTS

The socio-demographic and assistive complexity profile of the sample, which was composed of 20 patients, is described in Table 1. The average age was 62 years old; most of the respondents were male and placed in class II on the TISS-28 scale.

Table 1 - Profile of 20 patients afflicted by acute myocardia infarct in a college hospital. Niterói, Brazil, 2011

Variable	Average (SD)	
Age (years)	**62 ± 9**	
	n	**%**
Gender		
Male	13	65
Female	7	35
TISS – 28		
II	19	95
III	1	5

Image 1 presents the average and percentage variation of the HR in the moments before, during and after BB1 and BB2. During BB1, the average HR increased by 2% when compared with the previous moment and by 1% 15 minutes after finishing the bath; there was no statistical difference in the average between the moments observed (p=0.2).

When comparing the 15 minutes before the bed bath at 42.5ºC with the average of the period during the bath, the HR was kept unaltered; at the end, it decayed by 1%. Notwithstanding the minimal reduction of 1 bmp in the average (1%), a significant interaction was observed (p=0.02). After the multiple comparison of Bonferroni (**Images 1B and 1C**), it was detected that the difference found was between the moments before and after the bath (p=0.04), as well as during and after the procedure (p=0.01).

HR did not statistically differ between the two types of hydrothermal control (p=0.35) and after the bath (p=0.07) (**Images 1D and 1E**).

With regards to the variable SpO_2, represented in **Image 2**, both types of bath presented significantly statistical differences among the three moments observed. The Bonferroni correction showed that the difference took place between the moments before and during BB1 (p=0.001) **(Image 2B)**, reducing the SpO_2 average by 1%, and between the moments before and after BB2 (p=0.03) **(Image 2C)**; during and after bath (p=0.02) **(Image 2D)** the SpO_2 average increased by 1%, which was statistically higher during (p=0.04) and after (p=0.01) BB2, when compared with BB1 **(Image 2E)**.

With regard to the Axt variable, presented in **Image 3**, a significant difference was observed among the three moments analyzed for BB2 (p=0.00), which was not the same during BB1 (p=0.36). For BB2, the difference found was between the moments before and during the procedure (p=0.00) **(Image 3B)**, before and after (p=0.00) **(Image 3C)** and during and after (p=0.04) **(Image 3D)**, demonstrating a progressive increase in Axt. During the bath, the Axt did not have any significant alteration (p=0.3); however, at the end of BB2, the Axt was significantly higher than at the end of BB1 (p=0.00) **(Image 3E)**.

DISCUSSION

Bed bath, particularly for infarcted patients, is a subject that is rarely studied by researchers. In a recent article about the elaboration and validation of an information manual on bed bath for patients with acute coronary syndrome, researchers call attention to the temperature of the water, stressing the importance of keeping it stable based on the preferences of the patient, but not taking into consideration possible implications of the temperature of the water for tissue oxygenation or oxygen consumption of the client[1].

A study conducted by the Joanna Briggs Institute also does not discuss the evidence regarding the effects of water temperature during bed bath, reinforcing exclusively the maintenance of warm water as a strategy of comfort for oncological patients[2].

During this important nursing intervention, the evaluation of factors that can interfere in the stability of the oxy-hemodynamic standard is pertinent and essential to an effective and safe performance of the procedure.

After defining the sample, it was found that the average age of the participants was 62±9 years old, with a higher prevalence of the necrotic cardiac event in males, which is consonant with international studies, up to a 4.5:1 ratio, and an expressive occurrence of infarcts in very young patients (up to 40 years old)[3,4].

According to the TISS-28 complexity assisting scale, the gravity of illness in intensive care units can be stratified, based on the type and/or quantity of procedures the patient has undergone. In the study's sample, 19 patients were classified as II and only one was III. Hence, in regards to the characteristic, it was possible to define that the patients were physiologically stable; nevertheless, all required intensive nursing care and continual monitoring[5].

Based on the analysis of the variables of the study, it was seen that the initial average of HR and SpO_2 were similar in both baths and, because this is a crossover study, the method reinforces the real facts generated by the bed bath upon those variables, as, given that the patients are the same, they all started with the same initial HR and SpO_2 values.

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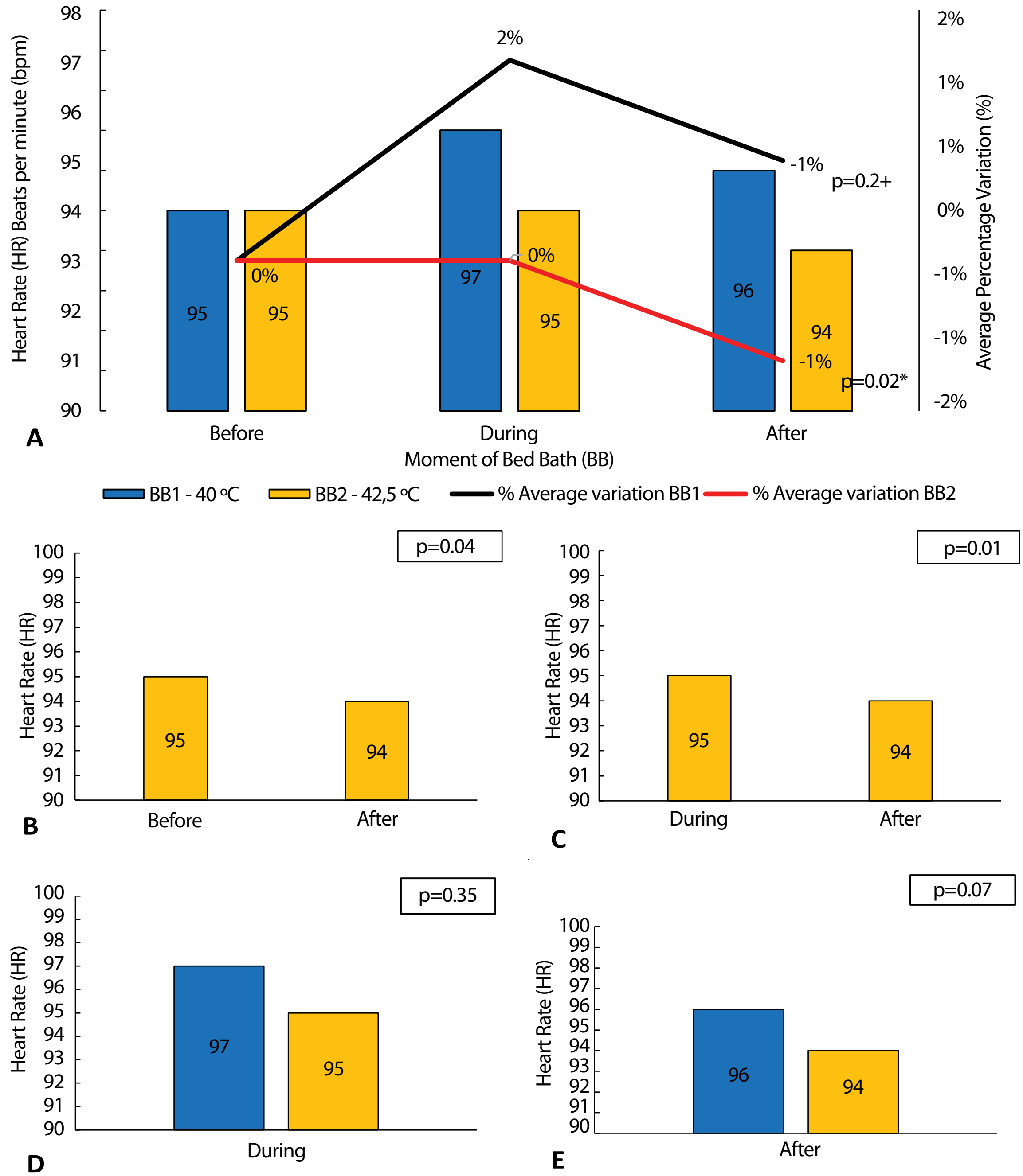
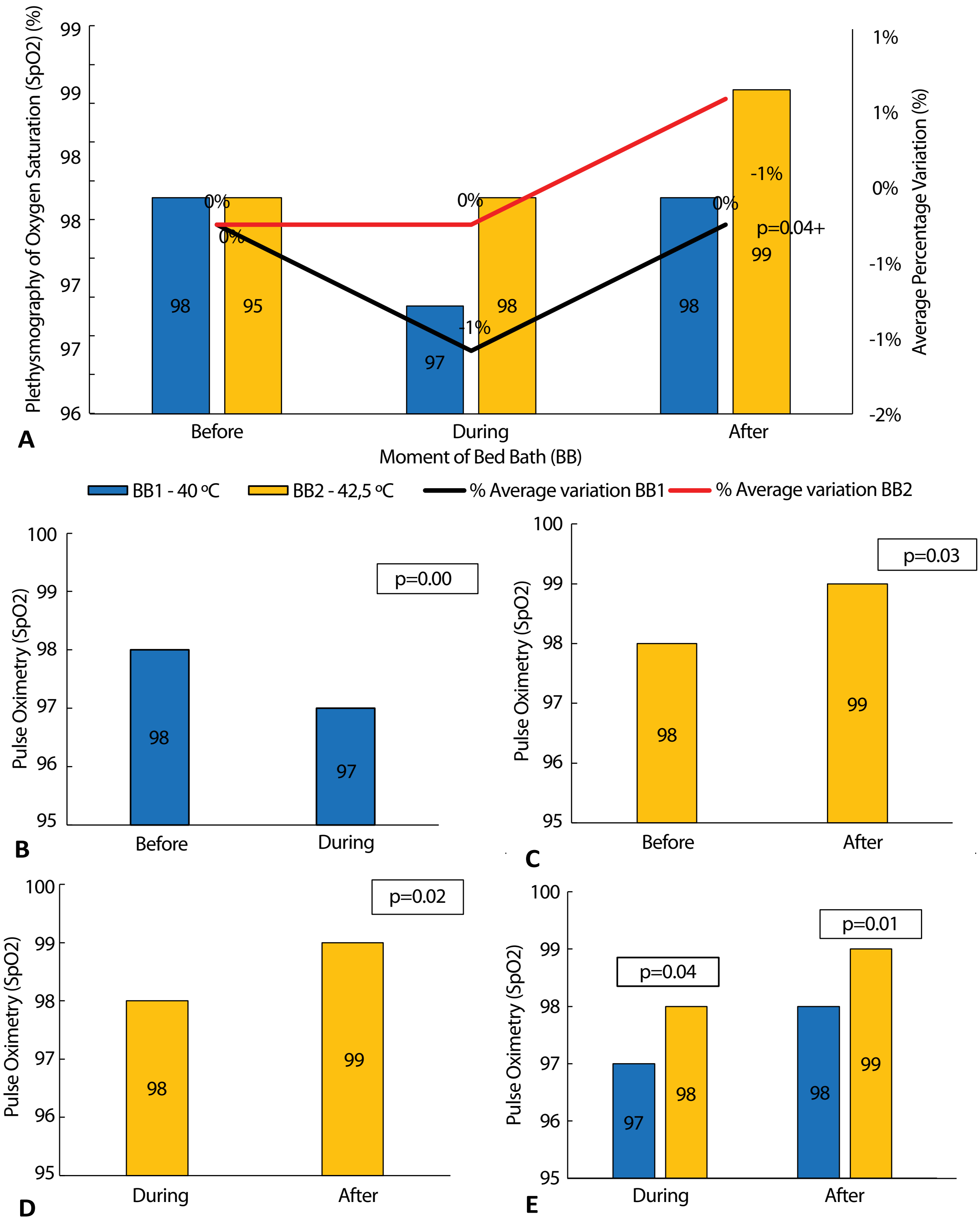
Image 1 – Comparison of the average of heart rate (HR) during bed bath (BB) with hydrothermal control at 40°C (BB1) and at 42.5°C (BB2), in 20 patients with acute myocardial infarct hospitalized in a college hospital in the municipality of Niterói, Brazil, 2011.



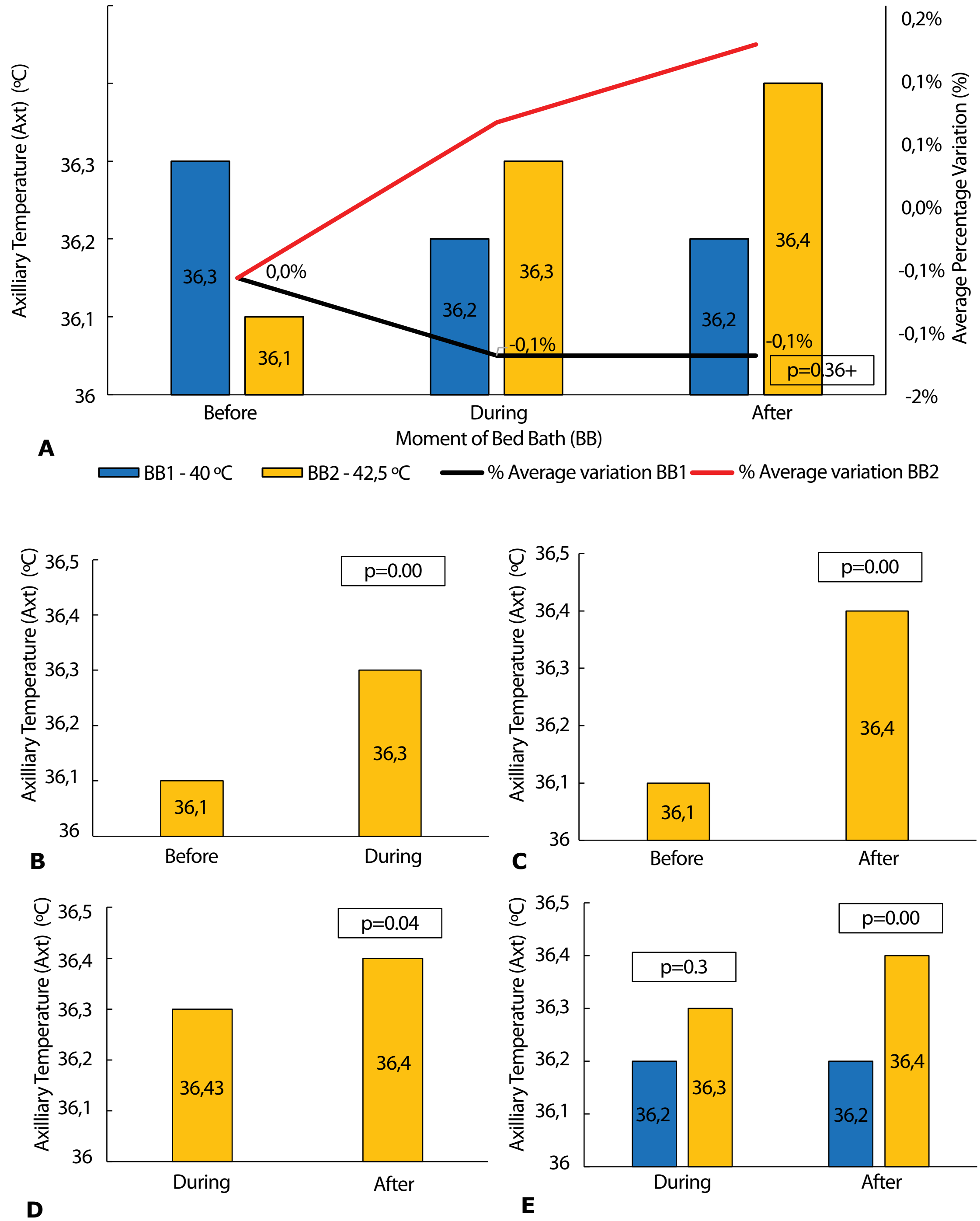
(A) ANOVA of repeated measures before, during, and after BB, and average percentage variation; (B) and (C) Bonferroni correction on BB2; (D) Paired t test student during BB1 and BB2; (E) Paired t test after BB1 and BB2.

Image 2 – Pulse Oximetry (SpO2) of bed bath with hydrothermal control at 40°C (BB1) and at 42.5°C (BB2), in 20 patients afflicted with acute myocardial infarct hospitalized in a college hospital in the municipality of Niterói, Brazil, 2011



(A) ANOVA of repeated measures before, during, and after BB, and average percentage variation; (B) Bonferroni correction on BB1; (C) and (D) Bonferroni correction on BB2; (E) Paired t test student during and after BB1 and BB2.

Image 3 – Axilliary temperature (Axt) of bed bath with hydrothermal control at 40°C (BB1) and at 42.5°C (BB2), in 20 patients afflicted with acute myocardial infarct hospitalized in a college hospital in the municipality of Niterói, Brazil, 2011



(A) ANOVA of repeated measures before, during, and after BB, and average percentage variation; (B), (C) and (D) Bonferroni correction on BB2; (E) Paired t test student during and after BB1 and BB2.

HR did not present differences between the two types of bath; however, BB2, in contrast to BB1, was able to significantly reduce HR. This variable is seen as a risk factor for morbimortality in various population samples, including those with coronary arterial disease. The control of HR variability is important to guarantee the decrease of metabolic demand and, as a consequence, the demand of oxygen of the cardiac muscle[6].

One of the recognized formats to control HR is the use of beta blockers under oral administration in all AMI patients. Beta blockers are pharmaceuticals that reduce HR, arterial pressure and the negative inotropic state, thus working to reduce the consumption of oxygen by the myocardial muscle. In addition, they improve myocardial perfusion, limiting the size of the infarct and improving cardiac function[7]. The use of these medications can be essential for the stability of HR during the period of hospitalization of the patient.

Another analyzed variable, SpO_2, was found under physiological values in both studied baths (>97%). A similar result was found in a study in Colombia, performed with patients after cardiac surgery[4].

During BB1, SpO_2 was reduced significantly; however, in absolute numbers it was a decrease of only 1%. This scenario allows researchers to infer that, besides the variations, the patients were able to recover from the drops in SpO_2 in a 15-minute interval after the procedure, as the previous study demonstrated[6].

Notwithstanding the current legislation that demands room temperature at intensive care units to be kept at around 21.5°C[8], forcing the exposition of patients to significant body and room shocking temperatures, favoring vasoconstriction and reduction of peripheral perfusion, interfering with the oxy-hemoglobin connection[8], at the moment after the bath, when the patients presented an increase of SpO_2 at BB2.

In the moments during and after BB2, the averages showed an increase ($p<0.05$), demonstrating the advantages of a hydrothermal control at 42.5°, when compared with 40°C. These findings match the results in other studies, in which hydrothermal control was found to be an important factor for maintaining the stability of SpO_2 during bed bath[6,7]. It is important to highlight that, despite previous studies also focusing on critical patients, they did not include cardiac patients in their sample, although they also presented similar complexity in treatment[6,7].

The Axt, classified as peripheral corporal temperature, is the temperature most observed in clinical practice. It is linked to the circadian cycle of central corporal temperature and the evaluation of this variable is essential to establish therapeutic measures and to evaluate the response of the patient to those measures. The observation of this vital sign is particularly important in individuals with cardiac illnesses, for which thermoregulation can cause a clinical impact with adverse results[10].

Individuals with cardiac ischemic illnesses have higher susceptibility to endothelial and vascular dysfunctions due to the presence of many heart risk factors, such as hypertension, smoking and diabetes, which are elements that interfere in the transmission of heat to the skin and consequent thermoregulation[17].

The initial average Axt in BB1 was 36.3°C and in BB2 36.1°C. In a multi-centered and prospective study performed with clients diagnosed with severe sepsis, the temperature range of 35.6–36.4°C presented mortality rate in 28 days at 34.4% and OR=2.03[11]. Consequently, it was evident that the lability present in the selected patients was due to temperature differences in the period before the studied baths, when transferring to another population, could determine the mortality of more than a

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third of the sample in 28 days. It is important to mention that Axt, when compared with the other methods of admeasurements considered as gold standard, can underestimate the real temperature[18].

BB2 was capable of elevating Axt during and after the intervention, which did not occur with the BB1 procedure. Moreover, the average Axt at BB2 after the procedure was significantly higher than BB1. When the baths were compared, a significant increase was observed after BB2, reaching 36.4°C, moving away from the important range of mortality risk[18].

As a limitation, this study would benefit from a more detailed description of the clinical characteristics of the population, with information such as the dosage of medication, and laboratory studies that can present drugs as elements that predispose the interpretation of analyzed variables. It is also important to observe that crossover studies combined with parallel clinical studies avoid issues of compatibility between the control group and the confounding variables[12].

CONCLUSION

From the clinical perspective, both baths with hydrothermal control at 40°C and at 42.5°C are safe considering the variables HR, SpO_2 and Axt. However, due to its capacity to reduce HR, to increase SpO_2 and to improve Axt, BB with hydrothermal control at 42.5° proved to be of significant advantage to physiologically stable AMI patients and was also shown to be a therapeutic intervention. The authors suggest new studies that focus on understanding the mechanisms that explain the relationship between water temperature during bed bath and the oxy-hemodynamic results.

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