Original Research Paper

Volume - 11 | Issue - 07 | July - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Emergency Medicine

A STUDY ON CORRELATION BETWEEN MODIFIED SHOCK INDEX AND SERUM LACTATE VALUES

Dr.Praveenkumar Biradar	Senior Resident, Department Of Emergency Medicine, BLDE, Vijayapura
Dr.Udaykumar Jaihind Khasage	Assistant Professor, Department Of Emergency Medicine, BLDE, Vijayapura
Dr.Veeresh B	Senior Resident, Department Of Emergency Medicine, BLDE, Vijayapura
Dr.Vijayakumara*	Assistant Professor, Department Of Emergency Medicine, KMC, Manipal. *Corresponding Author
Dr.Kasinath Biradar	Junior Resident, BLDE, Vijayapura

ABSTRACT **INTRODUCTION:** The Modified Shock Index is a test to identify occult shock in a patient with a normal blood pressure. High Lactate levels have been validated to identify the degree of shock and also response to resuscitation. The shock index (SI) is a bedside assessment defined as heart rate divided by systolic blood pressure, with a normal range of 0.5 to 0.7 in healthy adults. **METHODOLOGY:** Demographic data like age and sex was obtained. The patients were evaluated clinically, history and hemodynamic were noted. ABG was done on the patients and lactate levels were recorded. Requirement of Inotropic support, mechanical ventilation and dialysis were noted. All the findings were recorded on a predesigned and prepared proforma. **RESULTS:** The Modified Shock Index was split into three categories: <0.7, 0.7-1.3 and >1.3. The mean lactate in the <0.7 group, 0.7-1.3 group and the >1.3 group were 5.5000, 3.7060 and 4.8616 respectively. **CONCLUSION:** A Tukey post hoc test revealed that patients with modified Shock Index >1.3 had statistically significantly higher Lactate levels (5.729±2.846, p = 0.000) than patients with modified Shock Index 0.7 – 1.3 (3.706±1.520).

KEYWORDS : Correlation, Modified Shock Index, Serum Lactate Values

INTRODUCTION:

Triage of sick patients is an important tool which incorporates various vital signs and patient sensorium to appropriately sort out patients into their need for emergency care. A patient with a normal blood pressure who is however tachycardic may not be hemodynamically stable but may be triaged incorrectly; for this purpose, the shock index had originated which took into account heart rate and systolic blood pressure. This tool was found to be better than taking single vital sign readings for judging the instability of a patient. However, the flaw in the shock index was that it did not incorporate diastolic blood pressure which is also crucial in predicting shock. The "Modified Shock Index" was thus developed in 2012 by Liu et al, which took into account the heart rate and mean arterial pressure to more appropriately judge sickness severity. However, the test is still in the validation stage and has not yet come into guidelines or standards of care.[1,2]

The Modified Shock Index is a test to identify occult shock in a patient with a normal blood pressure. High Lactate levels have been validated to identify the degree of shock and also response to resuscitation

The shock index (SI) is a bedside assessment defined as heart rate divided by systolic blood pressure, with a normal range of 0.5 to 0.7 in healthy adults.[3] Allgöwer and Buri first introduced the concept in 1967 as a simple and effective means of gauging the degree of hypovolemia in hemorrhagic and infectious shock states. Experimental and clinical studies have shown that SI is linearly inversely related to physiologic parameters, such as cardiac index, stroke volume, left ventricular stroke work, and mean arterial pressure. A SI ≥ 1.0 has been associated with significantly poorer outcomes in patients with acute circulatory failure. Furthermore, SI was also shown to indicate persistent failure of left ventricular function during aggressive therapy of shock patients in the ED. In 1994, Rady et al found that a SI ≥ 0.9 predicted higher illness priority at triage, higher hospital admission rates, as well as intensive therapy on admission than pulse or blood pressure alone.The shock index (SI), is a measure of hemodynamic stability that is useful in predicting mortality and injury severity in trauma patients,The SI is superior to heart rate and systolic blood pressure alone in predicting mortality in geriatric trauma patients.[4] This suggests that SI may be a valuable tool for the early recognition and evaluation of critical illness in the ED, as well as a means to track progress of resuscitation.[5,6]

METHODOLOGY:

INCLUSION CRITERIA

All adult (>18years) patients received in the Emergency department on whom Lactate levels are performed.

EXCLUSION CRITERIA

Patients on cardiac rate control medication.

SAMPLE SIZE

Consider the correlation between modified shock index and lactate values 0.20 ,power 80% and with 95% confidence interval according to study conducted by ajaisingh et al ,the minimum required sample size is 271.The following formula has been used for sample size calculation

DATA COLLECTION

Demographic data like age and sex was obtained. The patients were evaluated clinically, history and hemodynamic were noted. ABG was done on the patients and lactate levels were recorded. Requirement of Inotropic support, mechanical ventilation and dialysis were noted. All the findings were recorded on a predesigned and prepared proforma.

All patients who fit into the inclusion criteria were requested for consent to join the study. The patients were further divided into sub-groups as per their working diagnosis as medical or surgical cases and definitive diagnosis were noted. The Modified shock index is calculated on arrival as "Heart rate / Mean arterial pressure" (MAP) = [(DBPx2) +SBP]/3)

The initial lactate values, vital signs and shock index were also noted. The patient was followed up till discharge.

STATISTICAL ANALYSIS

Statistical analysis was performed by using SPSS 22.0 version. The study subjects had been described according to their demographic profiles such as age and gender. Continuous variables like HR, SBP, DBP and MAP was presented as mean±SD and the categorical variables was presented as frequency or percentages and interpreted by student independent "t" test. The cut of values of modified shock index (MSI) was estimated by ROC curve. The correlations between physiological variables and MSI with lactate were performed by Karl pearsons coefficient of correlation. The association between MSI with Inotrope, intubation, dialysis and deaths were analyzed by χ^2 (Chi-square) test.

Interpretation of Pearson's Correlation Coefficient 0 < |r| <0 .3 weak correlation 0.3

< |r| <0 .7 moderate correlation

|r| > 0.7 strong correlation

RESULTS:

Table 1: Correlation between Shock Index (SI) grading and Lactate levels

Shock Index	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
< 0.5	3	4.6667	1.52753	.88192	.8721	8.4612	3.00	6.00
0.5 - 0.9	57	3.4807	1.64311	.21763	3.0447	3.9167	2.00	10.00
> 0.9	211	5.2374	2.64927	.18238	4.8779	5.5970	2.00	20.00
Total	271	4.8616	2.55921	.15546	4.5556	5.1677	2.00	20.00

The Shock Index was split into three categories: <0.5, 0.5-0.9 and >0.9. The mean lactate in the <0.5 group, 0.5-0.9 group and the >0.9 group were 4.6667, 3.4807 and 5.2374 respectively.

Table 2: Significance between the various SI groups and Lactate levels

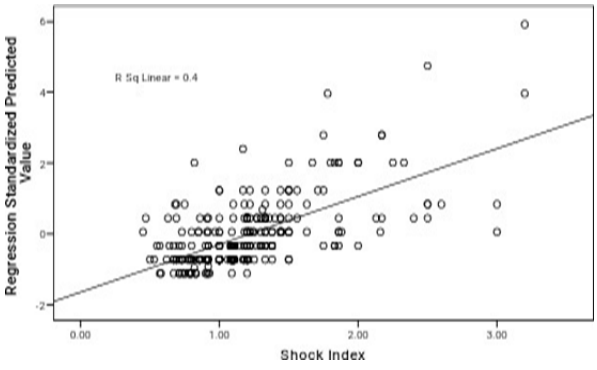
(I) Shock Index	(J) Shock Index	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Upper Bound	Lower Bound
< 0.5	0.5 - 0.9	1.18596	1.46074	.696	-2.2567	4.6287
	> 0.9	-.57077	1.43384	.916	-3.9501	2.8085
0.5 - 0.9	< 0.5	-1.18596	1.46074	.696	-4.6287	2.2567
	> 0.9	-1.75674(*)	.36812	.000	-2.6243	-.8892
> 0.9	< 0.5	.57077	1.43384	.916	-2.8085	3.9501
	0.5 - 0.9	1.75674(*)	.36812	.000	.8892	2.6243

There was a statistically significant difference between groups as determined by one- way ANOVA (F(2,268) = 11.397, p = 0.000).

A Tukey post hoc test revealed that patients with Shock Index >0.9 had statistically significantly higher Lactate levels (5.237±2.649, p =0.000) than patients with Shock Index 0.5-0.9 (3.480±1.643).

There was no statistically significant difference between the Shock index > 0.9 and < 0.5 groups (p = 0.916).

Graph 1: Scatter diagram depicting correlation between Shock Index and Lactate levels (p=0.000)



The above scatter diagram shows a linear relation between shock index and lactate levels

Table 3: Correlation between Modified Shock Index (MSI) grading and Lactate levels

Modified Shock Index	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
< 0.7	2	5.5000	.70711	.50000	-.8531	11.8531	5.00	6.00
0.7 - 1.3	116	3.7060	1.52026	.14115	3.4264	3.9856	2.00	10.0
> 1.3	153	5.7294	2.84600	.23009	5.2748	6.1840	2.00	20.0
Total	271	4.8616	2.55921	.15546	4.5556	5.1677	2.00	20.0

The Modified Shock Index was split into three categories: <0.7, 0.7-1.3 and >1.3. The mean lactate in the <0.7 group, 0.7-1.3 group and the >1.3 group were 5.5000, 3.7060 and 4.8616 respectively.

Table 4: Significance between the various MSI groups and Lactate levels

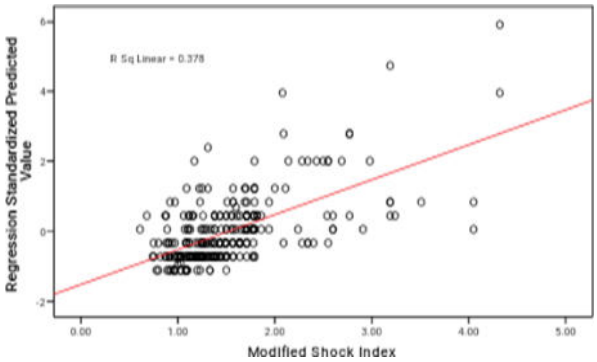
(I) Modified Shock Index	(J) Modified Shock Index	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Upper Bound	Lower Bound
< 0.7	0.7 - 1.3	1.79397	1.68580	.537	-2.1791	5.7671
	> 1.3	-.22941	1.68234	.990	-4.1944	3.7355
0.7 - 1.3	< 0.7	-1.79397	1.68580	.537	-5.7671	2.1791
	> 1.3	-2.02338(*)	.29101	.000	-2.7092	-1.3375
> 1.3	< 0.7	.22941	1.68234	.990	-3.7355	4.1944
	0.7 - 1.3	2.02338(*)	.29101	.000	1.3375	2.7092

There was a statistically significant difference between groups as determined by one- way ANOVA (F(2,268) = 24.245, p = 0.000).

A Tukey post hoc test revealed that patients with modified Shock Index >1.3 had statistically significantly higher Lactate levels (5.729±2.846, p = 0.000) than patients with modified Shock Index 0.7 – 1.3 (3.706±1.520).

There was no statistically significant difference between the Shock index > 1.3 and < 0.7 groups (p = 0.990).

Graph 2: Scatter diagram depicting correlation between Modified Shock Index and Lactate levels (p=0.000)



The above scatter diagram shows a linear relation between Modified shock index and lactate levels.

DISCUSSION:

Most hospital triage patients presenting to the Emergency department as Life threatening, possible life threatening and No urgency. But It is difficult to separate patients with possible Life-threatening Illness from those with less acute disease. The goal is to avoid potentially dangerous under-triage and to prioritize sick patients. In our study we evaluated the correlation between Modified Shock Index and Lactate levels.[7] Higher lactate levels are proven as an indicator of clinical prognosis; if Modified Shock Index was found to correlate with Lactate levels, it could be a valuable and cost-effective bed-side indicator for disease severity.

Lactate is always present in the circulation at low levels (1mmol/l). Most common cause of lactate elevation is due to tissue hypoxia and hypoperfusion. A current evidence based practise in emergency medicine and Intensive care is to use lactate level in the initial assessment of acutely ill or injured patient. Initial or serial lactate levels have been used to predict mortality in ED patients as well as shock of any cause. Khosravani et al reported that a Lactate Level higher than 2mmol/l was a significant independent predictor of mortality (18), so lactate is used as a standard and correlated with MSI, so that MSI can be validated for using as a bedside clinical assessment tool for identifying subclinical hemodynamic instability and assessing degree of shock and triaging the patients.[8,9]

Calculation of Shock Index had earlier been used for the same purpose. However, it uses only systolic blood pressure and heart rate. Diastolic blood pressure is an important component in critically ill patients as it may decrease much earlier than the systolic blood pressure. Mean arterial pressure (MAP) is calculated by using both the systolic blood pressure (SBP) and diastolic blood pressure (DBP)- MAP=[(DBPx2) +SBP]/3. Hence, the Modified Shock Index was formulated by incorporating Mean Arterial Blood pressure into the formula.[10]

"Modified Shock Index (MSI) = Heart Rate (HR) / Mean Arterial Pressure (MAP)"

MSI indicates stroke volume and systemic vascular resistance. High MSI denotes a value of stroke volume and low systemic vascular resistance which is a sign of hypodynamic circulation. So MSI can be a valuable tool in predicting the disease severity.

CONCLUSION:

- MSI has moderate correlation with serum lactate levels

REFERENCES:

1. Iserson KV, Moskop JC. "Triage in medicine, part I: Concept, history, and types". Annals of Emergency Medicine. 2006: 49 (3): 275–81
2. Rady MY, Smithline HA, Blake H, Nowak R, Rivers E. Comparison of the shock index and conventional vital signs to identify acute, critical illness in the emergency department. Ann Emerg Med. 1994;24:685–690
3. Talmor D, Jones AE, Rubinson L, Howell MD, Shapiro NI. Simple triage scoring system predicting death and the need for critical care resources for use during epidemics. Crit Care Med. 2007;35:1251–1256
4. Liu YC, Liu JH, Fang ZA, Guang-liang S, Jun X, Zhi-wei Qi, et al. Modified shock index and mortality rate of emergency patients. World J Emerg Med. 2012;3:114–7
5. Bakker J, Nijsten MW, Jansen TC. Clinical use of lactate monitoring in critically ill patients. Ann Intensive Care. 2013 May 10;3(1):12
6. Iain Robertson-Steel. Evolution of triage. Emerg Med J. 2006;23:154–155
7. Moskop JC, Iserson KV: Triage in medicine, part II: Underlying values and principles. Ann Emerg Med. 2007, 49 (3): 282-7. 10.1016
8. Storrow AB, Lindsell CJ, Collins SP, Fermann GJ, Blomkalns AL, Williams JM, Goldsmith B, Gibler WB. Emergency department multimarker point-of-care testing reduces time to cardiac marker results without loss of diagnostic accuracy. Point Care.2006;5:132–136
9. Storrow A, Lyon JL, Porter M. A systematic review of emergency department point- of-care cardiac markers and efficiency measures. Point Care. 2009;8:121–125
10. Clinical use of lactate monitoring in critically ill patients ,Jan Bakker, Maarten WN Nijsten, and Tim C Jansen, Ann Intensive Care. 2013; 3: 12 .Published online 2013 May 10.