Relationship between high-sensitivity Troponin T measurements and 30-day mortality after noncardiac surgery

PJ Devereaux, MD, PhD
McMaster University

Background

- >5 Million Americans ≥45 yrs undergo in-patient noncardiac surgery annually and 1.3% die in-hospital
  - cardiac complications are leading cause
- Myocardial injury after noncardiac surgery (MINS) is
  - defined as myocardial injury caused by ischemia that occurs during or within 30 days after surgery and is independently associated with mortality
- Diagnostic criteria for MINS, based on non-high sensitivity Troponin T assay, have been identified
- FDA recently approved usage of high-sensitivity Troponin T (hsTnT) assay, and globally many hospitals are using high-sensitivity troponin assays
- Little is known about relationship between perioperative hsTnT measurements and 30-day mortality and MINS

VISION design and methods

- Prospective, international, cohort study
- Eligibility criteria
  - ≥45 yrs underwent in-patient noncardiac surgery
- Representative sample
- Participating countries (23 centres in 13 countries)
  - North and South America, Europe, Asia, Africa, Australia
- Patients had hsTnT measurements 6-12 hours after surgery and daily for 3 days
  - 40.4% had preoperative hsTnT measurement

Analytic approach

- Iterative process (Cox proportional hazards models) exploring potential hsTnT thresholds to determine if there were hsTnT thresholds that independently altered patients' risk of 30-day mortality and had aHR ≥3.0 and risk of 30-day mortality ≥3.0%
- To determine diagnostic criteria for MINS
  - Cox proportional hazards model to ascertain if postoperative hsTnT elevations required an ischemic feature (e.g., ischemic symptom, ECG finding) to impact 30-day mortality

Results

- Among 21,842 participants
  - mean age 63 years
  - 49% were female
- most common types of surgery
  - major orthopedic (16%)
  - major general (20%)
  - low-risk (35%)
- 21,050 (96.4%) completed 30-day follow-up
- 266 patients (1.2%; 95% CI, 1.1-1.4) died within 30 days of surgery

Peak postoperative hsTnT thresholds associated with 30-day mortality

hsTnT thresholds	# of patients (%)	# of deaths (%)	aHR (95% CI)	p-value
<5 ng/L	5318 (24.4)	6 (0.1)	1.00	-
5 to <14 ng/L	8750 (40.1)	40 (0.5)	3.73 (1.58-8.82)	0.003
14 to <20 ng/L	2530 (11.6)	29 (1.1)	9.11 (3.76-22.09)	<0.001
20 to <65 ng/L	4049 (18.6)	123 (3.0)	23.63 (10.32-54.09)	<0.001
65 to <1000 ng/L	1118 (5.1)	102 (9.1)	70.34 (30.60-161.71)	<0.001
≥1000 ng/L	54 (0.2)	16 (29.6)	227.01 (87.35-589.92)	<0.001

- No interaction b/w postop hsTnT threshold ≥20 ng/L and eGFR or sex (interaction p=0.83 and 0.20)

- Absolute hsTnT change ≥5 ng/L increased patients' risk of 30-day mortality
  - aHR, 4.69; 95% CI, 3.52-6.25
- Among 4385 patients with elevated postop hsTnT
  - (i.e., 20 to <65 ng/L with change ≥5 ng/L or hsTnT ≥65 ng/L)
  - 481 (11.0%) had non-ischemic (e.g., sepsis) non-MINS hsTnT elevation
  - 13.8% of patients with elevated perioperative hsTnT had their peak value before surgery
- Elevated postoperative hsTnT without ischemic feature predicted 30-day mortality (aHR, 3.20; 95%, 2.37-4.32)
  - Identifying diagnostic criteria for MINS as
    - elevated postop hsTnT judged as resulting from myocardial ischemia (i.e., no evidence of a non-ischemic etiology), without requirement of ischemic feature

Postop variables associated with 30-day mortality after surgery

	Incidence (%)	Adjusted HR (95% CI)	Attributable Fraction (95% CI)
MINS	3904 (17.9)	3.69 (2.80-4.85)	24.2 (10.6-44.1)
Major bleeding	3101 (14.2)	2.77 (2.11-3.62)	14.4 (4.3-29.9)
Sepsis	886 (4.1)	4.96 (3.54-6.96)	9.4 (2.2-21.1)
New AF	273 (1.2)	1.85 (1.19-2.87)	1.9 (1.2-2.9)
Stroke	69 (0.3)	5.19 (2.75-9.78)	1.5 (0.3-3.1)

MINS

- 94.1% of MINS occurred by day 2 after surgery
- 3633 patients (93.1%) who had MINS did not experience an ischemic symptom
  - probably would have gone undetected without hsTnT monitoring
- Among 3904 patients who had MINS,
  - 846 (21.7%; 95% CI, 20.4-23.0) fulfilled universal definition of MI
    - elevated hsTnT with ≥1 ischemic feature
- CV complications increased among MINS patients
  - composite of nonfatal cardiac arrest, CHF, coronary revascularization, and mortality
    - odds ratio, 8.47; 95% CI, 6.94-10.34

Conclusions

- Elevated postoperative hsTnT measurements were strongly associated with 30-day mortality
  - results consistent regardless of eGFR and sex
- Given relevance of absolute change in hsTnT measurements in diagnosing MINS and 13.8% of patients had their peak value before surgery suggests
  - physicians should consider obtaining preoperative hsTnT measurement in patients who they plan to measure hsTnT after surgery
- MINS may explain 24% of perioperative deaths
- 93% of MINS would probably go undetected without troponin monitoring