An Evaluation Between Preoperative and Postoperative of Serum Troponin Level in Patients' Schedule For Non-Cardiac Surgery

Ahmed Abdullhadi Jabbar[1], Ali Hussein Mohammed[2], *and Nasser Salh Lhwak[3]

[1, 2, 3] Ministry of education, Directorate of education Thi-Qar, Iraq

E-mail: AhnedAbdelhadijabbar@gmail.com

E-mail: *Alialrumaidh@utq.edu.iq

E-mail: salehna1993@gmail.com

Abstract

Background: troponin is a complex protein considered as an important part of contractile apparatus in the skeletal and cardiac muscles. There are three subtypes of troponin (T, I, C) they become significantly released into circulation after surgery due to muscle damage. The study aim is identify the impact of surgery in serum troponin level by comparing the serum level of troponin a preoperatively and postoperatively non cardiac surgery. Method: 103 patients who were candidate for elective non-cardiac surgery, where first blood sample was drown from each patient preoperatively and the second blood sample was drown four hours after the surgery. Result: normal serum level of troponin (3-27) picogram/ml. According to age groups, this study shows increasing post-operative troponin level (but within normal range) in age group >50 years old P value 0.0001, and in age group less than 40 years old with P value 0.0001, and according to type of surgery the troponin more increase in major surgery with P value 0.0001. Conclusion: From this prospective study showed that the elevation in serum troponin in comparison preoperative and postoperative which has no clinical significance because the elevation was happened within physiological range.

Keywords: Non-cardiac surgery, Troponin, Cardiac troponin.

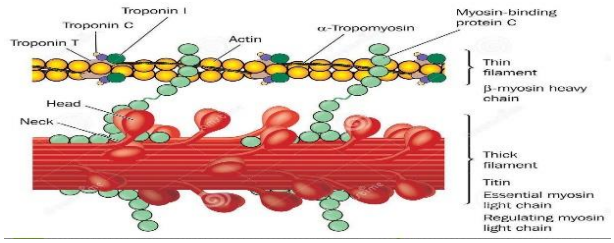
1. Introduction

Troponin is regulatory protein that is part of the contractile apparatus in the skeletal and cardiac muscle. It components of thin filament (which is actin and tropomysine) while the myosin represents the thick filament (Marston, & Zamora, 2020). There are three subtypes of troponin Fig (1)

T :binds the other troponin component to tropomyosine.

I :inhibit ATP activity when bound to actin.

C :binds to calcium ion and produce conformation changes in Tn I. (Marston & Zamora, 2020).



Figure(1): The interaction between actin and myosin filament (Tafuri, 2016)

The troponin is a protein exist in two forms within the cell; the majority is structurally bound within the thin filament of the contractile apparatus and a small percentage remain free in the cytosol (cTnI 2-4% and cTnT 68%). Acute cardiac injury releases the cytosolic protein in an early phase in blood Fig(2) and followed by the slower released of structurally bound troponin that results in a sustained elevation. Elevation cTn level indicates myocardial damage, but it does not provide any information regarding its cause (Katus, et al., 1991).

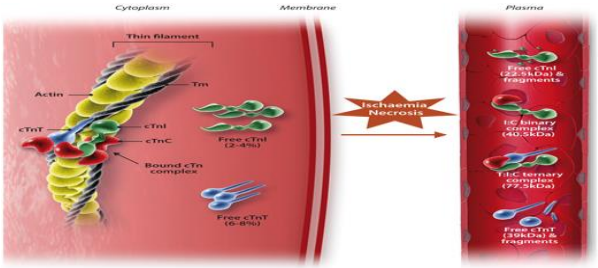


Figure (2): Release of cardiac troponin during myocardial infarction (Park, et al., 2017)

1. 2. The non-cardiac causes of troponin released

1) Pulmonary embolism: Pulmonary embolism and pulmonary hypertension cause pressure overload of right ventricle due to pulmonary artery obstruction which leads to increase pulmonary vascular resistance, that causes decreased myocardial perfusion and oxygen supply, these will cause cardiac damage and troponin release (Müller-Bardorff, et al., 2002).

2) Renal failure: elevation of troponin exists in approximately in 50% of patient with chronic renal insufficiency and also in patient on hemodialysis (Diris, et al., 2004).

3) Sepsis: elevation of cardiac troponin is frequently observed in patient with sever sepsis and septic shock, proposed mechanism are cytokine-mediated reversible myocardial membrane leakage and/or apoptosis

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(Parker, et al., 1984).
4) Physical exercise: prolonged extreme exercise may cause elevation in cTn levels and also may increase after prolonged walking in non-athletes and returned to baseline at 6 hours post exercise,this troponin release can be an indication of cardiac injury (Neumayr, et al., 2001; Kurz, et al., 2008).
5) Stroke: cardiovascular and cerebrovascular disease are closely associated with risk factors and pathogenesis, the proposed mechanism include neurologic myocardial stress which increased catecholamine release altering the autonomic function which may lead to myocardial injury (MI) by causing vasoconstriction and/or reduction in blood flow to coronary vessels (Akwe, et al., 2018).

2. Patient and method

We conducted the cross section study in Al-Nasiriyah general hospital, Thi-Qar province, Iraq from the first of May 2022 to the first of December 2022. The study included total 103 patients, divided into three age groups included (less than 40, 40 -49 and over 50) years. We obtained an oral approval from all patients who prepared for elective non-cardiac surgery.

2. 1. Study procedure

A preoperative blood sample was taken from patients immediately before induction and sent to hospital lab for measurement of serum troponin level, and the second blood sample taken from patients four hours after non-cardiac surgery in the surgical ward.

2. 2. Determination of troponin level

The test should be operated in room temperature: Before testing, Check/insert ID Chip onto the equipment. Draw 75uL of whole blood, serum or plasma with transfer pipette and add it to the buffer tube, mix well aftar that take 75uL of sample mixture to load it onto the sample well of the test cartridge, than insert it onto the test Cartridge Holder and click "Test'".15 minutes later, then the result will Show in the display (Al-Rekabi, 2019).

3. Results

The analysis of this study described by the following tables below in a systematic presentation.

Table (1): Demographic data of frequency Gender

Variable	Frequency	Percent
Male	33	32%
Female	70	68%
Total	103	100%

Table (2): Statistical analysis of troponin level according to age groups

Age Group/ year		Mean	N	SD	Sig.
< 40	PRE Troponin	4.5906	31	4.37273	0.0001
	POST Troponin	5.0755	31	4.05503	
From 40 to 49	PRE Troponin	3.2629	34	0.74369	0.024
	POST Troponin	4.6041	34	2.93773	
50 or more	PRE Troponin	5.4745	38	3.99059	0.0001
	POST Troponin	8.3447	38	3.98689	

This table shows that the level of serum troponin increased postoperatively in age group >50 years more than in other age groups(this elevation was within normal range) with p value 0.0001 and SD 3.9.

Table (3): Troponin level in relations to type of surgery

Type of surgery		Mean	N	SD	Sig.
Major operation	PRE Troponin	4.37086	4	3.13247	0.0001
	POST Troponin	6.07506	4	3.88752	
Intermediate operation	PRE Troponin	4.83392	3	4.16121	0.002
	POST Troponin	6.50132	3	4.40481	
Minor operation	PRE Troponin	4.39811	6	4.21536	0.021
	POST Troponin	5.79061	6	4.33652	

This table shows that the increase in troponin postoperatively is the same in all types of surgery and was within normal range of serum troponin, with p value <0.05 and SD4.

4. Discussion

This study compared the preoperative serum troponin level with a postoperative level for patients who underwent non-cardiac surgery to identify the impact of anesthesia and surgery on troponin level. The present study showed that an increased postoperative serum level of troponin in patients less than 40 years old because of bulky muscles that were injured during surgery and in patients over 50 years old due to ischemia that developed.
Postoperative myocardial damage is an independent predictor of 30-day mortality after non-cardiac surgery. Introduction of postoperative troponin monitoring as a standard of care is possible and may be beneficial in ameliorating the prognosis of patients undergoing non-cardiac surgery (van Waes, et al., 2013).
Chauin in 2010, found even in absence of cardiac disease, anesthesia and surgical stress in elderly patient may cause ischemia and increased serum level of troponin in patient underwent non-cardiac surgery. This is consistent with our study, because the mass of muscles that were injured during surgery that is released troponin from their cell structure.
van Waes, et al., 2013 in their study screened 2,232 patients ages 60 and older undergoing intermediate to higher risk non-cardiac surgery and found that 19% of the patients had elevated troponin levels, which correspond to our results that show elevation in troponin levels.
(Saunders, et al., 2009) found that the increased in troponin level due to hemorrhage, hypoxia and variability in heart rate and arterial blood pressure that might lead to little increased may suggest minor myocardial cell damage, and the elevation in level serum troponin in all cases postoperatively was within normal range, in comparison with current study which showed the major type of surgery had significant elevation in

troponin.

The postoperative released of cardiac troponin depend on the type of surgery and it will increased in complex and prolonged surgeries. (Mangano, et al., 1990)

5. Conclusion

From this prospective study showed that the elevation in serum troponin in comparison is preoperative and postoperative, which has no clinical significance because it happened the elevation within physiological range. We obtained results from the present study that require further studies to investigate the role of other factors effect on troponin level increase in serum and association between of this elevated with death in postoperative non-cardiac surgery patients.

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