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Research Brief

Very early postoperative troponin increase and clinical outcome in patients admitted to the recovery room after noncardiac surgery with suspected cardiac events

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ABSTRACT

We assessed the prognostic meaning of very early (<6 h) troponin increase after noncardiac surgery in a population of patients admitted to the recovery room, for whom troponin measurements were taken because of a suspected cardiac event. Among a total of 296 patients, abnormal troponin was found in 24 (8.1%). Ten patients in this group (41.7%) and 27 among those with normal troponin (9.9%) experienced cardiovascular death, myocardial infarction, or decompensated heart failure at one month ($p < 0.0001$). Troponin was independently associated with a two-fold risk of events ($p < 0.0001$). In these patients, very early troponin measurement in the recovery room may help to identify patients at risk of cardiovascular events.

1. Introduction

Cardiovascular events and mortality still represent a major clinical problem for the management of patients undergoing non-cardiac surgery.[1,2] Myocardial injury after non-cardiac surgery (MINS) is defined as a postoperative increase in high-sensitivity troponin that occurs within 30 days after surgery. Recently, several studies pointed out the clinical relevance of the detection of MINS in the first postoperative days, as it is independently associated with short-term mortality and complications.[3–6] The US FDA recently approved the use of troponin T as a marker of MINS,[7] validating its use as a prognostic tool in the early postoperative period.[8]

The clinical impact of a very early (<6 h) raise in troponin level after surgery, evaluated in the setting of the recovery room (RR), is still unknown. We retrospectively investigated the association between very early postoperative troponin increase and 30-day clinical outcome in a population of patients admitted to the RR after non-cardiac surgery.

2. Methods

The study population was taken from a prognostic database aimed at establishing the predictors of troponin increase among consecutive patients admitted to the RR in our facility after non-cardiac surgery. Details on the selection criteria were previously reported.[9,10] In our institution, the admission to the RR is decided by the anaesthesiologist according to an overall evaluation of patient's clinical risk and complexity, which includes the American Society of Anaesthesiologists (ASA) physical status score and the type of surgery. Among all patients admitted to the RR, the decision of taking a blood sample for troponin measurement is based on the presence of a suspected cardiac event, defined as at least one of the following complications, either during the surgical intervention or during the stay in the RR: signs or symptoms suggestive of myocardial ischemia (typical chest pain, or ischemic equivalents), electrocardiographic or echocardiographic modifications suggestive of ischemic etiology, sustained supraventricular or ventricular arrhythmias, and persistent hemodynamic instability. This is defined as at least one of the following: clinically relevant hypotension (systolic arterial pressure < 90 mmHg, acute symptomatic decrease of blood pressure, or acute reduction in urinary output related to blood pressure decrease), clinical signs of hypovolemia (peripheral vasoconstriction, decreased venous filling), oliguria

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(diuresis <0.5 ml/kg estimated body weight/hour), or elevated blood lactate (>50% above the upper normal limit) with clinical suspicion of hypoperfusion. In case of abnormal troponin levels, serial measurements (every 6–12 h) are usually performed, until a tendency towards troponin level normalization is observed. According to our protocols, all patients are awake for most of their stay in the RR. All patients undergo 12-lead ECG monitoring during their stay in the RR, whereas echocardiography is not performed as a routine, but only as a clinical decision of the attending anaesthesiologist.

For the purpose of this study, we considered for inclusion subjects for whom ≥1 troponin measurement was taken during their stay in the RR within 6 h from surgery. This cut-off reflects the minimal duration of stay in the RR, according to our institutional protocols. For patients in whom a longer stay is needed (e.g. because of haemodynamic instability), the anaesthesiologist can decide to delay the transfer to the ward. If the unstable condition persists after the daily closure of the RR, the patients is transferred to the ICU. Compared to our previous analysis aimed at establishing the predictors of troponin increase,[10] we extended the study period from January 2011 up to June 2015. The population was divided into two groups. Group 1 included patients with evidence of very early (≤6 h) troponin increase, defined as level >0.06 ng/dl. In this group, a troponin curve was systematically assessed. Group 2 included patients with normal troponin values. The study protocol was approved by the Local Ethics Committee (prot. N.10804_oss).

The endpoint was a composite of cardiovascular death, non fatal myocardial infarction, and decompensated heart failure within 30 days after surgery. Follow-up data were retrospectively obtained using the institutional database software, which includes complete information on hospitalization, access to emergency health care service, and data collected during the planned follow-up visitation.

Data were reported as mean ± SD for continuous variables and or number (percentage) for categorical variables. Logistic regression was used to explore the association between troponin increase and outcome. To adjust for covariates, firstly we tested the following variables in univariate logistic regression: age, gender, diabetes mellitus, CKD, hypertension, peripheral artery disease, previous stroke, history of atrial fibrillation, coronary artery disease, history of heart failure, ASA score, type of surgery and urgent intervention. Then, a stepwise multivariate model was built by testing troponin increase, together with all variables with univariate $p < 0.10$, within a stepwise procedure. A $p < 0.05$ was considered as significant. All analyses were performed using the SPSS software, version 22.0.

3. Results

A total of 296 subjects met the selection criteria in the study period. Among them, at least one increased troponin I level within 6 h after surgery was present in 24 patients (group 1). The remaining 272 patients had troponin under this cut-off (group 2). The main characteristics of the two study groups are shown in Table 1. Significant proportions of patients had cardiovascular risk factors and pre-existing cardiac disease, including history of atrial fibrillation, heart failure and coronary artery disease. Acute coronary syndrome was diagnosed in a minority of patients (13% and 11% in group 1 and 2, respectively).

A total of 10 (41.7%) patients in group 1 and 27 (9.9%) in group 2 experienced the endpoint ($p < 0.0001$) (Fig. 1). When all variables with $p < 0.10$ at univariable logistic regression were tested in a logistic multivariable analysis, the detection of very early troponin increase was an independent predictor of outcome ($\beta = 0.256$, $p < 0.0001$).

Table 1
Main characteristics of the study population. PM = pacemaker; ASA = American Society of Anaesthesiologists; VAS = visual analogue scale.

	Group 1	Group 2	*P* value
Age(years)	81.3 ± 15.4	75.7 ± 11.8	0.031
Female gender (%)	14 (58.3%)	133 (48.9%)	0.50
Diabetes mellitus (%)	7 (29.2%)	69 (25.4%)	0.86
Chronic kidney disease (%)	4 (16.7%)	30 (11.0%)	0.49
Systemic hypertension (%)	16 (66.7%)	171 (62.9%)	0.89
History of atrial fibrillation (%)	6 (25%)	59 (21.7%)	0.92
Previous PM implantation (%)	–	20 (7.4%)	0.24
Previous stroke (%)	–	16 (5.9%)	0.38
Peripheral artery disease (%)	2 (8.3%)	14 (5.1%)	0.63
History of heart failure (%)	1 (4.1%)	21 (7.7%)	0.99
History of coronary artery disease (%)	5 (20.8%)	49 (18.0%)	0.78
ASA physical status score	3.0 ± 0.8	2.9 ± 0.6	0.45
General anesthesia (%)	12 (50%)	167 (61.4%)	0.77
Type of surgery (%)			0.32
General	9 (37.5%)	90 (33.1%)	
Traumatological	9 (37.5%)	84 (30.1%)	
Urologic	3 (12.5%)	46 (16.9%)	
Gynecologic	2 (8.3%)	27 (9.9%)	
Orthopedic	–	24 (8.8%)	
Other	1 (4.1%)	25 (9.2%)	
Urgent intervention	10 (41.6%)	67 (24.6%)	0.11
Body temperature at admission (°C)	35.6 ± 0.8	35.4 ± 0.8	0.75
VAS at admission	0 [0–0.75]	0 [0–2.50]	0.040
Body temperature at discharge (°C)	36.5 ± 0.7	36.4 ± 0.6	0.45
VAS at discharge	0 [0–1]	1 [0–2]	0.002

4. Discussion

This retrospective, real world study explored the prognostic meaning of very early (≤6 h) postoperative high-sensitivity troponin I elevation, observed in a RR setting, among patients submitted to non-cardiac surgery and with suspected cardiac event. Current evidence suggests that only 20% of cases of perioperative myocardial injury develop in the preoperative or intraoperative period, and that the most of them occur in the first 48–72 h postoperatively.[11] Two large trials showed that early (<3 days) postoperative MINS is associated with mortality at 30 days,[3,4] suggesting a role of troponin as a prognostic screening tool.[12,13] Despite these findings, the best timing to evaluate troponin in the postoperative period is still unclear, as there are considerable differences across studies in the timing and number of measurements performed over this period.[3–6] In particular, the prognostic meaning of a troponin increase detected in the very early postoperative period (<6 h) in the RR setting was not assessed. Our findings may add to these studies by suggesting that the evidence of a troponin increase, detected in the first 6 h after non-cardiac surgery among patients admitted to the RR and with suspected cardiac event, is a strong and independent predictor of outcome at

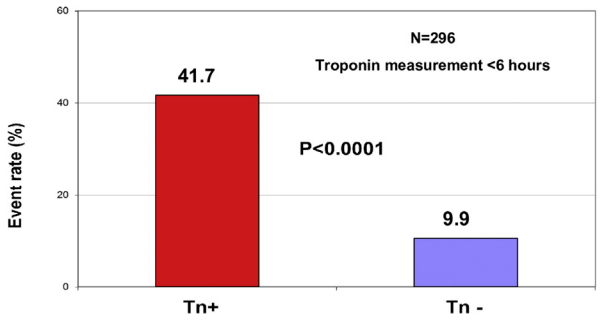

Fig. 1. Event rate according to troponin positivity.

30 days. These findings support the clinical importance of detecting perioperative myocardial injury for short term prognostic stratification.

According to current recommendations, troponin measurement is strictly indicated only in the setting of clinical signs or symptoms suggestive of myocardial ischemia, whereas the usefulness of routine screening in patients at high risk, but without signs or symptoms suggestive of myocardial ischemia, is still uncertain.[14] Our findings suggest that, in the elderly, troponin should be considered not only in the presence of clinical data suggestive of myocardial ischemia, but also for patients in whom a more comprehensive clinical evaluation, inclusive of rhythm stability at ECG monitoring and haemodynamic assessment, raises the suspicion of a cardiac event. Interestingly, such prognostic utility may be present even in the very early period, making troponin a potential useful tool in the RR setting. From a practical standpoint, the detection of a troponin increase may allow a more accurate risk stratification, with implications in terms of optimization of therapy and choice of the best postoperative path.[15]

This study has limitations. Since our population included elderly individuals, caution is needed to generalize the findings to younger populations. The analysis reflects a retrospective experience where troponin measurement was decided by the anaesthesiologist, and not in a systematic manner. In this regard, our study suffers from the inherent drawbacks of any retrospective analysis. Also, preoperative troponin levels were not considered. Lastly, important data such as BNP, Echo evaluation for LV function, lipid profile were not available in all patients.

Although these findings require validation in larger analyses, our results suggest that very early troponin evaluation in the RR setting among patients submitted to non-cardiac surgery and with suspected cardiac event may be a useful tool to identify patients at risk of cardiovascular complications after surgery.

Declaration of Competing Interest

All authors have none to declare.

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