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Review

An update on predictive biomarkers for major adverse cardiovascular events in patients undergoing vascular surgery☆,☆☆

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Abstract Cardiovascular complications signify a major cause of morbidity and mortality in patients undergoing vascular surgery adversely affecting both short- and long-term prognosis. During the last decade, unmet needs for a distinct cardiovascular risk assessment have led to an intensive research for establishment of biomarkers with sufficient predictive value. This literature review aims in examining the value of several biomarkers in predicting the incidence of major adverse cardiac events in vascular surgery patients. We reviewed the English language literature and analyzed the biomarkers as independent predictors or in correlation with other factors. We found several biomarkers showing a significant predictive value for a major adverse cardiovascular event in patients undergoing vascular surgery. These biomarkers can be used in clinical practice as outcome predictors, although sensitivity and specificity varies. Detection of subclinical cardiovascular damage may improve total risk estimation and facilitate clinical assessment of patients at risk for future cardiovascular events. The wide variety of sensitivity and specificity in predicting a MACE of these biomarkers exert the need for future trials in which these markers will be tested as adjunctive tools of cardiovascular risk estimation scoring systems.

1. Introduction

Cardiovascular complications represent a major cause of morbidity and mortality in patients undergoing vascular surgery that adversely affect both short- and long-term prognosis [1]. Nearly 60% of patients undergoing vascular surgery have coronary artery disease and only 8% of them have a normal

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Table 1 Studies of troponin prediction value

Study	N	Procedures	TnI or TnT	Myocardial injury (essay)	Myocardial infarction (%)	Prediction		
						Outcome (follow-up)	Cut-off	Predictive value
Gillman et al (2014)	455	Carotid, AAA repair, Peripheral bypass	TnT and hs-TnT	41/455 (9.0%)	14/455 (3.1%)	30-day MACE	TnT> 0.05 μg/L or hs-TnT> 50 ng/L	
Simons et al (2013)	16,363	Carotid, AAA repair, Peripheral bypass	Tn	211/16,363 (1.3%)	264/16,363 (1.6%)	30-day mortality and long-term (5-year) survival	>normal upper limit, as defined by the testing laboratory	HR 1.45 (1.10–2.0) 95% CI $P = .02$
Marston et al (2013)	182	Carotid, open AAA repair, endovascular AAA repair, Peripheral bypass	TnI	81/182 (44.5%)	56/182 (30.8%)	1-year cardiac events and mortality	>upper reference limit (set by manufacturer at 0.1 μg/L)	OR 1.61 (1.20–2.14) 95% CI $P < .01$
Linnemann et al (2012)	254	Acute lower limb ischemia	TnT		0/254 (0%)	In-hospital mortality	cTNT >0.01 ng/mL or >0.03 ng/mL	HR 3.4 (1.3–8.5) 95% CI $P = .010$
Kouvelos et al (2011)	295	149 Aneur 76 Car 70 PAD	TnI	93/295 (31.5%) TnI >0.02 ng/mL		MACE 1 year	0.4 ng/mL	Sensitivity 80% Specificity 81% $P = .008$
Winkel et al (2010)	513	254 AAA repairs 148 Carotid 111 PAD	TnT	81/253 (16%) (0.01 ng/mL)	54/513 (10.5%)	Cardiovascular outcome and mortality (2 years)	TnT-AUC >0.01 days*ng/mL	HR 20.2; 95% CI 10.2–40.0 HR 4.0; 95% CI 2.0–7.8
Winkel et al (2009)	220	220 AAA repairs	TnT	24/220 (10.9%)	4/220 (1.8%)	Death from all causes (median 2.9 years)	TnT >0.01 ng/mL	3.6-fold increased risk (95% CI, 1.8–7.2) for death in the asymptomatic group $P < .001$
Ali et al (2008)	43	open AAA repair	TnI	20/47 (47%) (0.54 ng/mL)	11/43 (25.6%)	MACE (mean 571 days)	TnI >0.54	OR 5.4 (1.2–24)
McFalls et al (2008)	377	AAA repair PAD	TnI	100/377 (26.5) 0.1 ng/mL	43/377 (11.4%)	Mortality 1 year (median 2.5 years)	TnI >0.1 ng/mL	20% VS 4.7% (1-year mortality) 0.73 vs 0.84 (survival in 2.5 years)
Barbagallo et al (2006)	75	38 AAA repairs 37 fem-pop bypasses	TnI	25/75 (33%) TnI >0.05 ng/mL	9/75 (12%)	MACE 1st month	TnI >0.05 ng/mL	100% sensitivity, 71% specificity, positive predictive