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Particularities in coronary revascularization in elderly patients presenting with ST segment elevation acute myocardial infarction (STEMI)

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SOUHRN

V současné době se stále zvyšuje incidence infarktu myokardu s elevacemi úseku ST (STEMI) u starších osob. V nejnovějších guidelines se doporučuje okamžité invazivní vyšetření a případná primární perkutánní koronární intervence (PCI) u všech pacientů bez ohledu na věk. Podle literárních údajů se však intervenční léčba starších pacientů se STEMI neprovádí v dostatečné míře.

Cílem naší studie bylo posoudit výsledky hospitalizace starších pacientů pro STEMI oproti mladším osobám z hlediska systematické intervenční léčby. Zajímali jsme se rovněž o některá, podle nás významná specifika léčby starších pacientů se STEMI.

Posoudili jsme údaje 975 po sobě následujících pacientů se STEMI přijatých do jednoho centra v období od ledna 2012 do července 2013; z toho 203 (20,8 %) pacientů bylo ve věku 75 let a více.

V porovnání s mladšími osobami byli starší pacienti většinou ženy (47,2 % vs. 22,7 %; $p < 0,001$) s vyšší prevalencí hypertenze (78,8 % vs. 65,0 %; $p < 0,001$), avšak nižší prevalencí kuřáctví (13,7 % vs. 48,8 %; $p < 0,001$) a dyslipidemie (54,7 % vs. 41,3 %; $p = 0,03$). Ve věkové kategorii ≥ 75 let jsme zaznamenali více kardiovaskulárních komorbidit: cévních mozkových příhod (11,8 % vs. 4,1 %; $p < 0,001$), fibrilací síní (23,6 % vs. 53,9 %; $p < 0,001$) a těžkých vaskulopatií (6,8 % vs. 1,2 %; $p < 0,001$). U starších pacientů byly častěji pozorovány známky srdečního selhání (Killipova třída > I: 21,1 % vs. 7,2 %; $p < 0,001$). U obou skupin byla stanovena podobná doba ischemie, 54,1 % vs. 55,1 % s převozem do nemocnice do šesti hodin.

U starší skupiny bylo provedeno méně PCI (74,3 % vs. 85,7 %; $p = 0,02$). Rozsah lézí na koronárních tepnách se významně nelišil, až na dva případy postižení kmene levé věnčité tepny u starších pacientů (12,2 % vs. 5,1 %; $p < 0,001$).

Mezi oběma skupinami nebyly významné rozdíly v léčbě během hospitalizace (duální antiagregační léčba, antikoagulace, beta-blokátory, inhibitory enzymu konvertujícího angiotensin [ACE]/blokátory receptorů AT_1 pro angiotensin II a statiny). Nemocniční mortalita všech našich pacientů byla 4,41 %, s hodnotami 11,3 % u starší skupiny a 2,59 % ve skupině ve věku < 75 let ($p < 0,001$).

Výsledky léčby starších pacientů se STEMI během pobytu v nemocnici byly horší, se zvýšenou mortalitou, zvláště u osob se srdečním selháním již při příjmu. U starších pacientů bylo provedeno méně PCI, i když ve farmakoterapii nebyl žádný rozdíl zjištěn. U všech pacientů bez ohledu na věk je nutno uplatňovat strategii okamžitého koronarografického vyšetření a v případě potřeby primární PCI.

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ABSTRACT

Nowadays, ST elevation acute myocardial infarction (STEMI) is seen with greater incidence in older patients. Current guidelines recommend an immediate invasive evaluation and eventually primary percutaneous coronary intervention (PCI) in all STEMI patients regardless of age. Nevertheless, data in literature show a significant underuse of interventional treatment in older patients with STEMI.

Our objective is to assess the in-hospital outcome of the elderly STEMI patients compared to the younger ones in the setting of systematic interventional management. We also discussed some particular aspects which we considered as significant concerning the management of elderly patients with STEMI.

We evaluated 975 consecutive STEMI patients admitted to a single centre between January 2012 and July 2013. There were 203 (20.8 %) patients ≥ 75 years old.

Compared to the younger group, in the older group there were more women (47.2% vs 22.7%; $p < 0.001$), an increased prevalence of hypertension (78.8% vs 65.0%; $p < 0.001$) but a decreased prevalence of smoking (13.7% vs 48.8%; $p < 0.001$) and dyslipidemia (54.7% vs 41.3%; $p = 0.03$). The ≥ 75 years group had more cardiovascular comorbidities: stroke (11.8% vs 4.1%; $p < 0.001$), atrial fibrillation (23.6% vs 53.9%; $p < 0.001$) and severe valvulopathies (6.8% vs 1.2%; $p < 0.001$). Elderly patients presented more frequently with signs of heart failure (Killip class > I: 21.1% vs 7.2%; $p < 0.001$). Both groups had similar ischemia time with 54.1% vs 55.1% presenting within 6 hours.

There were fewer PCIs performed in the elderly group (74.3% vs 85.7%; $p = 0.02$). The extension of coronary lesions was not significantly different between the two groups, except for left main disease in favour of the elderly (12.2 % vs 5.1 %; $p < 0.001$).

There were no significant differences between the two groups regarding the in-hospital treatment (dual antiplatelet, anticoagulation, beta-blockers, ACEI/ARB and statin).The in-hospital mortality for our entire study group was 4.41%, with a rate of 11.3% in the older group and 2.59 % in the < 75 years group ($p < 0.001$).

In-hospital outcome in older patients with STEMI is worse, with an increased mortality rate, especially when associated with heart failure on admission. Fewer PCI were performed in the older patients, although there was no difference in the pharmacological treatment. A strategy based on urgent coronary angiography and, if necessary, primary PCI, should be applied in all eligible patients irrespective of age.

Keywords:
ACS
Elderly
Guideline
Interventional
Primary PCI
Reperfusion
Revascularization
STEMI

Introduction

A recent World Health Organization (WHO) report identified coronary heart disease (CHD) as the leading cause of death worldwide [1]. Although mortality due to acute coronary events decreased progressively especially in developed countries [2] through improvement in the methods of treatment, including secondary prevention, and modification of risk factors by lowering total cholesterol and blood pressure and discouraging smoking and sedentary lifestyle [3], it remains responsible for about a third of all deaths in adulthood [4,5].

According to WHO, especially in the low to medium income countries, the burden of cardiovascular disease is increasing more rapidly due to population ageing [1]. Cardiovascular morbidity and mortality rise rapidly with increasing age. Patients older than 65 year account for 60% of myocardial infarction-related deaths [6]. Age is a well known risk factor for adverse outcome after an acute coronary syndrome (ACS), being a part of major algorithms for outcome prediction [7]. Recent data regarding the incidence of STEMI in the U.S. population showed a reduction of STEMI compared to NSTEMI incidence in elderly population. Analyzing the data between 2001 and 2010 from the Nationwide Inpatient Sample (NIS) database, Khera et al. identified that a reduction of STEMI from all type myocardial infarction occurred in the elderly (over 80 years) from 42.8% in 2001 to 23.8% in 2010 [8]. Nevertheless, the incidence remains high, due to the increasing number of elderly patients. However, different data comes from ISACS-TC registry (gathering information on ACS patients from 8 Eastern European transitional countries) [9]. In this registry the proportion of STEMI among ACS patients was 59% compared with 34.3% NSTEMI.

Considering these facts, the treatment of older patients presenting with STEMI represents a significant public health issue due to the high number of cases, their complexity and particularities.

Methods

We studied retrospectively a cohort of 975 consecutive patients with STEMI, admitted to our centre between January 2012 and July 2013. A total of 203 (20.8%) patients were ≥ 75 years old. The patients were followed during index hospital admission for STEMI. The data were extracted from the National STEMI Database of Romania, an observational registry with demographics, practice patterns and health outcomes.

Baseline characteristics, treatment and outcome for each patient were gathered from their admission notes and evaluated. We assessed the clinical risk factors: age, smoking, arterial hypertension, dyslipidemia and diabetes mellitus, and also the significant cardiovascular comorbidities: previous MI or PCI, atrial fibrillation, history of stroke and severe valvulopathies. The admission diagnosis of STEMI was made according to the current ESC guidelines [10]. The clinical presentation symptom was defined as the major complaint of the patient suggestive for ischaemia. We defined the total ischaemia time as the time from the symptom onset to the first balloon inflation. The primary endpoint was the in-hospital mortality rate.

Cases of binary variables were counted and divided according to age (≥ 75/< 75 years old); analysis was performed using the Chi-square test for one variable (with

Yates correction). Continuous variables were first F-tested, resulting in unequal variances; analysis was therefore performed using Welch's independent two-sample two-tailed T-test for heteroschedastic data and samples of unequal size, with a level of significance of < 0.05 for both.

Results

Our study population consists of 975 patients, 203 of which are over 75 years old. The median age of the older group is 80.6 (IQR 76–83) and the younger group is 56.9 (IQR 53–72) (Table 1). The oldest patient was 97 years old. There were more women in the older group (47.2% vs 22.7%; $p < 0.001$) and fewer smokers (13.7% vs 48.8%; $p < 0.001$). There were more hypertensives (78.8% vs 65.0%; $p = 0.01$) but less patients with dyslipidemia (41.3% vs 54.7%; $p = 0.03$) and a trend for less diabetics. The older group had more comorbidities, with more patients having atrial fibrillation (23.6% vs 5.9%; $p < 0.001$), severe valvulopathies (6.8% vs 1.2%; $p < 0.001$) and history of stroke (11.8% vs 4.1%; $p < 0.001$). There was no significant difference in the history of myocardial infarction.

In both groups, chest pain was the main symptom at presentation (78.2% vs 76.0%, p = NS). However, shortness of breath was significantly more prevalent in the older group (16.1 vs 6.3%, $p < 0.001$) and the heart failure expressed by Killip functional class > 1 was more frequent (21.1 vs 7.2%, $p < 0.001$). There was no difference in heart rate at presentation and a nonsignificant trend towards older patients presenting with tachycardia (19.7% vs 15.9%; $p = 0.19$). There were more patients with anterior myocardial infarction in the elderly group (52.2% vs 46.6%; $p = 0.33$). Cardiogenic shock was found in 2.9% in the elderly and 0.7% in the younger group. Surprisingly, there was no difference regarding the total ischaemic time with more than half of each group having an ischaemic time of less than 6 h (54.1 % vs 55.1%; p = NS).

Table 1 – Comparison between older (≥ 75 years) and younger patients (< 75 years) groups.

	< 75 (n = 772)	≥ 75 (n = 203)	*p*
Age, m (IQR)	56.9 (53–72)	80.6 (76–83)	< 0.001
Female, n (%)	176 (22.7%)	96 (47.2%)	< 0.001
Smokers, n (%)	377 (48.8%)	28 (13.7 %)	< 0.001
AHT, n (%)	502 (65.0%)	160 (78.8%)	0.01
Dyslipidemia, n (%)	423 (54.7%)	84 (41.3%)	0.03
DM, n (%)	200 (25.9%)	43 (21.1%)	0.28
Stroke, n (%)	32 (4.1%)	24 (11.8%)	< 0.001
Previous MI, n (%)	77 (9.9%)	19 (9.3%)	0.82
Severe valvulopathy, n (%)	10 (1.2%)	14 (6.8%)	< 0.001
Atrial fibrilation, n (%)	46 (5.9%)	48 (23.6%)	< 0.001
Presentation			
HR > 100 bpm, n (%)	123 (15.9%)	40 (19.7%)	0.19
SBP < 100 mmHg, n (%)	77 (9.9%)	22 (10.8%)	0.68
Anterior MI, n (%)	360 (46.6%)	106 (52.2%)	0.33
Killip class > 1, n (%)	56 (7.2%)	43 (21.1%)	< 0.001
Presentation time			
< 6 h, n (%)	426 (55.1%)	110 (54.1%)	0.86
In-hospital management			
ASA, n (%)	763 (98.8%)	191 (94.0%)	0.54
P2Y12 inhibitors, n (%)	760 (98.4%)	199 (98.0%)	0.91
Anticoagulation, n (%)	756 (97.9%)	197 (97.0%)	0.85
Beta-blocker, n (%)	714 (92.4%)	165 (81.2%)	0.13
ACEI/ARB, n (%)	713 (92.3%)	171 (84.2%)	0.27
Statin, n (%)	752 (97.4%)	189 (93.1%)	0.53
Coronary angiogram, n (%)	744 (96.3%)	171 (84.3%)	0.10
PCI, n (%)	662 (85.7%)	151 (74.3%)	0.02
Outcome			
Lowest LVEF, m (%) (IQR)	43.0 (38–48)	34,7 (30–40)	< 0.001
In-hospital death, n (%)	20 (2.59%)	23 (11.3%)	< 0.001

In a subgroup analysis, the elderly female group smoked less (8.3% vs 20%), were more hypertensives (85.4% vs 76.2%), had more DM (22.9% vs 18.8%) and dyslipidemia (48.9% vs 35.6%). At admission the females had a higher average HR (84 bpm vs 76 bpm) and a lower systolic BP (96 mmHg vs 131 mmHg), $p < 0.05$.

There was a trend towards fewer patients ≥75 years receiving a coronary angiogram for the index event (84.3% vs 96.3%; $p = 0.10$) but also they underwent significantly fewer percutaneous revascularizations (74.3% vs 85.7%; $p = 0.02$). There was a nonsignificant difference regarding the vascular approach with radial approach being chosen in 28.2% in the elderly vs 30.4% in the younger group (p = NS). The extension of coronary lesions (single-/bi-/trivessel disease) was not significantly different between the two groups, except for left main disease in favour of the elderly (12.2 % vs 5.1 %; $p < 0.001$). There was a non-significant difference concerning the in-hospital medical treatment of the two groups with similar rates of double antiplatelet treatment and anticoagulation.

Overall, the in-hospital mortality for our entire study group was 4.41%, with a rate of 2.59 % in the < 75 years group and 11.3% in the older group ($p < 0.001$). In a subgroup analysis we found that females had a higher mortality both in the elderly group (15% vs 7.7%) and in the younger group (3.49% vs 2.34%), $p < 0.05$.

Discussion

Our study deals with the treatment strategy and outcome of unselected STEMI patients in a high-volume primary PCI centre, with an emphasis on a high-risk subgroup that consists of patients over 75 years of age. It represents the first study of its kind in our country since the introduction of systematic primary PCI treatment of STEMI.

Traditional risk factors for coronary artery disease described in younger patients are also found in elderly patients. However, their prevalence depends on the studied population. Our population profile is similar to the risk factor profile of other registry populations. Generally, registry patients tend to be older and to have more risk factors compared to trial patients. This was demonstrated when data from several STEMI trials grouped in Virtual Coordinating Center for Global Collaborative Cardiovascular Research (VIGOUR) were compared to GRACE and NRMI registry populations [11]. Patients above 75 years represented 14% of the entire trials population, compared to 28% in the registry population. Furthermore, registry patients were more frequently hypertensive (57.2% vs 48.3%), diabetic (28.1% vs 18.4%) and had more often a history of cerebrovascular disease (10.7% vs 3.37%).

In elderly patients with acute coronary syndrome, clinical presentation can vary significantly. A recent study [12] which included 255 STEMI patients ≥ 75 years old analyzed the symptoms of presentation to the emergency room. It showed that 41% of patients presented with chest pain, 15.7% pre-syncope or syncope, 15.7% had dyspnea, 9.8% had gastrointestinal symptoms, 6.7% had malaise and 5.0% had delirium. Compared with those who had chest pain as first clinical complaint, patients with atypical clinical presentation had a longer time from symptom onset to the admission, had a higher Killip class on admission (Killip class ≥ III: 28.0% vs 10.5%, for atypical symptoms vs chest pain, respectively), received less reperfusion therapy (40.7% vs 77.1%), and had a higher mortality rate at one month (42.7% vs 21.0%).

There is little data on the reperfusion therapy for elderly population with STEMI. The available data on elderly patients with STEMI comes from subanalysis of major STEMI trials (in which the elderly are often excluded either because of age itself or due associated pathologies which are more frequent and /or more severe in this group) or from national registries [6].

Present STEMI guidelines [10,13] support timely reperfusion either interventional with primary PCI or farmacological (systemic thrombolysis) in patients presenting < 12 h after symptoms onset. No special remark is made concerning the elderly. Rapid reperfusion is mandatory for a favorable therapeutic outcome.

However, in elderly patients, reperfusion therapy is used to lesser extent compared to younger patients. Ancillary data from GRACE registry (2002) showed that almost one third of STEMI patients presenting within 12 hours from symptom onset did not receive any reperfusion therapy [14]. The authors identified age > 75 years as an independent predictor associated with failure to receive reperfusion therapy (OR of 2.63; 95% CI, 2.04 to 3.38). The underuse of reperfusion in elderly is also mentioned in a recent paper (2013) derived from the Belgian STEMI Registry [15]. In our study, there was also an underuse of invasive therapy explained by severe comorbidities, poor general status and in a lesser manner by the delayed time to presentation or diagnosis.

Patients with STEMI and shock represent a specific subset due to the high rate of mortality which is hardly influenced by reperfusion [16]. Current guidelines give class I indication for invasive strategy with the aim of early reperfusion in patients with STEMI and cardiogenic shock irrespective of age [10,13]. It is also recommended that in patients with cardiogenic shock due to pump failure, percutaneous treatment of a severe stenosis in a large noninfarct artery might be considered during primary PCI.

In the only randomized trial performed in patients with shock (SHOCK trial), there was a non-significant trend towards a worse outcome in the subgroup of elderly patients (>75 years) treated with an invasive approach [17]. This trend was opposed to the significant survival benefit with invasive approach that was demonstrated in this trial for the whole study group. However, the benefits of an invasive management in elderly patients with shock complicating STEMI were proven by several registries including the most recent registry report comes from the Korea Acute Myocardial Infarction Registry (KAMIR) [18]. In-hospital mortality rate for the 366 elderly patients (> 75 years old) patients with shock treated between 2008 and 2011 favoured an invasive approach (46.4% conservative vs 23.5% invasive, $p < 0.001$).

In light of these results, an invasive approach should not be denied to elderly patients with STEMI and cardiogenic shock. The advantages of invasive approach observed in registry based data might be determined by selecting only those patients considered eligible for this therapy accord-

ing to the judgement of the treating physician. As a consequence, the management of elderly patients with STEMI and cardiogenic shock should be decided after a careful evaluation of the patient in terms of previous comorbidities, functional status and even life expectancy.

From the technical point of view, in older patients there is an increased prevalence of vascular tortuosity and peripheral artery disease, multivessel coronary involvement, along with a higher incidence of complex lesions, small diameter arteries, calcified lesions, and diffuse disease, making fast and effective reperfusion a challenging target.

Radial approach, which was associated with a decreased incidence of bleeding complications at the access site, rapid mobilization, improved patient comfort [19], and a lower mortality in patients with STEMI is currently used more frequently. Traditionally, the radial approach was limited in elderly patients due to fear of vascular fragility, comorbidities and technical difficulties determined by a higher incidence of vascular tortuosity. In our study group, the decision regarding the vascular approach was made solely on physician's judgement and preference.

There are three major studies which have shown the feasibility and benefit of the radial approach in patients with acute coronary syndrome: RIVAL, RIFLE-STEACS and STEMI-RADIAL [20–22]. Compared with the femoral approach in patients with STEMI, the radial approach has been shown to be associated with significantly lower rates of cardiac death (5.2 % vs 9.2 %, $p = 0.020$), bleeding (7.8 % vs 12.2 %, $p = 0.026$) and hospital stay [21].

Another issue associated with radial approach is whether this approach was associated with a delay in providing reperfusion. Secco et al. [23] analyzed the data of 283 consecutive patients with STEMI > 75 years, treated with primary PCI which was carried through radial approach in 177 cases and through femoral approach in 106 cases. In these series, radial approach in elderly patients was not associated with an increase in door-to-balloon time. Thus, he demonstrated the feasibility and effectiveness of this approach in elderly patients with STEMI.

Freixa et al. [24] analyzed the benefit of left radial approach in octogenarians without history of CABG. Patients were randomized 1 : 1 to left versus right radial approach, having the procedure time and fluoroscopy time as primary endpoints. Subclavian artery tortuosity was more frequent with the right approach, but this difference did not result into a higher cross-over rate and procedure or fluoroscopy time. The study concluded that the left radial approach is a valid method in octogenarians and that it was not associated with benefits in terms of procedure or fluoroscopy time.

As a consequence, recent registry data from 2013, from France indicated an increase in radial artery access usage in elderly patients with STEMI from 60% in 2010 to almost 80% in 2012 [25].

A significantly underused predictor of adverse events in old patients with acute coronary syndromes is frailty. Frailty is a common geriatric syndrome related to adverse outcomes in older patients. It can be defined as a physiological state of low biological reserve which results in increased vulnerability to stressors [26]. Acute coronary syndromes represent a significant stress, and elderly patients may often respond in an unpredictable manner. When exposed to stress, the 'fragile patients' are at risk of developing adverse events, procedural complications, prolonged recovery, functional decline, all of which may result in disability or even death. Although a consensus definition and corresponding assessment tool does not exist yet [27], a widely used operational phenotype for frailty includes 5 criteria: exhaustion, weight loss, low physical activity, weak hand grip, and slow gait speed [28], known as the Fried score.

In a study that included 309 elderly patients hospitalized in a coronary care unit due to multivessel coronary artery disease, Purser et al. showed that frailty varies considerably depending on the assessment tool used: 27% on the Fried scale, 50% on walking speed < 0.65 m/s, and 63% on the Rockwood scale [29]. However, only walking speed was significantly associated with an increased 6 months mortality (OR 4.0).

Frailty was also studied in the setting of revascularization procedures. In one study that included 629 elderly patients undergoing PCI at the Mayo Clinic, the prevalence of frailty was 21% as assessed by the Fried scale before discharge, being associated with a significant increase in mortality at 3 years (28% vs 6 %, OR 2.74) [30].

Conclusions

Elderly STEMI patients represented almost a fifth of the STEMI patients treated consecutively in our centre and presented with a significantly higher in-hospital mortality compared to the rest of the patients.

A strategy based on urgent coronary angiography and PCI in the infarct related artery should be performed in all eligible patients irrespective of age. The expected benefit is bigger in higher risk patients.

Radial approach for primary PCI is a feasible approach, provided that the treating physician is experienced with this technique.

Specific geriatric assessment such as frailty evaluation should be included in cardiovascular risk assessment in the elderly, in order to refine the outcome prediction as advanced chronological age and other classical risk factors do not always provide an accurate reflection of the health status. Specific scoring systems which integrate the severity of coronary disease, the presence of comorbidities which may increase the risk of different therapeutic approaches and parameters that reflect the 'functional' rather than the chronological age may be needed for adequate tailoring of the therapy. In our study, we did not evaluate patients based on objective scoring systems and we based our therapeutic decisions solely on physician's judgment.

Conflict of interest
None of the authors has declared conflicts of interest.

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Ethical statement
The data used in this article are from RO-STEMI registry for an observational study. All patient private data were protected.

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