Original article

Pre-hospital delay of treatment in patients with ST segment elevation myocardial infarction undergoing primary percutaneous coronary intervention: experience of cardiac centre located in the vicinity of the centre of Warsaw

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Abstract

Background: Early reperfusion therapy with primary percutaneous coronary intervention (PCI) in patients with ST-segment elevation myocardial infarction (STEMI) improves left ventricular function and reduces mortality.

Aim: To assess the time delay in treatment of patients with STEMI referred to a twenty-four-hour interventional centre located in the vicinity of the centre of Warsaw.

Methods: We analysed 350 consecutive STEMI patients admitted to our Department between October 2005 and September 2006. The majority of the patients – 244 (69.7%), were admitted via hospitals without an interventional department. Sixty-two (17.7%) patients were transported directly by ambulance from home, 34 (9.7%) from a community health centre and 10 patients (2.9%) came by themselves from home or work. A detailed interview concerning the time of symptom onset was conducted in 342 patients (97.7%).

Results: Sixty-two (18%) patients arrived at the interventional centre within the first 2 hours from symptom onset: 6 women (5.5% of all women in the study population) and 56 (24.1%) men (p <0.0001). Within the first 2 hours, 32 (13.1%) patients were admitted via another hospital and 20 (32.2%) directly by ambulance (p <0.001). During the first 7 days of hospitalisation the following patients died: 2 (3.2%) patients admitted within the first 2 hours via another hospital, 6 (3.4%) patients among 178 admitted between 2 and 6 hours after pain onset, 4 (8.3%) among 48 admitted between 6 and 12 hours and 8 (14.8%) among 54 patients with the pain duration over 12 hours (p <0.02). During the first 7 days of hospitalisation 8 (3.3%) patients admitted within the first 6 hours after pain onset died compared with 12 (11.8%) admitted later (p <0.003).

Conclusions: In the interventional centre located near the centre of Warsaw symptom-onset-to-door time was 120 minutes only in 18% of patients with STEMI. Almost 70% of patients underwent interhospital transfer for primary PCI. Prolongation of the time from onset of symptoms to successful PCI worsened prognosis. When transporting patients with acute coronary syndrome, efforts should be made to avoid district hospitals without a catheterisation laboratory. Direct transportation by ambulance or helicopter with educated staff equipped with ECG teletransmission data, which may substantially shorten time to treatment, should be preferred.

Key words: STEMI, percutaneous coronary intervention, pre-hospital delay

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Introduction

Pre-hospital delay between onset of chest pain typical for acute coronary syndrome (ACS) and primary percutaneous coronary intervention (pPCI) restoring infarct-related artery patency plays a key role in the restoration of normal perfusion of myocardium and reduction of mortality [1–5]. This delay to perform PCI in the course of ACS is influenced by the time it takes for the patient or accompanying persons to make a decision to call for medical help, the time it takes the physician or rescue team of the ambulance service to establish proper diagnosis and patient transportation, and, finally, in-hospital delay [6].

Reduction of delay between first medical contact and infarct-related artery flow restoration depends on efficient management including prompt diagnosis and referral to a hospital with cath-lab facilities availability [6, 7].

Table I. Transportation to the catheterisation laboratory

	Number of patients
Via regional hospitals	244 (69.7%)
By ambulance Service	62 (17.7%)
From outpatient clinics	34 (9.7%)
From home	10 (2.9%)
Overall	350 (100%)

The aim of the study was to analyse the delay of ACS patients presenting with ST segment elevation myocardial infarction (STEMI) or acute left bundle branch block (LBBB) treated in our centre.

Methods

Study patients

Between October 1, 2005 and September 30, 2006 (365 days), 500 patients with ACS were treated in our Department, located in the vicinity of Warsaw centre. This group comprised 332 subjects with STEMI (66.4%) and 18 patients with acute LBBB (3.6%).

In the remaining 150 (30%) patients non-ST elevation ACS (NSTE-ACS) was diagnosed.

Among 350 individuals with STEMI or acute LBBB, there were 238 (68%) men and 112 (32%) women with a mean age of 62.7±11.3 years (median 61.8 years).

Qualification for PCI

Physicians on duty in the centre were responsible for patient selection for invasive therapy based on phone contact. Most often referral to the catheterisation laboratory was arranged by doctors of emergency departments of hospitals without invasive therapy facilities, ambulance rescue teams, or physicians of outpatient clinics after contacting physicians employed in our centre, when diagnosis of ACS was suspected or established. Some patients were transferred directly to the catheterisation laboratory without earlier arrangement by 'R' ambulance services. On rare occasions patients reached hospital directly from their homes or place of work without the help of a rescue team or via another hospital.

Transportation to the reference centre

The majority of patients reached our centre via regional hospitals in Warsaw, or surrounding centres (70%). Fewer patients were transported directly, not via another hospital, by ambulance services. The least numerous group of patients were referred from general or specialised outpatient clinics or reached hospital on their own from home or place of work (Table I). There were no differences with respect to the percentage of women and men reaching the catheterisation centre via other hospitals or directly.

Hospitalisation delay

Time from onset of infarction pain (or other symptoms and signs suggesting acute MI) to patient arrival at our centre with invasive therapy facilities was assessed by a physician in the hospital emergency department and recorded in the study questionnaire. The form of transportation to hospital was also recorded. The next part of the study questionnaire was completed during hospitalisation. Among other information, type and date of the coronary intervention was recorded.

A detailed history regarding the time of onset of symptoms and signs of MI was obtained from 342 patients or accompanying persons (97.7%). In 8 (2.3%) cases such data could not be obtained.

Statistical methods

Statistical analysis was performed using computer statistical package SAS 8.e. Results are presented as mean ± SD or numbers and parcentages.

Exact Fisher's test or χ^2 test with Yate's correction were used to examine the differences between categorical variables. Hypotheses were verified with p level ≤0.05.

Results

The majority of patients (52%) reached our department within 2-6 hours of the onset of pain. More male than female patients were transferred to our hospital (24.1 vs. 5.5%, p <0.0001) in the 'golden hour' (i.e. within 2 hours of the onset of symptoms). The opposite was true for patients admitted >2 hours from the onset of symptoms – 104 (95%) females vs. 176 (76%) males (p <0.0001). Detailed data are outlined in Table II.

Delay of hospitalisation in relation to the form of transfer to the reference centre is presented in Figure 1.

Of note, only 13.1% of patients with STEMI or infarction accompanied by acute LBBB were admitted to our department within the first 2 hours of the onset of pain if diagnosis was established in the first-contact hospital. Among patients diagnosed and directly transported by the ambulance team this percentage was 32.3% (Figure 2).

Mean time of waiting for PCI after arriving at our centre (door-to-reperfusion time) was 32±17 minutes and did not differ significantly between the groups of patients who died and those who were discharged alive from our hospital.

Mortality

During the first 7 days of hospitalisation 20 patients died. Mortality in relation to hospitalisation delay is presented in Table III.

Table II. Number and percentage of females and males with STEMI admitted to the department in relation to time from the onset of symptoms

Time	Overall	Females	Males	p
<2 hours	62 (18%)	6 (5.5%)	56 (24.1%)	
2-6 hours	178 (52%)	72 (65.5%)	106 (42.7%)	
6-12 hours	48 (14%)	12 (11%)	36 (15.5%)	0.0001
>12 hours	54 (16%)	20 (18%)	34 (14.7%)	

Table III. Delay of hospitalisation and early mortality (7-day) in STEMI patients

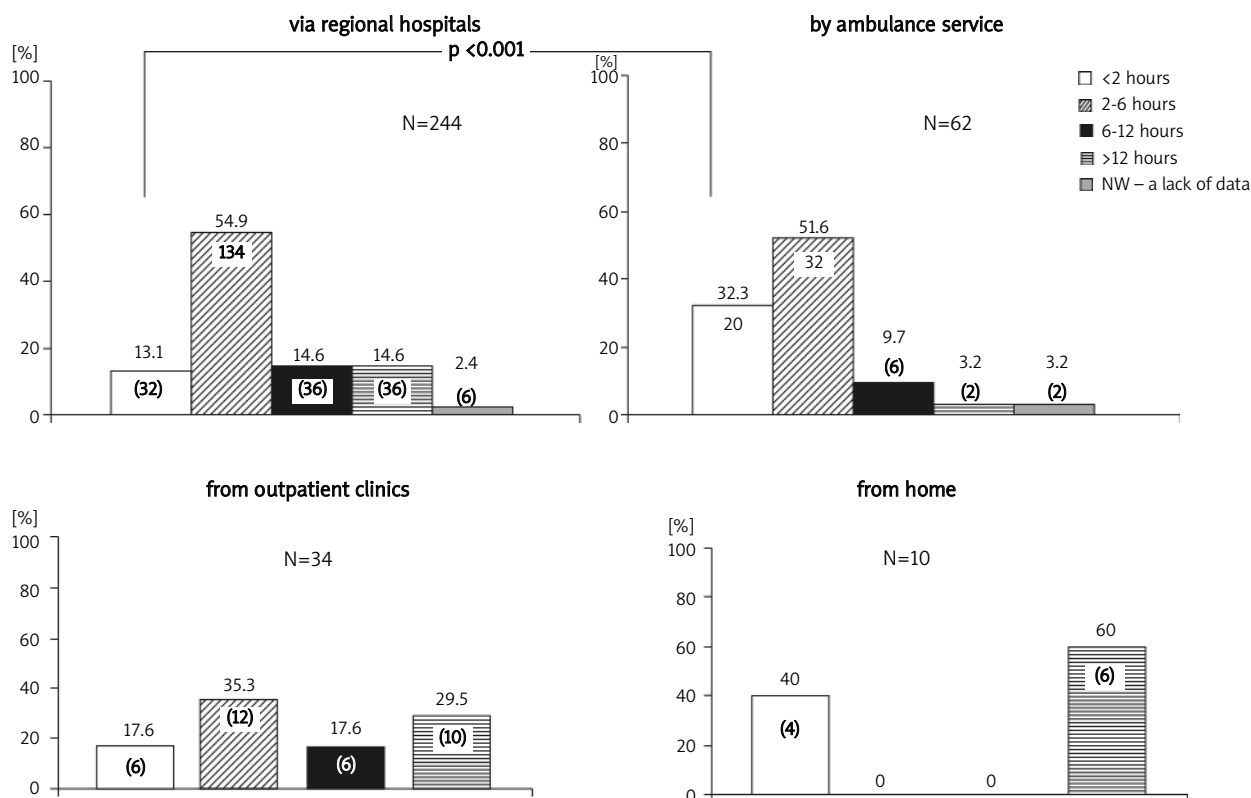| Delay	Discharge	Death	p
<2 hours	60	2 (3.2%)	
2-6 hours	172	6 (3.4%)	
6-12 hours	44	4 (8.3%)	<0.02
>12 hours	46	8 (14.8%)	
Total	322	20 (5.8%)	

Figure 1. Percentage of STEMI patients admitted with various time delays to the hospital with 24-hour catheterisation facilities availability located in the vicinity of Warsaw centre in relation to delay caused by regional hospital admissions or form of transportation (in brackets – number of patients)
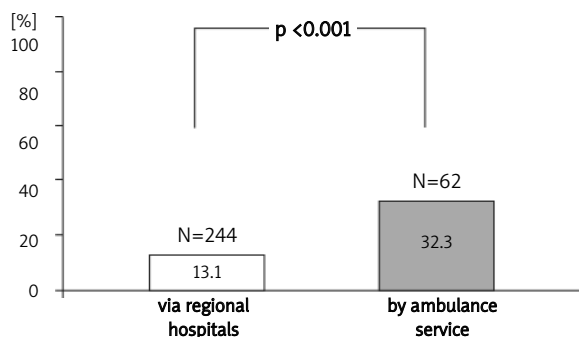

Figure 2. Percentage of STEMI patients admitted within 2 hours of the onset of symptoms to the hospital with 24-hour cardiac invasive treatment facilities availability in relation to the form of transportation

Table IV. Comparision of 7-day mortality between patients admitted within 6 hours of the onset of symptoms and those admitted later

Delay	Discharge	Death	p
<6 hours	232 (96.7%)	8 (3.3%)	
>6 hours	90 (88.2%)	12 (11.8%)	<0.003

Time between the onset of symptoms and admission to our department in STEMI patients who subsequently underwent PCI correlated with 7-day in-hospital mortality. Within the first 7 days lower mortality was found in the group of patients admitted <6 hours from the onset of symptoms than in those hospitalised with >6 hours delay (Table IV).

Discussion

Pre-hospital delay of reperfusion in STEMI results from a number of factors. The first one is time needed to decide whether or not to call for an ambulance or general practitioner, outpatient clinic or hospital emergency department. Prolongation of this time is mainly caused by patients themselves, especially those without coronary events in the past, and depends on psychological and environmental factors, education level and others [8]. Pre-hospital delay resulting from the patient's and/or accompanying persons' decision is a point of interest of cardiologists or physicians involved in medical emergency services (*mass media* should also be involved). Information about the threats resulting from ACS should be disseminated in an appropriate form and intensity to reach individuals at increased risk of coronary events.

In this report delay resulting from patient behaviour is not analysed, but its impact on the total pre-hospital delay is obvious.

Pre-hospital delay, also called *symptom-onset-to-door time* (time between the onset of symptoms and hospital admission) [4, 9] comprises the delay of condition reporting and transfer time to a centre with cath-lab availability. Published data and current guidelines [10-12] indicate that optimum time for interventional is less than 90 minutes from the first medical contact. Successful pPCI within 90 minutes has a significant advantage over thrombolytic therapy. *Door-to-balloon* time (time from arrival at the hospital to the infarct-related artery reopening) is a component of total procedure delay [13]. Our experience suggests that this delay should not exceed 20-40 minutes (mean 32±17 minutes) and may be only a result of waiting for patient consent or freeing a busy cath-lab.

Most registries and observational studies have found that only a small percentage of patients reached the catheterisation laboratory within the desired 90 minutes [14, 15]. Only in a few Polish centres did a high percentage of ACS patients undergo pPCI within 2 hours of the onset of symptoms [3].

Our department is located in the vicinity of Warsaw centre, and thus traffic jams may represent an important problem during the daytime hours. However, our data presented in this study suggest that one third of patients transported to the hospital directly by ambulance reached the hospital within 120 minutes of the onset of pain. This time becomes longer if the patient is first transported to the nearest hospital that initiates the diagnostic process and only then is further transportation to the reference centre arranged. Approximately 90% of patients diagnosed and transported this way reached our department beyond the first 120 minutes. Such an enormous delay was observed not only in a group of patients referred from hospitals located in the surrounding area of Warsaw (south-west area) but also more remote regions of Mazowsze Province, with over 100 km distance to our department.

In-depth analysis of the delay between the onset of symptoms and hospitalisation of our STEMI patients confirms the alarming finding of other investigators that pre-hospital delay is higher in women than men [9]. Of note, only 5.5% of women as compared to 24.1% of men reached our department within 2 hours of the onset of pain (p <0.001). The main reason for such a high percentage of women admitted to hospital after the 2nd hour is thought to be less typical symptoms that initially are not suspected by women and their relatives to be caused by acute MI.

In the case of STEMI 'time is muscle' and the risk of death increases with delay of infarct-related artery reperfusion. This well known fact is also reflected in our series. Our analysis is not based on the assessment of infarction size or its haemodynamic consequences, but on the most dramatic complication – 7 days in-hospital mortality. Mortality was 3.3% among patients admitted to the hospital within 6 hours of the onset of symptoms, significantly lower than 11.8% in a group of subjects that reached our department after that time (p <0.003). Simple analysis of 7-day in-hospital mortality risk (without follow-up) justifies the statement that prolonged transportation time of STEMI patients reduces survival in the early period.

Thus when planning rapid ACS patients' diagnostics and transportation to centres with cath-lab availability – also those located in the centres of large cities – a key issue is to avoid admission to hospitals without such facilities but rather prefer direct transfer by ambulance rescue teams equipped with diagnostic modalities and possibility to transmit telemetric data and use airborne transportation from remote areas, particularly in the periods of rush hours [7, 16-18].

Summary

1. Only 18% of patients reached the cardiology department with 24-hour catheterisation laboratory availability located in the vicinity of Warsaw centre within 2 hours (120 minutes) of the onset of STEMI symptoms.
2. The majority of patients (approximately 70%) were transferred by ambulance from other hospitals and only 18% of patients were transported to the cardiology centre by ambulance following the initial ECG diagnosis of STEMI in the ambulance or at the location where symptoms occurred.
3. Only 13.1% of patients referred from other hospitals compared to 32.3% diagnosed and transported directly by ambulance service reached our cardiology department within 2 hours (120 minutes) of the onset of symptoms (p <0.001).
4. Time between the onset of STEMI symptoms and hospitalisation in the department with invasive treatment facilities significantly influences the early prognosis – 7-day in-hospital mortality was 3.3% among patients admitted to hospital within the first 6 hours and 11.8% in those hospitalised later (p <0.003).

Conclusions

1. Prolonged time between the onset of STEMI symptoms and admission to a centre with invasive treatment facility availability worsens prognosis.
2. Transfer of ACS patients with ST-segment elevation or acute LBBB via regional hospitals without invasive treatment facilities increases delay of reperfusion.

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Opóźnienie leczenia ostrego zespołu wieńcowego z uniesieniem odcinka ST metodą pierwotnej angioplastyki wieńcowej w materiale ośrodka zlokalizowanego w pobliżu centrum Warszawy

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Streszczenie

Wstęp: Wczesna reperfuzja drogą przezskórnej interwencji na naczyniu wieńcowym (PCI) u chorych z ostrym zespołem wieńcowym (ACS) z uniesieniem odcinka ST poprawia funkcję lewej komory i obniża śmiertelność.

Cel: Ocena opóźnienia, z jakim chorzy z zawałem serca z uniesieniem odcinka ST (STEMI) docierają do ośrodka dysponującego dyżurującą przez całą dobę pracownią hemodynamiczną, zlokalizowanego w pobliżu centrum Warszawy.

Metodyka: W okresie od 1 października 2005 do 30 września 2006 r. w II Klinice Choroby Wieńcowej Instytutu Kardiologii w Warszawie leczono 350 osób ze STEMI. Najliczniejsza grupa chorych – 244 (69,7%) – dotarła do kliniki za pośrednictwem szpitali niedysponujących możliwością leczenia inwazyjnego. Bez pośrednictwa innego szpitala, przez pogotowie ratunkowe zostało przywiezionych 62 (17,7%) chorych, z przychodni 34 (9,7%), a samodzielnie z domu lub pracy dotarło do kliniki 10 (2,9%) osób. Szczegółowy wywiad dotyczący czasu rozpoczęcia objawów MI uzyskano od 342 chorych (97,7%).

Wyniki: W ciągu pierwszych 2 godz. (120 min) od początku bólu zawałowego do kliniki dotarły 62 (18%) osoby – 6 kobiet (5,5% badanej populacji kobiet) i 56 (24,1%) mężczyzn (p <0,0001). Za pośrednictwem szpitali rejonowych w ciągu 2 godz. od zachorowania przywieziono 32 (13,1%) osoby, a 20 (32,2%) chorych transportowało pogotowie ratunkowe z pominięciem szpitali pośredniczących (p <0,001). Śmiertelność 7-dniowa w grupie chorych przyjętych w ciągu pierwszych 2 godz. od początku objawów STEMI wyniosła 3,2% (2 z 62), 3,4% wśród przyjętych pomiędzy 2. a 6. godz. (6 z 178), 8,3% wśród hospitalizowanych pomiędzy 6. a 12. godz. (4 z 48) i 14,8% (8 z 54) chorych z objawami utrzymującymi się >12 godz. przed przyjęciem (p <0,02). Śmiertelność 7-dniowa wśród chorych przyjętych w ciągu pierwszych 6 godz. od początku objawów MI wyniosła 3,3% i 11,8% w grupie przyjętych później (p <0,003).

Wnioski: Do kliniki dysponującej możliwością leczenia ACS metodami inwazyjnymi i zlokalizowanej w centrum Warszawy w ciągu 120 min od zachorowania dociera zaledwie 18% chorych ze STEMI. Prawie 70% chorych ze STEMI jest kierowanych do ośrodka ze szpitali pośredniczących w diagnostyce i niedysponujących możliwością leczenia inwazyjnego. Wydłużenie czasu, jaki upływa od początku objawów STEMI do hospitalizacji w ośrodku dysponującym możliwością leczenia inwazyjnego, pogarsza rokowanie. Pośrednictwo szpitali niedysponujących możliwością leczenia inwazyjnego chorych z ACS z uniesieniem odcinka ST lub ostrym LBBB wydłuża czas od początku objawów do interwencji na naczyniu wieńcowym.

Słowa kluczowe: STEMI, przezskórna interwencja wieńcowa, opóźnienie przedszpitalne

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