Assessment of the main factors influencing return to work following myocardial infarction: A longitudinal study

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ABSTRACT

Background: Myocardial infarction (MI) is one of the most important causes of mortality and morbidity in developing countries. Also, MI can cause disability and adversely affect on patients' quality of life and economical condition.
Aim & objectives: To assess the main demographic, occupational and clinical variables that might affect the return to work status following MI.
Methods: We surveyed 384 patients who referred to a general hospital between 2007 and 2009, for acute MI. Participants were employed and with no history of MI. Also, the required data was gathered from the medical records.
Results: Most of patients had returned to work (79%). The mean delay for return to work was 2.2 months. Based on logistic regression analysis, predictor factors of returning to work were: age, duration of hospitalization , left ventricular ejection fraction, history of diabetes mellitus, occurrence of angina after MI in hospital and CABG surgery (P-value<0. 05).
Conclusions: Successful return to work after first MI is related to clinical, demographic, psychological and occupational variables. Precise evaluation of occupational factors such as job title, metabolic rate required for that job and fitness for work may affect successful return to work.

Keywords: Myocardial infarction, Return to work, Work capacity evaluation

Introduction

Coronary artery disease is one of the leading causes of death all over the world and includes 40% of deaths in developed countries.[1-4] MI may worsen the patients' quality of life and economic condition.[5-7]In the United State 1,500,000 individuals experience MI annually and one-third of them die.[8]

According to Maeland's and Meen study, 3, 5 and 7 years survival rate after MI were 84.1%, 75.9% and 68.6% respectively and in comparison with general population, the relative mortality risk was reported 4.8 for the first year, 3.1 for the second year and 2.1 for the next five years.[9]

An estimate puts the annual coronary artery current cost at around$100 billion in the United State.[10]

MI is common in working population[1,11] and is one of the most causes of disability.[12,13] MI in workers leads to working disability in some jobs. Owing to MI, 90 million workdays are lost annually in the United State.[14] The use of fibrinolysing drugs, angioplasty treatment, coronary artery bypass surgery and also heart rehabilitation program has resulted to decreasing of mortality and disability after MI in recent two decades.[15,16] Evaluation of return to work after MI incidence is important to any countries.[11] As a result of previous studies, the return to work after MI incidence differs between 63-94% at the United State [17,18], 58-89% at Swedish and Norway[11,19], 85-87% at Belgium[20,21], 40-60% at Germany[22] and 90% at Denmark.[23]

Some of these differences are dependent to methods; follow up duration after MI, age, society and patients' culture and attitudes, type of evaluated jobs, information references, social insurances support against workers and also labor law of each country.

Different medical and non-medical reasons have influence on return to work rate. In several studies, the return to work following MI is associated to non-cardiac diseases, angina pectoris, left ventricle ejection fraction and also exercise test results.[24-26] Return to work rate following MI is related to non-medical factors such as age, education, previous work status, job satisfaction and depression.[27]

Judgment about time of return to work and estimation of worker suitable time to return to work is a complex and important category. Rapid return to work after MI has economic profits but may result in patients' worsen physical and mental condition and quality of life.[28]

Also early return to work at inappropriate time, in poor clinical condition and in inappropriate job and business activity, leads to disease aggravation or even recurrent MI and may have serious consequences. Thus, it becomes important that physicians made aware of effective causes and return to work following MI determinant indices.

As a result of previous studies, the effective variables in return to work following MI are multi-factorial and include demographic, mental, occupational, economical, social and also clinical variables.[29-32]

Aim and objectives

In this survey, we evaluated current status of return to work rate following MI and its effective factors in our country, Iran. We wish the results get used as guidelines on the appropriate decisions about time of return to work following MI.

Methods and study design

In this study, we surveyed all patients who admitted with MI at a general hospital in Tehran between June 2007 and March 2009.
We evaluated the return to work status of the patients. This evaluation has performed in 2008 and 2009. Inclusion criteria included hospital admission due to MI and employment before MI occurrence. Exclusion criteria included history of last MI and deaths at hospital.
In the present study, we evaluated the return to work status of patients with MI for 7 months after MI. Among 480 patients with MI, 384 of them responded the telephone (response rate 80%).
Required information including demographic, clinical and occupational variables was obtained based on patients' medical record using a questionnaire.
The questionnaire included information about age, sex, marital status, patients' job, cigarette smoking, duration of hospitalization, history of diabetes mellitus, hypertension, hyperlipidemia, ischemic heart disease, infarction type, left ventricle ejection fraction rate, cardiac enzymes level, triglyceride, cholesterol, blood creatinine, blood pressure and heart rate.
Patients' heart rate and blood pressure and also creatinine, triglyceride and cholesterol levels at admission time in emergency service were registered in questionnaire. The highest levels of cardiac enzymes including CK (creatinine phosihokinase), CK-MB (creatinine phosphokinase MB isoenzyme) and troponine during hospitalization were registered.
Patients' jobs were classified with regard to required energy or metabolic rate in terms of watt/m^2. [33] Also jobs were classified in three groups: manual works (e.g. construction worker), professional and clerical works (e.g. teacher and physician) and semi-professional (e.g. driver and seller). [34] We made contact with patients by telephone number that was registered in medical records. Required information about return to work such as full-time or part-time work, time of return to work and symptoms while working (include chest pain and dyspnea) were gathered for each patient.
Full-time work considered as at least 8h-time workday and part-time work considered as workday lower than 8 hours. This study was approved by the Ethics Committee of Tehran University of Medical Sciences.

Statistical methods

Mean, standard deviation (SD) and range of quantitative variables were calculated. We used independent t-test for analysis and comparison of quantitative factors and chi-square test for qualitative factors. The logistic regression method was used to modify the confounding factors and evaluating the relationship between return to work and other variables more precisely. P values less than 0.05 were considered as statistically significant. The results of statistical analysis are expressed as odds ratio (OR) with 95% confidence intervals (95% CI). All the mentioned calculations were performed using SPSS 11 software.

Results

In this study 384 patients were surveyed. The mean age of patients was 52 years old with a range of 27-68 years. 372 patients were male (97%) and 12 patients were female (3%).

213 patients had semi-professional work (55.5%), 120 patients had professional and clerical work (31.3%) and 51 ones had manual work (13.2%).
Among all surveyed patients, 303 hospitalized patients (79%) had returned to work, 68.8% (264 patients) to full-time work and 10.2% (39 patients) to part-time work.
The average duration of work avoidance after MI was 2.2 months.
Among patients who returned to work; 45.5% returned after one month and during 2, 3, 4 and 6 next months, 67.3%, 79.2%, 87.1% and 93.1% of patients were returned to work respectively.
The demographic factors which significantly related to return to work were age and cigarette smoking (P<0/05). In patients who returned to work, the average of age was 51.2 years and in patients who did not return to work was 56.4 years (P=0.02). The clinical factors including ejection fraction rate, duration of hospitalization, cardiac angina in hospital after MI, history of ischemic heart disease, hypertension and coronary artery bypass surgery were correlated with return to work significantly (P<0.05). Probability of return to work in patients with ejection fraction higher than 40% was 3.3 times higher than patients with ejection fraction lower or equal to 40% (95%CI=1.96-5.57, RR=3.3, P<0.001). Also, the occupational factors including professional works and occupational metabolic rate lower than 100 watt/m^2 , were correlated significantly with return to work (P<0.05). In jobs which required energy lower than 100 watt/m^2, the return to work was 2.3 times higher than the jobs which required energy equal or more than 100 watt/m^2, (95% CI=1.38-3.83, RR=2.3, P<0.001).
Sex and marital status had no significant relationship with return to work. Also, the heart rate and blood pressure, creatinine, triglyceride and cholesterol levels, cardiac enzymes level and type of MI had no significant correlation with return to work (P>0.05). The demographic, occupational and clinical characteristics of return to work are summarized in tables 1, 2 and 3.
As a result of regression analysis, predictive factors of return to work after MI are age, duration of hospitalization , history of diabetes mellitus, angina after MI, coronary artery bypass surgery and ejection fraction rate (P-value<0.05) (table 4).
In this survey, cardiac symptoms while working is considered as an index which shows poor return to work rate. Also, we classified patients who returned to work according to required occupational metabolic rate and ejection fraction under 3 groups: low risk, moderate risk and high risk. Low risk group considered as patients who had occupational metabolic rate lower than 100 watt/m^2 and ejection fraction higher than 40%. Moderate risk group included patients who had occupational metabolic rate lower than 100 watt/m^2 and ejection fraction equal or more than 40% also patients who had occupational metabolic rate equal or more than 100 watt/m^2 and ejection fraction equal or higher than 40%. High risk group included patients who had occupational metabolic rate equal or more than 100 watt/m^2 and ejection fraction equal or lower than 40%. In high risk group, 44.6% of patients had cardiac symptoms while working, whereas in moderate and low risk groups, this rate was 35.3% and 20.1% respectively and this difference was significant (P<0.05). A comparison of low and high risk groups, the probability of cardiac symptom incidence while working was 3.28 times more in high risk group than low risk group (95%CI=1.57-6.86,P =0.003).

Discussion

Evaluation of disability due to MI is an important issue in occupational health system. Recognition of main effective variables in return to work may prevent workday lost or re-infarction at work.

In this survey, 79% of patients returned to work after MI and most of them returned to full-time work. In Abbas et al. study, 78% of patients returned to work during 6 months after MI.[5] In study of Bhattacharyya et al. 80% of patients returned to work (almost full-time work) during 12 months following acute coronary syndrome.[6]As a result of a study in urban and rural areas of Norway, return to work rate after MI was 73%.[35] In our study, average duration of work avoidance was 2.2 months. In previous studies, the range of this duration was variable between 3.4 to 5.5 months.[6,21,36]

Our study showed that some demographic, occupational and clinical factors such as age, duration of hospitalization and left ventricle ejection fraction rate can be considered as predictive factors of return to work. In this study, the demographic factors which correlated with return to work were age and cigarette smoking. Age was mentioned as a predictive factor of return to work in most previous studies.[36-38] In Abbas et al. study smoking history was one of the negative predictive factors of return to work.[5]

In our study, sex and marital status had no correlation with return to work. In a study which performed on return to work status after first MI in Finland, the return to work rate was almost similar in both genders in different age groups ($P > 0.05$) .[10]

Also in study of Bhattacharyya et al. sex and marital status had no efficiency on return to work after acute coronary syndromes.[6]

In the present study, the occupational factors which correlated significantly with return to work were professional and clerical job and also occupational metabolic rate lower than 100 watt/m.[2] Only few previous studies were focused on type of patients' job and required occupational metabolic rate. But in one study, high physical activity required for job was mentioned as a negative variable for return to work after MI.[34]The results of a previous study demonstrated that agricultural and industrial workplaces with lower professional level had lower return to work rate than other occupational groups.[39] In Varaillac et al. study which evaluated the return to work after MI in 174 patients, the type of jobs and physical stress were correlated with return to work.[36] Our study found out patients with non-professional and manual work returned to work significantly lesser than patients with professional and clerical work. Also patients with high energy demanded jobs return to work lesser in comparison with other jobs.

In this study, clinical factors which correlated significantly with return to work were duration of hospitalization, cardiac angina following MI at hospital, history of ischemic heart disease, ejection fraction, history of diabetes mellitus, hypertension and also coronary bypass surgery following MI. In Abbas et al. study angina was predictive factor of return to work after MI.[5]

In a cross-sectional study which performed on 89 patients, associated variables with delayed return to work after MI were coronary artery bypass surgery and history of cardiac diseases.[40]

In this study, some of patients returned to work with inappropriate situation which cause cardiac symptoms while working. In this study, among patients who returned to work, high risk group patients (required occupational metabolic rate higher than 100 watt/m^2 and ejection fraction lower than 40%) experienced cardiac symptoms significantly more than low risk group patients (required occupational metabolic rate lower than 100 watt/m^2 and ejection fraction higher than 40%) while working. Thus, risk assessment before patients' return to work is an important issue.

Age, required occupational energy, duration of hospitalization and left ventricle ejection fraction are the most important variables in risk assessment following MI.

Study limitations

Unfortunately, the information of patients' medical record was not complete enough. Thus we couldn't access to some information such as occupational history, mental factors, educational level and exercise test reports. In our study, because of lack of exercise test reports in medical records, we couldn't evaluate fitness for work using aerobic capacity which has especial importance in judgment of successful return to work.

Conclusions

The return to work rate is dependent to legislation and socio-economic situation in every country. Patients follow-up after MI for clinical, mental and social characteristics is important and effective for successful return to work. Finally, it seems that attention to mental and physical abilities after MI and fitness evaluation for occupational demands can prevent unpleasant accidents and work force lost.
Regarding our study limitations, we suggest future research using prospective methodology in future for more precise results about return to work following first MI and related factors.

Competing interests

We declare that we do not have any competing interest.

Authors' contributions

Mir Saeed Attarchi contributed to the study design, Data collection, data analysis and interpretation of data. **Azadeh Amiri Rigi** contributed to the Data collection, analysis and interpretation of data. **Elham Mirzamohammadi** contributed to the analysis and interpretation of data. **Saber Mohammadi** contributed to the analysis and interpretation of data. All authors have been involved in drafting the manuscript.

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Table 1: Demographic and occupational characteristics of patients and return to work status

*** Non-significant (P-Value>0.05)**

Variable		Return to work Number (percent)	P-Value
Sex	**Male (n=372)** **Female (n=12)**	294(79%) 9(75%)	* N.S
Marital status	**Married (n=351)** **Single (n=33)**	276 (78/6%) 27 (81/8%)	*N.S
Smoking	**No (n=151)** **Yes (n=233)**	133(88%) 170(72%)	0.017
Occupational classification	**Manual work (n=51)** **Professional and clerical work (n=120)** **Semi-professional work (n=213)**	45(88.2%) 114(95%) 144(67.6%)	<0.001
Occupational metabolic rate	**<100wat/m^2 (n=270)** **≥100wat/m^2 (n=114)**	225(83.3%) 78(68.4%)	<0.001

Table 2: Clinical characteristics of patients and return to work status (qualitative variables)

Variable		Return to work Number (percent)	P-Value	Relative risk	95% CI (confidence interval)
Cardiac angina at hospital	**No (n=330)** **Yes (n=54)**	270(81.8%) 33(61.1%)	<0.001	2.86	(1.54-5.29)
History of ischemic heart disease	**No(n=303)** **Yes (n=69)**	258(81.9%) 45(65.2%)	<0.002	2.41	(1.36-4.27)
Left ventricle Ejection fraction	**≤40%(n=95)** **>40%(n=289)**	59(62.1%) 244(84.4%)	<0.001	3.30	(1.96-5.57)
Diabetes Mellitus	**No(n=300)** **Yes (n=84)**	247(82.3%) 56(66.6%)	0.045	1.66	(1.18-3.96)
Hypertension	**No(n=279)** **Yes (n=105)**	228(81.7%) 75(71.4%)	0.028	1.78	(1.06-3.01)
Coronary bypass	**No(n=321)** **Yes (n=63)**	264(82.2%) 39(61.9%)	<0.001	2.85	(1.59-5.1)
Hyperlipidemia	**No(n=294)** **Yes (n=90)**	231(78.6%) 72(80%)	0.771	0.91	(0.51-1.64)
Type of MI	**Anterior(n=189)** **Inferior (n=126)** **Anterior & Inferior (n= 9)** **NSTEMI[1](n=60)**	150(79.4%) 102(81%) 6(66.7%) 45(75%)	0.637	-----	----

[1] NSTEMI=Non ST-Elevation Myocardial Infarction

Table 3: Clinical characteristics of patients and return to work status (quantitative variables)

Variable	Return to work (mean ±standard deviation)	non-return to work (mean ±standard deviation)	P-value
Hospitalization duration (day)	5.5±2.3	9.4±16	<0.001
Heart rate (heat/min)	77.3±14.2	79.8±13	0.126
Systolic blood pressure (mmHg)	130.6±26.9	133.8±20.2	0.326
Diastolic blood pressure (mmHg)	82.8±16.6	81.1±11.8	0.398
Creatinine (mg/dL)	1.2±0.5	1.1±0.3	0.638

Table 4: Relationship between study variables and return to work following MI using logistic regression analysis

Variable		P-value	Adjusted odds ratio	95% confidence interval
Age (year)	**≤ 55**	<0.001	1.726	(1.07-1.48)
	> 55	---	1	---
Diabetes Mellitus	**Yes**	---	1	---
	No	0.013	2.48	(1.20-5.12)
Period of hospitalization (day)	**≤ 7**	<0.001	1.27	---
	>7	---	1	(1.11-1.45)
Angina at hospital	**Yes**	---	1	---
	No	0.01	2.84	(1.27-6.31)
Coronary bypass	**Yes**	---	1	---
	No	0.012	2.81	(1.25-6.33)
LVEF (%)	**≤40**	---	1	---
	>40	<0.001	4.89	(2.42-9.87)

Left Ventricle Ejection Fraction