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Importance of cardiac troponin-I in the preoperative period of patients without prior cardiac events but suffering from left coronary branch obstruction

Importância da troponina-I cardíaca nos portadores de obstrução no tronco da artéria coronária esquerda sem evento cardíaco prévio

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Abstract

Objective: **To evaluate the importance of cardiac troponin-I serum levels in the preoperative period of patients suffering from left coronary branch obstruction but without prior cardiac events.**

Method: **The cardiac troponin-I serum levels of 115 patients with obstructive coronary disease were analyzed. The ages of the patients varied between 32 and 81 years old with a mean age and standard deviation of 59.7 ? 10.5 years. The patients were divided into two groups: Group A, 41 patients suffering from left coronary branch obstruction with the degree of obstruction varying between 20% to subtotal occlusion (about 60%) and Group B, 74 patients without left coronary branch obstruction. All the patients were submitted to catheterism and no evidence of previous acute myocardial infarction (AMI) was identified. Chemoluminescence was utilized to measure the cardiac troponin-I level using the Sanofi-Pasteur Access apparatus, with values of less than 0.l nanograms per milliliter (ng/ml) considered normal.**

Results: **No association was evidenced between the degree of left coronary branch obstruction and troponin-Ic serum levels (P= 0.4617), however the average serum levels of troponin-I, in Groups A and B were 0.3841 ng/mL and 0.1711 ng/mL respectively (P=0.0324 Mann-Whitney test; OR = 4.44 95% CI 1.60 - 12.31).**

Conclusions: **The patients of Group A have 3.44 times higher chance of presenting with myocardial injury as identified by increased cardiac troponin-I levels than Group B, independent of the degree of left coronary branch obstruction. The sensitivity of clinical suspicion of myonecrosis was relatively low (31.7%), but the specificity was high (90.5%). However the clinical importance of the documentation of myonecrosis in a determined percentage of patients with branch injury without electrocardiographic evidence is stressed. Thus, patients with left coronary branch obstruction should be quickly submitted to operative procedures, in order to avoid worsening of the myonecrosis.**

However the clinical importance of the documentation of myonecrosis in a determined percentage of patients with branch injury without electrocardiographic evidence is stressed. Thus, patients with left coronary branch obstruction should be quickly submitted to operative procedures in order to avoid worsening of the myonecrosis.

Descriptors: **Troponin I. Biological markers. Coronary disease. Myocardial ischemia. Myocardial infarction.**

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Resumo

Objetivo: **Avaliar a importância dos níveis séricos de troponina I-cardíaca no pré-operatório de pacientes portadores de obstrução no tronco da artéria coronária esquerda (OTCE) sem evento cardíaco prévio.**

Método: **Foram analisados os níveis séricos da troponina I-cardíaca de 115 pacientes com doença coronariana obstrutiva, com idade variando entre 32 e 81 anos (média e desvio-padrão de 59,7±10,5 anos). Os pacientes foram divididos em dois grupos: Grupo A - 41 pacientes portadores de OTCE, variando o grau de obstrução entre 20% de perda do diâmetro e subtotal (moda de 60%); Grupo B - 74 pacientes sem OTCE. Todos os pacientes foram submetidos a cineangiocoronariografia de forma eletiva e não apresentavam infarto agudo do miocárdio prévio. O método empregado na dosagem da troponina-I cardíaca foi o da Quimioluminiscência, admitindo-se como valor normal abaixo de 0,1 nanogramas por mililitro (ng/ml).**

Resultados: **Não houve correlação entre o grau de OTCE e os níveis séricos de troponina-Ic (P= 0,4617), porém a média dos níveis séricos da troponina-I nos grupos A e B foi, respectivamente, 0,3841 ng/ml e 0,1711 ng/ml (P=0,0324); teste de Mann-Whithey; OR= 4,44 (IC95% 1,60 – 12,31).**

Conclusões: **Os pacientes do grupo A têm 3,44 vezes mais chance de apresentar lesão miocárdica representada por elevação de troponina I-cardíaca que o grupo B, independente do grau da OTCE. A sensibilidade para suspeita clínica de mionecrose foi relativamente baixa (31,7%), porém a especificidade foi elevada (90,5%). Destaca-se, entretanto, a importância clínica da documentação de mionecrose em uma determinada porcentagem de pacientes com lesão de tronco, sem constatação eletrocardiográfica. Assim, os pacientes com OTCE devem ser submetidos com rapidez a procedimento operatório, a fim de evitar extensão da mionecrose.**

Descritores: **Troponina I. Marcadores biológicos. Coronariopatia. Isquemia miocárdica. Infarto do miocárdio.**

INTRODUCTION

The principal cause of obstructive coronary artery insufficiency is atherosclerosis, which is a narrowing of the lumen due to the build up of cholesterol-rich plaques. It is considered a highly prevalent disease with high morbidity and mortality in adults, throughout the world. The rupture of an unstable plaque can cause acute ischemic syndrome, resulting in exposure of lipids from the plaque to the circulating blood, occasionally forming a blood clot. The partial obstruction of the coronary artery produces unstable angina, which is characterized by the presence of chest pain during rest. A total obstruction of the coronary artery causes acute myocardial infarction (AMI). The caliber and the length the coronary artery are affected and the type of plaque and its location are all factors that directly influence the consequences of acute ischemic syndrome.

The atheroma plaque most feared by clinical cardiologists and surgeons, is that which forms in the left coronary branch, as it can cause severe post-AMI complications. There are case reports of the use of intra-aortic balloons in the preoperative period, to give support to patients with unstable angina and severe left coronary obstruction [1].

Left coronary branch obstruction (LCBO) is potentially a lethal disease however, it can be treated effectively if a precise diagnosis is made [2]. To determine the diagnosis and prognosis of cardiac events such as unstable angina and AMI in patients suffering from LCBO with hemodynamic instability together with alterations in electrocardiograms is easy. This cannot be said for normal complementary examinations.

The best therapeutic conduct for patients suffering from LCBO seems to be surgical according to the Coronary Artery Surgery (CAS) and Veterans Administration Cooperative (VAC) Studies, which demonstrated that coronary artery bypass grafting in patients with LCBO gives a greater survival rate [3,4]. Off-Pump Coronary Artery Bypass (OPCAB), has also demonstrated to be a safe and effective alternative in patients without prior AMI and with ejection fractions greater than 40%. The evaluation of the caliber of the coronary arteries and the use of support equipment in OPCAB are important for the optimization of the operative technique [5].

The most widely used biochemical marker of myocardial injury is the creatine-kinase isoenzyme, CK-MB. However, this test has its diagnostic limitations, which include a delay of several hours after an acute ischemic event before abnormal results are identified and its low specificity, that is, the test's capacity to correctly differentiate between cardiac and other non-cardiac diseases. Additionally, the sensitivity of the CK-MB test is not sufficiently high to detect minor myocardial injury, due to the analytical imprecision of measuring its activity and the wide range of normal levels [6].

In an attempt to identify new alternatives, other methods using more efficient markers of myocardial injury have appeared. The most promising ones with growing interest involve the cardiac troponins T (cTnT) and I (cTnI) [7,8]. Together with Troponin C, these proteins compose a complex that regulates myocardial contraction. Although the troponins are normally found in the "core" of the contractile filaments, a small quantity of cTnT and cTnI are identified free in the cytoplasm.

Although initial clinical trials investigating cardiac troponins concentrated on diagnosis of AMI, results demonstrated their importance as a possible early marker with a peak seen within the first 4 to 6 hours and also as a late marker, as levels remain high for 10 days after a cardiac event [9,10].

The high sensitivity of the cardiac troponins have indicated that these tests can be useful in patients with unstable angina, where the level of coronary artery obstruction is often considerably lower than for patients who suffered AMI. This fact was highlighted by FONAROW [10] in a trial using troponin I to assess precordial pain in patients who were treated in the emergency service of the UCLA Medical Center. In this study it was possible to safely rule out the existence of myocardial injury in less than half the time compared to the traditional approach using CK-MB.

In patients without prior cardiac events who were diagnosed with LCBO by coronary cineangiography during elective cardiological evaluations, important doubts appeared about the existence or not of myonecrosis related to the degree of intracoronary artery obstruction and also in respect to the delay until the operation was performed [11].

The objective of the present study was to evaluate the importance of high serum cardiac troponin I levels in the preoperative period of patients with LCBO who had not suffered prior cardiac events.

METHOD

The serum cardiac troponin I levels of 115 randomly selected patients suffering from obstructive coronary disease were analyzed. Seventy were male (60.8%) and the ages varied from 32 to 81 years old with a mean of 59.7 ± 10.5 years.

Diagnosis was confirmed by coronary cineangiographies. None of the patients had suffered from prior events related to acute ischemic syndrome.

The patients underwent coronary cineangiography and were allocated to two groups. Group A comprised of 41 patients with LCBO, with the degree of obstruction varying from 20% to subtotal, with about 60% reduction of the lumen and Group B comprised of 74 patients without LCBO.

The serum levels of cardiac Troponin I were measured by chemoluminescence using the Sanofi-Pasteur Access apparatus with acceptable normal values considered as being less than 0.1 nanograms per milliliter (ng/mL).

Patients were evaluated in the preoperative period with a concern that the troponin I serum levels might increase related to the degree of obstruction and the location of the atheroma plaque. The sensitivity, specificity, predictive value and accuracy were evaluated and the Odds Ratio was calculated for a 95% confidence interval. To compare frequencies the Fisher Exact test was utilized and to compare means the Mann-Whitney test was used. An alpha error of 5% was considered acceptable.

The Ethics Committee on Research of Braile Heart Surgery Institution approved this study.

RESULTS

There was no correlation between the degree of LCBO and the troponin Ic serum levels (P-value = 0.4617), but the mean troponin I serum levels of Groups A and B were 0.3841 ng/mL and 0.1711 ng/mL, respectively (p-value = 0.0324; Mann-Whitney test, OR = 4.44 95% CI 1.60 – 12.31). The sensitivity, specificity, positive predictive value and accuracy with the respective confidence intervals were: 31.7% (17.5%-46%), 90.5% (83.9%-97.2%), 65.0% (44.1%-85.9%), 69.6% (61.2% - 78.0%), respectively - Table 1.

Table 1. Groups A and B with their troponin Ic serum levels

	Group A Nº of patients	Group B Nº of patients
Troponin I > 0.1 ng/mL	13	7
Troponin I < 0.1 ng/mL	28	67
Total	41	74

Group A we correlated the degree of obstruction (< 60 X = 70%) with the serum levels of Troponin I > 0.1 ng/mL I-c

COMMENTS

Left coronary branch obstructions are for cardiologists a very worrying condition. Stable angina, AMI, arrhythmias, cardiac insufficiency and sudden death are frequent complications, increasing the morbid-mortality of these patients. FASSEAS et al. [12] demonstrated the necessity of using intra-aortic balloons in the preoperative period in 170 patients suffering from LCBO.

Cardiac events appear in the first 60 days after coronary cineangiography with instable angina being the most common event. In these cases emergency surgery is highly recommended. Studies have demonstrated that delays to operate in the case of these patients can lead to fatal or non-fatal AMI [11].

In this study, only patients who presented with LCBO

without evidence of hemodynamical instability and patients without LCBO were included. Cardiac troponin I serum levels, a strong predictor of cardiac events, were analyzed. HAMM et al. [13] reported on 773 patients who had suffered from acute precordial pain for less than 12 hours who did not present with high ST segment values evidenced using electrocardiography. High serum levels of troponin T were observed in 123 patients (16%) and high troponin I levels were seen in 171 (22%). Among the 47 patients who evolved with AMI, troponin T was positive in 44 cases (94%) and troponin I was positive in all 47 cases. Among 315 patients with unstable angina, the levels of troponins T and I were elevated in 22% and 36% subjects respectively, and the rates of cardiac events, including death or non-fatal AMI in patients with negative tests was extremely low (1.1 and 0.3% for troponins T and I, respectively).

The results of this present study, showed that even without clinical signs of acute ischemic syndrome, a percentage of patients presented with high serum levels of cardiac troponin I. The mean cardiac troponin I levels of patients suffering from LCBO compared to patients without LCBO, demonstrated a statistically significant difference. The degree of injury was not a determining factor, as patients with moderate atheroma plaque presented with high cardiac troponin I serum levels.

Age is considered a risk factor for patients suffering from coronary artery insufficiency. However, STOUFFER et al. [2], in a comparative study between old and young patients diagnosed as suffering from LCBO, demonstrated the presence of severe atheroma plaque in both groups and the age difference was not an isolated factor risk. Clemens VON BIRGELEN et al. [14] in a clinical investigation using intracoronary ultrasound in LCBO patients over a 12-month follow-up period, showed a linear relation between the level of cholesterol, LDL fraction, and the annual increase in the atheroma plaque. The conclusion was that a concentration of 75 mg/dL of LDL cholesterol is necessary for the progression of the plaque .

We believe that the location and instability of the atheroma plaque together, can regulate the degree of myocardial injury. This highlights the importance of measuring the cardiac troponin I in the preoperative period in patients suffering from LCBO, in order to prevent fatal and non-fatal cardiac events.

CONCLUSION

Group A patients have a 3.44 times higher chance of presenting with myocardial injury as identified by increases in the cardiac troponin I levels when compared to Group B subjects independent of the degree of left coronary branch obstruction The sensitivity of clinical suspicion of myocardial injury was relatively low (31.7%), but the specificity was high (90.5%). However, the clinical importance of documentation of myocardial injury in a specific percentage of patients with left coronary branch injury but without electrocardiographic evidence is important. Thus, patients with LCBO and high cardiac troponin I serum levels should be quickly submitted to surgery, in order to avoid aggravation of the myocardial injury.

BIBLIOGRAPHIC REFERENCES

1. Kim KB, Lim C, Ahn H, Yang JK. Intraaortic balloon pump therapy facilitates posterior vessel off-pump coronary artery bypass grafting in high-risk patients. Ann Thorac Surg 2001;71:1964-8.

2. Stouffer GA, Mott L, Brizolara A, Subbarao V. Left main coronary artery disease in adults younger than 50 years: a comparison with older patients. Catheter Cardiovasc Interv 2000; 51:11-7.

3. Caracciolo EA, Davis KB, Sopko G, Kaiser GC, Corley SD, Schaff H et al. Comparison of surgical and medical group survival in patients with left main coronary artery disease. Long-term CASS experience. Circulation 1995;91:2335-44.

4. Veterans Administration Coronary Artery Bypass Surgery Cooperative Study Group. Eleven-year survival in the Veterans Administration randomized trial of Coronary Bypass Surgery for stable angina. N Engl J Med 1984;311:1333-9.

5. Leal JC, Godoy MF, Braile DM, Buffolo E. Revascularização miocárdica sem circulação extracorpórea em lesão de tronco da artéria coronária esquerda: a última fronteira? Rev Bras Cir Cardiovasc 2003;18:133-6.

6. Hamm CW, Katus HA. New biochemical markers for myocardial cell injury. Curr Opin Cardiol 1995;10:355-60.

7. Godoy MF, Braile DM, Purini Neto J. A troponina como marcador de injúria celular miocárdica. Arq Bras Cardiol 1998;7:629-33.

8. Mair J. Cardiac troponin I and troponin T: are enzymes still relevant as cardiac markers? Clin Chim Acta 1997; 257:99-115.

9. Antman EM, Tanasijevic MJ, Thompson B, Schactman M, McCabe CH, Cannon CP et al. Cardiac-specific troponin I levels to predict the risk of mortality in patients with acute coronary syndromes. N Engl J Med 1996; 335:1342-9.

10. Fonarow GC. UCLA Clinical Practice Guideline: cardiac troponin I assay diagnostic module. Cost & Quality 1996;2:7-10.

11. Rocha AS, Silva PR. Can patients with left main coronary artery disease wait for myocardial revascularization surgery? Arq Bras Cardiol 2003; 80:191-3.

12. Fasseas P, Cohen M, Kopistansky C, Bowers B, McCormick DJ, Kasper K et al. Pre-operative intra-aortic balloon counterpulsation in stable patients with left main coronary disease. J Invasive Cardiol 2001;13:679-83.

13. Hamm CW, Goldmann BU, Heeschen C, Kreymann G, Berger J, Meinertz T. Emergency room triage of patients with acute chest pain by means of rapid testing for cardiac troponin T or troponin I. N Engl J Med 1997; 337:1648-53.

14. Birgelen C, Hartmann M, Mintz GS, Baumgart D, Schmermund A, Erbel R. Relation between progression and regression of atherosclerotic left main coronary artery disease and serum cholesterol levels as assessed with serial long-term (> or =12 months) follow-up intravascular ultrasound. Circulation 2003; 108:2757-62.