SHORT COMMUNICATION

Diagnosis and treatment of acute myocardial infarction in tertiary and secondary care hospitals in Estonia

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Abstract

Aim: To compare validity of AMI diagnosis and treatment of AMI patients between tertiary and secondary care hospitals in Estonia. Methods: Two tertiary and seven secondary care hospitals responsible for the treatment of most AMI patients in Estonia were included in the analysis. A random sample of 520 patients admitted to these hospitals with AMI in 2001 was taken from the Estonian Health Insurance Fund database. Medical records were reviewed by trained experts using a standardized data collection form. Results: Forty cases were excluded due to selection errors by the Health Insurance Fund. Of the remaining cases, a diagnosis of AMI was confirmed in 93.3% of cases in tertiary care hospitals and in 83.5% of cases in secondary care hospitals (p<0.001). A total of 210 cases from tertiary and 213 cases from secondary care hospitals with confirmed AMI diagnoses were included in subsequent analysis. Utilization of β-blockers, aspirin, and reperfusion therapy was similar in both types of hospitals. In tertiary care hospitals, ACE inhibitors and statins were more frequently used during hospital stay and recommended at discharge compared with secondary care hospitals. In-hospital mortality was similar in both types of hospitals both before and after adjustment. Conclusions: Tertiary care physicians adhered more strictly to the current definition and guidelines for the management of AMI than did secondary care physicians. However, there is still a need for further improvement in both hospital settings according to international guidelines.

Key Words: acute myocardial infarction, diagnosis, hospital type, treatment

Background

In Estonia, cardiovascular disease, including acute myocardial infarction (AMI), is the main cause of death, accounting for more than 50% of all causes of death [1]. Developed countries have shown a marked decline in cardiovascular disease mortality during the past three decades [2,3], partially due to growing effectiveness of the treatment of AMI and secondary prevention methods [3,4]. In Estonia, the death rate still continues to increase for middle-aged men and women [5].

Gaps between medical care practised and the recommendations derived from evidence-based research are widespread [6,7]. Physicians who practise in tertiary care settings show better adherence to guidelines than physicians in other settings [8,9]. Thus, a major need for treatment quality improvement exists in order to offer comprehensive and effective cardiac care on equal terms to all patients. In 2001, local guidelines for diagnosis and management of AMI were not implemented in Estonia. However, the use of European and American guidelines [10–13] was recommended by
the Estonian Society of Cardiology. Thus, the purpose of this study was to compare the validity of AMI diagnosis and treatment of AMI patients between tertiary and secondary care hospitals.

**Material and methods**

The Estonian health insurance system is a social insurance and it relies on the principle of solidarity. On 31 December 2001, 93.9% of the population of Estonia (1,278,086 of 1,361,200 inhabitants) were insured. From Health Insurance Fund data, during the period 1 January to 31 December 2001, 2,686 hospitalized cases with AMI diagnosis (2,365 individuals) were found (diagnosis code I 21–I 22 according to International Classification of Diseases 10th Revision) [14]. Two tertiary (with availability of percutaneous coronary interventions [PCI]) and seven secondary care hospitals (without availability of PCI), responsible for the treatment of most AMI patients in Estonia, were included in the analysis. For the purposes of our research the following exclusion criteria were applied: (1) cases in which patients were readmitted with AMI within 28 days of the first admission, in order to identify initial hospitalization; (2) a length of stay less than 3 days if the patient was discharged alive and not transferred to another hospital; (3) patients who were not admitted to the hospitals studied. A stratified (by type of hospitals) random sample (n=520) was derived from the remaining cases (n=1,955).

As the primary purpose was to assess the differences in management, a minimum number of 200 patients in both study groups was defined assuming a utilization rate of specific treatments of at least 40% (power 80%, significance level 5% to detect absolute differences of >15%). Such differences were considered clinically important. Because of possible false-positive AMI diagnoses and possible selection errors in the Health Fund database, sample size was increased to 520 records.

Medical records were reviewed by trained experts using a standardized data collection form. All cases with a false-positive AMI diagnosis were re-evaluated and confirmed by the expert group. The criteria for the AMI diagnosis were based on consensus documents [10,15].

**Statistical analysis**

STATA program version 8.1 was used [16]. Comparisons between groups were performed using a t-test or Mann–Whitney U-test for continuous variables, and a chi-squared test for categorical variables. Differences in complications and in-hospital mortality were analysed by logistic regression. The rate ratio with 95% confidence intervals was displayed as a ratio of the rate in tertiary care hospitals to the rate in secondary care hospitals, and it was calculated with software Compare2, version 1.31 [17].

**Results**

In total, 520 case records were reviewed; 210 cases from tertiary and 213 cases from secondary care hospitals with a confirmed AMI diagnosis were included in further analysis. Forty of the cases were excluded due to selection errors that arose in the compilation of the study population by the Health Insurance Fund. Of the remaining cases, a diagnosis of AMI was confirmed in 93.3% in tertiary and 83.5% in secondary care hospitals (p <0.001).

Baseline characteristics of the study groups are summarized in Table I. Smoking status was documented in medical records in 60% of cases in tertiary and in 54% of cases in secondary care hospitals. Lipid profiles (previous known cholesterol values or cholesterol measurements during first 24 h of index hospitalization) were found in 39.5% of cases in tertiary compared with 33.8% of cases in secondary care hospitals.

The use of pharmacological and reperfusion therapies is shown in Table I. ACE inhibitors and statins were used more frequently in tertiary care hospitals. Usage of reperfusion therapy was equal in secondary and tertiary care hospitals.

In-hospital mortality and complications are presented in Table II.

ACE inhibitors and statins were recommended at discharge more frequently in tertiary, and nitrates in secondary care hospitals (Table III).

**Discussion**

The current study shows that tertiary care hospitals adhered more strictly to the current definition and guidelines on the treatment of AMI.

A consensus document regarding the redefinition of MI was published in 2000 [10]. We found that the new biomarker-based AMI definition was not properly used in secondary care hospitals in 2001. Also, a recent study showed that redefinition of AMI has not yet been widely adopted [18].

In the present study, the patient groups in the different types of hospitals were similar in most characteristics, except for proportion of women and
prevalence of hypertension. This may be the result of chance or a consequence of simple randomization procedure. This study demonstrated insufficient reporting of smoking status in medical records and insufficient attention to lipid levels, as also reported earlier [19,20].

Reperfusion therapy and adjunctive medical therapy with aspirin, β-blockers, and ACE inhibitors have been proven to reduce mortality in AMI patients [21–23]. In our study, the use of reperfusion treatment is fairly similar in different types of hospitals. At the same time, more than 50% of

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>Tertiary care hospitals</th>
<th>Secondary care hospitals</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years (mean)</td>
<td>68.3±12.7</td>
<td>68.3±12.4</td>
<td></td>
</tr>
<tr>
<td>&lt;75y, %</td>
<td>69.1</td>
<td>65.7</td>
<td>1.05 (0.92–1.20)</td>
</tr>
<tr>
<td>Men, %</td>
<td>66.7</td>
<td>52.1</td>
<td>1.28 (1.09–1.50)</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>70.0</td>
<td>57.3</td>
<td>1.22 (1.06–1.41)</td>
</tr>
<tr>
<td>Diabetes mellitus, %</td>
<td>19.1</td>
<td>16.4</td>
<td>1.16 (0.77–1.75)</td>
</tr>
<tr>
<td>Previous MI, %</td>
<td>29.5</td>
<td>23.9</td>
<td>1.23 (0.90–1.69)</td>
</tr>
<tr>
<td>Previous heart failure, %</td>
<td>27.1</td>
<td>26.8</td>
<td>1.01 (0.74–1.39)</td>
</tr>
<tr>
<td>STEMI, %</td>
<td>61.4</td>
<td>56.3</td>
<td>1.09 (0.93–1.28)</td>
</tr>
<tr>
<td>Anterior MI, %</td>
<td>36.7</td>
<td>34.7</td>
<td>1.06 (0.82–1.36)</td>
</tr>
<tr>
<td>Length of stay, days (median)</td>
<td>10.0</td>
<td>12.0</td>
<td></td>
</tr>
</tbody>
</table>

In-hospital treatment

Aspirin | 87.1 | 88.3 | 0.99 (0.92–1.06) |
β-blockers | 79.5 | 76.1 | 1.05 (0.94–1.16) |
ACE inhibitors | 70.5 | 37.1 | 1.90 (1.56–2.31) |
Statins | 26.7 | 5.6 | 4.73 (2.61–8.57) |
Any reperfusion therapy in STEMI patients | 42.6 | 43.3 | 0.98 (0.74–1.31) |
Thrombolysis in STEMI patients | 34.9 | 43.3 | 0.81 (0.59–1.10) |
Primary PCI in STEMI patients | 7.7 | NA |  |

Unadjusted OR (95% CI)

Adjusted OR (95% CI) a

OR (95% CI)=odds ratio with 95% confidence interval; VF=ventricular fibrillation; a by multivariate logistic regression analysis adjusting for gender and hypertension.

Table III. Treatment recommendations for AMI patients at discharge in tertiary and secondary care hospitals.

<table>
<thead>
<tr>
<th></th>
<th>Tertiary care hospitals,%</th>
<th>Secondary care hospitals,%</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>85.1</td>
<td>79.8</td>
<td>1.07 (0.97–1.18)</td>
</tr>
<tr>
<td>Nitrates</td>
<td>61.9</td>
<td>85.3</td>
<td>0.73 (0.64–0.83)</td>
</tr>
<tr>
<td>β-blockers</td>
<td>71.3</td>
<td>68.7</td>
<td>1.04 (0.90–1.19)</td>
</tr>
<tr>
<td>Calcium antagonists</td>
<td>21.6</td>
<td>14.1</td>
<td>1.53 (0.95–2.44)</td>
</tr>
<tr>
<td>ACE inhibitors</td>
<td>66.3</td>
<td>37.4</td>
<td>1.77 (1.42–2.22)</td>
</tr>
<tr>
<td>Statins</td>
<td>31.5</td>
<td>14.5</td>
<td>2.14 (1.39–3.28)</td>
</tr>
</tbody>
</table>

RR=rate ratio; 95% CI=95% confidence intervals; a proportions of medication recommendation were calculated per patient discharged alive and not transferred.
ST-elevation myocardial infarction (STEMI) patients did not receive reperfusion therapy, which is greater than that found in other studies [6,7]. This finding sets a clear target for improvement for each hospital. The low rate of primary PCI was a result of insufficient availability – catheterization laboratories operated 5 days/week during working hours. Utilization of β-blockers and aspirin was similar, but the utilization of ACE inhibitors and statins varied during in-hospital period and at discharge in different hospital settings. These medications are clearly underused and further improvement is required.

Study limitations

The major limitation of our study is a relatively small study population. A high proportion of patients were not included in the study, which can cause selection bias. Although records were selected at random, it is possible that the findings are not generalizable to the larger population.

Conclusions

Tertiary care physicians adhered more strictly than secondary care physicians to the current definition and guidelines for the management of AMI. Therefore, further efforts are needed to improve the diagnostics and management of AMI in accordance with international guidelines, including development of local guidelines, and proper use of healthcare resources in Estonia.

Acknowledgements

Data from the Health Insurance Database were obtained and study population randomly selected by Mrs Maie Thetloff. The study was supported by a grant from the Estonian Health Insurance Fund and by Estonian Science Foundation grant nos 4627 and 5782. The research of A. Baburin was financed by Estonian Science Foundation grant nos 4627, and 5782. The major limitation of our study is a relatively small study population. A high proportion of patients were not included in the study, which can cause selection bias. Although records were selected at random, it is possible that the findings are not generalizable to the larger population.

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[16] Stata users guide, College Station, TX: Stata Press, 1997.


