COMPARISON BETWEEN BRAIN NATRIURETIC PEPTIDES, CARDIAC TROPONIN I AND CPK-MB MARKERS IN MAJOR ABDOMINAL NON-CARDIAC SURGERY AS AN INDEX OF SEVERITY OF PERIOPERATIVE CARDIOVASCULAR RISK

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ABSTRACT

Objectives*: The efficacy of principal biomarkers (BNP, Troponin I HS and CK-MB) was evaluated in the sera of ten patients undergoing major abdominal non-cardiac surgery to determine the relative predictive value of BNP compared to common cardiac markers. The data obtained indicate that perioperative levels (especially postoperative levels) of BNP may be associated with increased risk of averse cardiac events after surgery compared to traditional markers of cardiac necrosis.*

Key words*: Brain natriuretic peptides, cardiac troponin I, and CPK-MB markers.*

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Introduction

Cardiovascular pathology is still a frequent cause of death in hospital patients undergoing major abdominal non-cardiac surgery, so early identification and treatment is essential[1]. The recent use of new cardiovascular biomarkers with high diagnostic and prognostic value, such as brain natriuretic peptide (BNP), has been recognized as highly specific and sensitive, both in predicting left ventricular systolic dysfunction and in the probability that cardiac events may occur[2]. Thus BNP is useful in the diagnosis, monitoring and treatment of cardiac decompensation[3]. Many studies indicate the importance of BNP in cardiac pathology, and hence BNP may be very useful as a marker to classify increased risk of cardiac events in the perioperative period. BNP is more significantly altered in the postoperative period[4], compared to traditional markers of cardiovascular necrosis such as troponin[5] and CK-MB[6], since it is a protein commonly or exclusively released by myocardial cells and found in the circulation after their necrosis. BNP may be essential in the diagnosis and treatment of acute coronary patients.

Materials and methods

We enrolled 10 patients between October 2013 and February 2014 hospitalized in the Anesthesiology and Intensive Care unit of the Polyclinic Hospital of the University of Catania, Italy. The patients were between 60 and 80 years old, 7 males and 3 females, who had the following cardiac diseases: 3 patients had cardiac ischemia treated with angioplasty, 1 patient had chronic cardiac ischemia with dilative cardio-myopathy and hypertension, 2 patients had progressive AMI, 2 patients had paroxysmal atrial fibrillation, 2 patients had concentric hypertrophy and hypertension (see Table 1). The patients underwent major non-cardiac surgery, specifically: 1 patient underwent left hemicholecystecomy, 3 patients underwent cholecystectomy by laparoscopy, 1 patient underwent splenectomy, 2 patients underwent laparolcele, 1 patient underwent secondary hepatic

resection for hepatic carcinoma, and 2 patients underwent surgery for inguinal hernia. All of the operations entailed general anesthesia and received standard perioperative care. Before the operations (T-0) and within 12-24h from the beginning of the post-operative phase (T-1) we measured BNP, troponin, and CK-MB in all patients.

Patient #	Type of Cardiopathy	Surgery	Date of Operation	SOFA Score	Sampling time	BNP (0.0-100 pg/ml)	CK-MB (0.0-4.3 ng/ml)	Trop I hs (0.00-0.02 ng/ml)
1	angioplastic cardiac ischemia	inguinal hernia	17/11/13	4	T0 (PREOP)	200	1.8	0.04
					T1 (12-24 h POST OP)	616	2	0.03
2	chronic cardiac ischemia with dilative cardio-myopathy and	left hemicholecystecomy	29/10/13	2	T0 (PREOP)	243	1.5	0.02
					T1 (12-24 h POST OP)	917	3	0.03
3	angioplastic cardiac ischemia	hepatic resection	14/11/13	2	T0 (PREOP)	20.3	1	0.01
					T1 (12-24 h POST OP)	195	1.1	0.02
4	angioplastic cardiac ischemia	cholecystectomy by laparoscopy	20/11/13	3	T0 (PREOP)	272	1	0.01
					T1 (12-24 h POST OP)	272	1.5	0.07
5	progressive AMI	laparolcele	28/11/13	2	T0 (PREOP)	45	2	0.01
					T1 (12-24 h POST OP)	264	1.4	0.01
6	paroxysmal atrial fibrillation	splenectomy	03/12/13	2	T0 (PREOP)	27.4	1.1	0.01
					T1 (12-24 h POST)	37.3	3.5	0.01
7	concentric hypertrophy and hypertension	cholecystectomy by laparoscopy	09/01/14	5	T0 (PREOP)	198	1	0.02
					T1 (12-24 h POST)	122	1.6	0.02
8	cardiac ischemia with dilative cardio-myopathy and hypertension	cholecystectomy by laparoscopy	03/02/14	2	T0 (PREOP)	182	1.4	0.03
					T1 (12-24 h POST)	840	2	0.04
9	progressive AMI	inguinal hernia	14/02/14	2	T0 (PREOP)	37	1	0.01
					T1 (12-24 h POST)	234	1.8	0.02
10	paroxysmal atrial fibrillation	laparocele	18/02/14	3	T0 (PREOP)	23.2	1.2	0.01
					T1 (12-24 h POST)	132	3	0.01

Tab. 1: Data for the 10 patients studied.

We used the TRIAGE ALERE (ex BIOSITE) instrument for measurements, which utilizes a fluorescent immune-dosage device and provides results in 20 minutes, to measure the markers with the following reference range. BNP: 0.0-100pg/ml, troponin I HS: 0.00-0.02ng/ml, CK-MB: 0.0-4.3ng/ml. We used EDTA tubes for the whole blood samples to avoid possible degradation of BNP in vitro.

The Sequential Organ Failure Assessment score (SOFA) was also calculated for all the patients in the study in the preoperative period**.**

Results

The values of the markers from the 10 patients were analyzed at T-0 (Table 2,3,4). The BNP values were below normal in 5 patients, while the BNP values in the other patients were beyond the cutoff of 100pg/ml (Figure 1). The troponin I HS values at T-0 were normal (cutoff 0.02ng/ml) for all but 1 patient whose value was above the normal range (Figure 2). The CK-MB values for all patients at T-0 were normal, i.e. below the cutoff of 4.3ng/ml.

At T-1 the BNP values increased significantly for 7 patients, most of whom already had values above normal at T-0. In 1 patient the BNP value decreased at T-1 but remained above the cutoff; in another patient the value remained high but stable;

P. #.	Data int.	T0/T1	BNP in pg/ml
1	17/10/13	T0	200.00
		T1	616.00
2	29/10/13	T0	243.00
		T1	917.00
3	14/11/13	T0	20.30
		T1	195.00
4	20/11/13	T0	272.00
		T1	272.00
5	28/11/13	T0	45.00
		T1	264.00
6	03/12/13	T0	27.40
		T1	37.30
7	09/01/14	T0	198.00
		T1	122.00
8	03/02/14	T0	182.00
		T1	840.00
9	14/02/14	T0	37.00
		T1	234.00
10	18/02/14	T0	23.20
		T1	132.00

Tab. 2: BNP values at time T-0 and T-1.

P. #.	Data int.	T0/T1	TROP hs in ng/ml
1	17/10/13	T0	0.04
		T1	0.03
2	29/10/13	T0	0.02
		T1	0.03
3	14/11/13	T0	0.01
		T1	0.02
4	20/11/13	T0	0.01
		T1	0.07
5	28/11/13	T0	0.01
		T1	0.01
6	03/12/13	T0	0.01
		T1	0.01
7	09/01/14	T0	0.02
		T1	0.02
8	03/02/14	T0	0.03
		T1	0.04
9	14/02/14	T0	0.01
		T1	0.02
10	18/02/14	T0	0.01
		T1	0.01

Tab. 3: Troponin I HS at time T-0 and T-1.

P. #.	Data int.	TO-T1	CK-MB in ng/ml
1	17/10/13	T0	1.80
		T1	2.00
2	29/10/13	T0	1.50
		T1	3.00
3	14/11/13	T0	1.00
		T1	1.10
4	20/11/13	T0	1.00
		T1	1.50
5	28/11/13	T0	2.00
		T1	1.40
6	03/12/13	T0	1.10
		T1	3.58
7	09/01/14	T0	1.00
		T1	1.60
8	03/02/14	T0	1.40
		T1	2.00
9	14/02/14	T0	1.00
		T1	1.80
10	18/02/14	T0	1.20
		T1	3.00

Tab. 4: CK-MB at time T-0 and T-1.

and in another patient the BNP value remained in the normal range. The troponin I HS values at T-1 remained normal in 5 patients (marginally significant), but increased in 4 patients (only one increase was significant).

In 1 patient the value decreased but remained beyond the cutoff. The CK-MB values at T-1 were virtually the same as T-0, except for 2 patients whose values increased slightly and within the normal range (Figure 3). The SOFA score at T-0 was between 2 and 5, with the risk of death less than 10%.

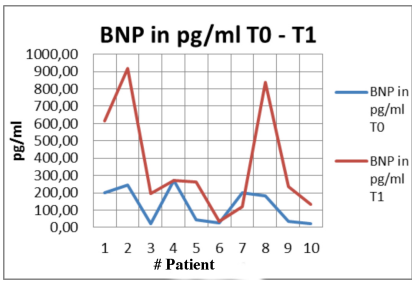

Fig. 1: BNP values at time T-0 and T-1.

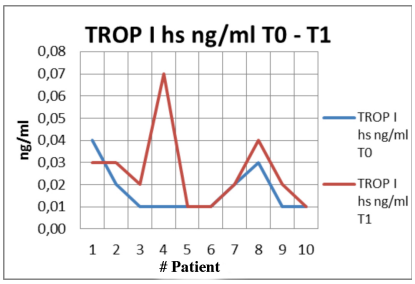

Fig. 2: Troponin I HS at time T-0 and T-1.

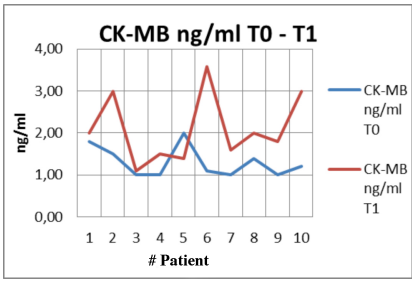

Fig. 3: CK-MB values at time T-0 and T-1.

Conclusion

We found that preoperative and especially postoperative BNP values may be associated with a higher risk of adverse cardiac events after surgery in cardiac patients undergoing major abdominal non-cardiac surgery, compared to traditional markers of cardiac necrosis, even though troponin I HS and CK-MB values are valid. Hence, BNP values are useful in classifying risk in the perioperative period, which allows clinicians to appropriately treat patients to maintain hemodynamic stability and be placed in the appropriate setting: in-patient ward, ICU, etc.[7].

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