quality indicators and mortality in Belgian STEMI patients Period 2009-2017

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 Belgian hospitals. This has formed the basis of the development of STEMI networks with pre-arranged rapid transfer protocols between community hospitals and PCI centres. This concept was promoted at the start of the Belgian STEMI registry in 2007. To assess the quality of acute cardiac care, quality indicators have been developed by international task forces and within the college and the working group of acute cardiology. The most important indicators concerning treatment of STEMI have been defined and implemented in the Belgium STEMI database from 2009. Recent large scaled international studies have shown a clear correlation between adherence to quality and mortality. Whether this correlation is also present in Belgium, is unknown. Accordingly, the present report describes the adherence to quality and its effect on mortality in a large group of STEMI patient for the period 2009-2017.

Methods:

We collected data from 22702 patients admitted in 55 hospitals (30 with PCI facilities) between period of 2009 and 2017. 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, 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. Collapse with cardiopulmonary resuscitation (CPR) was also registered as this factor is not incorporated into the TIMI risk score.

Quality indicator:

Following quality parameters were registered and are based upon the European QI's for STEMI:
a)Types of reperfusion strategy: thrombolysis (TL), percutaneous coronary intervention (PCI) or no reperfusion.
b)Time delays between diagnosis and treatment, subdivided into diagnosis-to-balloon time (time between first ECG with STEMI diagnosis and the balloon inflation) and the door-to-balloon (time between arrival in the PCI centre and the balloon inflation).

A global quality score was assigned to each patient according to the following rules (the higher the score the more adherent to quality recommendations)

Domein	Scoring
Reperfusion	0 = No reperfusion therapy
	1 = Trombolyse
	2 = PCI
Door-to-balloon	0 = > 90 minutes
	1 = 60-90 minutes
	2 = < 60 minutes
Diagnosis-to-balloon/-needle	0 = > 120 minutes
	1 = 90-120 minutes
	2 = < 90 minutes
TOTAAL SCORE	**0-6**

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.

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: TIMI risk score and cardiac arrest as patient related factors and reperfusion therapy/time lines as quality related factors. For all analyses, a value of $p < 0.05$ was considered statistically significant.
.

Results

The total study population consisted of 22702 STEMI patients. In 13403 patients information about time lines were present. Patients with time line information had a lower risk profile and lower in hospital mortality than patients without time line information. (see Table 1)

	With time inform. N= 13403	Without time inform. N=9299	P value
TIMI risk score	3.9 ± 2.6	4.2 ± 2.6	<0.001
Cardiac arrest,%	9.8%	12.1%	<0.0001
Mortality,%	5.5%	7.2%	<0.0001

Quality indicators

The majority of patients (93%) underwent primary PCI as reperfusion therapy. Thrombolysis was given in 3% of the patients and 4% of the patients did not receive any reperfusion therapy mainly because of late presentation and/or severe comorbidity.

The average diagnosis-to-balloon time was 90 min ± 79 with a median of 73 min. DiaTB<90min was present in 66% of the patients, DiaTB between 90-120 min was present in 15% of the patients and prolonged DiaTB (>120min) was present in 19% of the patients.
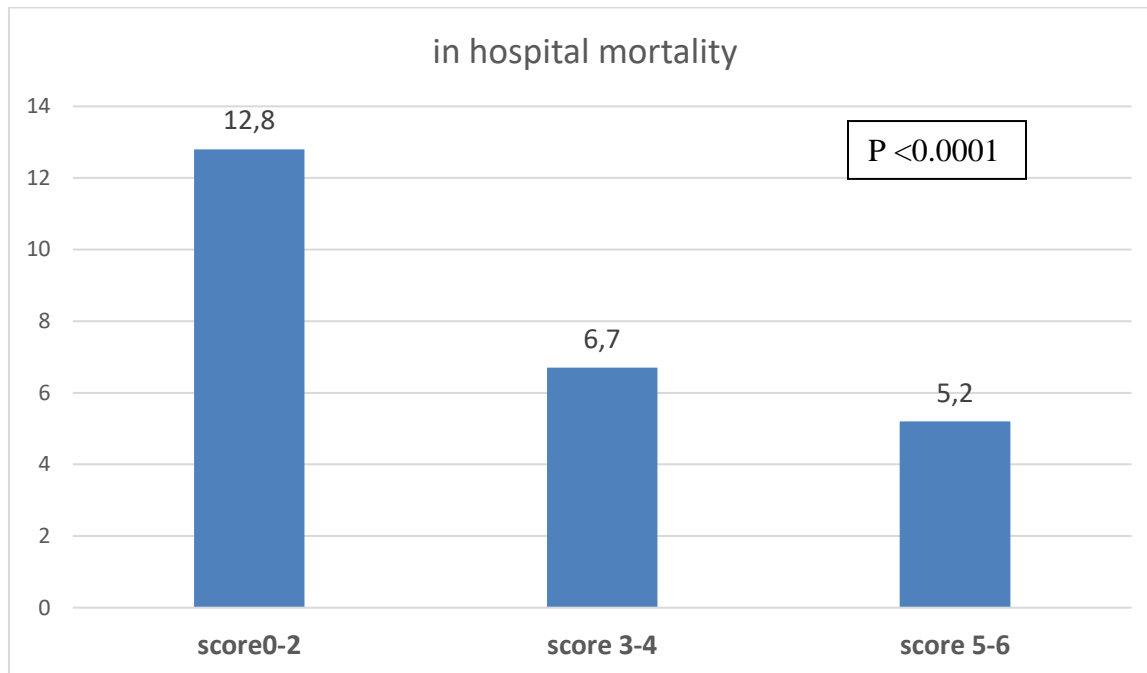
The average door-to-balloon time was 57 min ± 49 with a median of 43 min. DoTB<60min was present in 68% of the patients, DoTB between 60-90min was present in 16% of the patients and prolonged DoTB (>90min) was present in 16% of the patients.

The average global quality score was 4.9 ± 1.3 with a median of 5. The majority of the patients (67%) has a good quality score (5-6), 25% has an intermediate score (3-4) and 8 % has a bad score (<3)

Quality indicators and relation with mortality

The in-hospital mortality of the total study population was 6.2%. In hospital mortality in the patients without cardiac arrest was 3.5% whereas the mortality of cardiac arrest patients was 30%.

There was a significant trend to lower mortality for better quality scores (see figure 1): the mortality for patients with a good quality score was 5.2% versus 12.8% for patients with a bad quality score (p<0.0001).

in hospital mortality

P <0.0001

	score0-2	score 3-4	score 5-6
	12,8	6,7	5,2

The relation between quality adherence and mortality persisted also after correction for baseline risk profile. Adjusted mortality risk ratio was 1.26 (95% CI 1.15-1.36) for each decrease of the global risk score by 1 point. Logistic regression analysis with the individual quality indicators revealed that door-to-balloon was a more powerful predictor for mortality than diagnosis-to-balloon time (see table 2).

	Odds ratio	95% CI	P value
Timi risk score	1.58	1.51-1.66	<0.0001
Cardiac arrest	9.0	6.9-11.7	<0.0001
Diagnose to balloon time, min	1.002	1.0003-1.0038	0.02
Door to balloon time,min	1.0036	1.0013-1.0059	0.002
No reperfusion	7.4	2.9-18.2	<0.0001

DISCUSSION and CONCLUSIONS

 The present report describes the relation between adherence to quality indicators and in hospital mortality in patients admitted with STEMI in the Belgian hospitals.
We could demonstrate, for the first time, that mortality more than doubles in patients with a poor quality adherence as compared to patients with good quality adherence (5.2 vs 12.2%) also after correction of baseline risk profile. In the present study 2/3 of our patients received adequate reperfusion therapy within recommended timelines (PPCI within 90 minutes after diagnosis and within 60 min after arrival in the PCI centre). It can be expected that the global mortality in Belgium will further decrease if recommended optimal reperfusion therapy is offered to all our STEMI patients. Whereas pPCI has already a high penetration rate (>90%) in our country, still many patients have prolonged diagnosis to treatment times because of suboptimal transfer policy and/or because of suboptimal internal organisation within the PCI centre. The most optimal transfer policy is the direct transfer of STEMI patients (from home or from community hospital) to the nearest PCI capable hospital with early notification of the catheterisation laboratory team, preferentially by EMS and direct transfer to the cath lab, bypassing the emergency room.

The present findings are in line with recent international studies. The study of Bebb et al demonstrate in a population of AMI (both STEMI and non-STEMI) that eleven Qis, among them timely pPCI, were significantly inversely associated with 30-day mortality. Primary PCI performed within 60 min after arrival in the PCI centre was associated with 0.57 risk for 30-day mortality.

The present highlights also that patients in whom quality indicators were not adequately reported are more at high risk than patients with good reporting of quality indicators. Underreporting has been encountered in other international registries and the study of McCabe et al could show that underreporting was associated not only with high risk patient profile but also with less adherence to recommended reperfusion therapy.

The present findings will be communicated to the participating hospitals and are a strong argument to further monitor the quality of care of STEMI patients, particularly time delay indicators in all patients admitted in all Belgian hospitals.

Contact person

On behalf of the steering committee

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

References

Steg PG, James SK, Atar D, Badano LP, Blomstrom-Lundqvist C, Borger MA, Di MC, Dickstein K, Ducrocq G, Fernandez-Aviles F, Gershlick AH, Giannuzzi P, Halvorsen S, Huber K, Juni P, Kastrati A, Knuuti J, Lenzen MJ, Mahaffey KW, Valgimigli M, van 't Hof A, Widimsky P, Zahger D. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J* 2012;**33**(20):2569-2619..

Schiele F, Gale CP, Bonnefoy E, Capuano F, Claeys MJ, Danchin N, et al. Quality indicators for acute myocardial infarction: A position paper of the Acute Cardiovascular Care Association. European Heart Journal-Acute Cardiovascular Care. 2017;6(1):34-59.

Masoudi FA, Bonow RO, Brindis RG, et al. ACC/AHA 2008 statement on performance measurement and reperfusion therapy: a report of the ACC/AHA Task Force on Performance Measures (Work Group to address the challenges of performance measurement and reperfusion therapy). Circulation. 2008;118:2649-2661.

Knot J, Widimsky P, Wijns W, Stenestrand U, Kristensen SD, Van' TH, Weidinger F, Janzon M, Norgaard BL, Soerensen JT, van de Wetering H, Thygesen K, Bergsten PA, Digerfeldt C, Potgieter A, Tomer N, Fajadet J. How to set up an effective national primary angioplasty network: lessons learned from five European countries. *EuroIntervention* 2009;**5**(3):299, 301-299, 309.

Kalla K, Christ G, Karnik R, Malzer R, Norman G, Prachar H, Schreiber W, Unger G, Glogar HD, Kaff A, Laggner AN, Maurer G, Mlczoch J, Slany J, Weber HS, Huber K. Implementation of guidelines improves the standard of care: the Viennese registry on reperfusion strategies in ST-elevation myocardial infarction (Vienna STEMI registry). *Circulation* 2006;**113**(20):2398-2405.

Bebb O, Hall M, Fox KAA, Dondo TB, Timmis A, Bueno H, et al. Performance of hospitals according to the ESC ACCA quality indicators and 30-day mortality for acutemyocardial infarction: national cohort study using the United KingdomMyocardial Ischaemia National Audit Project (MINAP) register. European heart journal. 2017;38(13):974-82

McCabe JM; Kevin F. Kennedy KF; Eisenhauer AC; Waldman HM; Mort EA; Pomerantsev E; Resnic FS; Yeh RS. Reporting Trends and Outcomes in ST-Segment–Elevation Myocardial Infarction National Hospital Quality Assessment Programs. Circulation. 2014;129:194-202