Compilation and evaluation of clinical practice guidelines for comprehensive approaches to patients with acute chest pain in the emergency room at Al-Zahra Hospital in Isfahan

Recopilación y evaluación de las directrices de práctica clínica para enfoques integrales de pacientes con dolor torácico agudo en la sala de urgencias del Hospital Al-Zahra en Isfahán

Mehrdad Esmailian[1], Foad Safdari nejad[2]

[1]Associate Professor of Emergency Medicine, Emergency Medicine Research Center, Al-Zahra Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran; https://orcid.org/0000-0002-3510-4462   Foad Safdari nejad

[2]Resident of Emergency Medicine, Emergency Medicine Research Center, Al-Zahra Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran; https://orcid.org/0000-0001-7651-5535

*Corresponding Author: Foad Safdari nejad, Resident of Emergency Medicine, Emergency Medicine Research Center, Al-Zahra Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran. Corresponding Author EMAIL: Safdarinejad@gmail.com

Abstract

Introduction & Aim: This study aimed to develop a standard of clinical guidelines for dealing with patients with acute chest pain in the emergency department at Al-Zahra Hospital in Isfahan.

Methods: In the first phase, a comprehensive approach and guidelines for patients with unstable angina referred to the emergency department, according to experts from the heart and emergency medicine and using valid sources was developed. In the second phase, the guidelines ere evaluated in a clinical trial. In this trial, 100 patients were randomly assigned into intervention and control groups. The waiting time for the first visit, paraclinical measures, appropriate treatment; the physician's satisfaction with treatment, the patient's admission to the emergency room, number of visits and treatment outcome; the patient's satisfaction from emergency services and treatment outcome were compared between two groups.

Results: The mean of patients waiting time to receive the first visit, paraclinical measures, and appropriate treatment in the intervention group were significantly lower than the control group (P-value<0.05). The mean of physician's satisfaction score from the treatment process, patient's admission to the emergency room, number of visits and outcome of treatment in the intervention group was significantly higher than the control group (P-value<0.05). The mean patient satisfaction score from the emergency services in the intervention group was significantly higher than the control group (P-value=0.0001).

Conclusions: The developed guidelines for dealing with patients with acute chest pain in the emergency room significantly reduce the patient's waiting time in receiving care and improve the satisfaction of the physicians and the patients.

Keywords: Acute Chest Pain; Ischemic Heart Disease; Emergency Department.

Resumen

Introducción y objetivo: el objetivo de este estudio fue desarrollar una pauta clínica estándar para tratar a los pacientes con un agudo dolor en el pecho en el servicio de urgencias del Hospital Al-Zahra en Isfahán.

Métodos: en la primera fase, se desarrolló un enfoque y pautas integrales para pacientes con angina inestable que acudieron al servicio de urgencias, según expertos del corazón y medicina de emergencia y utilizando fuentes válidas. En la segunda fase, las pautas fueron evaluadas en un ensayo clínico. En este ensayo, 100 pacientes fueron evaluados aleatoriamente en grupos de intervención y control. Se compararon entre dos grupos, el tiempo de espera para la primera visita, medidas paraclínicas, tratamiento adecuado, la satisfacción del médico con el tratamiento, la admisión del paciente a la sala de emergencias, el número de visitas y el resultado del tratamiento, la satisfacción del paciente de los servicios de emergencia y el resultado del tratamiento.

Resultados: la media del tiempo de espera de los pacientes para ser recibidos por la primera visita, medidas paraclínicas y el tratamiento adecuado en el grupo de intervención fueron significativamente más bajos que en el grupo de control (valor de p <0.05). La media de la puntuación de satisfacción del paciente de los servicios de emergencia en el grupo de intervención fue significativamente mayor que el grupo de control (valor de p= 0.0001).

Conclusiones: las pautas desarrolladas para tratar a pacientes con agudo dolor torácico en la sala de emergencias reducen considerablemente el tiempo de espera del paciente para recibir atención y mejoran la satisfacción de los médicos y pacientes.

Palabras clave: dolor torácico agudo, enfermedad isquémica del corazón, servicio de urgencias.

Introduction

Cardiovascular diseases have been recognized as the leading cause of death in the world in the last decade and they are recognized as a global epidemic[1,2]. In 2016, cardiovascular diseases accounted for 17.9 million deaths, which include 31% of all deaths in the world. In 2015, the prevalence of acute chest pain and ischemic heart disease in the world is estimated to be 7.3 and 110.5 million cases, respectively[4]. In Iran, ischemic heart disease is the second leading cause of death in people between the ages of 15 and 49 years[5]. Despite rapid diagnostic and therapeutic advances, one-third of patients with heart attacks die, and two-thirds of those who survive never recover completely and do not return to normal life[1,2]. Acute chest pain is a major symptom in people with ischemic heart disease, and the patient with these symptoms should be treated as early as possible and take diagnostic and therapeutic measures as soon as possible[6]. Besides, this pain is one of the most common complaints of patients in the emergency department, so that 6% of emergency visits in the United States, England and Wales are related to acute chest pain[7,8]. The cause of chest pain is very heterogeneous and includes a wide range of conditions ranging from lethal diseases to minor problems so that among these patients, it is difficult and challenging to quickly determine if ischemic heart disease occurs[9,10].

Based on the previous studies in North America and Europe, 2% to 5.3% of patients referring to emergency with acute chest pain with the poor diagnosis have been affected by ischemic heart disease, and death rate in these patients was almost twice than that in hospitalized people[11,12]. Moreover, 60-80% of acute chest pains are not due to ischemic heart disease and 50% to 62.7% of these patients have non-heart causes that do not require diagnostic tests and prolonged observation[9,10,13]. Several guidelines have described the evaluation strategies for patients referring to emergency with chest pain to estimate the probability of diagnosing ischemic heart disease and the risk level for unwanted clinical consequences. In one of the guidelines of the National Institute for Health and Clinical Excellence concerning evaluating chest pain, no recommendation has been provided to manage the situation, as soon as it is diagnosed[14]. In another clinical guideline of this institute about unstable angina (chest pain), local executive methods were provided to manage the situation[15]. In another clinical guideline presented in London in 2010, the need to provide necessary information for patients and informing them of the decisions that will be taken was emphasized[16]. In Iran, the standard certificate of treatment services for acute chest pain was developed by Abdi et al in 2015. It defined and identified the disease and the technical specifications of services, service management, and protocol implementation in patients with acute chest pain[17]. Although tools for assessing chest pain are still being developed and updated, translation of the new methods into an effective clinical evaluation of time and resources for emergency care can be a complex problem. Also, given the limitation of the guidelines for dealing with patients with acute chest pain in an emergency in Iran and the differences in the various health care systems and characteristics in the Iranian population and those of other countries, it seems necessary to develop such a guideline. Thus, the present study was conducted with two goals of dealing with patients with acute chest pain referring to the emergency department of Alzahra hospital in Isfahan. The primary objective of this study was to prepare and develop a standard clinical guideline based on the review of other guidelines and views of the professors and cardiologists and emergency medicine specialists. The secondary goal of this study was to assess the effect of the implementation of the guidelines developed in a clinical trial.

Materials and methods

The present study was conducted in two phases after examination and approval at the Ethics Committee of Isfahan University of Medical Sciences. In the first phase of the study, to prepare and develop a clinical guideline for dealing with patients with unstable chest pain, all cases needed for proper dealing with patients with unstable chest pain referring to the emergency department were provided in writing in a guideline form in regular inter-group sessions in heart and emergency medicine departments. This guideline includes everything deemed necessary, including the ways of diagnosing a patient in the hospital triage and the way of providing necessary care and treatment and para-clinical measures. In the development of this guideline, three clinical guidelines for chronic heart failure of the UK Health National Institute (2010), Scotland Guidelines Network (2007) and the European Heart Community (2012) were used[19,17]. Accordingly, after evaluating the resources by content analysis method, the questions were designed and the considered options were extracted. The content of the options included "the factors needed for the definitive diagnosis and identification of unstable chest pain (such as typical and specific symptoms)," "helping to determine prognosis, "the accurate and complete introduction of chest pain," clinical evaluations in examining the angina pain characteristics". Finally, the options were designed after examining and analyzing the localization capability with the help of a group of cardiologists and emergency medicine specialists in the form of guidelines and the algorithm for dealing with patients with unstable chest pain referring to the emergency department. The

developed guideline includes 38 options that cover all stages of dealing with these patients in the patients' triage, the time and the way of providing services and the evaluation of physicians, therapeutic measures, and a two-month follow-up of the patient. Based on the presented guideline and algorithm (Figure 1), after referring the patient for unstable chest pain and their triage according to the ESI system, they were visited by a first-year resident and they were assigned into high-risk and low-risk groups based on the guideline and evaluation of the Heart Score. Low-risk patients are transferred to Emergency 3 and high-risk patients are transferred to Emergency 1 or Emergency 2 for follow up. In the next stage, the patients underwent troponin tests by two-year or three-year residents and low-risk patients with negative troponin were discharged and high-risk patients with negative troponin are hospitalized and cared about undergoing cardiac tests. In the case of positive troponin after transferring the patients to the CPI and performing cardiac consultation and recovery services (if required), they were transferred to adult CCU and received the care after performing cardiac stress test (Figure 1).

Figure 1. Algorithm of dealing with patients with unstable angina referred to the emergency department of Alzahra Hospital in Isfahan
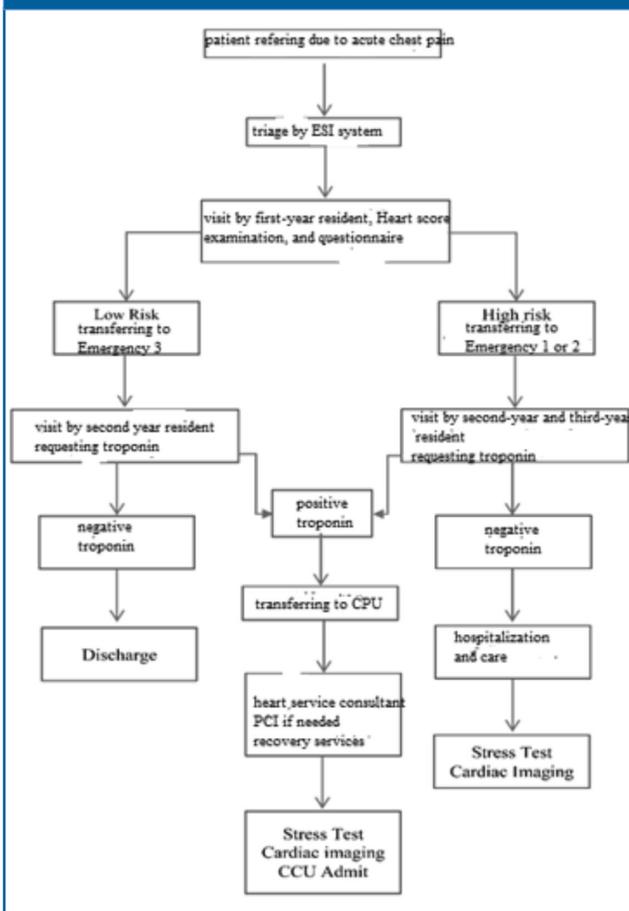
In the second phase of this study, the effect of the implementation of the developed guideline was evacuated using a clinical trial. This trial was performed on 100 patients with unstable chest pain referring to the emergency department of Alzahra Hospital in Isfahan. The inclusion criteria of the study included severe unstable chest pain with a duration of fewer than 12 hours and age higher than 25 years. The research exclusion criteria also included specific traumatic or radiological evidence associated with chest pain, transferring to other hospitals, and lack of possibility of a two-month follow up to examine the outcome of the treatment. Before the inclusion of the patients, the written consent was taken from the patient, after explaining the research objectives. The selected patients were randomly assigned to two intervention and control groups using Random Allocation software. In the intervention group, the patients were evaluated and cared according to the guideline and algorithm, while the patients in the control group were evaluated and cared according to the routine process of dealing with these patients. To evaluate the effect of the developed guidelines, patients' waiting times, physician and patient satisfaction, and outcome of the treatment were compared in two groups. Patients' waiting times included the waiting time to receive the first visit, the waiting time for paraclinical measures, and the waiting time of patients to receive appropriate treatment. Physician satisfaction included the physician's satisfaction with the treatment process, the patient's hospitalization in the emergency department, the frequency of patient's visit, and satisfaction with the outcome of the treatment, and the patient's satisfaction with the emergency services. Additionally, the outcome of the treatment was evaluated in the form of recovery, death, or patients' referring until the presence of a patient in the emergency. The collected data were analyzed using SPSS24 software. Quantitative variables were reported as mean ± standard deviation and qualitative variables were reported as frequency (%). To compare the mean of quantitative variables between two groups, the t-student test was used, and to compare the outcome of treatment between two groups, the Chi-square test was used. The significance level in all cases was considered less than 0.05.

Results

The patient inclusion and the study procedure are presented in (Figure 2). Out of 111 patients studied, 11 patients did not meet the inclusion criteria or did not have the willingness to participate in the study. One hundred patients were divided into two groups of intervention and control groups (50 patients in each group) and were followed up to discharge from the emergency department. During the follow-up period, 1 patient in the control group was excluded. Finally, the data of 50 patients in the intervention group and the data of 49 patients in the control group were analyzed.

Figure 2. Study flowchart
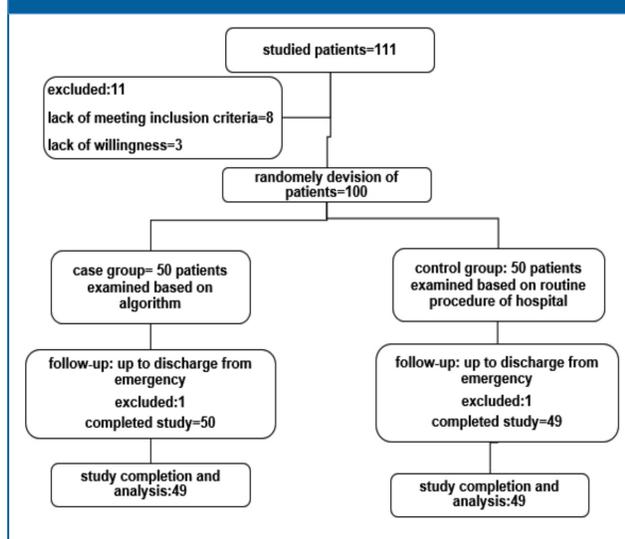
(Table 1) shows the characteristics of patients in the two groups studied. The mean age and the gender of the patients in the two groups did not differ significantly. Heartbeat rate per minute and systolic and diastolic blood pressure in the intervention group was higher than those in the control group, but the differences were not statistically significant (P- value>0.05). The heartbeat rate per minute was similar in two groups. In the intervention and control groups, 74% and 67.3% of the patients, respectively, were transferred to the emergency department by ambulance (P-value>0.05). Also, there was no significant difference between the two groups in terms of frequency of smoking, hypertension, diabetes, hyperlipidemia and history of heart disease (P-value>0.05).

Table 1. characteristics of the studied patients

	Intervention group	Control group	P-value
Age (year)	23 ± 6	25 ± 4	> 0.05
Gender			> 0.05
Male	72	37	> 0.05
Female	28	11	
Heartbeat rate per minute	70.18 ± 8.84	90.16 ± 6.81	> 0.05
Systolic blood pressure	7.19 ± 5.139	2.21 ± 3.142	> 0.05
Diastolic blood pressure	1.12 ± 2.80	5.10 ± 3.79	> 0.05
Transfer by ambulance	(74) 37	(3.67) 33	> 0.05
Tobacco use	(38) 19	(8.42) 21	> 0.05
Hypertension	(70) 35	(5.73) 36	> 0.05
diabetes	(28) 14	(5.22) 11	> 0.05
Hyperlipidemia	(34) 17	(6.32) 16	> 0.05
History of heart disease	(24) 12	(20) 9	> 0.05

Results are presented as mean ± standard deviation or frequency (%)
P-values, comparisons of variables between the two groups using independent T-test and Chi-square test

(Table 2) presents the results of comparing waiting times, physician and patient satisfaction, and outcomes of treatment in patients in the study groups. The mean waiting time for patients in the intervention group was significantly lower than that of the control group (P-value<0.05). The mean of waiting time for the first visit was 23.7 minutes in the control group and 11.6 minutes in the intervention group (P-value=0.0001). The mean waiting time for patients in the control group was 63.3 minutes and 38.9 minutes in the intervention group (P-value=0.0001). The mean score of physician and patient satisfaction in the intervention group was significantly higher than that of the control group (P-value<0.05). The mean score of the physician satisfaction with the treatment process was 4.9 out of 10 in the control group, and 7.6 out of 10 in the intervention group (P-value =0.0001). The mean score of the physician satisfaction with the patient's therapeutic outcome was 5.3 out of 10 in the control group and 8.2 out of 10 in the intervention group (P-value =0.0001). The mean score of satisfaction with emergency services was 4.3 out of 10 in the control group, and 7.9 out of 10 in the intervention group (P-value = 0.0001). The treatment outcome did not differ significantly between the two groups (P-value = 0.157). Death was seen only in one case of patients in the control group and the referral cases were 38.8% in the control group and 28% in the intervention group.

Table 2. Comparison of waiting times, physician and patient satisfaction and outcomes in studied patients

	Control group	Intervention group	P-value
Patients waiting time to receive first visit (min)	5.9 ± 7.23	6.5 ± 6.11	0.0001
Patients waiting time for paraclinical measures (min)	6.13 ± 5.37	3.10 ± 3.31	0.012
Patient waiting time to receive appropriate treatment (min)	4.21 ± 3.63	5.16 ± 9.38	0.0001
Physician's satisfaction with the treatment process	6.2 ± 9.4	8.1 ± 6.7	0.0001
Physician satisfaction with hospitalization time in the emergency	3..2 ± 5.5	6.2 ± 1.8	0.0001
Physician satisfaction with the frequency of patient visit	5.1 ± 0.5	9.1 ± 4.8	0.0001
Physician satisfaction with treatment outcome of patient	2.2 ± 3.5	8.1 ± 2.8	0.0001
Patient satisfaction with emergency services	4/3 ± 3/4	6/2 ± 9/7	0.0001
Treatment outcome			
Recovery	(2.59) 29	(72) 36	
death	(2) 1	0	0.157
referral	(8.38) 19	(28) 14	

Results are presented as mean ± standard deviation or frequency (%)
P-values, comparisons of variables between the two groups using independent T-test and Chi-square test

n the present study, a guideline and algorithm were designed to deal with patients with unstable angina who referred to the emergency department according to the view of experts and by using valid sources and its impact on the implementation was evaluated in a clinical trial. The results of the study showed that the developed guideline had a positive effect on reducing patient waiting times and patient and physician satisfaction. The mean waiting time for patients to receive the first visit decreased almost by 50% and the mean waiting time for patients to receive paraclinical measures and appropriate treatment decreased significantly. Moreover, the implementation of the guideline significantly improved the physician's satisfaction with the treatment process, the outcome of the treatment, the time of hospitalization in an emergency, and the frequency of the patient visit and the patient satisfaction with the emergency services.

The results of the study show that by implementing the guideline and algorithm designed in this study, it is possible to identify the high-risk patients and by differentiation of these patients, it is possible to take effective steps in performing the diagnostic and therapeutic measures in these patients. By additional taking the unnecessary measures at low-risk patients, and as a result, timely discharge of patients, it is also possible to reduce the hospital costs. In recent years, the development of diagnosis accelerating protocols in patients with acute chest pain has been studied[20,21]. Several studies have shown that the use of diagnosis accelerating protocols in patients with emergency acute chest pain has led to the identification of low-risk patients. In addition to speeding up the discharge process of patients, it has prevented unnecessary diagnostic and therapeutic measures[22,23]. In an observational study, then et al investigated and followed-up 3582 patients with acute chest pain. They showed that based on the diagnosis accelerating protocols, 10% of patients were at low risk of ischemic heart disease and were discharged from the hospital sooner and during a one-month follow up of these patients, only 1% of them were seriously affected[22]. The results of a clinical trial showed that the use of the diagnosis accelerating protocol reduced the duration of hospitalization of patients with acute chest pain through the identification of low-risk patients[20]. In the study conducted by Baugh et al., the results of implementing the clinical evaluation and management protocol standardized based on Heart Score in dealing with patients with acute chest pain in the emergency department showed that the length of hospitalization in low-risk patients was significantly lower than that of high-risk patients[23]. The results of the studies are similar to the results of this study. These results show the positive effect of guidelines and algorithms in an emergency in dealing with patients with acute chest pain. As most of the referrals to the emergen-

cy of the hospitals are due to acute chest pain, the implementation of such guidelines can reduce the congestion of patients in emergency rooms, reduce the hospital costs, and reduce the need for unnecessary diagnostic tests[30]. In the development of guidelines and algorithms designed in the present study, the Heart Score and troponin test are important indicators used in the diagnosis of low-risk and high-risk patients and their follow-up and care. The Heart Score indicator was designed almost ten years ago in Europe to help physicians for quick diagnosis of acute and non-cardiac chest pain in the emergency department. It prevented unnecessary cardiac tests by identifying the low-risk patients[24].

Conclusions

t has been shown that this indicator can reduce up to 50% of unnecessary cardiac stress tests or cardiac imaging, leading to the reduced economic burden of health[25]. Besides, the results of the studies have shown that troponin test in patients with acute chest pain increases the accuracy of the diagnosis of ischemic diseases in comparison with other conventional tests and it is useful in identifying low-risk patients, and consequently, faster discharge of them[26-28]. Thus, the results derived from the clinical trial section of the study suggest that the guideline and algorithm designed in this study have improved the performance of the medical staff and it can be implemented, focusing on important issues in dealing with these patients in the emergency room. However, further studies in applying this guideline and examining its outcomes in other hospitals can lead to the routine implementation of the guideline in all emergencies of the country. One limitation of this study was the lack of follow-up of patients after discharge from the emergency. Given the importance of follow-up of the patient after discharge from the hospital, is necessary that the patients be followed-up in further studies to evaluate the long-term outcomes of the guidelines. The second limitation of the study was the low number of samples made it impossible to analyze information based on the inclusion of patients at low risk or high-risk groups. The third limitation of the present study is conducting a study in one hospital (emergency department at Alzahra Hospital) and as this hospital is a general hospital and as large percentage of patients has been transferred by ambulance, there is a possibility that these patients to be different from the patients with acute chest pain transmitted to a specialized heart hospital. Therefore, it is recommended that further studies be carried out on a larger sample to examine this guideline. In general, the results of the present study show that the guideline and algorithm for dealing with patients with acute chest pain in an emergency in this study significantly reduced the patient waiting time in receiving care and

www.revhipertension.com

Revista Latinoamericana de Hipertensión. Vol. 14 - N° 4, 2019

improved patient and physician satisfaction. Therefore, further studies are required to confirm the results of our study so that this guideline can be used comprehensively manner in all of the emergency departments of the hospitals in Iran.

References

1. Patrick T. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, et al; 2013ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines 2013. J Am Coll Cardiol. 2013;61(4):e78-e140.

2. Tamis-Holland JE1, O'Gara P. Highlights from the 2013 ACCF/AHA Guidelines for the Management of ST-Elevation Myocardial Infarction and Beyond. Clin Cardiol. 2014; 37(4):252-9.

3. Roth A, Johnson C, Abajobir A, Abd-Allah F, et al. Global, Regional, and National Burden of Cardiovascular Diseases for 10 Causes, 1990 to 2015. Journal of the American College of Cardiology. 2017;70(1):26-28.

4. Forouzanfar MH, Sepanlou SG, Shahraz S, BESc PN, Pourmalek F, Lozano R, et al. Evaluating causes of death and morbidity in Iran, global burden of diseases, injuries, and risk factors study 2010. Archives of Iranian medicine. 2014;17(5):304.

5. Miltenburg VZ, Addy JM. "Incidence and follow-up of Braunwald subgroups in unstable angina pectoris." Journal of the American College of Cardiology. 1995;25(6):1286-1292.

6. Bulgakov, A. V., Babieva, N. S., Levanova, E. A., Gridyaeva, L. N., Erofeeva, M. A., Sokolovskaya, I. E., & Davidyan, L. Y. (2018). Specific features of psycho-emotional states of working women during pregnancy. Electronic Journal of General Medicine, 15(6).

7. Goodacre S, Cross E, Arnold J, et al. The health care burden of acute chest pain. Heart. 2005;91:229–30.

8. Roffi M, Patrono C, Collet JP, et al. ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;2014:e139–228. Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J 2015;2016:267–315.

9. Amsterdam EA, Wenger NK, Brindis RG, Casey DE, Ganiats TG, Holmes DR, Jaffe AS, Jneid H, Kelly RF, Kontos MC, Levine GN. 2014 AHA/ACC guideline for the management of patients with non–ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology. 2014 Dec 23;64(24):e139-228.

10. Pope JH, Aufderheide TP, Ruthazer R, Woolard RH, Feldman JA, Beshansky JR, Griffith JL, Selker HP. Missed diagnoses of acute cardiac ischemia in the emergency department. New England Journal of Medicine. 2000 Apr 20;342(16):1163-70.

11. Montassier E, Batard E, Gueffet JP, et al. Outcome of chest pain patients discharged from a French emergency department: a 60-day prospective study. J Emerg Med. 2012;42:341–4.

12. Chew DP, Scott IA, Cullen L, et al. National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand:Australian Clinical Guidelines for the Management of Acute Coronary Syndromes 2016. Heart Lung Circ. 2016;25:895–951.

13. National Institute for Health and Clinical Excellence. Chest pain of recent onset: assessment and diagnosis of recent onset chest pain or discomfort of suspected cardiac origin. Clinical guideline CG95. London: NICE, 2010. http://guidance.nice.org.uk/CG95 (accessed 18 Jun 2010).

14. National Institute forHealth and Clinical Excellence.Unstable angina and NSTEMI: the earlymanagement of unstable angina and non-STsegment- elevationmyocardial infarction. Clinical guideline CG94. London: NICE, 2010. http://guidance.nice.org.uk/CG94 (accessed 18 Jun 2010).

15. Liam Smeeth, Jane S Skinner, John Ashcroft, Harry Hemingway and Adam Timmis. NICE clinical guideline: chest pain of recent onset, British Journal of General Practice, 2010.

16. Abdi, S, Salari Far, A, Firouzi, A, Saedi, T. Standard Certificate of Heart Failure of Management Services, Specialized Workshop of the Scientific Committee on Acute Chest Pain, 2015

17. Chronic heart failure National clinical guideline for diagnosis and management in primary and secondary care, National Institute for Health and Clinical Excellence, 2010.

18. Management of chronic heart failure Scottish Intercollegiate Guidelines Network, 2007.

19. ESC Guidelines for the diagnosis and treatment of acute and chronic heart Failure European Society of Cardiology, 2012

20. Than M, Aldous S, Lord S, Goodacre S, Frampton M.A, Troughton R, et al. A 2-Hour Diagnostic Protocol for Possible Cardiac Chest Pain in the Emergency Department A Randomized Clinical Trial. JAMA Internal Medicine Published. 2013:e1-8.

21. Goodacre SW, Bradburn M, Cross E, et al. The Randomised Assessment of Treatment using Panel Assay of Cardiac Markers (RATPAC) trial: a randomised controlled trial of point-of-care cardiac markers in the emergency department. Heart. 2011;97: 190–96.

22. Than M, Cullen L, Reid M, Lim S, Aldous S, Ardagh W, et al. A 2-h diagnostic protocol to assess patients with chest pain symptoms in the Asia-Pacifi c region (ASPECT): a prospective observational validation study. Lancet 2011; 77:1077–84.

23. Baugh CW, Greenberg J, Mahler S, Kosowsky J, et al. Implementation of a Risk Stratification and Management Pathway for Acute Chest Pain in the Emergency Department. Crit Pathw Cardiol. 2016; 15(4):131–137.

24. Poldervaart JM, Reitsma JB, Six J, et al. Using the HEART score in patients with chest pain in the emergency department. Ann Intern Med. 2017;167:688.

25. Dai S, Huang B, Zou Y, Guo J, et al. The HEART score is useful to predict cardiovascular risks and reduces unnecessary cardiac imaging in low-risk patients with acute chest pain. Medicine. 2018;97(22):1-5.

26. Thygesen K, Mair J, Giannitsis E, Mueller C, Lindahl B, Blankenberg S, et al. How to use high-sensitivity cardiac troponins in acute cardiac care. Eur Heart J. 2012;33:2252–2257.

27. Mueller C. Biomarkers and acute coronary syndromes: an update. Eur Heart J. 2014;35:552–556.

28. Haaf P, Drexler B, Reichlin T, Twerenbold R, Reiter M, Meissner J, et al. Highsensitivity cardiac troponin in the distinction of acute myocardial infarction from acute cardiac noncoronary artery disease. Circulation. 2012;126:31–40.

29. Sudharson T, Karthikeyan KJ, Mahender G, Mestri SC, Singh MB. Assessment of Standards in Issuing Cause of Death Certificate before and after Educational Intervention. Indian Journal of Forensic Medicine & Toxicology. 2019;13(3):25-8.

30. Venkateswarrao S. A Retrospective Study of Snake Bites in Tirupati Region. Indian Journal of Forensic Medicine & Toxicology. 2019;13(3):29-33.