Original Research Article

Evaluation of modified shock index and mortality rate of patients at Emergency Department of tertiary care hospital in Tamil Nadu

T. Bhuvanenswari[1*], B. Devaraj[2]

[1]Associate Professor, Department of Physiology, Saveetha Medical College and Hospital, Saveetha University, Thandalam Chennai, Tamil Nadu, India
[2]Assistant Professor, Department of Emergency Medicine, Saveetha Medical College and Hospital, Saveetha University, Thandalam, Chennai, Tamil Nadu, India
[*]Corresponding author email: **drbhuvanarajah@gmail.com**

International Archives of Integrated Medicine, Vol. 4, Issue 11, November, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 17-10-2017 **Accepted on:** 24-10-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: T. Bhuvanenswari, B. Devaraj. Evaluation of modified shock index and mortality rate of patients at Emergency Department of tertiary care hospital in Tamil Nadu. IAIM, 2017; 4(11): 47-51.

Abstract

Introduction: A number of systems or alerts are implemented in the ED to identify and bring resources to patients with traumatic injuries, ST-elevation myocardial infarctions, or acute strokes, but there is currently no system that we are aware of directed toward vital sign abnormalities. Rapid response teams (RRT) or medical emergency teams were created in many in-hospital settings as an effective mechanism to get physicians and nurses to the bedside of patients with acute changes in clinical stability. They were based on physiological criteria as well as a change in clinical status.
The aim of the study: To determine whether modified shock index (MSI) is associated with mortality that is superior to heart rate, blood pressure, or the shock index (SI) in emergency patients.
Materials and methods: The study was conducted on 80 patients who presented to Saveetha Institute of Medical Science and Hospital, Emergency Department from March to August 2017. We gathered data of the patients on age, gender, vital signs, levels of consciousness, presenting complaints, and SI and MSI were calculated for all patients.
Results: After adjustments for differences in the other vital signs, comorbidities, gender and age the following vital signs were independently associated with1-day mortality: oxygen saturation, systolic blood pressure, temperature, level of consciousness, respiratory rate, pulse rate, and age. The highest odds ratios were observed when comparing unresponsive to alert patients (OR 31.0, CI 16.9 to 56.8),

patients ≥ 80 years to <50 years (OR 35.9, CI 10.7 to 120.2) and patients with respiratory rates <8/min to 8–25/min (OR 18.1, CI 2.1 to 155.5).

Conclusion: MSI is a clinically significant predictor of mortality in emergency patients. It may be better than using heart rate and blood pressure alone. SI is not significantly correlated with the mortality rate of the emergency patient. MSI is an important predictor of mortality in patients presenting to the emergency department and it may be better than blood pressure and heart rate. SI is not significantly correlated with the mortality of emergency patients. When a patient with normal vital signs on the triage desk, MSI can be calculated to decide whether the condition of the patients is critical. Since this is a retrospective study, a prospective study is needed to confirm the result.

Key words

Emergency Room, Vital Signs, Oxygen Saturation, Shock Index.

Introduction

Vital signs are used every day in healthcare systems in a number of ways, for example, in the Emergency Department(ED) for diagnostics as an aid in the identification of deterioration in patients, and to identify the need for intensive care unit (ICU) transfers and as a component in the ED triage. In triage, patients are prioritized according to their medical need, which has an immediate effect on their time-to-doctor [1]. One of the main prerogatives of triage is to ensure that the sickest patient at the greatest risk of deterioration is rapidly identified. A systemic review in 2011 studied the existing evidence for the association of vital signs and presenting symptoms with mortality among patients presenting to the ED [2]. They concluded that the association between individual vital signs and mortality has rarely been studied in the ED setting and is supported by little to no evidence. Shock index (SI) or heart rate (HR) divided by systolic blood pressure (SBP) has been suggested as such a marker that can be used to predict the severity of hypovolemic shock. And it has also been used in emergency patients with sepsis and some other serious conditions [3]. In most studies, SI can be a valuable tool, raising suspicion when it is abnormal even when heart rate and blood pressure are not [4]. But patients present to the emergency department are complex, they may have. Different triage systems have been used in the emergency departments of various countries. Of these methods, the Emergency Severity Index (ESI)-which is a five-level triage system has shown promising reliability and validity. Several studies have shown a significant association between the ESI level and the outcome of the visit to the emergency department, including future admission, duration of hospital stay, resource consumption and the outcome of the disease, most importantly, mortality [5]. It has been estimated that 30-40% of those who visit the emergency department are categorized into ESI level 3. This level of triage includes those cases with less acute medical conditions needing two or more different types of resources. Patients primarily categorized into ESI level 3, will be considered for up-triage to ESI level 2 in the presence of danger zone heart rate (HR), respiratory rate (RR) and Oxygen (O2) saturation [6, 7].

Materials and methods

Selection of participants inclusion criterion was patients who visited the adult ED between January and August 2016. Exclusion criteria were: age < 18 years, deceased upon arrival to the ED, data on mortality or missing, presenting symptom registered as circulatory or respiratory arrest, and patients whose first triage priority was blue because they are usually directed to the fast track before they have their vital signs measured. 3 patients who had a respiratory rate (RR) < 5 per minute and SpO2 > 95 %, 18 patients who had a systolic blood pressure (SBP) <20 mmHg, and 47 patients who had a diastolic blood pressure (DBP) > SBP. Altogether there were 22

161 patients, who met the criteria and had nearly all kinds of situations emergency doctors may encounter. Data were collected on age, gender, vital signs on the triage desk, levels of consciousness, presenting complaints. SI and MSI were calculated and multivariate regression analysis was made.

Statistical analysis

Using the SAS software, we performed multivariate logistic regression analysis. Because SI, MSI, heart rate, and blood pressure were interrelated, we analyzed each of them respectively against other factors.

Results

All the 80 patients complained of a headache, chest pain, tachypnea, abdominal pain, altered mental status, trauma, and hemorrhage. Among these patients, 15 (4.2%) were admitted to the ICU and 3 (1.8%) died. To mimic real emergency department conditions, we collected major complaints instead of diagnosis, which cannot be obtained at the triage desk.

Out of these cases, 80 patients were including 40 (43.6%) females and 31 (56.4%) males who had been up-triaged from ESI level3 to 2 due to danger zone RR, HR or O2 saturation were enrolled in the current study. The mean ± SD age of the patients was a 39.85 ± 18.98 year ranging from 18 to 98 years (**Table – 1, 2**).

Table – 1: The emergency room variables level during the course of admission.

Emergency indication variables	**No of patients (N= 80)**
Age	39.85±18.98
Heart rate (beats/min)	83±18
Systolic blood pressure (mmHg)	128±26
Diastolic blood pressure (mmHg	73±15
Pulse oximetry (%)	98±2
Shock index	0.72±0.21
Modified shock index	1.01±0.29
Abdominal pain (%)	18.3
Chest pain (%)	14.0
Altered mental status (%)	12.38
Vomiting	8.9
Edema	9.4

Table – 2: The O2 saturation, respiratory rate, among the emergency room visiting patients.

Parameters	**No of patients (N = 80)**	**%**
RR below 20	54	50%
RR above 20	26	25%
O2 saturation above 92%	24	20%
O2 saturation below 92%	56	50%

Discussion

According to the findings of the current study, abnormal RR was the cause of up-triage from ESI level3 to 2 in 489 out of 551 cases (88.6%). Among the remaining 62 cases (11.3%), 50 (9.1%) were up-triaged due to abnormal HR [8]. The ESI level was changed from 3to 2 in only 12 cases (2.2%) due to the sole finding of abnormal O2 saturation. Considering the fact that a total number of 2179 patients were categorized as ESI level2, only 2.3% and 0.5% of cases were placed into this ESI level due to abnormal HR and O2 saturation, respectively [9]. Most importantly, out of 12 cases that were up-triaged from ESI level 3 to 2, 10 had an underlying a disorder that could explain the chronic low blood O2saturation, 1 should have been triaged into ESI level 2 in the first place, and the remaining 1 case could not be investigated further [10]. As a result, the observation of lowO2 saturation seems to be of lesser importance compared to RR and HR in determining the level of triage and may even be unnecessary in deciding the triage level of these patients. Previous studies on selected smaller patient populations have also found these large variations in the predictive value of different vital signs [11]. The comparison of the predictive value of different vital signs are based on the RETTS-A categorization and cannot be automatically generalized for use in the comparison between the predictive value of

different vital signs in general. However, this study indicates that some vital signs predictive value for mortality is clearly underestimated in RETTS, which is the most used triage system in Sweden On the other hand, triage does not solely aim to predict mortality but to prioritize the patients with the most urgent needs highest. Patients with a decreased level of consciousness or old age had the highest odds of mortality in the current study [12]. Age and level of consciousness upon admission to the ED have been identified as significant and relatively strong predictors of mortality in previous smaller studies on less comprehensive materials. In the current study, deviations in vital signs adhering to breathing - the respiratory rate and oxygen saturation resulted in higher odds of mortality than deviations in vital signs adhering to circulatory function, that is, systolic blood pressure and pulse rate [13]. A low or high respiratory rate and low oxygen saturation have been identified previously as having an independent association with mortality. Results from previous studies with respect to presenting with a low systolic blood pressure are conflicting because it has been found to be associated sometimes with mortality and other times has failed to be identified as associated with mortality [14]. A low PR and a high PR are other vital sign values that have both been identified and have failed to be identified as independently associated with mortality.MSI indicates stroke volume and systemic vascular resistance. A high MSI denotes a value of stroke volume and low systemic vascular resistance, a sign of hypo dynamic circulation. Thus the patient may be compensating and the decompensation is rapid [15]. A low MSI indicates that SI and SVR are high, and the patients in a hyperdynamic state, which can also be a sign of serious conditions. Given the limited resources and information available at triage, MSI can be a valuable tool in predicting disease severity. Our results show that in patients with an MSI greater than 1.3, there is an increased probability of ICU admission and death [16]. Based on the findings of these studies, it may be suggested to first measure RR in patients categorized in ESI level 3. If RR is normal, HR should be measured, and the assessment of O2 saturation could be delayed until the results of these two vital signs turn to be normal and maybe even unnecessary [17]. The assessment of O2saturation in those with an ESI level 3 may be omitted in the case of severe overcrowding of the emergency department. The current study had some limitations. The outcome of disease after being transferred out of emergency ward was not investigated. The investigation of long-term outcome, including the probable future need for admission to ICU, should provide a more accurate estimation regarding the value of RR measurement in the assessment of patients with ESI level 3.

Conclusion

In conclusion, MSI is an important predictor of mortality in patients presenting to the emergency department and it may be better than blood pressure and heart rate. SI is not significantly correlated with the mortality of emergency patients. When a patient with normal vital signs on the triage desk, MSI can be calculated to decide whether the condition of the patients is critical. Since this is a retrospective study, a prospective study is needed to confirm the result.

References

1. Adams JG, Biros MH. The Endangered Safety establishing a Measure of Control. Acad Emerg Med., 2001; 8: 1013-5.
2. Baumann MR, Strout TD. Triage of geriatric patients in the emergency department: validity and survival with the Emergency Severity Index. AnnEmerg Med., 2007; 49: 234–40.
3. Birkhahn RH, Gaeta TJ, Van Deusen SK, Tloczkowski J. The ability of traditional vital signs and shock index to identify ruptured ectopic pregnancy. Am J Obstet Gynecol., 2003; 189: 1293-1296.
4. Buist MD, Moore GE, Bernard SA, Waxman BP, Anderson JN, Nguyen TV. Effects of a medical emergency team on

reduction of incidence of and mortality from unexpected cardiac arrests in hospital: a preliminary study. BMJ, 2002; 324: 387–90.

5. Cannon CM, Braxton CC, Kling-Smith M, Mahnken JD, Carlton E, Moncure M. Utility of the shock index in predicting mortality in traumatically injured patients. J Trauma, 2009; 67: 1426-1430.
6. Chan PS, Jain R, Nallmothu BK, Berg RA, Sasson. Rapid response teams: a systematic review and meta-analysis. Arch Intern Med., 2010; 170: 18–26.
7. Dong SL, Bullard MJ, Meurer DP, et al. Predictive validity of a computerized emergency triage tool.cad Emerg Med., 2007; 14: 16–2.
8. Eitel DR, Travers DA, Rosenau AM, Gilboy N, Wuerz RC. The emergency severity index triage algorithm version2 is reliable and valid. Acad Emerg Med., 2003; 10: 1070-80.
9. Fernandes CM, Tanabe P, Gilboy N, et al. Five-level triage: a report from the ACEP⁄ENA Five-level Triage Task Force. J Emerg Nurs., 2005; 31: 39–50.
10. Gilboy N, Tanabe P, Travers DA, Rosenau AM, Eitel DR. Emergency Severity Index, Version 4: Implementation.
11. Goldhill D, White S, Sumner A. Physiological values and procedures in the 24 h before ICU admission from the ward. Anaesthesia, 1999; 54: 529-34.9.
12. Mehrdad Seilanian Toosi, John D. Merlino, Kenneth V, Leeper. Prognostic value of the shock index along with transthoracic echocardiography in risk stratification of patients with acute pulmonary embolism. Am J Cardiol., 2008; 101: 700-705.
13. Moldenhauer K, Sabel A, Chu ES, Mahler PS. Clinical triggers: an alternative to a rapid response team.Jt Comm J Qual Patient Saf., 2009; 35: 164–74.
14. 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.
15. 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.
16. Tanabe P, Gimbel R, Yarnold PR, Kyriacou DN, Adams JG. Reliability and validity of scores on The emergency severity Index version 3. Acad Emerg Med., 2004; 11: 59-65.
17. Travers DA, Waller AE, Bowling JM, flowers, Tintinalli J. Five-level triage system more effective than three-level in the tertiary emergency department. J Emerg Nurs., 2002; 28: 395-400.