

Patient and doctor delay in acute myocardial infarction: a study in Rotterdam, the Netherlands

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SUMMARY

Background. Early thrombolytic therapy for patients having a myocardial infarction limits infarct size and improves survival.

Aim. A study was undertaken to examine the components of pre-hospital delay in patients with retrospectively proven myocardial infarction.

Method. Data were gathered from 300 patients with a documented myocardial infarction admitted to three hospitals in Rotterdam, the Netherlands. Interviews were carried out with patients, questionnaires were given to their spouses or significant others, medical information was provided by cardiologists, and logbook information was gathered from the ambulance service.

Results. Half of all patients (51%) called for medical help within 30 minutes of symptom onset. General practitioners arrived within 11 minutes in half of the 257 cases to which they were called. However, in half of the 257 cases, decision making by the general practitioner before the patient was sent to a hospital took more than 82 minutes. The ambulance arrived within 15 minutes in 90% of all 242 cases, while the time required for stabilization of the patient by the ambulance staff and transport to the hospital took a median of 15 minutes.

Conclusion. Compared with earlier studies, patients with a myocardial infarction called for help sooner. However, it may take a considerable time before the general practitioner refers the patient to hospital. Further research is needed to design measures which will improve the diagnostic power of the general practitioner in order to further reduce pre-hospital delay.

Keywords: myocardial infarction; treatment delay by doctor; treatment delay by patient; thrombolytic therapy.

Introduction

IN patients with evolving myocardial infarction, thrombolytic therapy should be administered as soon as possible. Timely thrombolytic therapy limits infarct size and improves survival.¹⁻³ Although such therapy has been shown to be beneficial up to 12 hours after the onset of symptoms, thrombolytic therapy is most effective if coronary re-perfusion can be achieved very early.¹⁻⁵

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In some settings, thrombolytic therapy is initiated by the general practitioner⁶ or ambulance personnel.⁷ However, therapy is usually initiated in a hospital. The delay between symptom onset and initiation of therapy can be divided into four components: patient delay, doctor delay, ambulance delay and hospital delay.^{4,5}

Patient delay is the interval between the onset of symptoms and the call for medical help by the patient or by someone on behalf of the patient.

In the Dutch health system, as in the United Kingdom, a call for medical help will nearly always be directed to a general practitioner. Doctor delay is defined as the time between the call for medical help by the patient, and the decision by the general practitioner to admit the patient to hospital. This doctor delay includes the time between the call for help and arrival of the general practitioner at the patient's home, and the time required by the physician to decide that admission is warranted. In Rotterdam, general practitioners can also refer patients to a diagnostic electrocardiogram and enzyme service.⁸

Ambulance delay is the time between the call for ambulance transport and the patient's arrival in hospital, including the time it takes for the ambulance to reach the patient, the time required for preparation of the patient for transport and the actual transport time. Ambulances have a legal requirement in the Netherlands to reach a patient within 15 minutes in an emergency.

Hospital delay is the interval between arrival of the patient by ambulance in hospital, and the initiation of therapy at a coronary care unit. Initiation of therapy is defined as the moment when thrombolytic therapy is started or when another medical agent is administered (for example, aspirin, heparin, intravenous nitrates), aiming to reduce myocardial damage. All patients with a suspected myocardial infarction are admitted to a coronary care unit.

Previous reports indicate patient delay to be the most important component of the total delay in hospital admission.⁹⁻¹² In 1978 Hart reported a median patient delay of 60 minutes (range one minute to 48 hours) and a median total delay until hospital admission of 127 minutes (range 14 minutes to 53 hours).¹¹ Since that time, the media have published much information on myocardial infarction. In addition, a system for pre-hospital thrombolytic therapy by ambulance personnel was initiated in Rotterdam in 1989.⁷

In 1990 and 1991 a survey was undertaken to reassess the various components of pre-hospital delay among patients with myocardial infarction in the Rotterdam region of the Netherlands.

Method

Between March 1990 and October 1991, patients with a (in retrospect) documented myocardial infarction were studied when admitted to the coronary care units of the Thoraxcenter, University Hospital Rotterdam Dijkzigt, the Havenziekenhuis or the Zuiderziekenhuis in Rotterdam.

Myocardial infarction was diagnosed when a typical enzyme pattern was found with a peak creatine kinase release exceeding twice the normal limit and when electrocardiographic signs indicative of evolving myocardial infarction were observed. Patients were selected if they were less than 75 years of age, were living in the Netherlands, spoke Dutch, had developed a myocardial infarction outside hospital, remembered and could reproduce the events preceding hospital admission, and had no

other concurrent illness. There was no delay time limit on inclusion into the study.

After receiving their consent, patients were interviewed approximately five days after hospital admission. All patients were still in the hospital at this time, including those who had had a small infarct. The structured interview, based on the patient delay questionnaire,¹³ recorded the time of onset of symptoms as well as the time at which it was decided to call for medical help. In an open question, patients waiting longer than 30 minutes before calling for help were asked why they waited this long. A revised patient delay questionnaire was given to the spouse or significant other. This allowed independent verification of the responses by the patient. The logbook of the ambulance service was reviewed to ascertain the timing of various telephone calls and ambulance activities. Information regarding the severity of the infarct and patient's history was provided by the cardiologists at the coronary care units. Data included the peak creatine kinase concentration and the sum of the ST segment deviations on the admission electrocardiogram,¹⁴ as indicators of infarct size.

Analysis

In the analysis, patients were split into two groups (median split method): those who called for help within 30 minutes after onset of symptoms and those who waited more than half an hour. The median of the total doctor delay times was also used to form two groups; the short doctor delay group comprised patients whose general practitioners arrived at the patient and decided within 95 minutes that a hospital admission was necessary and the long doctor delay group which comprised patients who waited more than 95 minutes before the general practitioner arrived and an admission decision was taken.

To compare the short and long doctor delay group, single typical symptoms of myocardial infarction were added up into a total score with a range from 0 to 6 (0 = no typical symptoms, 6 = six different typical symptoms). Non-parametric tests (Mann Whitney *U* and chi square) were used.

Results

A total of 300 consecutive cases were included: 237 men (79.0%) and 63 women (21.0%). The mean age of the men was 58 years (standard deviation (SD) 10 years), while the women were slightly older: mean age 60 years (SD 11 years). Peak creatine kinase level ranged from 104 to 6010 IU l⁻¹. A history of previous myocardial infarction, angina, coronary angioplasty or bypass surgery was present in 103 patients.

The questionnaire was returned by 257 spouses or significant others. There were no appreciable differences between the responses from the patients and the corresponding significant others. The Pearson correlation coefficient between the answers of spouses and patients regarding the length of patient delay was 0.81. Three patients did not recall all the events prior to hospital admission so the responses by the spouses were used.

Patient delay in calling for help varied between three minutes and 115 hours, median 30 minutes. A total of 154 patients called for help within 30 minutes of the onset of symptoms while 146 waited more than half an hour. The total delay until hospital admission ranged from 15 minutes to 144 hours, median three hours. Those patients waiting longer than 30 minutes before calling for help reported that they had expected the symptoms to disappear (73.3% of 146), had not considered the symptoms to be of cardiac origin (45.2%) or did not want to bother the general practitioner or the ambulance service (17.8%).

The symptoms reported by the patients are summarized in Table 1. Chest pain, sweating, pain in the left arm and tightness of the chest were reported by more than 40% of the patients. Stabbing chest pain, left sided chest pain and pain in the epigast-

Table 1. Symptoms reported by all 300 patients with evolving myocardial infarction and by those waiting 30 minutes or less to call the doctor and those waiting more than 30 minutes.

| Symptom | % of patients with symptom ^a | | |
|---------------------------|---|--------------------------------------|-------------------------------------|
| | Total (n = 300) | In short delay group (n = 154) | In long delay group (n = 146) |
| Chest pain (mid-chest) | 62.7 | 63.6 | 61.6 |
| Sweating | 55.7 | 57.8 | 53.4 |
| Pain in left arm | 46.0 | 46.8 | 45.2 |
| Tightness of chest | 44.0 | 44.8 | 43.2 |
| Dyspnoea | 31.3 | 35.7 | 26.7 |
| Nausea/vomiting | 29.3 | 27.9 | 30.8 |
| Pain in the jaw/neck/back | 27.3 | 26.6 | 28.1 |
| Pain in shoulders | 24.7 | 26.6 | 22.6 |
| Dizziness | 16.0 | 20.1 | 11.6 |
| Weakness in arms/fingers | 14.3 | 14.9 | 13.7 |
| Paraesthesia in fingers | 13.0 | 12.3 | 13.7 |
| Stabbing chest pain | 10.3 | 9.7 | 11.0 |
| Left sided chest pain | 6.0 | 5.8 | 6.2 |
| Pain in epigastric area | 6.0 | 4.5 | 7.5 |
| Unusual fatigue | 4.3 | 4.5 | 4.1 |
| Palpitations | 1.0 | 1.3 | 0.7 |
| Stiff fingers | 0.7 | 0.6 | 0.7 |

n = number of patients in group. ^aMost patients reported several symptoms.

ric area were reported infrequently. There were no significant differences between symptoms reported by patients calling for help within 30 minutes or those calling after 30 minutes.

The general practitioner was called by 257 patients. A total of 132 patients were seen by the general practitioner who within 95 minutes decided hospital admission was necessary; 125 patients waited for longer than 95 minutes. In 202 cases, the doctor called an ambulance, 27 patients were referred to the hospital using their own transport and six patients were brought to the hospital by the general practitioner. Nine patients were referred to the diagnostic electrocardiogram and enzyme service; the service called an ambulance in six of these cases. In 13 cases the general practitioner undertook no action; these patients decided by themselves to go to the hospital, six of whom called an ambulance. The ambulance was called directly, without the assistance of a general practitioner, by 27 patients. Fourteen other patients reported to the accident and emergency department of one of the hospitals, and two patients directly contacted a cardiologist. The cardiologist called an ambulance in one of these cases.

The distribution of the different components of delay until hospital admission, for those patients who called their general practitioner and subsequently were referred to hospital by ambulance is shown in Figure 1. It shows that 73% of those patients asked for help within 90 minutes, while 10% waited longer than six hours. Figure 2 shows that a considerable part of the total delay in pre-hospital admission was related to the general practitioner. The doctor arrived promptly (median 11 minutes, range 1–101 minutes), but took a considerable amount of time to decide to admit the patient (median 82 minutes, range one minute to 143 hours). The general practitioner administered glyceryl trinitrate to 69 patients (26.8%). In 41 cases (16.0%), the general practitioner initially decided to wait and see. Subsequently (many hours later), the general practitioner referred these patients to the hospital when the symptoms persisted or became worse.

In those cases where the doctor delay appeared to be short, slightly more patients reported symptoms generally recognized as typical myocardial infarction symptoms. Chest pain, sweating,

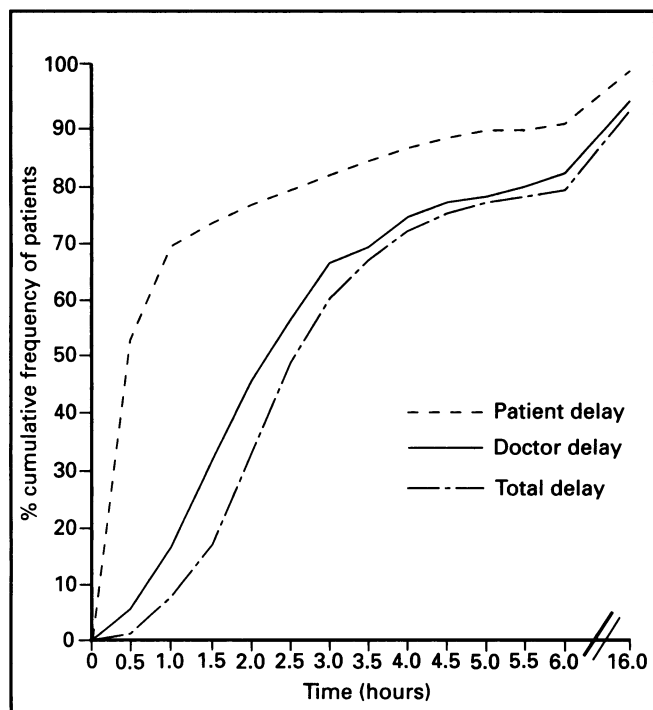


Figure 1. Cumulative frequency distribution of the 202 patients who were transported by ambulance to hospital after they contacted a general practitioner, where patient delay is the interval between onset of symptoms and call for medical help; doctor delay is the interval between the call for help and the admission decision of the doctor; and total delay is the interval between onset of symptoms and arrival in hospital.

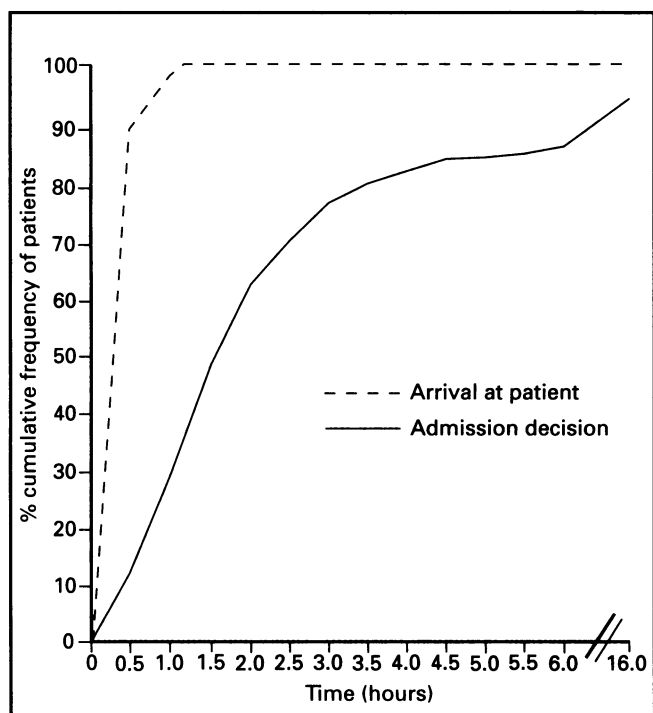


Figure 2. Cumulative frequency distribution of doctor delay among the 257 patients seen by a doctor, where arrival at patient is the interval between the call for help and the doctor's arrival at patient; and admission decision is the interval between the doctor's arrival at the patient and the moment the admission decision is made by the doctor.

pain in the left arm and pain in the jaw, neck or back were more prominent in the short doctor delay group than the long doctor delay group (Table 2). Patients in the short doctor delay group mentioned a somewhat larger number of symptoms than the long doctor delay group.

The ambulance reached the patient within the legally required 15 minutes in 90.0% of all 242 cases. Preparation for transport and transport to the hospital required a median of 15 minutes, range 3–90 minutes.

There were no apparent differences between patients calling for help within or later than 30 minutes, in the presence of previous cardiac disease, the time of day at which symptoms appeared or indicators of infarct size. There were no differences in patient delay between those cases where the patient called for help, or those where the significant other called. No age differences were found in relation to patient and doctor delay.

Discussion

Compared with a hospital admission percentage for acute myocardial infarction of 68% men and 32% women in 1992,¹⁵ women seemed to be slightly under-represented in the sample studied here. Previous studies published in the 1970s and 1980s reported patient delay to be the predominant factor in total treatment delay.^{9-12,16,17} This is in contrast to the present study findings of a relatively short patient delay (median 30 minutes) and a considerable doctor delay. The reduction in patient delay may be the result of publicity campaigns regarding diagnostic services⁸ and the introduction of pre-hospital thrombolytic therapy in the Rotterdam area.⁷ Similarly, a study in the UK reported a shorter patient delay compared with previous studies.¹⁸ Furthermore, it should be noted that the present data were provided by the patients or their relatives, while some previous studies relied on data provided by general practitioners,^{11,12} which may be associated with some bias. As in other studies^{10,12,19-21} no relationship was observed between the presence or absence of previous cardiac disease and patient delay.

The considerable doctor delay warrants further investigation. From the interviews it was apparent that a long doctor delay often occurred in cases where patients showed less typical symptoms. Furthermore, physical signs of infarction, including tachy-

Table 2. Symptoms typical of myocardial infarction reported by patients whose doctor took 95 minutes or less to decide upon hospital admission, and by patients whose doctor took more than 95 minutes to decide.

| Typical symptom | % of patients with symptom | |
|------------------------|--------------------------------|-------------------------------|
| | In short delay group (n = 132) | In long delay group (n = 125) |
| Chest pain (mid-chest) | 65.9 | 57.6 |
| Sweating | 59.1 | 50.4 |
| Pain in left arm | 47.7 | 41.6 |
| Tightness of chest | 33.3 | 38.4 |
| Pain in jaw/neck/back | 31.1 | 27.2 |
| No. of symptoms | | |
| 0 | 0.8 | 4.0 |
| 1 | 16.0 | 23.2 |
| 2 | 36.6 | 30.4 |
| 3 | 32.8 | 33.6 |
| 4 | 11.5 | 7.2 |
| 5 | 2.3 | 1.6 |
| 6 | 0 | 0 |

n = number of patients in group.

cardia and heart failure, are less apparent very early after the onset of symptoms, which makes the diagnosis more difficult.²² When symptoms are vague, a psychosocial origin may be suspected by the general practitioner. Previous studies showed that for patients with uncomplicated suspected myocardial infarction, hospital admission does not confer any clinically significant benefit.^{23,24} It may be that in the present study these patients were initially left at home by the general practitioner, although this is not common practice. When the patient's condition worsened, the general practitioner may then have decided that a hospital admission was warranted. As a result of this strategy, a long doctor delay was recorded.

An important task of the general practitioner is to recognize patients with a clinically significant somatic disease, such as evolving myocardial infarction, and to distinguish these patients from the larger group of patients with more benign problems, who do not need immediate hospitalization. The present study was limited by the fact that it was restricted to patients with a documented myocardial infarction. Previous studies in the Rotterdam area indicated that general practitioners were correct in 96% of those cases where they excluded a myocardial infarction in patients with chest pain, but the exact number of patients visited by the general practitioner who were not referred was not recorded in the study.²⁵

The considerable doctor delay observed in the present study may be reduced in the future by various actions including increasing the awareness of general practitioners about the frequent absence of specific symptoms in patients with myocardial infarction. Further research could be undertaken on communication between patients and general practitioners and the actions of the latter (such a study is currently being carried out in the Rotterdam area which may provide more information about the reasons behind the long general practitioner decision time). The introduction of a rapid electrocardiography service at patients' homes could assist the diagnostic process. In April 1993, a triage was initiated by the ambulance service as an extension of a previous project.⁷ With the aid of a short questionnaire completed by the general practitioner, and on site computerized electrocardiography, a recommendation was provided to the general practitioner to initiate thrombolytic therapy (provided by ambulance personnel) where there was evidence of a large evolving or an established fresh infarction; to refer the patient to the hospital for further assessment; or to keep the patient at home, in the case of non-specific symptoms and a normal electrocardiogram.²⁶ Pre-hospital triage resulted in a 12% reduction in the number of patients admitted to a coronary care unit.

In addition to the pre-hospital delay, there may be a considerable delay in the hospital before thrombolytic therapy is initiated in patients with evolving myocardial infarction. This was not part of the present study. Nevertheless, it seems appropriate that in-hospital delay may also be reduced by specific measures, including initiation of thrombolytic therapy in the emergency room prior to admission to the coronary care unit.²⁷

In conclusion, the current investigation has shown that patient delay seems to be shorter, compared with earlier studies. Doctor delay appears to be the biggest part of the total pre-hospital delay. Further research is needed to determine methods of improving the diagnostic power of the general practitioner.

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