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Trends in reperfusion therapy of STEMI patients in Belgium for the period 2007-2013

Prof dr M Claeys

National Coordinator STEMI registry

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Background

The current guidelines for the management of ST-segment elevation myocardial infarction (STEMI) recommend primary percutaneous coronary intervention (pPCI) as the preferred treatment strategy if it can be conducted in a timely fashion by an experienced catheterisation team. However, because of logistical restraints, PCI can only be offered in less than 50% of European/Belgian hospitals. This has shifted the focus toward extension of PCI benefits to patients who present to community hospitals with no interventional capabilities. Several randomised trials have demonstrated that transferring STEMI patients to PCI-capable hospitals for primary PCI is safe and leads to better outcomes than administration of thrombolytic therapy at community hospitals. This has formed the basis of the development of STEMI networks with prearranged rapid transfer protocols between community hospitals and PCI centres. This concept was promoted at the start of the Belgian STEMI register in 2007.
Accordingly, the current study evaluates the evolution of reperfusion therapy in Belguim for the period 2007-2013, both for PCI-capable hospitals and for community hospitals .

Methods:

We collected data from 25 of the 27 PCI-capable hospitals and 55 of 83 community hospitals between period of 2007 and 2013. Collection of data was carried out by electronic web-based registry that is governed by an independent software company specialised in electronic data capture solutions (Lambda-plus- website: http://www.lambdaplus.com).
A number of baseline characteristics for each patient was included which allowed to stratify the patients according to a previous validated TIMI risk score: age, gender, collapse with cardiopulmonary resuscitation (CPR), history of coronary artery disease (CAD) or peripheral artery disease (PAD), location of infarction, total ischemic time. age, hemodynamic status on admission, history of atherovascular disease, history of hypertension or diabetes. Following types of reperfusion strategy were defined: thrombolysis (TL), percutaneous coronary intervention (PCI) or no reperfusion. We looked also to time delays between diagnosis and treatment. In addition, for TL and for no-reperfusion patients subsequent invasive evaluation (either in the acute phase or more electively during hospitalisation) was recorded.

The primary endpoint was in-hospital death from all causes as late as 30 days after admission. Vital status was assessed in the final hospital before home discharge.

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Statistical Analysis

Continuous variables are presented as the mean values with corresponding standard deviation (SD). Comparisons between groups were made with an unpaired t-test. The differences between proportions were assessed by chi-squared analysis. Independent determinants of in-hospital death were determined by means of multiple logistic regression analysis and reported as odds ratios (ORs) and 95% confidence intervals (CIs). Following factors were included in this analysis: age, gender, weight, history of CAD or PAD, arterial hypertension, diabetes mellitus, Killip class, blood pressure and heart rate on admission, infarct location, cardiac arrest with rescuscitation, total ischemic time. For all analyses, a value of $p<0.05$ was considered statistically significant.

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Results

Trends in baseline characteristics .

The total study population consisted of 15816 patients. Of the total population, 6437 patients (41%) were admitted to a community hospital and 9379 (59%) to a PCI-capable hospital. The most important trends over time of baseline characteristics are depicted in table 1. Over time baseline risk profile, as assessed by TIMI risk score improved significantly. This improvement was mainly related to lower prevalence of arterial hypertension, peripheral artery disease and cardiogenic shock. In addition, over time, more patients were treated within 4hours of onset of pain.

Table 1

year number	2007 1791	2008 2571	2009 2677	2010 2477	2011 2267	2012 2058	2013 1975	p-value
Age	62.8	63.1	63.2	62.6	62.5	63.1	62.8	0.4
TIMI	4.3	4.3	4.2	4.1	4.0	4.1	4.2	0.0001
AHT,%	46.8	44.2	44.5	43.4	42.9	42.6	41.	0.01
PAD,%	11.5	10.8	8.6	8.6	8.7	8.5	7.3	0.0001
TIT<4h,%	59.2	57.8	59.1	62.5	63.0	61.2	61.9	0.006
Shock,%	14.1	18.4	17.4	12.9	13.1	10.7	13.3	0.0001

Values are represented as mean ± standard deviations or as percentages.
Abbreviations: AHT, arterial hypertension; PAD, peripheral artery disease;TIMI risk score, Thrombolysis in Myocardial Infarction risk score; TIT, total ischemic time

Trends in reperfusion therapy and outcome

Changes in reperfusion therapy are depicted in figure 1A-B. There was a profound shift towards more primary PCI from overall 77% to 94%. This trend was particularly observed in the community hospitals. The primary PCI rate in community hospitals increased from 56% to 90% at the cost of less thrombolysis and less conservative treatment (p<0.0001). Also in PCI capable hospitals there was a further increase of primary from 89% to 96% (p<0.001).

Figure 1A: time trend in reperfusion therapy in PCI capable hospitals

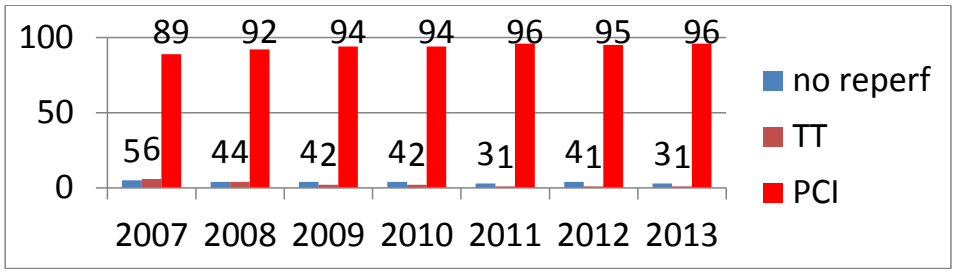
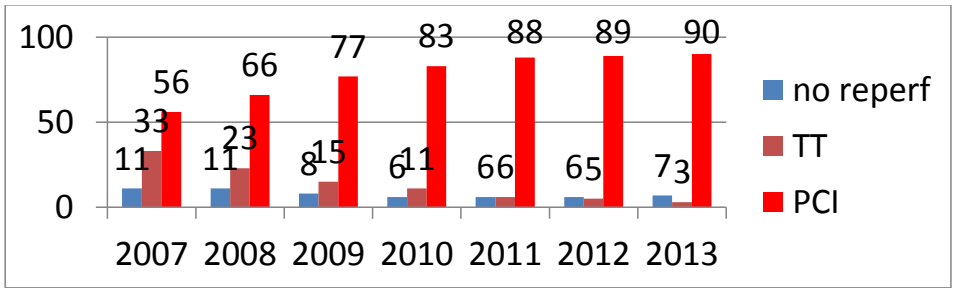


Figure 1B: time trend in reperfusion therapy in community hospitals



Values are represented as percentages.
Abbreviations: PCI , percutaneous coronary intervention; TT, thrombolysis

Parallel to this transition from thrombolysis to pPCI, the proportion of patients with prolonged DTB (>120min) increased from 11% to 15% and in the subgroup of patients with an early (<3h) infarction the proportion of patients with DTB>90min almost doubled from 9% to 17%.(see figure 2A-B).

Figure 2A: time trend in time delays between diagnosis and PCI in all STEMI patients

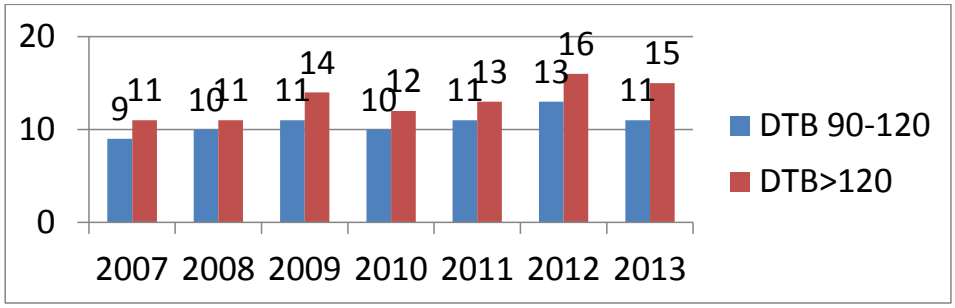
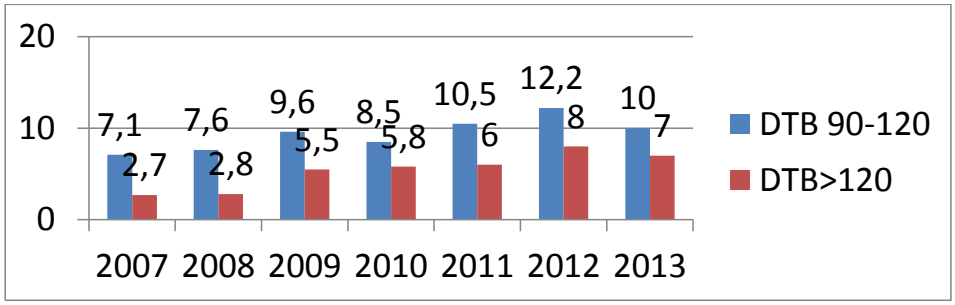


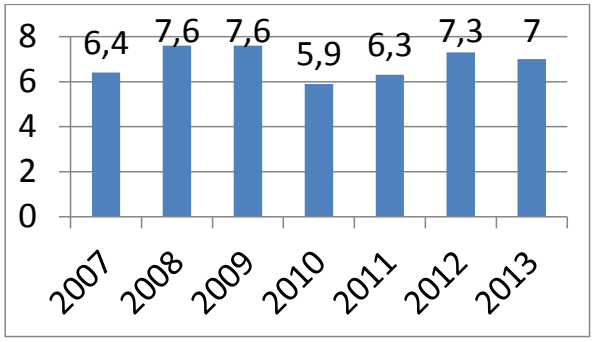
Figure 2B: time trend in time delays between diagnosis and PCI in early STEMI patients



Values are represented as percentages.
Abbreviations: PCI , percutaneous coronary intervention; DTB, diagnosis to balloon time

The in-hospital mortality of the total study population was 6.8% and occurred within a median of 2 days (25th and 75th percentiles: 0-7days) after admission. Despite decrease in TIMI risk score and higher use of pPCI, the in hospital mortality did not change significantly over time and ranged between 6.4% and 7.6% (fig 3)

Fig 3. In-hospital mortality (%)



DISCUSSION and CONCLUSIONS

The present study demonstrates that thanks to the promotion and implementation of the concept of STEMI network in Belgium, PCI rate increased significantly, particularly in the community hospitals, and reached a penetration rate of >90% which is in line with European recommendations.

The transition of thrombolysis to transfer for pPCI in the setting of a STEMI network was, however, associated with almost 50% increase of the proportion of patients with prolonged diagnosis-to-balloon time . The reason for this prolonged diagnosis to balloon time remains speculative and requires more in depth analysis of treatment time delays. However, it is conceivable that the emergency medical system (EMS) capacity was not adapted to the increased need for transferring patient to PCI capable hospitals. Indeed, there are still hospitals without PCI facilities that rely on the PCI hospital's MUG/SAMU facilities to pick up the patients, obviously tremendously adding to the delays. The most optimal transfer policy is the direct transfer of STEMI patients (from home or from community hospital) to the nearest PCI capable hospital but more logistic support to EMS services will be needed to achieve this goal. Previous studies have clearly shown that prolonged time delays are associated with higher mortality rates. Therefore, more delay in

treatment might have off-set the mortality benefit expected from increased pPCI use in our study.
The present findings have been communicated on several local and national scientific meetings and are a strong argument to further monitor the quality of care of STEMI patients. In view of the suboptimal time delay results, specific time delay indicators will be developed and monitored which will allow us to better define gaps in transfer policy in Belgium.

Contact person

On behalf of the steering committee

Prof dr Marc Claeys: Project coordinator marc.claeys@ua.ac.be

Gewijzigde veldcode

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