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Cagán S, Besedová I, Jurkovicová O, Riecanský I, Trnovec T
Wimmerová S

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The AUDIT Project: Factors Affecting Thrombolytic Therapy in 3,123 Patients With Acute Myocardial Infarction

S. Cagáň[1], T. Trnovec[1], I. Riečanský[2], O. Jurkovičová[3], S. Wimmerová[1], I. Besedová[1]

In the course of a year (16/09/1997 – 15/09/1998), the management of health care for patients with acute myocardial infarction (AMI) was audited in Slovakia. The questionnaire-based prospective multicenter study involved 66 departments treating AMI-patients and included 3123 patients, of whom 1074 (34.6 %) underwent thrombolytic therapy (TLT). This paper reports on factors influencing TLT under the specific conditions in Slovakia. The median time from onset of symptoms to treatment was 185 min, and the median time from arrival at the hospital to the beginning of treatment (door-to-needle time) was 30 min. Most frequently TLT-treated patients presented themselves in the hospital within 2 hours after onset of symptoms (58.3 %). Still, 29.9 % of patients arriving between 6 and 12 hours after onset of symptoms were nevertheless treated by TLT. The in-hospital delay was longer for patients with a history of repeated AMI, angina pectoris, or hypertension. With regard to age, sex, and diabetes, there was no difference in the duration of hospital delay. On the other side, the study has found a clear predominance of pre-hospital over hospital delay. We have also discovered a great potential for increasing TLT-administration to patients older than 64 years, women, and patients with repeated/next AMI as well as administering TLT in the night-time. Night-time TLT-administration has been hindered mainly by patient delay (median 120 min) and partly also by a prolongation of transportation time in the night (to a median of 59.5 min). The main factors for not accomplishing TLT were: late arrival into the hospital (> 12 hours after symptoms onset, 34.9 %), uncertain indication of TLT (29.9 %) and contraindications (16.1 %). *J Clin Basic Cardiol 2002; 5: 183–8.*

Key words: acute myocardial infarction, thrombolytic therapy, clinical audit

Acute myocardial infarction (AMI) is a particularly significant event in the natural course of the ischaemic heart disease (IHD). Often it is a single dramatic or even a repeated peaking of IHD in a certain period of its development. It can result in important short- or long-term consequences. It is associated with high, mainly early mortality. The present study was done in Slovakia, a region characterised by an epidemic of cardiovascular disease (CVD) lasting for several decades [1, 2]. It manifests itself as a premature cardiovascular mortality attributable to all CVD, but particularly to ischaemic heart disease.

The importance of the time factor in thrombolytic therapy (TLT) is known from experimental and clinical observations targeted to infarction size, saving of jeopardized myocardium and to reducing mortality of AMI-patients. In the era of thrombolytic therapy, the time interval between onset of symptoms and the beginning of the therapy is directly related to the prognosis of AMI-patients: The sooner the therapy starts, the better the prognosis [3, 4]. Late arrival of AMI-patients into the hospital or a delay in initiating TLT-treatment results in a decrease of the number of patients treated by thrombolysis and also by a decrease of the therapeutic efficiency of TLT [5]. The administration of TLT within 2 hours after the beginning of AMI will save 35, within 4 hours 25, but in the following 4 hours only 19 lives per 1000 treated patients [4]. The result of the treatment is optimal when TLT begins as early as possible following the onset of symptoms evidencing AMI [3, 6, 7]. The administration of TLT within one hour after the onset of symptoms resulted in a 45 % mortality decrease in comparison with an untreated group of AMI-patients [3]. It is remarkable that from all the preventable causes of death, the most frequent is death due to a delay in TLT-administration for AMI-patients [8].

In order to identify the ways leading to an effective intervention in the course of AMI, a thorough knowledge of the management of AMI-patients is needed. Since there was no complex data on the management of AMI-patients available in Slovakia, a project "Audit of diagnostic and therapeutic measures of patients with acute coronary syndromes during the pre-hospital and hospital phases" (AUDIT), which focused on the assessment of important data necessary for improving the management of AMI-patients, was initiated.

The aim of the present paper is to report on the influences of some demographic, clinical, and situational pre-hospital and hospital factors on the realization of TLT and on the number of thrombolysed AMI-patients.

Methods

As a tool for evaluating the quality of health care and the compliance with clinical practice guidelines in the management of AMI-patients in Slovakia, a clinical audit was used. The AUDIT project was realized in Slovakia as a prospective multicentric study. The collection of data involved 66 departments in 64 health care establishments (about 2/3 of all facilities in the country) in the period from September 16, 1997 to September 15, 1998. 3123 patients were included into the AUDIT project. All of them were admitted into the hospital with the diagnosis of AMI or of suspected AMI, that being within 96 hours after onset of symptoms, and they were all discharged with a diagnosis of a first or a repeated AMI. The data of every patient were recorded by the physician in a questionnaire designed for this purpose. The study represented an independent audit and no specific procedures pertaining to thrombolysis and other means of reperfusion or to any other diagnostic and therapeutic approaches were recommended. A local coordinator organized AUDIT in each of the participating hospitals. The health care for AMI-patients or suspected AMI-patients was in agreement with the current, locally adopted methods. The completed question-

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From the [1]Institute of Preventive and Clinical Medicine, Bratislava, the [2]Slovak Institute of Cardiovascular Diseases, and the [3]4th Clinic of Internal Medicine, Faculty of Medicine, Comenius University, Bratislava, Slovak Republic.
Correspondence to: Prof. Tomas Trnovec, Institute of Preventive and Clinical Medicine, Limbová 14, 83301 Bratislava, Slovak Republic; e-mail: trnovec@upkm.sk

naires, after being reviewed by the local coordinator, were sent for further processing to the Institute of Preventive and Clinical Medicine in Bratislava, where they were reviewed by the principal investigator before being entered into the database. If indicated by the principal investigator, the questionnaires were sent back for additional entries or corrections. The data were then entered into a relational database ACCESS 97 and processed by EXCEL 97 and the statistical package SPSS. The normal distribution was tested by the Kolmogorov-Smirnov test, and the data for every two groups were compared using the Mann-Whitney U test and for more groups using the Kruskal-Wallis test.

AMI was diagnosed when 2 of the following criteria were fulfilled: (1) a typical chest pain lasting > 20 minutes, (2) a development of pathologic Q waves or evolutionary ST- and T-wave changes on the electrocardiogram, and (3) a typical increase and decrease of serum creatine kinase level above twice the upper limit of the normal.

The basic components of the delay from onset of symptoms to treatment are

1.) total pre-hospital delay (from onset of symptoms to arrival at the hospital) and
2.) in-hospital delay or door-to-needle time (time from arrival at the hospital to initiation of TLT).

Total pre-hospital delay was further divided into:

a.) patient related (ie failure to recognize the seriousness of the problem and delay in seeking emergency care – patient time delay) and
b.) transport time delay (pre-hospital evaluation and transport time).

The time of onset of symptoms is defined as the beginning of a continuous persistent (sometimes intermittent) discomfort that brought the patient to the hospital.

In this paper we analyse the data based on our experience with 1074 AMI-patients treated by TLT. TLT was administered in the hospitals, and streptokinase was almost exclusively used. It was administered as usually recommended: 1.5 million units in the course of 1 hour, and in accordance with [9] for patients with ST segment elevation or with a left bundle-branch block. The mean age of included patients was 60.9 ± 11.65 years. 639 (59.5 %) of them were older than 64 years. Of all patients, more than 2/3 were males (69.2 %). The mean age of men and women (30.8 %) was 58.5 ± 11.32 and 66.2 ± 10.36 (years), respectively.

Results

The basic information on TLT-administration to our patients is shown in Tables 1–4. The median time from the onset of symptoms until the beginning of the treatment was 185 min (Tab. 1), until arrival at the hospital 140 min (Tab. 2), and the median time from the arrival at the hospital until the beginning of TLT (door-to-needle time) was 30 min (Tab. 3). Patients who entered the hospital within 2 hours after onset of symptoms were treated by TLT most frequently (58.3 %). Nevertheless, from patients arriving between 6 and 12 hours after onset of symptoms almost 1/3 (29.9 %) was still treated by thrombolysis (Tab. 4).

Table 1. Interval from onset of symptoms until beginning of TLT

Distribution	Number of patients	%	Cumulatively
≤ 2 h	299	30.3	
> 2 h ≤ 4 h	308	31.2	61.5 %
> 4 h ≤ 6 h	150	15.2	76.7 %
> 6 h ≤ 12 h	153	15.5	92.2 %
> 12 h	77	7.8	100 %

Data available for 987 patients (91.9 %); median 185 (115, 345) min; mean ± SD 341 ± 568.2 min

Table 2. Interval from onset of symptoms until arrival to the hospital

Distribution	Number of patients	%	Cumulatively
≤ 1 h	206	20.2	
1–2 h	263	25.7	45.9 %
2–4 h	257	25.2	71.1 %
4–6 h	121	11.8	82.9 %
6–12 h	119	11.7	94.6 %
> 12 h	56	5.4	100 %

Data available for 1022 patients (95.2 %); median 140 (75, 275) min; mean ± SD 269.2 ± 485.1 min

Table 3. Interval from arrival at the hospital until beginning of TLT

Distribution	Number of patients	%	Cumulatively
≤ 30 min	609	59.9	
> 30 min ≤ 1 h	207	20.3	80.2 %
> 1 h ≤ 2 h	106	10.4	90.6 %
> 2 h ≤ 4 h	47	4.6	95.2 %
> 4 h	48	4.8	100 %

Data available for 1017 patients (94.7 %); median 30 (15, 51.5) min; mean ± SD 87 ± 356.3 min

Table 4. Accomplishment of TLT with regard to total pre-hospital delay

Pre-hospital delay		TLT	
Delay	Number of patients	Number of patients	%
≤ 2 h	805	469	58.3
> 2 h ≤ 4 h	585	257	43.9
> 4 h ≤ 6 h	267	121	45.3
> 6 h ≤ 12 h	398	119	29.9
> 12 h	642	56	8.7

Data available for 2697 patients (86.8 %)

Table 5. In-hospital delay with respect to patient characteristics

Patient characteristics	Number of patients	%	Median delay [min]	p
Age ≤ 64	606	94.8	30 (15, 50)	
Age > 64	414	94.5	30 (15, 55)	N.S.
Males	707	95.3	30 (15, 50)	
Females	309	93.4	30 (15, 51.5)	N.S.
After AMI	131	12.9	35 (15, 80)	
First AMI	886	87.1	30 (15, 50)	≤ 0.05
Angina pectoris present	251	24.7	30 (15, 60)	
Angina pectoris absent	766	75.3	28 (15, 50)	≤ 0.01
Hypertension present	432	42.5	30 (15, 50)	
Hypertension absent	585	57.5	25 (15, 50)	≤ 0.05
Diabetes mellitus present	184	18.1	30 (15, 45)	
Diabetes mellitus absent	833	81.9	30 (15, 35)	N.S.

Data available for 1017 patients (94.7 %)

Door-to-needle time (Tab. 5) was longer for patients with a history of repeated AMI, angina pectoris and hypertension. No differences in in-hospital delay were found with regard to age, sex, diabetes, and total pre-hospital delay. The median door-to-needle time was the same (30 min) for patients admitted during the first 2 hours and between 2 to 6 hours after onset of symptoms (Tab. 6). A comparison of the onset-to-treatment time (median 185 min) or of the total pre-hospital delay (median 140 min) with the door-to-needle time (median 30 min) shows a clear predominance of pre-hospital delay over hospital delay. The data on TLT accomplishment (Tab. 7) show that TLT was realized only for 29.1 % of patients with hypertension, for 28.3 % of patients with diabetes mellitus and for 20.3 % of patients with pulmonary oedema or shock. The patients with higher and highest risk of death

Table 6. In-hospital delay with respect to total pre-hospital delay.

Pre-hospital delay			In-hospital delay	
Delay	Number of patients	%	Median [min]	Mean [min] ± SD
≤ 2 h	453	46.6	30	75.0 ± 260.6[†]
> 2 h ≤ 6 h	354	36.4	30	79.9 ± 331.7[†]
> 6 h ≤ 12 h	114	11.7	22.5	101.0 ± 547.5[†]
> 12 h	51	5.3	30	104.5 ± 233.4[†]
≤ 140 min[*]	495	50.9	30	73.5 ± 250.5
> 140 min	477	49.1	30	89.5 ± 397.4 N.S.

Data available for 972 patients with TLT (90.5 %). [*] Median of total pre-hospital delay = 140 min; [†] No significant differences between data for the individual time intervals were shown by Kruskal–Wallis test

Table 7. Data on accomplishment of TLT and non-accomplishment of TLT

Patient characteristics[*]	Accomplishment of TLT				Non-accomplishment of TLT	
	Number of patients	Patients with TLT		p	Number of patients	%
		Number	%			
Age ≤ 64 years	1446	639	44.2			
Age > 64 years	1656	435	26.3	≤ 0.001		
Male	1943	742	38.2			
Female	1160	331	28.5	≤ 0.001		
After AMI	679	159	23.4			
First AMI	2392	911	38.1	≤ 0.001		
Hypertension present	1934	562	29.1			
Hypertension absent	1189	512	43.1	≤ 0.001		
Diabetes mellitus present	982	278	28.3			
Diabetes mellitus absent	2141	796	37.2	≤ 0.001		
AMI with complications	1320	474	35.9			
AMI without complications	1803	600	33.3	N.S		
Lung oedema or shock present	231	47	20.3			
Lung oedema or shock absent	2892	1027	35.5	≤ 0.001		
Arrival of patient > 6 h after onset of symptoms					117	5.8[†]
Arrival of patient > 12 h after onset of symptoms					710	34.9[†]
Uncertain indication					608	29.9[†]
Determined contraindications					328	16.1[†]
Absence of patient's consent					5	0.2[†]
For unknown reasons					358	17.6[†]

[*] Data available for 1019 patients. [†] Percentages were calculated from the 2033 patients without TLT. There may be several reasons for not accomplishing TLT in one patient. Therefore their sum 2126 > 2033 of patients without TLT.

Table 8. Data[*] on circadian variability of onset of symptoms, arrival of patient at the hospital, beginning of TLT, patient time delay and transport time delay

Time interval	Symptoms onset		Arrival at hospital		Beginning of accomplished TLT		Patient time delay[†]			Transport time delay[‡]		
	Number	%	Number	%	Number	%	Number	%	Median [min]	Number	%	Median [min]
00.00–05.59	218	21.4	139	13.6	132	12.9	214	21.4	120 (40, 320)[¶]	209	21.2	59 (30, 105)[¶]
06.00–11.59	376	36.9	346	34.0	324	31.8	367	36.7	60 (30, 175)[¶, ||]	365	36.9	45 (27.5, 82.5)[¶]
12.00–17.59	247	24.2	319	31.3	331	32.5	241	24.1	60 (30, 145)[¶, ||]	238	24.2	40 (20, 60)[¶, ||]
18.00–23.59	178	17.5	215	21.1	232	22.8	178	17.8	65 (30, 210)[¶, §]	175	17.7	40 (25, 65)[¶, +]

[*] Data available for 1019 (94.9 %) patients with TLT; [†] Data available for 1006 (93.7 %) patients with TLT; [‡] Data available for 991 (92.3 %) patients with TLT; [¶] p ≤ 0.001 by Kruskal-Wallis test; [||] p ≤ 0.001 vs 1st time interval by Mann-Whitney U test; [§] p ≤ 0.05 vs 1st time interval by Mann-Whitney U test; [+] p ≤ 0.01 vs 1st time interval by Mann-Whitney U test

from their AMI were the least likely to receive TLT. Still, it was applied only to a small percentage of patients during the night time, mainly between 00.00 and 5.59 a.m. (12.9 %).

The data on the circadian variability of the onset of AMI, the arrival of patients at the hospital and the starting of a TLT-treatment are shown in Table 8. In the time interval from 00.00 to 5.59 a.m., the smallest number of patients with AMI-symptoms arrived at the hospital, which obviously also resulted in the smallest number of patients thrombolysed during this time interval. The reasons for this are the long delays in patient time delay and, partly, in transport time. It can be seen from the data that the main factors are extended patient delay (median 120 min) but also a slight prolongation of transportation time (median 59.5 min). In other words, during the night-time, fewer patients with AMI-symptoms came to the hospital than during a similar period during the day. Also, their transport to the hospital was not as prompt as during a similar daytime period.

Discussion

The arrival of AMI-patients at the hospitals in Slovakia is markedly delayed. For 3123 patients included into the AUDIT project, the main reason for the late arrival at the hospital was a late decision to seek medical help reflected in a fatally long duration of patient time delay (median 140 min). The median of total pre-hospital delay was 240 min. The percentage of patients who decided to seek medical help within 2 and within 4 hours after onset of symptoms was 48.3 % and 61.7 %, respectively. Only 29.8 % of patients reached the hospital within an optimal time interval of 2 hours after onset of symptoms and 51.5 % of patients reached it within a still acceptable time interval of 4 hours [10]. The median of transport time delay was 55 min and 58.8 % of patients reached the hospital within the first hour after their decision. Almost 20 % of AMI-patients entered the hospital later than 2 hours afterwards. The AUDIT project revealed interesting data on the transport/arrival of AMI-patients to/at the hospital with regard to the decision of the patient/bystander. The greatest percentage of the patients who reached the hospital within 60 min were those who called the emergency medical service (72.9 %) vs only 31.9 % of patients who decided to visit a doctor. Only 34.9 % of patients called emergency medical service. Moreover, at least 90.7 % of patients reached the hospital within 120 min when transported by the emergency medical service and only 59.7 % of patients when visiting a doctor [11]. By influencing these factors, an earlier arrival of a greater number of AMI-patients at the hospital could be achieved.

The infarction size and an unequivocal saving of the myocardium is a time-dependent phenomenon. The sooner TLT is performed, the greater its effect [7, 12–14]. In the present, an early administration of TLT is required, in spite of the fact that it is still a matter of discussion how great the benefit from its early realization is [15–17]. An early administration of TLT may not only result in reopening the coronary artery occluded by the thrombus, but also in saving a great part of the myocardium jeopardized by necrosis. The statement "time is a muscle" [18] based on experimental studies and clinical practice, is justified. An early reperfusion, with respect to its life saving potential, should be considered as urgent as the therapy of heart arrest [19, 20]. Though the time factor in the latter is more important, after an optimalization of both therapeutic strategies the contribution to the reduction of mortality is similar.

As much as 50–60 % of patients may be considered as potential candidates for TLT [21]. The late arrival of patients at the hospital (total pre-hospital delay) affects not only the efficiency of TLT, but also the number of patients for whom TLT is realized. Our team has also reviewed similar studies made in various Western European countries. In spite of a different social and economic climate during the past decades, many similarities between our data and data from these studies were found. In Slovakia, TLT was realized for 34.6 % of AMI-patients. The greatest number of thrombolysed patients (58.3 %) was found in the group of patients who were admitted into the hospital within 2 hours after onset of symptoms, and TLT was administered to 29.9 and 8.7 % of patients admitted between 6–12 and more than 12 hours following onset of symptoms, respectively. All of these data agree remarkably well with those assessed for Denmark [5]. In a study done in Sweden [22], the median time from onset of symptoms to treatment (onset-to-needle time) was 2 hours 50 min (in Slovakia 3 h 5 min), and the median of the in-hospital time delay (door-to-needle time) was 55 min (Slovakia: 30 min). In Finland [23] the median of the onset-to-treatment time (2 hours 40 min; Slovakia: 3 h 5 min) was very similar to that found in Sweden. Only for 13 % of AMI-patients TLT started within 1 hour (within 30 min 59.9 % and within 1 hour 80.2 % in Slovakia), for 38 % within the first 2 hours (Slovakia: 90.6 %), and for 16 % of patients was TLT realized later than 6 hours after onset of symptoms (in Slovakia later than 4 hours 4.8 %). The median door-to-needle time was 40 min (Slovakia: 30 min). As well as in our study, the in-hospital delay was acceptable for patients with a clear indication of TLT. It was considerably prolonged for 33 % of patients with diagnostic and therapeutic problems related to TLT. These represented the single significant factor influencing the hospital delay [23]. In the USA, TLT was realized within 30 min after admission for 23 % of AMI-patients, within 1 hour for 63 %, and within 90 min for 83 % of patients [24]. In comparison, the data from Slovakia are favourable. Here TLT was realized within 30 min for as much as 59.9 % of AMI-patients, within 60 min for 80.2 %, and within 2 hours after admission for 90.6 % of AMI-patients. When compared to the American data, the AUDIT study found a longer median time from onset of symptoms to treatment (median 3 h 5 min), but a shorter in-hospital delay (median 30 min). The in-hospital delay determined for AMI-patients was shorter than that found in Finland [23] and Sweden [22], and also shorter when compared to delays found in preceding studies [25–27].

Patients with TLT also show a striking predominance of pre-hospital over hospital delay. A median pre-hospital delay of 140 min postpones the realization of TLT considerably more than a median door-to-needle time of 30 min. The greatest in-hospital delay (Tab. 5) was found in patients with repeated/next AMI, and in patients with a history of angina pectoris and hypertension. In these diseases, the course of AMI is often atypical. Possible changes in ECG already present prior to AMI make the diagnosis of AMI difficult. The duration of the door-to-needle time was not longer for women, for patients older than 64 years, and surprisingly also not for patients with diabetes mellitus. The diagnostic and therapeutic problems (most often small changes in ECG and suspected contraindications of TLT) can occur in many patients with TLT (as much as 33 %) [23].

We did not confirm data showing a relationship between a prolonged door-to-needle time and the duration of the total pre-hospital delay [22]. The in-hospital delay was the same (30 min) for patients admitted within 2 hours as for those admitted between 4 and 6 hours and after 12 hours. A short median in-hospital delay (about 20 min) was stated also in the GISSI-2 study [31]. The same medians were found for patients arriving at the hospital 2 or even 12 hours after the onset of AMI. Different data were obtained when the door-to-needle time was expressed as a mean value: It was 30 min for patients admitted within 2 hours and as much as 3 hours for patients who presented themselves after 12 hours. We did not find any significant differences even when evaluating the mean values (Tab. 6).

Our data (Tab. 7) indicate several groups in which there is a potential to increase the number of TLT: patients older than 64 years, women, patients with a repeated/next AMI, with hypertension and diabetes, lung oedema and shock. This is not to say that we can be satisfied with the number of thrombolysed patients in other comparable groups with a better score. The main factors for not accomplishing TLT in 2033 patients were: Late (> 12 h after onset of symptoms) arrival at the hospital (34.9 % of patients), uncertain indication of TLT (29.9 %), and contraindications (16.1 %).

The circadian variability of the median patient time delay and the median transportation time influenced the arrival time of the patient at the hospital. Also the number of TLT administrations was influenced by these factors. A pronounced and significant decrease in the number of patients presenting themselves in the hospital during the time interval from 00.00 a.m. to 5.59 a.m. (Tab. 8), followed by a decrease of thrombolysed patients, can be related either to patient time delay or to transportation time delay. It can be seen from data in Table 8 that mainly an increase in the patient time delay resulted in a decrease in the number of patients who presented themselves at the hospital in the time interval from 00.00 a.m. to 5.59 a.m. Surprisingly, this decrease was not compensated during the next time interval from 6.00 a.m. to 11.59 a.m., but rather later. As seen from these data, it is crucial to shorten the patient time delay during the night hours, mainly between midnight and early morning. Our data agree with others, showing that the occurrence of AMI during the night is related to a longer patient time delay [5, 28].

It must be noted that the transportation time delay includes not only the time needed for the actual transport of the patient to the hospital, but also the necessary time for examination, preparation for transport, response of the ambulance to the patient call, etc. Factors such as the availability of doctors and of the emergency medical service during the night can be more significant than transportation time delay itself. Probably more AMIs could be unrecognised at first examination during the night time compared to day time and the patients got to the hospital after a deterioration of their state, sometimes also after a repeated examination by the doctor.

Conclusions

(1) The variable character of the pre-hospital and in-hospital circumstances influencing TLT, not only in Slovakia, but also elsewhere, depend on socio-demographic, psychological, and clinical factors, environmental influences [29], and situational factors. Influential are personal, professional, social, and health specificities of the population and the means of the administration of health care and its quality level with regard to patients with acute events, including availability of medical care and its comfort. Equally important is the educational level of the population and different cultural traditions in individual countries also play a role [29]. The traditions may play a role both on behalf of patients as on behalf of the providers of care for patients with acute coronary syndromes.

(2) There is a need to determine the most important local factors delaying TLT and the number of patients treated by TLT in various countries. The analysis of data obtained in the AUDIT project will help to identify barriers hindering an early TLT or another efficient treatment and factors associated with their delay. Such data are inevitably necessary for designing a (national) program of intervention aiming at an earliest possible arrival of patients with AMI into the hospital and at an early efficient therapy.

(3) The similarity of our data to those of "western" countries is surprising: In spite of different social and health care systems for 40 years and of the transformations taking place since the nineties, no striking differences were found. This similarity may also be due to the fact that elements of the western type of health care were also interwoven into the health care in Eastern European countries.

(4) The health status of the Slovak population is significantly affected by the high (> 50 %) mortality due to cardiovascular diseases. The study was completed under the conditions of a protracted transformation of the health care system since 1990 and we have faced a lack of resources in the last years. The study involved hospitals with markedly different diagnostic and therapeutic standards and involved a non-selected group of patients with AMI. In spite of not being incidental, it furnished a wealth of information on the current management of patients with AMI in Slovakia.

(5) The data obtained can be used not only by physicians, but also by all providers and realizers of health care, for the elaboration of a national strategy and procedures targeted to the earliest arrival of patients with AMI into the hospital, and to an efficient TLT for the greatest possible number of patients with AMI.

(6) The data show that in Slovakia relevant guidelines were implemented into clinical practice, eg of the European Society of Cardiology [9] and Guidelines of American College of Cardiology/American Heart Association [30].

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