

# Five-year survival of 728 patients after myocardial infarction

## *A community study*

S POHJOLA, P SILTANEN, M ROMO

*From the Research Department of the Finnish Heart Association, Helsinki, and from the First Medical Department of the University Central Hospital of Helsinki, Finland*

**SUMMARY** This study deals with the five-year survival of 728 myocardial infarction patients who survived the first 28 days after the onset of symptoms. The series was collected by the Helsinki Coronary Register and includes all cases of acute myocardial infarction in the population who were under 66 years of age during the period 1 July 1970 to 30 June 1971. Of the 219 patients who subsequently died, 81.8 per cent died from ischaemic heart disease. The mortality was highest during the first year after the acute phase but did not decrease after the second year. The mortality was higher in patients with a transmural infarction (five-year mortality 34.0%) compared with those with a nontransmural infarction (19.7%). The mortality also was higher for recurrent acute myocardial infarctions than for first attacks. The five-year mortality for women was less (20.5%, age-adjusted) than for men (31.6%). This is mainly because of the higher incidence of nontransmural infarcts in women. Acute ischaemic heart disease is more common, more often fatal, and has a poorer long-term prognosis in men than in women in Helsinki. The acute mortality from acute ischaemic heart disease is high in Helsinki when compared with other WHO registers and, in addition, the long-term prognosis seems to be relatively poor in Helsinki.

The Coronary Registers co-operating with WHO gather community-based data of the severe forms of acute ischaemic heart disease, both acute myocardial infarctions and sudden coronary deaths. The Helsinki Coronary Register started on 1 September 1969, and a series of 1224 patients who suffered an attack of acute ischaemic heart disease within one year from 1970 to 1971 has now been followed for five years. Previous long-term follow-up studies have usually been based on hospital series. In countries in which only some of the patients with acute myocardial infarction are treated in the hospital, hospital series tend to include a large number of more severe cases, and their follow-up may give a less favourable overall prognosis for this disease. In Finland, nearly all patients with acute myocardial infarction are treated in hospitals, but concentration of severe cases might take place in hospitals provided with a coronary care unit. A non-selected series collected by a coronary register provides a good opportunity for the study of long-term prognosis after acute myocardial infarction.

Received for publication 14 May 1979

The high acute myocardial infarction attack rate among Finns and their high early mortality have been shown in several studies,<sup>1-5</sup> but it is not known if the long-term prognosis after myocardial infarction is worse than elsewhere.

In the present study the five-year survival after the acute phase of acute myocardial infarction of the 728 patients from the Helsinki Coronary Register was studied in relation to age, sex, previous infarction, and transmural infarction.

### **Patients and methods**

The Coronary Register in Helsinki records all cases suspected of having an attack of acute ischaemic heart disease among residents of Helsinki under 66 years of age. The completeness of recording is checked in many ways. A detailed description of the operation of the WHO Registers and in particular of the Helsinki Register<sup>5</sup> has been published previously.<sup>6-8</sup> Collection of data was almost complete for deceased cases as the death certificates of all Helsinki residents are sent to the municipality

of residence regardless of the place of the attack. There is some loss among those suffering an attack outside Helsinki, since if they survive and are previously on a disability pension they may be left outside the Register. The number of such patients is, however, very small.

All of the patients entered in the Register were interviewed by the Register's nurse as soon as the patient's clinical state allowed. In 28 days the patients were classified on the basis of pain anamnesis, enzyme, and electrocardiographic findings into the diagnostic categories according to the directives issued by WHO.<sup>5</sup> The criteria for the categories were as follows:

*Definite acute myocardial infarction*: The patients with unequivocal serial electrocardiographic changes; or typical history of chest pain and raised serum enzyme levels or equivocal electrocardiographic changes and raised enzymes.

*Possible acute myocardial infarction*: The patients with typical chest pain, but insufficient evidence to include the case under definite acute myocardial infarction and no good evidence for another diagnosis.

An additional classification of acute myocardial infarction as transmural or nontransmural was possible in 87 per cent of patients surviving the acute phase on the basis of the electrocardiographic findings as follows:

*Transmural acute myocardial infarction*: The development of a typical rise in the ST segment (>1 mm), inversion of the T wave, and pathological Q wave in a serial electrocardiogram, or a diagnostic combination of these in the only electrocardiogram taken in a case classified as acute ischaemic heart disease according to the criteria given above.

*Nontransmural acute myocardial infarction*: ST segment depression and/or symmetrical T wave inversions developing and persisting in serial electrocardiograms without QRS changes, or corresponding changes found in the only electrocardiogram taken in a case classified as acute ischaemic heart disease according to the criteria given above. Cases in which the changes may have been caused by digitalis, electrolyte disturbances, or other such factors were omitted.

The series used in this study comprised patients under 66 years of age suffering an acute myocardial infarction during the period 1 July 1970 to 30 June 1971, and surviving the first 28 days. Originally, 1224 patients suffered an attack of acute ischaemic heart disease during the one-year period, and 728 patients (59.5%) survived the first 28 days. Each patient was included in the series only once.

The patients received a questionnaire from the

Register every year during the five years' follow-up time. It was always sent at the same time of the year as the patient had suffered his infarction, with the latitude of a week. The 428 patients who answered the fifth year's questionnaire were classified as survivors. The survival of the other 300 patients was checked at first from the Helsinki Coronary Register. The data on deaths were obtained from the Register if the patient had died from acute ischaemic heart disease at less than 65 years of age. The survival of the rest of the patients was checked by the personnel of the Register from the microfilms which are published annually by the Finnish officials, and include the name, the social security number, and the data on all deaths in Finland. The official statistics of deaths in Finland is very accurate and reliable, and it is practically impossible for any death to escape the official statistics. After checking the survival of every patient in the series, the cause of death for the deceased patients was obtained from the Death Cause Register of the Statistical Office of the City of Helsinki, which collects the death certificates of the Helsinki inhabitants regardless of the place of death. The cause of death was classified as ischaemic heart disease if the basic or immediate cause of death given in the certificate was a fresh myocardial infarction or chronic ischaemic heart disease or a state after previous acute myocardial infarction without other cause of death. Thus, by using information from the questionnaires, the files of the Helsinki Coronary Register, and the official statistics, it was possible to find out the survival time for all patients with the exactness of one day during the follow-up time. In addition, it was possible to know the cause of death for all deceased patients.

The age adjustment used in the study was made using the direct method.<sup>9</sup> The statistical tests were carried out using the Mantel-Haenszel test<sup>9</sup> for the data stratified as regards age, and the usual  $\chi^2$  test in other cases. The use of the latter is indicated in the text within parentheses.

## Results

Of 1224 patients from Helsinki who suffered an attack of acute ischaemic heart disease during the period 1 July 1970 to 30 June 1971, 728 patients were alive after the first 28 days. Of these 728 patients, 77.3 per cent were classified as definite acute myocardial infarction and 22.7 per cent as possible acute myocardial infarction; 30.1 per cent of the patients were women. In 77.7 per cent of the patients the infarction was the first. The distri-

Table 1 Cumulative five-year mortality of men with a primary or recurrent acute myocardial infarction who survived 28 days, expressed as percentage

Age (y)	6 months		1 year		2 years		3 years		4 years		5 years		N	
	First	Previous	First	Previous	First	Previous	First	Previous	First	Previous	First	Previous	First	Previous
≤44	0	12.5	3.5	25.0	10.3	37.5	15.5	37.5	17.2	37.5	17.2	37.5	58	8
45-49	7.6	13.3	7.6	13.3	11.3	13.3	11.3	20.0	15.1	33.3	17.0	33.3	53	15
50-54	7.7	4.4	11.5	13.0	16.7	26.1	19.2	34.8	24.4	43.5	25.6	56.5	78	23
55-59	6.9	10.0	10.9	10.0	13.9	23.3	20.8	30.0	22.8	56.7	38.4	60.0	101	30
60-64	6.7	12.5	16.9	15.0	23.6	22.5	28.1	30.0	31.5	32.5	36.0	42.5	89	40
65	11.1	40.0	11.1	40.0	33.3	60.0	33.3	60.0	33.3	60.0	66.7	60.0	9	5
Total	6.2	11.6	10.8	14.9	16.2	24.8	20.4	31.4	23.5	42.1	26.3	46.3	388	121
Standard		11.0		15.2		25.3		31.4		42.5		48.3		

Table 2 Cumulative five-year mortality of women with a primary or recurrent acute myocardial infarction who survived 28 days, expressed as percentage

Age (y)	6 months		1 year		2 years		3 years		4 years		5 years		N	
	First	Previous	First	Previous	First	Previous	First	Previous	First	Previous	First	Previous	First	Previous
≤44	0	0	0	0	0	0	0	0	0	0	0	0	5	1
45-49	0	0	0	0	8.7	0	13.7	0	13.0	0	17.4	0	23	2
50-54	0	0	3.6	0	3.6	0	3.6	0	3.6	0	7.1	25.0	28	4
55-59	4.9	0	9.8	0	14.6	0	14.6	0	22.0	10.0	22.0	20.0	41	10
60-64	6.8	20.0	11.0	30.0	17.8	35.0	21.9	40.0	27.5	55.0	31.5	65.0	72	20
65	0	0	0	25.0	0	25.0	0	25.0	22.2	25.0	22.2	50.0	9	4
Total	3.9	9.8	7.3	17.1	12.3	19.5	14.5	22.0	19.6	31.7	22.3	43.9	178	41
Standard												37.5		

bution of the population for age, sex, and previous infarction can be seen in Tables 1 and 2.

During the five years after the acute phase 219 patients died, that is 30.1 per cent of the 728 patients. A necropsy was performed in 32.7 per cent. The cause of death of 177 patients was either a new acute myocardial infarction or chronic ischaemic heart disease with no other cause of death. Thus 80.8 per cent of deaths were the result of ischaemic heart disease. Cardiovascular diseases as a whole were the cause of a total of 91.4 per cent of the deaths (Table 3).

Table 3 Causes of death in five-year follow-up of 728 patients with acute myocardial infarction who survived 28 days

Cause of death	No.	Per cent
Ischaemic heart disease	177	80.8
Other heart disease than ischaemic heart disease	3	1.4
Other cardiovascular disease than cardiac disease	20	9.1
Other than cardiovascular disease	19	8.6
Total	219	100.0

Mortality after the acute phase was highest during the first year and especially during the first six months of that year. Of those who survived the acute phase, 11.0 per cent died during the 11 months following it. During the second, third, fourth, and fifth year 6.6, 4.8, 6.6, and 5.4 per cent of those alive at the beginning of each year died, respectively. For the patients who suffered their first infarction, the corresponding figures were 9.7, 5.9, 4.2, 4.6, and 3.6 per cent.

There was a difference in mortality between men and women; 26.5 per cent of the women and 31.6 per cent of the men died ( $p < 0.05$ ) (Tables 1 and 2). The age-adjusted mortality for women was 20.3 per cent (Fig. 1). The mortality for both sexes exceeded conspicuously the mortality for the Helsinki population of the same age.

Mortality clearly increased with age: 20.1 per cent of the men and 12.9 per cent of the women (18.8% of the total) under 50 years of age died within the five years of the acute phase, whereas 35.7 per cent of the men and 28.7 per cent of the women between 50 and 65 years of age died, that is 33.4 per cent of the total.

The five-year mortality in the category 'definite

acute myocardial infarction' was 32.2 per cent while it was 19.4 per cent in the category 'possible acute myocardial infarction' ( $P < 0.001$ ). The age-adjusted mortality in the category 'possible acute myocardial infarction' was 20.1 per cent, or slightly closer to the mortality of definite acute myocardial infarctions than to that of the Helsinki population of the same age (Fig. 2).

Of the 566 patients suffering their first acute myocardial infarction, 25.1 per cent died within the five years, whereas 47.5 per cent of the 162 patients with a recurrent acute myocardial infarction died during this period ( $P < 0.001$ ) (Fig. 3). Those suffering a recurrent acute myocardial

infarction were older than those with a primary acute myocardial infarction, and the age-adjusted mortality for the patients with more than one infarction was 45.7 per cent.

Of the men 76.2 per cent suffered a first acute myocardial infarction, and 81.3 per cent of the women suffered a first acute myocardial infarction ( $p > 0.05$ ,  $\chi^2$  test). The five-year mortality among men with a primary acute myocardial infarction was 26.3 per cent and among those with a recurrent acute myocardial infarction 46.3 per cent, 48.3 per cent as adjusted for age ( $p < 0.001$ ) (Tables 1 and 2). There were proportionally more deaths in younger age groups in men with a recurrent acute myocardial infarction than in those with a first infarction, and, though the group with recurrent infarction consisted of older patients, the difference in five-year mortality between these groups was still present after age-adjustments. The five-year mortality among women with a primary infarction was 22.3 per cent and among those with a recurrent infarction 43.3 per cent, 37.5 per cent as adjusted for age ( $p < 0.05$ ) (Table 2). The five-year mortality among male patients with a primary acute myocardial infarction (26.3%) was considerably greater than that of female patients with a first infarction (17.3%, adjusted for age as regards men). The difference was not, however, statistically significant ( $p > 0.05$ ). The difference between the sexes in the mortality

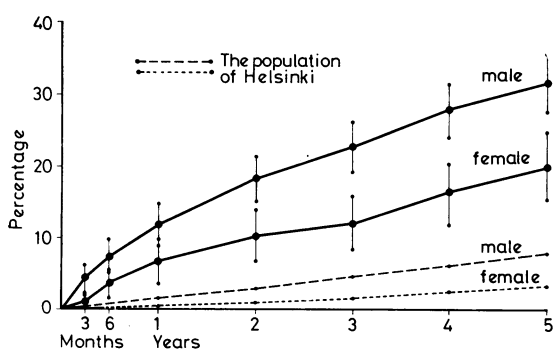


Fig. 1 The cumulative five-year mortality with 95 per cent confidence limits among men and women after the acute phase of infarction. The figures for women are adjusted for age.

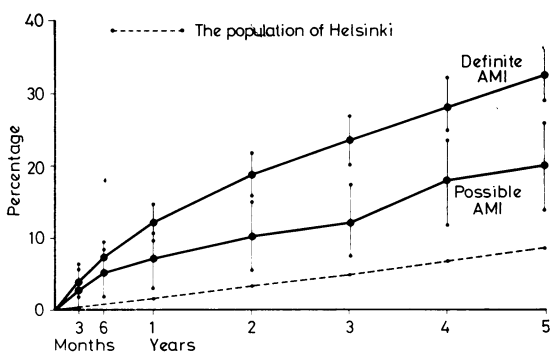


Fig. 2 The cumulative five-year mortality with 95 per cent confidence limits in the categories 'definite acute myocardial infarction' and 'possible acute myocardial infarction' after the acute phase of infarction. The figures for the category 'possible acute myocardial infarction' are adjusted for age.

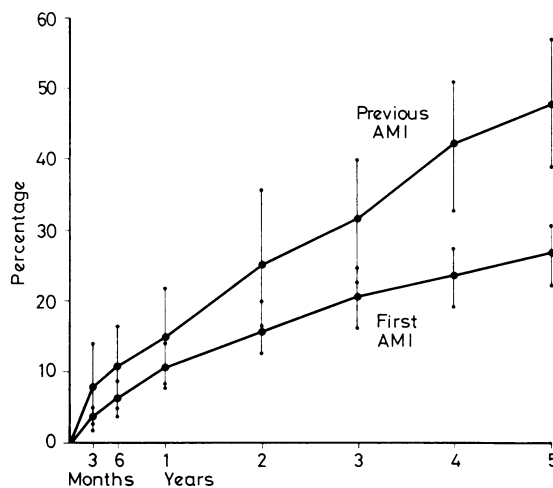


Fig. 3 The cumulative five-year mortality with 95 per cent confidence limits of men with a primary acute myocardial infarction or a recurrent acute myocardial infarction after the acute phase of infarction. The figures for recurrent acute myocardial infarctions are adjusted for age.

of patients with more than one infarction was also without statistical significance ( $p > 0.05$ ) (Fig. 4).

Of all cases, 33.8 per cent were classified as non-transmural acute myocardial infarction. In women the proportion of nontransmural acute myocardial infarction was higher; 24.2 per cent of those with transmural infarction and 42.7 per cent of those with nontransmural infarction were women ( $p < 0.001$ ,  $\chi^2$  test). Of the 418 patients with a transmural acute myocardial infarction 34.0 per cent died, whereas of the 213 patients with a nontransmural acute myocardial infarction 19.7 per cent died; after age adjustment the last figure was 19.5 per cent ( $p < 0.001$ ). There was no information on the transmurality of acute myocardial infarction in 97 patients. Mortality in this group was 35.7 per cent over a period of five years. Of the 317 men with a transmural infarction 34.7 per cent and 18.9 per cent of those 122 men with a nontransmural infarction (19.4% as adjusted for age) died during the five-year follow-up period ( $p < 0.001$ ) (Fig. 5). Of the 101 women with a transmural infarction 31.7 per cent, and of the 91 women with a non-transmural infarction 20.9 per cent (22.0% as

adjusted for age) died within five years ( $p > 0.05$ ). Mortality from a nontransmural acute myocardial infarction was nearly the same among both men and women ( $p > 0.10$ ). Mortality among men with a transmural infarction was higher (34.7%) than that among women (23.3%, age adjusted as regards men) (Fig. 6), but this difference was not statistically significant ( $p > 0.05$ ).

## Discussion

The series used in this study comprised patients under 66 years of age who suffered a definite or probable acute myocardial infarction within a period of one year. Patients with an asymptomatic acute myocardial infarction, and the few patients who, in spite of their symptoms, did not see a physician are naturally not included in the series, but otherwise the series represents nearly all of the patients with acute myocardial infarction under 66 years of age in Helsinki during one year.

Since the WHO criteria for possible acute myocardial infarctions in survivors are, however, somewhat loose, it might be objected that there were patients in this category who in reality suffered a prolonged attack of angina pectoris. However, the number of those patients is probably small. Only 3 per cent (24) of all patients surviving the acute phase were included in the series solely on the basis of pain, and 77.5 per cent of all 728 patients surviving the acute phase fulfilled the WHO criteria of definite acute myocardial infar-

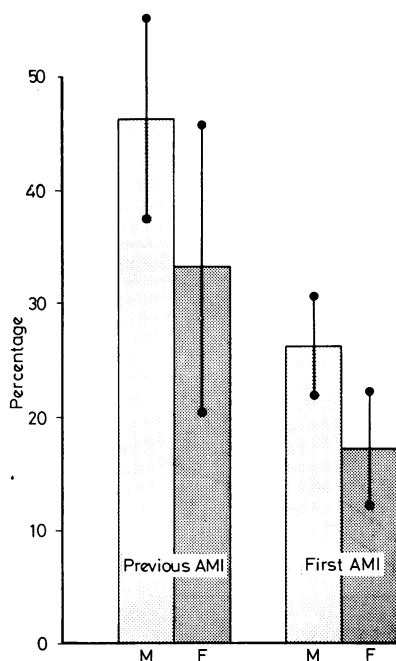


Fig. 4 The cumulative five-year mortality with 95 per cent confidence limits of men and women for recurrent and primary infarction after the acute phase. The figures for women are adjusted for age using the age distributions of men as the standard.

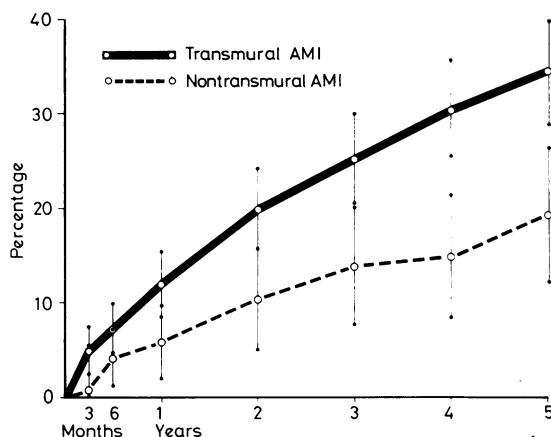


Fig. 5 The cumulative five-year mortality with 95 per cent confidence limits among men with transmural and nontransmural infarction after the acute phase. The figures for the nontransmural acute myocardial infarctions are adjusted for age.

tion. The five-year mortality of possible acute myocardial infarctions after the acute phase was somewhat smaller than that of definite acute infarctions. Nevertheless, when the fact that most nontransmural infarctions (which had a better prognosis) probably belonged to the category 'possible acute infarction' (c.f. the diagnostic criteria) is taken into account, the prognosis after the acute phase supports the view that a majority of the cases falling under the category 'possible acute myocardial infarction' probably consisted of patients suffering an acute myocardial infarction. The data on survival after the acute myocardial infarction were complete for each patient to the exactness of one day. The results of the study on the five-year mortality of patients with acute myocardial infarction from Helsinki can be considered reliable.

Only 32.7 per cent of those who died after the acute phase came to necropsy, but the result that about four out of five patients died of ischaemic heart disease agrees well with the results presented in studies made in other countries.<sup>10-15</sup> Of the patients who survived the acute phase 11.0 per cent died during the next 11 months. In the 21 WHO registers the 11-month mortality among registered cases adjusted for age and sex is 5 to 17 per cent;

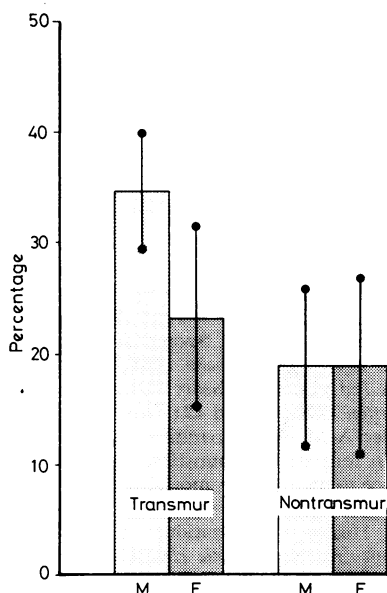


Fig. 6 The cumulative five-year mortality with 95 per cent confidence limits of men and women with transmural and nontransmural infarction after the acute phase. The figures for women are adjusted for age using the age distributions of men as the standard.

the figure in Helsinki is 13.9 per cent.<sup>5</sup> According to the results from the Coronary Register in London 7 per cent of the men and 10 per cent of the women died during the 11-month period after the acute phase.<sup>16</sup> Thus, the prognosis for the first year after the acute phase seems to be less favourable in the Helsinki Register, even though the differences are not very great. In the Gothenburg Register, 15.2 per cent of the patients under 65 years of age discharged from the hospital died within two years, but this evidently includes only the WHO category 'definite acute myocardial infarction'.<sup>13</sup> Of those counted as definite acute myocardial infarctions in the present study 19.0 per cent died within two years after the acute stage, and thus the two-year mortality is somewhat higher in Helsinki than in Gothenburg, though the differences are small.

Long-term follow-up studies (three to five years) have been previously made on patients with acute myocardial infarction mostly using patient series in a specific hospital.<sup>11 12 14 17-26</sup> Patient series collected from army health care systems<sup>27 28</sup> and from insurance company series<sup>29 30</sup> have also been used in long-term follow-up studies. These series contain patients of very different types and it is difficult to compare their results since the diagnostic criteria, age and sex distribution, and severity of the cases vary in different studies. The earliest studies have been criticised for methodological errors which are considered to have made the follow-up studies in the '50s and partly even in the '60s unreliable.<sup>31</sup> Though the problems of selectivity of the study population are smaller in the register-based studies, the measures of frequency and outcome are sensitive, for example to the interpretation of diagnostic criteria and to the frequency and immediacy of the tests.<sup>32</sup> In addition, the grouping of different diagnostic categories together creates problems for comparison of studies. Evidently, not a single five-year study has yet been published using an unselected study population from a coronary register covering a large community. A four-year follow-up study from the coronary register in London has been reported, but its scope was to predict sudden death from the electrocardiogram, and it includes only patients who attended a three-month post-infarction investigation. The four-year mortality was 19.6 per cent, and the population included both definite and possible acute myocardial infarctions.<sup>15</sup> In the present study the corresponding four-year mortality for those under 65 years of age and alive three months after infarction was 24.0 per cent. Previous follow-up studies give a five-year mortality of 18 to 44 per cent for those who survived the acute phase, depending on the age and sex structure and severity of the disease. In comparison, in spite

of the problems, the 30.1 per cent five-year mortality in unselected patients with acute myocardial infarction under 66 years of age in the present study does, however, seem quite large compared with the results of previous studies. The mortality in the category 'definite acute myocardial infarction' was even higher, 33.2 per cent. The 'HIP' study was a follow-up of 4.5 years of 564 male patients who survived one month after infarction. The series comprised men under 65 years of age with primary infarction, and the 4.5-year survival in the series was 81 per cent.<sup>29</sup> In the present study the corresponding figure for five-year survival was considerably lower, 73.9 per cent.

Several workers have noted that the mortality after the acute phase is highest during the first months.<sup>13 14 29 33</sup> This was the case in the present study, too. On the other hand, the mortality in this series did not decrease after the second year of follow-up, and the annual mortality during the whole follow-up period considerably exceeded that of the Helsinki population of the same age.

Age had an unfavourable effect on the five-year mortality, as has been shown in the majority of the previous studies. It has been noted, however, that the survival of younger patients with acute myocardial infarction is relatively smaller than that of older patients, if it is compared with the mortality of the general population within the same age groups.<sup>29</sup>

No clear differences between the sexes were found previously in the long-term survival,<sup>13</sup> even though not many long-term follow-up studies with large numbers of female patients with acute myocardial infarction have been published. In the present study the five-year mortality among women was lower than that among men, and age adjustment increased the difference still further. The lower mortality among women could be because a relatively larger proportion of women suffered a non-transmural infarction for, when the transmural of infarction was standardised, there was no statistically significant differences in the mortality between men and women. Women also suffered a recurrent acute myocardial infarction somewhat less often than men. Myocardial infarction in Finland, at least in the population of working age in Helsinki, seems to be less serious in women than in men: the incidence of acute ischaemic heart disease among women is clearly lower than among men,<sup>5</sup> women are less prone to both sudden death and death during the first 28 days than men,<sup>7</sup> and their long-term mortality is clearly smaller than that of men, mainly because they tend to suffer a smaller infarction with fewer recurrences than men.

The five-year mortality among men with a

transmural acute myocardial infarction was nearly double that of men with a nontransmural infarction. This probably reflects the usually smaller size of myocardial damage in nontransmural infarction compared with transmural infarction. Published reports have presented data, especially recently, which indicate that the prognosis for nontransmural infarction does not differ from that for transmural infarction, or is even poorer.<sup>22 34-37</sup> The series used in these studies was, however, fairly small. Both of the groups in the present study were large, though no classification into transmural or non-transmural infarction could be made for 13 per cent of the patients. Even if all these patients were in the nontransmural group, which is highly unlikely, this would not be enough to negate the considerable difference in mortality between the groups.

### Conclusion

The prognosis for patients of working age in Helsinki who had an attack of acute ischaemic heart disease is poor. Only 41.6 per cent of all those 1224 patients who suffered a definite or probable acute myocardial infarction or sudden coronary death during a one-year period were alive after five years. Compared with other follow-up studies the infarctions in Helsinki seem to have a higher fatality rate than in other countries especially in the early phase,<sup>5</sup> but also thereafter. The exceptionally high mortality from myocardial infarction of the Finnish population of working age, especially that of men, is caused by both the high incidence and the high fatality of the disease in the acute phase, right from the first hour after the attack.

### References

- <sup>1</sup>Keys A, Karvonen MJ, Fidanza F. Serum cholesterol studies in Finland. *Lancet* 1958; **2**: 175-8.
- <sup>2</sup>Härö, AS. Kuolleisuus Suomessa ja muissa Pohjois-maissa 1948-64. *Duodecim* 1966; **82**: 1136-51.
- <sup>3</sup>Keys A. (ed.) Coronary heart disease in seven countries. *Circulation* 1970; **41** and **42**; Suppl 1: 1-211.
- <sup>4</sup>Bolander A-M. A comparative study of mortality by cause in four nordic countries, 1966-68, with special reference to male excess mortality. Stockholm: Statist Rep Be 9, 1971.
- <sup>5</sup>World Health Organization. *Myocardial infarction community registers. Public Health in Europe 5*. Copenhagen: WHO Regional Office for Europe, 1976.
- <sup>6</sup>Siltanen P. The ischaemic heart disease register as a frame for preventive measures. *Adv Cardiol* 1972; **8**: 214-25.
- <sup>7</sup>Romo M. Factors related to sudden death in acute ischaemic heart disease. A community study in Helsinki. *Acta Med Scand [Suppl.]* 1973; 547.

- <sup>8</sup>Pohjola S. Work-return and 5-year prognosis after myocardial infarction. A community study in Helsinki. Helsinki: Academic dissertation, 1978.
- <sup>9</sup>Fleiss J. *Statistical methods for rates and proportions*. New York: Wiley, 1973.
- <sup>10</sup>Levine SA; Rosenbaum FF. Prognostic value of various clinical and electrocardiographic features of acute myocardial infarction. II ultimate prognosis. *Arch Intern Med* 1941; **6**: 1215–31.
- <sup>11</sup>Norris RM, Caughey DE, Deeming LW, Mercer CJ, Scott PI. Coronary prognostic index for predicting survival after recovery from acute myocardial infarction. *Lancet* 1970; **2**: 485–7.
- <sup>12</sup>Norris RM, Mercer CJ. Long-term prognosis following treatment in a coronary-care unit. *Aust NZ J Med* 1973; **3**: 31–7.
- <sup>13</sup>Vedin A, Wilhelmsson C, Elmfeldt D, Säve-Söderbergh J, Tibblin G, Wilhelmsen L. Deaths and non-fatal reinfarctions during two-years' follow-up after myocardial infarction. *Acta Med Scand* 1975; **198**: 353–64.
- <sup>14</sup>Helmers C, Lundman T, Maasing R, Wester PO. Mortality pattern among initial survivors of acute myocardial infarction using a life-table technique. *Acta Med Scand* 1976; **200**: 469–73.
- <sup>15</sup>Tunstall Pedoe H. Predictability of sudden death from resting electrocardiogram. Effect of previous manifestations of coronary heart disease. *Br Heart J* 1978; **40**: 630–5.
- <sup>16</sup>Tunstall Pedoe H, Clayton D, Morris JN, Brigden W, McDonald L. Coronary heart attacks in East London. *Lancet* 1975; **2**: 833–8.
- <sup>17</sup>Honey GE, Truelove S. Prognostic factors in myocardial infarction. *Lancet* 1957; **1**: 1209–12.
- <sup>18</sup>Hagström RM, Billings TV Jr, Ball COT, Meneely GR. The risk of sudden death following myocardial infarction. *Arch Environ Health* 1967; **15**: 450–4.
- <sup>19</sup>Waris EK, Siitonen L, Himanka E. Heart size and prognosis in myocardial infarction. *Am Heart J* 1966; **71**: 187–95.
- <sup>20</sup>Aintablian A, Hamby R, Zeitlin W. Ten-year follow-up in patients with anterior and inferior wall infarction (abstract). *Circulation* 1975; **51** & **52** Suppl II: 149.
- <sup>21</sup>Kentala E, Pyörälä K, Heikkilä J, Sarna S, Luurila O. Factors related to long-term prognosis following acute myocardial infarction. *Scand J Rehabil Med* 1975; **7**: 118–24.
- <sup>22</sup>Cannom DS, Levy W, Cohen SL. The short-and long-term prognosis of patients with transmural or non-transmural myocardial infarction. *Am J Med* 1976; **61**: 452–8.
- <sup>23</sup>Weinberg SL. Natural history six years after acute myocardial infarction. Is there a low-risk group? *Chest* 1976; **69**: 23–8.
- <sup>24</sup>Conley MJ, McNeer JF, Lee KL, Wagner GS, Rosati RA. Cardiac arrest complicating acute myocardial infarction: predictability and prognosis. *Am J Cardiol* 1977; **39**: 7–12.
- <sup>25</sup>Kitchin AH, Pocock SJ. Prognosis of patients with acute myocardial infarction admitted to a coronary care unit. II: Survival after hospital discharge. *Br Heart J* 1977; **39**: 1167–71.
- <sup>26</sup>Mulcahy R, Hickey N, Graham J, MacAirt J. Factors affecting the 5-year survival rate of men following acute coronary heart disease. *Am Heart J* 1977; **93**: 556–9.
- <sup>27</sup>Beard OW, Hipp HR, Robins M, Verzolini V. Initial myocardial infarction among veterans: ten year survival. *Am Heart J* 1967; **73**: 317–21.
- <sup>28</sup>Zukel WI, Cohen BM, Mattingly TW, Hrubec Z. Survival following first diagnosis of coronary heart disease. *Am Heart J* 1969; **78**: 159–70.
- <sup>29</sup>Weinblatt E, Shapiro S, Frank CW, Sager RV. Prognosis of men after first myocardial infarction: mortality and first recurrence in relation to selected parameters. *Am J Public Health* 1968; **58**: 1329–47.
- <sup>30</sup>Frank CW, Weinblatt E, Shapiro S. Angina pectoris in men. Prognostic significance of selected medical factors. *Circulation* 1973; **47**: 509–17.
- <sup>31</sup>Seigel DG, Loncin H. A critique of studies on long-term survivorship of patients with a myocardial infarction. *Am J Public Health* 1968; **58**: 1348–54.
- <sup>32</sup>Tunstall Pedoe H. Uses of coronary heart attack registers. *Br Heart J* 1978; **40**: 510–5.
- <sup>33</sup>Beard OW, Hipp HR, Robins M, Taylor JS, Ebert RV, Beran LG. Initial myocardial infarction among 503 veterans. *Am J Med* 1960; **28**: 871–83.
- <sup>34</sup>Dimond GE. Prognosis of men returning to work after first myocardial infarction. *Circulation* 1961; **23**: 881–5.
- <sup>35</sup>Madias JE, Chahine R, Gorlin R, Blacklow D. Is the nontransmural myocardial infarct 'different' from the transmural infarct? (abstract). *Circulation* 1972; **45** & **46**; Suppl II: 161.
- <sup>36</sup>Genovese MG, Salaki JS, Kennedy RI, Grace WI. Subendocardial infarction: what happens later. *Am Heart J* 1976; **92**: 542–3.
- <sup>37</sup>Luria MW, Knoke JD, Margolis RM, Hendricks, FH, Kuplic JB. Acute myocardial infarction. Prognosis after recovery. *Ann Intern Med* 1976; **85**: 561–5.

Requests for reprints to Dr S Pohjola, The Finnish Heart Association Research Institute, Fredrikinkatu 20 B, 00120 Helsinki 12, Finland.