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High sensitivity troponin T concentrations in patients undergoing noncardiac surgery: A prospective cohort study☆

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ABSTRACT

Objectives: To determine the proportion of noncardiac surgery patients exceeding the published 99th percentile or change criteria with the high sensitivity Troponin T (hs-TnT) assay.
Design and methods: We measured hs-TnT preoperatively and postoperatively on days 1, 2 and 3 in 325 adults.
Results: Postoperatively 45% (95% CI: 39–50%) of patients had hs-TnT ≥ 14 ng/L and 22% (95% CI:17–26%) had an elevation (≥14 ng/L) and change (>85%) in hs-TnT.
Conclusion: Further research is needed to inform the optimal hs-TnT threshold and change in this setting.

Introduction

Noncardiac surgery has made substantial advances in treating diseases and improving patients' quality of life; however, it is also associated with major vascular complications [1]. The Vascular events In noncardiac Surgery patIents cOhort evaluation (i.e., VISION) Study is a large (i.e., 40,000 patient) international prospective cohort study evaluating major vascular complications in a representative sample of patients ≥ 45 years of age undergoing noncardiac surgery. At the beginning of the study, all sites were using the 4th generation troponin T (hence referred to as TnT) assay, but with the 5th generation high sensitivity TnT (hence referred to as hs-TnT) assay gaining regulatory approval there will be a shift to using hs-TnT in this population. The characteristics of the hs-TnT assay in this population are unknown.

Recent publications have reported the analytical characteristics of hs-TnT assay with respect to the 99th percentile (≥14 ng/L) in a healthy population, the reference change values (RCVs; >85%), and the optimal change criteria to identify non-ST segment elevation myocardial infarction (NSTEMI; >242%) [2–4]. The PEACE Study demonstrated that 11% of patients with stable coronary artery disease exceeded an hs-TnT assay value ≥ 14 ng/L and that this value was an independent predictor of cardiovascular death [5]. Questions persist, however, regarding whether the reference interval from a healthy population should be applied to all patient populations in all settings [6]. We sought to determine the prevalence of patients exceeding the published 99th percentile versus the derived reference intervals from the preoperative samples from a substudy of VISION patients. We also assessed the different change criteria (85% versus 242%).

Methods

Study population

The VISION Bio-bank Study is a substudy of VISION, and includes a prospective sample of VISION patients who are ≥45 years of age, undergoing elective or emergent noncardiac surgery requiring overnight hospital admission, and receiving a general or regional anesthetic. Recruitment into the VISION Bio-bank Study has occurred at the following three Canadian hospitals: the Hamilton Health Sciences, Hamilton, Ontario, Saint Joseph's Healthcare, Hamilton, Ontario, and Winnipeg Health Sciences Centre, Winnipeg, Manitoba. All VISION Bio-bank patients have blood drawn preoperatively and on the 1st, 2nd, and 3rd days after surgery. As evaluating change was one of the aims of this study, we included only those subjects with specimens in storage at all four time points (i.e., preoperative and days 1, 2, and 3 after surgery). For this study we planned to include the first 325 eligible subjects from the VISION Bio-bank.

Risk for these subjects was assessed using the Revised Cardiac Risk Index, which is the most commonly used perioperative risk index [7]. This index consists of 6 equally weighted risk factors: high-risk surgery, history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, use of insulin therapy for diabetes, and a preoperative serum creatinine > 175 μmol/L.

The non-parametric upper 95th (with 95% CIs) and 99th (with 90% CIs) percentiles were calculated for the preoperative specimens from the included patients [8]. Secondary analyses were also performed removing the 4 individuals who required emergent surgery (for a study population n = 321) and we determined the 95th percentile in those below and above 65 years of age and based on sex.

Laboratory measurements

As part of the VISION Study the TnT 4th generation assay was measured postoperatively on day 1 (n = 306 patients), day 2 (n = 297), and day 3 (n = 300) after surgery. The hs-TnT assay was measured from the bio-bank samples at all 4 time points and physicians were unaware of these results (n = 1300 specimens from 325 subjects). The reported limit of blank for the hs-TnT assay is 3 ng/L [2] with concentrations below this level also listed as 3 ng/L for this

Table 1
VISION Bio-bank substudy characteristics.

Variable	Study population (n = 325)
Age (years)	
Mean ± SD	65 ± 11
Median (25th–75th percentile)	65 (57–75)
Sex	
Female n (%)	159 (49%)
Surgery n (%)	
Vascular	26 (8%)
General	53 (16%)
Thoracic	33 (10%)
Major urology or gynecology	43 (13%)
Major orthopedic	94 (29%)
Major neurosurgery	25 (8%)
Low risk surgeries	64 (20%)
Revised cardiac risk index n (%)	
0	177 (54%)
1	91 (28%)
2	37 (11)
≥3	20 (6%)
Duration of surgery in minutes	
Mean ± SD	143 ± 88
Median (25th–75th percentile)	124 (83–173)
hs-TnT (ng/L)[a]	
Pre-operative median (25th–75th)	5 (3–12)
Pre-operative prevalence (%) ≥ 14 ng/L	21% (95% CI:17–25%)
Day 1 median (25th–75th percentile)	9 (3–17)
Day 1 prevalence (%) ≥ 14 ng/L	34% (95% CI:29–39%)
Day 2 median (25th–75th percentile)	10 (4–21)
Day 2 prevalence (%) ≥ 14 ng/L	38% (95% CI:32–43%)
Day 3 median (25th–75th percentile)	8 (3–16)
Day 3 prevalence (%) ≥ 14 ng/L	30% (95% CI:25–35%)

[a] hs-TnT preoperative concentration lower than postoperative days ($p<0.001$; Kruskal–Wallis all pairwise comparisons).