

Correlation of Admission Troponin Levels with Cardiac Markers in Burn Patients

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Introduction

Patients with major burn injury often have systemic physiologic changes as a direct result of the trauma. These changes occur in various organ systems, but the cardiovascular system is one that is greatly affected. Burn injury often leads to abnormal cardiac function which manifest in the immediate setting as reduced HR, blood pressure, cardiac contractility, and cardiac output. It appears that after the immediate burn period, the physiology of the cardiovascular system begins to shift as the burn injuries result in increased concentrations of plasma catecholamines which lead to systemic hypermetabolism which clinically manifest as elevated HR and cardiac output which could sometimes be seen years post burn injury. Essentially, the immediate post burn setting is characterized by depressed cardiac function, which evolves into increased cardiac output and cardiac stress as the injury progresses. While cardiac function can be monitored in a variety of ways, Troponin I has been used as a biomarker for ischemic disease and cardiac dysfunction for years. The current relationship between TnI levels and clinical cardiac markers such as HR and BP have not been well studied in burn patients.

Research Objective

Do admission troponin levels correlate with BP and HR findings in patients with burn injury (TBSA 10% or greater)?

Methods

A prospective observational trial of 40 burn patients with burn injury (TBSA 10% or greater) admitted to the burn unit at Valleywise Health Medical Center in Phoenix. Criteria for elevated TnI levels were based upon reference ranges provided by the hospital lab, where TnI levels less than 0.034ng/mL were considered normal, and levels >0.034ng/mL were considered elevated. Initial TnI levels, BP, HR, TBSA were collected alongside demographic information. The groups were analyzed using Wilcoxon Rank Sum for the primary continuous parameters.

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Results

No significant difference in Age, Gender, Ethnicity, initial SBP, DBP, MAP, HR, and total # deceased between the group of burn patients with significantly elevated TnI versus the group of burn patients with normal TnI. There was a statistically significant difference in the TBSA burned with the significantly elevated TnI having significantly more surface area burned compared to the normal TnI group, where $p=0.0264$.

Table 1: Demographics, TnI levels, Cardiac Markers (HR, BP), Burn information

		High Troponin I (>0.034 ng/mL)	Normal Troponin I (<0.034 ng/mL)	Wilcoxon Rank sum (P-Value)	Fisher's Exact test (P-Value)
N		15 (37.5%)	25 (62.5%)	-	-
Sex	Males (%)	12 (80%)	21 (84%)	-	1
Ethnicity	Hispanic (%)	1 (6.67%)	3 (12%)	-	1
Age	Years	50±22	53±17	0.549	-
Height	meters	1.74±0.1	1.76±0.1	0.327	-
Weight	kilograms	79.2±16.6	87.76±16.0	0.137	-
TBSA	%	42.4±29.4	24.66±17.2	0.0264	-
Initial TnI	ng/mL	0.405±0.59	0.0186±0.01	<0.0001	-
Initial Systolic BP	mmHg	128±27	130±30	0.857	-
Initial Diastolic BP	mmHg	76±21	75±17	0.968	-
Initial MAP	mmHg	93±21	94±20	0.889	-
Initial Heart Rate	bpm	108±28	100±21	0.529	-
Deceased	# (%)	7 (46.67%)	4 (16%)	-	-

Table 1: Values above are represented as n (%) or as mean ± SD. P values are shown with boldface indicating statistically significant values of $p<0.05$. Groups were compared using either Wilcoxon rank sum or Fisher's Exact test depending on if the variable was continuous or non-continuous.

Conclusion

What we learned was that in our trial of 40 patients, there was no significant difference in any of those markers between burn patients with normal serum TnI and burn patients with significantly elevated TnI. Burns with higher TBSA percentages are significantly correlated with elevated TnI. Thus, it can be hypothesized that vital signs are not the most effective determinant of cardiac function in patients with burn injury. While vital signs and clinical judgement should always be the first tools in one's arsenal, the use of TnI as a biomarker is an important factor to consider in the treatment of burn injury as studies have shown that a positive troponin test is strongly correlated with increased risk of cardiac death. Major conclusions that can be drawn are that clinical markers and vital signs are not correlated to TnI levels. Since TnI levels are used as a gold standard biomarker to assess myocyte damage and have a direct correlation with cardiac death in burn patients, it can be said heart rate and blood pressure measurements are not necessarily as useful as biomarkers in the evaluation of true cardiac health in the setting of burn injury.

Summary and Future Goals

- The level of TnI increase in burn injury does not appear to correlate with clinical markers of cardiac function such as HR and BP
- Percent of TBSA burned is positively correlated with the initial TnI levels
- Limitations included lack of exclusion criteria for patients with pre-existing cardiac conditions, limitations of an observational study, and low power due to small sample size