CECIDOC Study

Combination of ECG and Cardiovascular risk factors could Increase Diagnostic performance Of Chest pain triage at ED

Study Protocol and Statistical Analysis Plan
04-09-2019

Gregoire C., Casarin C., Pirot A.S., Van Der Haert L., Vanden Berghe P., Penaloza A., Castanares-Zapatero D., Dechamps M..

Université Catholique de Louvain

St Luc University Hospital

PI : Melanie Dechamps

melanie.dechamps@uclouvain.be

Background

Acute chest pain triage in the Emergency Department (ED) may prove challenging, since similar symptoms can reveal both mild or life-threatening disorders, and the clinical presentation itself is known not to be reliable for evaluating the risk of acute coronary syndrome (ACS)[1,2].

The first priority in patients with suspected ACS is to identify those with ST-elevation myocardial infarction (STEMI), since these patients require urgent reperfusion therapy. Both European and American cardiology guidelines recommend implementation of a 12-lead electrocardiogram (ECG) within 10 min of arrival in the ED[3,4].

In contrast, in the absence of electrocardiographic changes consistent with ischemia, the ACS rate is low (1–8% depending on the number of risk factors)[3], and ACS are associated with lower in-hospital mortality [4,5,6].

Emergency Department (ED) triage systems for acute chest pain are either based on clinical features or on a 12-lead ECG. A recent study showed the systems having a similar diagnostic performance but different characteristics since clinical-based triage had a higher sensitivity and ECG-based triage had a higher specificity[7]. The lack of sensitivity of ECG based triage was explained by the fact that patients with a normal or non-ischemic ECG were assigned to a low-acuity triage score, defined as inadequate (false negative) for ACS patients. Conversely, the lack of specificity of clinical based triage was due to a large number of patients with benign pathology assigned to a high-acuity triage score to perform a 12-lead ECG within the 10 minutes after the first medical contact as required.

We therefore hypothesized that combination of 12-lead ECG and cardiovascular risk factor could increase the sensitivity of ECG based triage for chest pain patients with a normal or non-ischemic ECG.

Methods

Selection of participants

All consecutive patients above 18 years of age, presenting at ED with acute non-traumatic chest pain as main complaint will be systematically included in the study.

Study design

We plan a prospective, single-center, observational study in a teaching hospital in Brussels, Belgium.

Triage of chest pain patients will be performed using the “French Emergency Nurses Classification version 2” (FRENCH) triage system[8], which is currently used in our ED. FRENCH score is a 5-levels triage system classifying patients from category 1 corresponding to the “immediately life-threatening condition” to category 5 corresponding to the “less or non-urgent situations”. Maximum authorized waiting period before first medical assessment according to severity category are respectively: immediate response, 20 minutes, 60 minutes, 120 minutes and undefined. Initial triage of chest pain

patients is based on vital signs, than if normal patients with a normal or unmodified ECG are sorted into category 3, those with an abnormal ECG without evidence of ischemia are classified into category 2, while those with ECG showing signs of ischemia (ST elevation, ST depression, new onset of a left bundle branch block, or T-wave inversions) are classified into category 1. Patients with lateral chest pain of a probable musculoskeletal nature are sorted into category 4 without performing an ECG.

The FRENCH triage (ECG-based triage) will be compared to a modified FRENCH triage system (ECG Score- based triage) upgrading high-risk patients with a normal ECG from category 3 to category 2. We defined high-risk patients as patients having a Systemic Coronary Risk Estimation (SCORE) above 10 % according with the 2016 European Guidelines on cardiovascular disease prevention in clinical practice[9]. To facilitate calculation of the SCORE at triage, we defined one major or four minor criteria required to upgrade the patients.

The major criteria are:

1. History of Cardio-vascular disease
    a. acute coronary syndrome
    b. stroke or IAT.
    c. aterial revascularization procedure of peripheral artery.
2. Diabetes
3. End-stage renal disease or dialysis

The minor criteria are:

1. Man
2. Above 60 years of age
3. Hypertension
4. Smoker
5. Dyslipidemia

The above criteria will be collected by the triage nurse using a computerized form designed for the study. On this basis, the computer will additionally sort the patients using our modified triage scale, with blinded result avoiding bias in the initial nurse triage. This modified triage will therefore not be taken into account and management of the patients will not be modified.

Medical data will also be collected by physicians using a dedicated computerized form, particularly cardiovascular risks factors and complications occurring during the ED stay (arrhythmia, heart failure, shock).

The final diagnosis will be determined at the end of a 30-day follow-up, by either reviewing patient's files or a phone call to patients or relatives. ECG interpretation and diagnosis of acute myocardial infarction will be based on the universal definition of myocardial infarction[10]. Pulmonary embolism and aortic dissection will be substantiated by computed tomography (CT), chest infection by relevant positive biomarkers and a chest X-ray, gastroesophageal reflux by gastroscopy or positive therapeutic test with a proton pump inhibitor, and abdominal pathology by biology, imaging, or both. Musculoskeletal pain will be diagnosed if all of the above-mentioned investigations are normal, and movement and palpation enhanced superficial pain. Finally, patients with a normal physical

examination, ECG, chest X-ray, and blood tests who did not report any event during the 30-day follow-up, and who therefore have no definite cause for their chest pain, will be sorted into a dedicated group called 'unclear diagnosis'.

The local hospital ethics committee approved the study protocol (CEHF 2017/18AOU/407), and patients will provide their written informed consent to participate in this study.

Statistical methods

To evaluate triage system's diagnostic performance, we will compare the triage score of patients with ACS (final diagnosis of STEMI, non-ST-elevation myocardial infarction [NSTEMI] or unstable angina [UA]) to a control group made up of patients with chest pain from mild severity diseases (including digestive diseases, chronic obstructive pulmonary disease (COPD) exacerbation, musculoskeletal chest pain, and all unclear diagnoses without any medical event in the follow-up period). Patients with other severe diseases, abnormal heart rate, abnormal blood pressure, respiratory distress, or hypoxemia will be excluded from the control group having a triage score driven by these conditions rather than by the ECG.

Since for ACS most of the arrhythmic events occur within 12 h of symptom onset[11,12] and ACS patients should be monitored[13], we defined for ACS a triage Score of 1 or 2 (high-acuity triage score) as adequate (true positive), and a triage Score of 3, 4, or 5 (low-acuity triage score) as inadequate (false negative). Conversely, for the control group with mild severity diseases, we defined a triage Score of 1 or 2 (high-acuity triage score) as inadequate (false positive), and a triage Score of 3, 4 or 5 (low-acuity triage score) as adequate (true negative). Receiver operating characteristic (ROC) curves will be generated to assess each triage system's accuracy in classifying a patient in ACS versus control group.

Capability of triage nurses to collect cardiovascular risk factors will be assessed comparing data collected at triage to these collected by the physician in the medical computerized file.

Sample Size

Based on our previous study (7), FRENCH score AUC under the ROC curve was 0.69. We hypothesized a correlation of 0.9 between the two tests. To show a difference of 0.06 between the AUC of the tests with a power of 0.8 (alpha 0.05) we calculated a sampled size of 233 patients. Given the uncertainty of the correlation, we planned to enrol 500 patients.

References

[1] Ramsay G, Podogrodzka M, McClure C et al (2007) Risk prediction in patients presenting with suspected cardiac pain: the GRACE and TIMI scores versus clinical evaluation. QJM 100:11–18

[2] Body R, Carley S, Wibberley C et al (2010) The value of symptoms and signs in the emergent diagnosis of acute coronary syndromes. Resuscitation 81:281–286

[3] Lee Thomas H, Goldman Lee (2000) Evaluation of the patient with acute chest pain. NEJM 342:1187–1195

[4] Cannon CP, McCabe CH, Stone PH et al (1997) The electrocardiogram predicts one-year outcome of patients with unstable angina
and non–Q wave myocardial infarction: results of the TIMI III Registry ECG Ancillary Study. J Am Coll Cardiol 30:133–140

[5] Kaul Padma, Yuling Fu, Chang Wei-Ching et al (2001) Prognostic value of ST segment depression in acute coronary syndromes:
insights from PARAGON-A applied to GUSTO-IIb1. J Am Coll Cardiol 38:64–71

[6] Barrabe´s JA, Figueras J, Moure C et al (2000) Prognostic significance of ST segment depression in lateral leads I, aVL, V5 and V6 on the admission electrocardiogram in patients with a first acute myocardial infarction without ST segment elevation. JACC
35(7):1813–1819

[7] Melanie Dechamps, Diego Castanares-Zapatero,Patrick Vanden Berghe,,Philippe Meert, Alessandro Manara1 (2016) Comparison of clinical-based and ECG-based triage of acute chest pain in the Emergency Department. Intern Emerg Med DOI 10.1007/s11739-016-1558-8

[8] Taboulet P, Moreira V, Haas L et al (2009) Triage with the French emergency nurses classification in hospital scale: reliability
and validity. Eur J Emerg Med 16(2):61–67

[9] Massimo F. Piepoli (Italy),ArnoW. Hoes and all. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. *European Heart Journal*, Volume 37, Issue 29, 1 August 2016, Pages 2315–2381

[10] Thygesen K, Alpert JS, Jaffe AS et al (2012) Third universal definition of myocardial infarction. Circulation 126:2020

[11] Rahimi K Incidence, time course, and predictors of early malignant ventricular arrhythmias after non-ST-segment elevation myocardial infarction in patients with early invasive treatment. Eur Heart J 2006

[12] Piccini JPSustained ventricular tachycardia and ventricular fibrillation complicating non-ST-segment-elevation acute coronary syndromes. Circulation 2012

[13] Marco Roffi, Carlo Patrono and all ; 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation (ESC), *European Heart Journal*, Volume 37, Issue 3, 14 January 2016, Pages 267–315.