

Myocardial Injury is More Common than Deep Venous Thrombosis after Vascular Surgery and is Associated with a High One Year Mortality Risk

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WHAT THIS PAPER ADDS

This is the first study to prospectively assess the incidence of myocardial injury after non-cardiac surgery (MINS) and venous thromboembolism (VTE) in a cohort of patients undergoing vascular surgery. It proved that MINS occurs more often than VTE and is associated with high mortality. These results suggest that clinicians involved in peri-operative care should consider implementing peri-operative troponin monitoring into everyday practice in order to improve the detection rate of peri-operative arterial complications.

Objective/background: Venous thromboembolism (VTE) has been considered the dominant major life threatening vascular complication after non-cardiac surgery, but recent studies have shifted the emphasis toward myocardial injury after non-cardiac surgery (MINS) as a common adverse event in the peri-operative setting. The aim of the present study was to compare the incidence and influence on mortality of two dominant venous and arterial events in the peri-operative period by prospectively screening a consecutive cohort of patients undergoing vascular surgery.

Methods: This was a sub-study of Vascular Events In Non-cardiac Surgery Patients Cohort Evaluation (VISION), the main objective of which was to evaluate major peri-operative complications after non-cardiac surgery. Patients undergoing vascular surgery had their blood collected to measure the Roche fifth generation high sensitivity troponin T (hsTnT) assay before and four times after surgery (6–12 h post-operatively, on the first, second, and third day following the procedure). MINS was defined as an elevated post-operative hsTnT ≥ 65 ng/L or an hsTnT ≥ 20 to < 65 ng/L with an absolute change of ≥ 5 ng/L that was judged to be due to ischaemia. All patients underwent ultrasound venous compression testing for deep vein thrombosis (DVT) before, 4, and 7 days after surgery and follow-up was performed by telephone 30 days and 1 year after surgery.

Results: In total, 164 consecutive patients were included in this sub-study. MINS was diagnosed in 39 patients (23.8%) and DVT in four patients (2.4%). The 1 year mortality was higher in MINS (9/39 [23.1%]) than non-MINS patients (9/125 [7.2%]; $p = .006$). None of the patients who developed DVT died in the first year after surgery.

Conclusion: MINS is a common complication after vascular surgery. It occurs more frequently than DVT and is associated with high 1 year mortality.

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INTRODUCTION

Every year more than 200 million adults worldwide undergo major non-cardiac surgery with 30 day mortality exceeding 1%.^{1–3} The majority of vascular surgery patients have

atherosclerosis and multiple cardiovascular risk factors and comorbidities.^{4,5} Patients undergoing vascular surgery, usually with pronounced peripheral artery disease (PAD), seem to be at a particularly high risk of both venous and arterial complications.^{6–8} There is growing evidence that traditional cardiovascular risk factors are also associated with venous thromboembolism (VTE).⁹

For many years VTE has been considered a major life threatening vascular complication of non-cardiac surgery. While the risk of post-operative VTE in general surgery patients is well established in the literature, the exact

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incidence of deep venous thrombosis (DVT) and pulmonary embolism (PE) following vascular surgery remains unclear, and data from prospective studies using active ultrasound screening for DVT in the peri-operative period is limited.

At the same time, there are growing data on the prevalence and importance of major arterial complications after non-cardiac surgery, such as acute myocardial infarction (MI) and stroke. Recently, a new arterial complication has been described: myocardial injury after non-cardiac surgery (MINS). According to large prospective cohort studies, MINS influences short and long-term all cause mortality after surgery.²

Based on the available data, it was hypothesised that, among patients undergoing vascular surgery, arterial complications are more common than venous complications and have a greater influence on 1 year mortality. To confirm this hypothesis, a prospective study was performed with active screening for the most common arterial and venous complications (i.e., MINS and DVT). Patients were clinically assessed for other arterial (MI, stroke) and venous (PE) events.

MATERIALS AND METHODS

Patients and methods

The study was conducted between May 2011 and December 2012. Study personnel enrolled consecutive consenting patients who fulfilled the eligibility criteria at the St. John Grande Hospital, Kraków, Poland. This study was a sub-study of the Vascular Events In Non-cardiac Surgery Patients Cohort Evaluation (VISION) Study. The main objective of the VISION Study was to evaluate the incidence of major peri-operative vascular events after non-cardiac surgery in a large international representative population of adults having non-cardiac surgery. Inclusion criteria included age ≥ 45 years, vascular surgery performed under general or regional anaesthesia (i.e., plexus block, spinal, or epidural), and hospitalisation after surgery for at least 4 days. Patients who did not consent to screening for MINS or DVT were excluded. All patients were assessed by an internal medicine specialist and/or anaesthetist prior to surgery. Those at higher risk of cardiovascular complications, estimated with validated risk score (the revised cardiac risk index (RCRI)), were seen by a cardiologist and had an echocardiogram prior to the procedure. None of the patients was rescheduled or disqualified from surgery after the pre-operative work-up. None of the patients underwent routine coronary angiography, stress echocardiography, exercise stress test, or single photon emission computed tomography (SPECT) as a pre-operative cardiac work-up.

Research personnel interviewed all participants and examined their medical records to obtain information on potential pre-operative predictors of major peri-operative complications (peripheral arterial disease, coronary artery disease, history of stroke, transient ischaemic attack (TIA), hypertension, diabetes, history of smoking, body mass index, atrial fibrillation, history of DVT/PE, congestive heart

failure, cancer). Patients had their blood collected to measure fifth generation high sensitivity troponin T (hsTnT) before surgery, 6–12 h after surgery and on the first, second, and third day after surgery. Cardiac troponin T was measured using the hsTnT assay (Roche Diagnostics, Mannheim, Germany) on the Elecsys 2010/cobas e411 immunoanalyser. The analytical performance variables of this assay were as follows: limit of detection 5 ng/L; coefficient of variation $< 10\%$; normal range < 14 ng/L (99th percentile in a healthy reference population).^{10–12}

Deep venous thrombosis screening was undertaken using an ultrasound compression test with 13-6 MHz vascular probe (Sonosite M-Turbo, Washington, DC, USA) before surgery, 4 days after surgery, and 7 days after surgery by two independent, experienced physicians. In case of disagreement, a third physician was asked to perform the test. With the patient supine, the following venous segments were examined: common femoral vein; proximal part of the great saphenous vein; deep femoral vein; proximal femoral vein; distal femoral vein. The examination was continued in a sitting position, and patients had their popliteal vein examined down to the trifurcation.

Cardiovascular events

Study personnel evaluated patients for evidence of cardiovascular arterial (MINS, MI, stroke, cardiovascular death) and venous (DVT, PE) complications during their in hospital stay.

Study personnel contacted patients or their relatives at 30 days and 1 year after surgery. Information collected in the follow-up included death, MI, stroke, DVT, PE, presence of cardiovascular risk factors, DVT risk factors, medications, and re-hospitalisation for re-operation or any other reason.

MINS was defined as a hsTnT ≥ 20 to < 65 ng/L with an absolute change ≥ 5 ng/L or a hsTnT ≥ 65 ng/L within 30 days of undergoing surgery that was judged to be a result of an ischaemic aetiology.³ Expert unblinded physician adjudicators evaluated all patients with an elevated hsTnT level. They assessed the patient's medical history, clinical notes, imaging studies, and laboratory data related to the elevated hsTnT measurements, to determine if any ischaemic feature was present (i.e., whether a patient fulfilled the universal definition of MI) or that the hsTnT elevation was due to a non-ischaemic aetiology (e.g., sepsis, pulmonary embolus, atrial fibrillation, cardioversion, chronic troponin elevation), and to confirm that the myocardial injury had occurred during or after surgery rather than before surgery. MI was defined according to the third universal definition of MI.¹³

The Caprini risk score for post-operative DVT was assessed with the available online calculator using demographic and clinical data obtained by research personnel (<http://venousdisease.com/dvt-risk-assessment-online>).¹⁴

Statistical analysis

Categorical variables are presented as n (%), and continuous variables as medians (interquartile range [IQR]) unless otherwise specified.

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