Quality control project in ST elevation myocardial infarction

STEMI registration in Belgium

Focus on Octo/nonagenarian STEMI population

Background

The number of octo/nonagenarians is continuously increasing over the years in the Western world. Age is the foremost important independent risk factor of cardiovascular outcome (both for mortality and morbidity). Moreover, in elderly STEMI patients, the high mortality rate seems not to improve over the years.
Although octo/nonagenarians are clearly a high-risk subgroup of STEMI patients, the use of diagnostic procedures and medical management in this group remains suboptimal. Octo/nonagenarians are often underrepresented in trials on treatment options in STEMI patients. Data are limited to small subgroups from randomized controlled trials (RCTs) on comparing primary percutaneous coronary intervention (PPCI) to thrombolysis (TL). Two multicenter RCTs are stopped prematurely, because of slow recruitment. The first shows a tendency to improve 30-day outcome in STEMI patients aged ≥75 years treated with PPCI, compared to TL , and the second reveals only a benefit of PPCI in patients aged 70 to 80, with no difference in outcome in octo/nonagenarians in general.
We aimed to evaluate treatment strategies and in-hospital mortality in an unselected population of octo/nonagenarian STEMI patients in Belgium.

Methods:

Collection of data is 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 is included which allows 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 are defined: thrombolysis (TL), percutaneous coronary intervention (PCI) or no reperfusion. In addition,

for TL and for no-reperfusion patients subsequent invasive evaluation (either in the acute phase or more electively during hospitalisation) was recorded.

Door-to-needle time (DTNT) is defined as time from diagnosis of STEMI until initiation of TL and was available in 775 patients (86.9% of the patients that received TL). Door-to-balloon time (DTBT) is defined as time from diagnosis of STEMI until first balloon inflation and was available in 7411 patients (96.8% of the patients that were treated with PCI). DTNT is subdivided into early (DTNT <30min), intermediate (DTNT ≥30 and <60min) and late (DTNT ≥60min), and DTBT into early (DTBT<60 min), intermediate (DTBT ≥60 and <120 min) and late (DTBT ≥120min).
The primary endpoint is in-hospital death from all causes as late as 30 days after admission. Vital status is assessed in the final hospital before discharge at home.

Access to the registry was available in the first part of 2007 only to the members of the steering committee and from 1/7/2007 access was extended to all Belgian hospitals with acute cardiac care program. Over time there was a gradual increase in the enrolment of STEMI patients. For the present study we report the data of 3872 STEMI patients that were included from 1/1/2007 until 31/12/2011 in a total of 90 hospitals

Statistical Analysis

Absolute numbers and percentages are shown for categorical variables, and medians with interquartile range (IQR) for continuous variables. For descriptive purposes, binary variables are compared between subgroups by χ^2 test (for ≥3 groups) and by Fisher's Exact Test (for 2 groups). Predictors of in-hospital mortality are analyzed by multiple logistic regression and reported as odds ratio (OR) and 95% confidence interval (95%CI). A significance level of 0.05 is assumed for the statistical tests. All P-values are results of two-tailed tests. Statistical analysis is performed with SPSS statistical software, version 15.0.

Results

Patients and demographic characteristics

The total study population consists of 9076 STEMI patients of which 1092 are aged ≥80 years (12%). Sixty% of the octo/nonagenarians are <85 years, 31% are between 85 and 89 years, and a minority is nonagenarian (7% between 90 and 94 years and 2% ≥95 years). In the octo/nonagenarian group, there are more female patients and the prevalence of AHT, PAD, CAD, and low body weight is higher, compared to their younger counterparts. The octo/nonagenarians have more often cardiac failure (Killip class>1), a low systolic blood pressure on admission, and the location of the infarction is more often anterior (all p<0.05)(Table 1). Cardiogenic shock is present in 136 (12.5%) octo/nonagenarians vs. 586 (7.3%) younger patients (p<0.001). The median of the TIMI risk score in octo/nonagenarians is 7 (IQR 5-9) vs. 3 (IQR 2-5) in the younger patients.

Table 1. Baseline characteristics of the octo/nonagenarian group and the younger group

	<80 years	≥80 years	p
n	7984	1092	
Age, m (IQR)	60 (52-70)	84 (81-86)	
Female, n (%)	1691 (21.2%)	539 (49.4%)	< 0.001
AHT, n (%)	3360 (42.1%)	657 (60.2%)	< 0.001
DM, n (%)	1199 (15.0%)	185 (16.9%)	0.097
Weight <67kg, n (%)	1182 (14.8%)	427 (39.1%)	<0.001
PAD, n (%)	690 (8.6%)	198 (18.1%)	<0.001
CAD, n (%)	1439 (18.0%)	256 (23.4%)	<0.001
Killip class >I, n (%)	1595 (20.0%)	433 (39.7%)	<0.001
CPR, n (%)	867 (10.9%)	118 (10.8%)	1.000
SBP<100mmHg, n (%)	1496 (18.7%)	275 (25.2%)	<0.001
HR>100bpm, n (%)	1126 (14.1%)	178 (16.3%)	0.053
Anterior MI, n (%)	3436 (43.0%)	529 (48.4%)	
Non-anterior MI, n (%)	4486 (56.2%)	531 (48.6%)	< 0.001
LBBB, n (%)	62 (0.8%)	32 (2.9%)	
TIMI risk score m (IQR)	3 (2-5)	7 (5-9)	<0.001

p values are calculated using χ^2 test (for ≥3groups) and Fisher's Exact Test (for 2 groups). n: number, m, median, IQR: interquartile range, AHT: arterial hypertension, DM: diabetes mellitus, kg: kilogram, PAD: peripheral artery disease, CAD: coronary artery disease, CPR: cardiopulmonary resuscitation, SBP: systolic blood pressure, HR: heart rate, bpm: beats per minute, MI: myocardial infarction, LBBB: left bundle branch block

Reperfusion strategy and time to reperfusion

The type of reperfusion therapy and treatment time delay significantly differ between octo/nonagenarians and the younger group (Table2). In both groups, most patients receive PCI (77% in octo/nonagenarians and 85% in younger patients). Compared to the younger group less PCI, equally rate of TL, and more no-reperfusion are used in the octo/nonagenarians (p<0.001) (Table 2). Invasive evaluation post TL (either in the acute phase or electively during hospitalization) occurs in 62 (61.4%) octo/nonagenarians and in 680 (86.0%) younger patients (p<0.001). Invasive evaluation (acute or more electively) in the total population is carried out in 936 (85.7%) of the older patients versus 7724 (96.7%) of the younger patients (p<0.001). The ischemic time is longer in the octo/nonagenarians (p<0.001), more than half of the octo/nonagenarians have an ischemic time of more than 4 hours. DTNT/DTBT in the subgroup that receives reperfusion therapy (TL or PCI) is longer in the octo/nonagenarians (p<0.001).

Table 2. Treatment option and reperfusion times for the octo/nonagenarian group and the younger group

	<80 years	≥80 years	
n	7984	1092	
Treatment			
TL, n (%)	791 (9.9%)	101 (9.2%)	
PCI, n (%)	6818 (85.4%)	840 (76.9%)	p< 0.001
No-reperfusion, n (%)	375 (4.7%)	151 (13.8%)	
Ischemic time			
<4h n (%)	4899 (61.4%)	513 (47.0%)	p<0.001
≥4h n (%)	3085 (38.6%)	579 (53.0%)	
n	7302	884	
DTNT/DTBT			
Early n (%)	3975 (54.4%)	425 (48.1%)	
Intermediate n (%)	2348 (32.2%)	322 (36.4%)	p = 0.002
Late n (%)	979 (13.4%)	137 (15.5%)	

p values are calculated using χ^2 test (for ≥3 groups) and Fisher's Exact Test (for 2 groups), n: number, TL: thrombolysis, PCI: percutaneous coronary intervention, h: hours, DTNT/DTBT: door-to-needle time/door-to-balloon time

In-hospital mortality and its predictors

Overall in-hospital mortality is 6.9% in total population; 5.5% in the younger group, and 17.8% in octo/nonagenarians (p<0.001). In a logistic regression model, including all baseline characteristics and reperfusion strategy, age is an independent predictor of in-hospital mortality in the registry at large (OR 1.05, 95%CI 1.04-1.06). Age ≥80 is associated with a 3.24 fold increase in in-hospital mortality (adjusted risk ratio 2.43, 95%CI 1.92-3.08). Table 3 shows the independent predictors of mortality in the octo/nonagenarians versus non octo/nonagenarians. Age, PAD, higher Killip class, need of cardiopulmonary resuscitation (CPR), low systemic blood pressure (SBP), high heart rate (HR) are independent predictors of in-hospital mortality in both groups. Longer ischemic time and type of reperfusion therapy chosen are both no longer independent predictors in octo/nonagenarians compared to the younger group [when TL is compared to PCI and no-reperfusion (Table 3) as well as in a subgroup analysis within the reperfused group (TL versus PCI), data not shown]. Female gender is no independent predictor in octo/nonagenarians while AHT is an octo/nonagenarian specific independent predictor (Table 3).

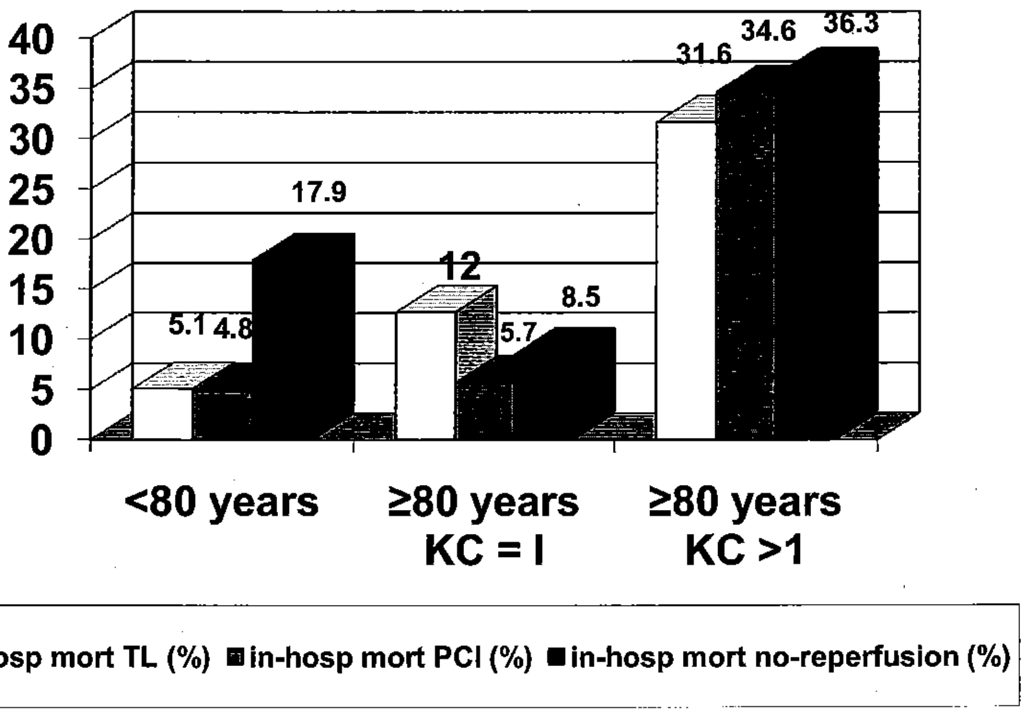
Table 3. Predictors of in-hospital mortality

n	All 9076 OR (95% CI)	≥80 years 1092 OR (95% CI)
age	1.05 (1.04-1.06)	1.07 (1.01-1.12)
Female gender	1.33 (1.06-1.67)	1.33 (0.88-2.01)
Body weight <67kg	1.05 (0.82-1.35)	1.09 (0.72-1.65)
CAD	1.07 (0.85-1.36)	0.93 (0.60-1.43)
PAD	1.84 (1.42-2.39)	2.02 (1.29-3.15)
AHT	1.06 (0.86-1.31)	1.62 (1.08-2.42)
DM	1.02 (0.79-1.32)	0.91 (0.56-1.46)
CPR	4.90 (3.88-6.19)	4.09 (2.50-6.68)
SBP <100mmHg	2.79 (2.23-3.48)	2.66 (1.77-4.00)
HR ≥100bpm	1.33 (1.07-1.65)	1.81 (1.18-2.77)
Infarct location		
* anterior	0.92 (0.53-1.59)	1.73 (0.59-5.08)
Killip class >I	5.48 (4.30-6.97)	3.54 (2.31-5.41)
Ischemic time ≥4h	1.49 (1.21-1.83)	1.23 (0.84-1.80)
Reperfusion		
* TL vs no reperf	0.63 (0.41-0.96)	1.41 (0.67-2.96)
* PCI vs no reperf	0.41 (0.30-0.55)	0.82 (0.49-1.37)

Predictors of in-hospital mortality are analyzed by multiple logistic regression. Values are expressed as odds ratio (OR) with 95% confidence interval (95% CI). n: number, kg: kilogram, CAD: coronary artery disease, PAD: peripheral artery disease, AHT: arterial hypertension, DM: diabetes mellitus, CPR: need of cardiopulmonary resuscitation, HR: heart rate, bpm: beats per minute SBP: systolic blood pressure, h: hours, TL: thrombolysis, PCI: percutaneous coronary intervention

Within the octo/nonagenarians, further analysis reveals that hemodynamically stable patients (Killip class = 1) significantly benefit from PCI as compared to TL (adjusted risk ratio 3.19, 95%CI 1.27-8.00). On the other hand, the in-hospital mortality is extremely high (> 30%) in the patient group with cardiac failure (Killip class >1), without benefit of any reperfusion therapy (P = 0.88) (Figure 1).

Figure 1. In-hospital mortality for younger patients, octo/nonagenarian stable and octo/nonagenarian unstable patients depending on type of reperfusion therapy.



In-hosp: in-hospital, mort: mortality, TL: thrombolysis, PCI: percutaneous coronary intervention, KC: Killip class

Discussion and Conclusion

The present study describes reperfusion strategy and in-hospital outcome in more than 1000 unselected octo/nonagenarians STEMI patients and is at this moment one of the greatest databases of this high risk STEMI population. Our main findings are the underuse of invasive strategies although PCI shows clear mortality benefit in octo/nonagenarian STEMI patients, particularly in the hemodynamic stable subgroup, and secondly the fact that thrombolysis offers no mortality benefit as compared to no-reperfusion in octo/nonagenarians.

For the underuse of invasive strategies, there might be several explanations. First, octo/nonagenarians have, compared to the younger patients, more comorbidities which may play a role in the decision making to reperfuse or not. Further, although well appreciated as a risk group, initiation of therapy in octo/nonagenarians usually is delayed. Total ischemic time and DTNT/DTBT are longer in elderly patients, compared to their younger counterparts. These results are consistent with previous findings. Atypical clinical presentation leads to time delay and probable to higher prevalence of cardiac failure on admission. Finally, female gender is more represented in the octo/nonagenarian group, compared to the younger group. Female gender has been associated in previous studies with lower use of invasive evaluation.

Our findings discourage the use of thombolysis in octo/nonagenarians because of lack of mortality benefit not only in comparison with PCI but also in comparison with no-reperfusion therapy. The reason for lower success of TL in older patients are partly related to longer ischemic time delay in elderly. Benefit of thrombolysis has been shown to be the greatest when given within the first hours of symptoms. In addition potential benefit of TL could be offset by a higher risk of major, often fatal, hemorrhagic complications observed in older patients. The observed benefit of PCI over TL is in concordance with a recent meta-analysis showing superiority of PPCI over TL in elderly patients with STEMI and with a recently, a multicenter, retrospective observational study showing a benefit on short- and long-term mortality of PPCI compared to TL in patients aged 80 years or more.

Conclusion:

In-hospital mortality of octogenarian STEMI patients remains high and is particularly related to a high prevalence of cardiac failure. Octo/nonagenarian STEMI-patients receive less PCI than younger patients although mortality benefit of PCI remains valid, particularly in hemodynamic stable patients. Our data suggest that more timely invasive approach might prevent evolution to cardiac failure and may so improve survival rate in elderly STEMI patients.

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June 2011