REVIEW ARTICLE

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Evolution of mortality rates in ST elevation myocardial infarction

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Abstract: *The purpose of this paper is to provide information about mortality rate in patients undergoing primary angioplasty for STEMI. Cardiovascular diseases lead to one third of the deaths worldwide, surpassing the mortality rate produced by neoplasia, acute respiratory failure and diabetes mellitus all together. In the world, approximately 17 million die annually because of cardiovascular disease and every 5 seconds one is suffering from a myocardial infarction.*
In 2010, in our country was implemented a national program (RO-STEMI) to offer rapid interventional treatment for patients with STEMI, aligned to ESC Guidelines. At the beginning only small parts of the patients were transferred to the hospital in charge for STEMI, so, we chose to study patients from the second year of the program and from last year. We made a retrospective study, including patients with STEMI that reached our hospital for primary angioplasty in the first 12h after the debut of the symptoms, aiming to make a parallel between the in-hospital mortality rates at maximum one month after the primary PCI. In order to be included, the patients must present ST elevation and another 1 out of 3 criteria (clinical, echocardiographic and biological changes suggestive for myocardial infarction).
The main target was to evaluate the evolution of early mortality rates post primary PCI after the changes in the ESC Guidelines and the progresses in the medical field. A secondary target was to correlate mortality rates with the presence of comorbidities or risk factors.

INTRODUCTION

Alexander Muirhead is reported to have attached wires to a feverish patient's wrist to obtain a record of the patient's heartbeat in 1872 at St Bartholomew's Hospital.[1]

Another early pioneer was Augustus Waller, of St Mary's Hospital in London.[2] His electrocardiograph machine consisted of a Lippmann capillary electrometer fixed to a projector. The trace from the heartbeat was projected onto a photographic plate that was itself fixed to a toy train. This allowed a heartbeat to be recorded in real time.

An initial breakthrough came when Willem Einthoven, working in Leiden, the Netherlands, used the string galvanometer (the first practical electrocardiograph) he invented in 1901.[2]

This device was much more sensitive than both the capillary electrometer Waller used and the string Galvanometer that had been invented separately in 1897 by the French engineer Clément Ader.[3]

Einthoven had previously, in

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1895, assigned the letters P, Q, R, S, and T to the deflections in the theoretical waveform he created using equations which corrected the actual waveform obtained by the capillary electrometer to compensate for the imprecision of that instrument. Einthoven also described the electrocardiographic features of a number of cardiovascular disorders. In 1924, he was awarded the Nobel Prize in Medicine for his discovery.[3] In 1937, Taro Takemi invented the first portable electrocardiograph machine.[4]

Cardiovascular diseases represent the main cause of death worldwide, 30% of them being caused by coronary artery disease. Myocardial infarction (MI) is one of the five main manifestations of coronary heart disease, namely stable angina pectoris, unstable angina pectoris, MI, heart failure and sudden death.[5]

Myocardial Infarction (MI) is defined by myocardial cell necrosis due to significant and sustained ischemia. Most frequently it is an acute manifestation of atherosclerosis-related coronary heart disease. MI results from either coronary heart disease, which implies obstruction to blood flow due to plaques in the coronary arteries or, much less frequently, to other obstructing mechanisms (e.g. embolism, spasm of plaque-free arteries).[6]

The clinical presentation of MI varies from a minor coronary event to life-threatening clinical situations or sudden death.[2] The criteria for STEMI are well known – specific, prolonged >15-20 min pain, specific site, and it is not ameliorated by nitroglycerin intake. The ECG shows persistent ST elevation or new onset of LBBB. Specific biomarkers are represented by high-sensitive Troponin I, CK/CK-MB, which have a specific dynamic curve.[7]

In 2010 in our country debutantes a national program named ”RO-STEMI”. In this program all patients with STEMI, from a well-defined area, are send to a certain hospital for being coronarographic evaluated. Due to this program more than 63% of patients’ beneficiated of myocardial reperfusion and the mortality rate dropped all over the country from 13 to 7%.[8]

MATERIALS AND METHODS

It’s been realized a retrospective study in STEMI patients in our hospital, on all patients from 2012 and 2016. All the patients included in this study respected STEMI criteria for diagnosis. We took 252 patients from 2012, out of which 29% were women and 71% were men, and 136 from 2016, with a non-significant difference in gender balance (28% women and 72% men). The number of patients is smaller in 2016 than in 2012 because in the beginnings of the national program there were only a small number of hospitals being part of it. In present the number of STEMI hospitals has increased so STEMI patients are distribute to more STEMI centers than during the past years.

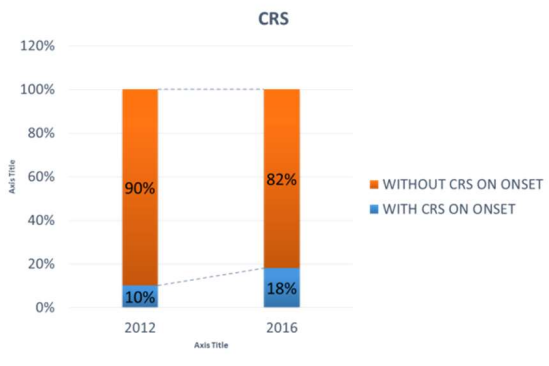
RESULTS

During this period of time, the median age of suffering an infarction was 60 years for men, with no significant difference between years, but for women the age evolved, so now, usually women suffer a myocardial infarction at about 63, compared with 66 years old in 2012.

The onset can be seen as a predictor for evolution and a gravity factor for STEMY patients.

A cardiorespiratory stop onset represents a high gravity risk factor. We noticed that in 2016 were twice more patients, than 2012, with cardiorespiratory stop on onset of STEMI. Knowing that, it is expected that the mortality rate being higher in 2016 that 2012.

Figure 1 Distribution of patients by cardiorespiratory stop onset.



The distribution of modifiable risk factors is the same for the 2 groups, the change consists of the number of risk factors present at the same patient, which was

definitely higher last year (in average 2 risk factors per patient in 2012 vs. average 3.5 risk factors/patient in 2016). Even if we strongly advise the patients to quit smoking, and there is also a huge implication of the government in this, the number of smokers increased, but the good news is that their mortality has a decreasing trend over the years.

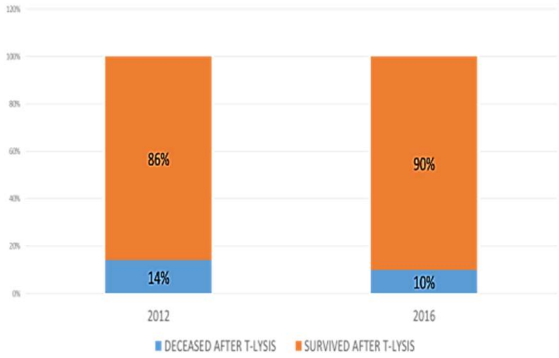
The median time from pain to cath-lab has lowered from 12h in 2012 to 9h in 2016. This improvement could be in one side due to well function of RO-STEMI program, and in other side due to improvement in social health education, the patients being better informed about myocardial infarction symptom-tology which decrease pain-call time.

If we take a look to the coronary lesions, we can see that first affected artery is left anterior descending artery (LAD), followed by right coronary artery (RCA), circumflex artery and marginal artery.

A very important observation is the growth of the number of patients with right coronary artery involvement, with can be associated with right ventricle infractions and an extremely poor prognosis. Also right coronary artery involvement means a higher risk of malignant arrhythmias and sudden cardiac death. 45% of STEMI patients had only one affected vessel, 40% had 2 affected vessels and only 15% had three coronary arteries affected most of them with CABG indication.

Only 15% of the patients in 2012 were thrombolysed before PCI, while in 2016 the use of t-lyse increase to more than 30% of the patients, this measure helps physicians to buy time for them to reach the cath lab.

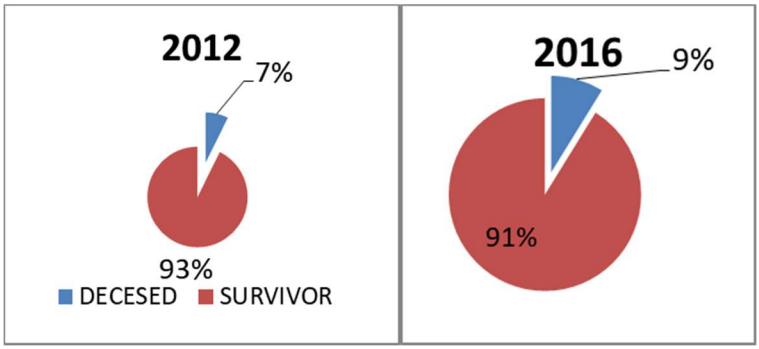
Figure 2 Rate of deceased after thrombolysis



From the number of those thrombolised, only a small amount has died, but none because of a bleeding. All died because of malignant arrhythmias or asystolia secondary to the myocardial infarction. Notice that in 2016, even though the number of thrombolised patients was bigger than in 2012, the rate of deceased patients after thrombolysis was smaller in 2016 than in 2012. The reason for this difference could be a better triage of elected patients and the evolution of thrombolytic agents.

At the beginning, drug eluded stents were extremely rare and expensive, nowadays we use much more frequently DES then bare metal stents, in 2016 73% of used stents were DES and the target is using only DES, as the indication in ESC guideline.[7] This made the rate of early in stent restenosis to go from almost 20% to 0%.

Figure 3 Mortality rate in the two groups of patients



Due to the shortening of the time from symptoms-onset to revascularization and from associating more frequently thrombolysis with PCI, the number of those with ventricular dysfunction has dropped significantly.

Even though the number of thrombolysis raised, and the time to cath lab is shorter, the number of patients who didn`t make it to the cath lab is increasing, the mortality rate has increased from 2012 to 2016. If we consider that the rate of cardiorespiratory stop as onset as a high gravity factor and if we see that the patients in 2016 were more complex than in 2012, then the high mortality rate is expected. Another factor suggests that the gravity of cases was higher in 2016 is that the number of deceased patients without reperfusion was higher in 2016.

CONCLUSIONS

The National Program RO-STEMI became more effective by increasing the number of involved hospitals.

During time the mortality rate have had a slightly increasing trend due to a growth of the number of risk factors/patient, an increase in the severity of the coronary lesions, an increase in the number of the lesions in the right coronary artery, and a poorer prognosis in echocardiography.

The time from symptoms onset to cath lab decreased and by associating more frequently thrombolysis for "buying" more time, so the chances for the ventricle to remodel remain low.

By respecting the ESC guidelines for each period of time, even though the early mortality rate seems to have an ascending trend, the overall mortality rate and longtime prognosis of the STEMI patients are getting better.

It is very important to make such an analysis from time to time, in order to make thinks go better and see where some changes could be made.

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