Value of Measuring Troponins Before and After Open Vascular Operations: When and How Does It Help in Patient Management

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Clinical significance of preoperative elevated troponin levels prior to CABG

- Troponins frequently measured as part of the preoperative workup of patients undergoing CABG
- Elevated troponin was present in 47 patients (12.4%) preoperatively
- Intraoperative variables did not differ between the two groups
- 30 day mortality (6.4% vs. 0.9%) was significantly higher in the elevated troponin group
- In multivariable analysis, elevated troponin remained a predictor for cardiac arrest - OR 5.8

Buratto E et al. Heart, Lung and Circulation 2014

Clinical significance of preoperative elevated troponin levels prior to non-cardiac surgery

- There is an association between cTN1 measured in the immediate preoperative period and adverse postoperative outcomes
- 1175 patients undergoing non cardiac surgery
- 1.4% had MI
- Initial preoperative troponin levels were high in 73 patients, with the highest levels noted in AAA and other vascular surgery patients
- Initial high troponin level correlated highly with postoperative MI or other cardiac complications

Lee TH et al. Am J Cardiol 1996

Why measure troponins routinely – even in asymptomatic individuals?

- The majority of postoperative troponin elevations (74%) occur within 48 hours of surgery
- During this time period, most patients are receiving analgesic medication, and 65% of patients with a perioperative troponin elevation do not experience any ischemic symptoms

Why measure troponins routinely – even in asymptomatic individuals?

- The mortality rate of patients with post-operative troponin elevation without symptoms is no different from those who do experience symptoms
- The time to a clinically significant event following an elevated troponin level is not immediate, potentially allowing a window for interventions to modify this risk
Cardiovascular events are a major cause of morbidity and mortality following vascular surgery. Patients who suffer postoperative troponin elevation are at increased risk of death after their surgery. Multivariable association between troponin levels and 30-day mortality is shown. Survival curve of each category of troponin I (TnI) elevation is presented. Perioperative myocardial necrosis following vascular surgery is associated with long-term death.
**Benefit of GPIIb/IIIa Inhibitor by Tn Status**

<table>
<thead>
<tr>
<th>Trial</th>
<th>TnT-negative</th>
<th>TnT-positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAGON B</td>
<td>0.125</td>
<td>1</td>
</tr>
<tr>
<td>PRISM</td>
<td>0.125</td>
<td>1</td>
</tr>
<tr>
<td>CAPTURE</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>COMBINED</td>
<td>0.125</td>
<td>1</td>
</tr>
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*Circulation 2001;103:2891-2896.

**Why troponin may be the perfect biomarker?**

*Ability of Troponin Elevations to Predict Benefit From an Early Invasive Strategy in Patients With Acute Coronary Syndromes*

**Personalized Therapy with Perioperative Troponin Elevation**

**Post-op Measurement**

- **Patient type A**
  - Troponin:
  - Treatment A
  - "Biosignatures"

- **Patient type B**
  - Troponin:
  - Treatment B

**With these issues in mind**

- We retrospectively analyzed data from 220 consecutive patients from 9/2009-9/2010 that underwent open vascular surgery and had troponin levels checked in the perioperative period.
- Included operations consisted of carotid endarterectomy, above/below knee amputation, open aneurysm repair, extremity bypass, and thromboembolectomy.
- Perioperative antiplatelet use was recorded for each patient and defined as use within 72 hours prior to surgery.

**Incidence and outcomes of myocardial necrosis**

- Perioperative myocardial infarction (WHO definition).
- Perioperative myocardial ischemia (cTnT ≥ 0.10 ng/ml)*

*Used by majority of papers: The cutoff level of 0.10 ng/ml is associated with increased 30 day mortality compared to lower cutoff levels (11.6% vs. 3.9%, P <0.001)

**Our patient population – open vascular surgery population**

- Prior MI 17.7%
- CAD 45.9%
- Drug eluting stent 13.3%
- Bare metal stent 5%
- Coronary bypass 19.3%
Results

- 220 patients were evaluated for this study
- Mean age was 74.3 ± 10.8 years
- 73 (33.2%) women and 147 (66.8%) men
- 13 (5.9%) patients were diagnosed with myocardial infarction
- 54 (24.5%) patients developed myocardial ischemia
- Significant demographic predictors of myocardial ischemia were diabetes, chronic kidney disease, and congestive heart failure

Myocardial necrosis following vascular surgery

<table>
<thead>
<tr>
<th>Stage of Chronic Kidney Disease</th>
<th>% of patients with Trop ≥ 0.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 n = 40</td>
</tr>
<tr>
<td>2</td>
<td>20 n = 70</td>
</tr>
<tr>
<td>3</td>
<td>30 n = 77</td>
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<tr>
<td>4</td>
<td>40 n = 25</td>
</tr>
<tr>
<td>5</td>
<td>50 n = 8</td>
</tr>
</tbody>
</table>

Perioperative antiplatelet therapy may lower the incidence of myocardial necrosis

- Perioperative antiplatelet use was defined as use within 72 hours prior to surgery
- Perioperative use of aspirin or clopidogrel was associated with a lower risk of myocardial ischemia
  - (adjusted OR 0.41; 95% CI 0.18-0.94)
- Combined use of aspirin and clopidogrel was infrequent (10%) and was not associated with a lower risk of myocardial ischemia
  - (adjusted OR 0.68; 95% CI 0.21-2.22)

Conclusions

- Postoperative troponin monitoring is a simple test which could easily be incorporated into routine postoperative care
- Its powerful prognostic ability will enable the clinician to identify patients who will suffer from short-term cardiovascular morbidity and long-term mortality
- As of yet no definitive treatment of these patients has been established, but it is likely that their prognosis may be modifiable
- There is significant need for clinical trials to identify effective therapies to improve the outcomes of patients with myocardial injury after non-cardiac surgery

Acknowledgements