Non Clinical Risk Factors of Myocardial Infarction: A Meta-Analysis Approach

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Abstract

Background: Myocardial Infarction (MI) is a coronary heart disease that is one of the main causes of the mortality over the globe. There are various clinical and non-clinical risk factors that can be further classified as modifiable and non-modifiable. This study has explored the role of some Non Clinical factors like; Gender, Education and Family history with MI using Meta-analysis approach.

Methods: The published literature from 1990 to 2015 on MI was collected by using several databases and search engines. A review of the collected literature (28 studies) showed that the studies under analysis were of different origins and had different objectives. For each study, Odds Ratio and 95% confidence intervals was extracted and pooled with a random effect model, weighting for the inverse of the variance. Meta-analysis software version 2.0 was used to analyze heterogeneity analysis and estimate pooled estimates through random effect model.

Results: The study has showed that gender (OR=1.391 and 95% C.I.: 1.140, 1.697), family history of heart diseases (OR=3.206 95% C.I.:2.064, 4.981) and low education level or illiteracy (OR=1.552 and 95%C.I.: 1.132, 2.128) are the significant risk factors in developing Myocardial Infarction.

Conclusion: This study has concluded that the included factors in this study are significantly related to the Myocardial Infarction. Gender difference, family history of heart disease and low education are the important risk factors in causing this fatal disease.

Keywords: Myocardial infarction; Gender; Education; Family history; Risk factors; Meta-analysis

Introduction

Cardiovascular disease is a commonly used term that refers to the diseases that affect the heart and other parts of the cardiovascular system of the body. The cardiovascular diseases that affect the coronary arteries of the heart are called Coronary Heart Diseases (CHD) [1]. Myocardial Infarction (MI) is one of the diseases in this group. A large number of people die every year due to this fatal disease. In 2013, the number of people who died from cardiovascular disease (CVD) was more than 17.3 million (95% uncertainty interval, 16.5 to 18.1), representing an increase from 1990 of 40.8% [2]. The burden of Coronary Heart Disease is increasing at a greater rate in South Asian countries than the other countries of the world. It has been estimated that the risk of MI would be doubled in the next 20 years [3]. According to American Heart Association, approximately one of every six deaths in United States is caused by MI [4,5]. Another study showed that the high prevalence of MI in Pakistan with more than 30% of the population over 45 years of age is affected by this disease [3]. This statistics has revealed that this disease is growing at alarming rate in the world. A mammoth literature is available on this disease. As a result many medical, social, economic, demographic risk factors were explored in the literature.

In this literature medical factors got significant attention by medical professionals and practitioners. The least attention has been paid to non-clinical factors (demographic and socioeconomic factors) which can play significant role in causing MI [6-8]. Age, gender and family history of MI are demographic factors and education is a socioeconomic factor. Age and gender has been found as powerful risk factors of MI [9]. It has also been observed that chances of getting MI increases as the age of the patients increases. Another study shows that MI in patients less than the age of 40 is 10% of all the cases [10]. A study conducted in Bangladesh shows that the incidence of AMI was more frequent among the patients of age group 50-59 years [11]. Recently a health survey conducted in England suggests that 4% of men and 0.5% of women have had an MI [12]; however, after the age of 70 both genders have equal chance of getting this disease. It has been observed that women have experienced their first MI on the average 9 years later than men [13].

Family history of heart diseases has also emerged as an important predictor of MI in many studies. A family history of MI increases the risk of CHD especially for MI. The National Cholesterol Education Program highlights that an individual may have a positive history of MI if his close blood relative male (father or brother) has MI younger than 55 years or female (his mother or sister) has MI younger than 65 years [14].

Socioeconomic Status (SES) refers to the combination of social and economic indicators like; education, income, occupation etc. A study...
shows that low level of education, low income and unhealthy life style also increase the risk of MI particularly in women [15]. The current study has focused on the low education level as one of the indicators of socioeconomic status because it is very difficult to find out the income and life style subjects of the most of our collected 28 published researches. Education is generally regarded as an indicator of an individual’s general knowledge and problem solving skills. Low level of education is the most consistent risk factor for MI globally [16]. It has been observed that a person who does not get education is at a greater risk of developing MI than that that gets any type of education [17,18]. Furthermore, education also has an inverse relation with the mortality after getting attacks of MI. It might be assumed that self-management can differ in educated person. It has been found that education level is independently and strongly associated with MI particularly among younger men [19]. In this study, there is an attempt to pool the results of different studies regarding associations of these non-clinical risk factors with MI through a Meta-Analysis Approach.

Material and Methods

The researchers have searched online databases like Medline, Pubmed, Embase, Mesh etc., googled the medical subjects heading “Myocardial Infarction” and key words “Socio-economic,” “Demographic”, “gender as risk factor of MI”, “education as a risk factor of MI”, “Family History as a risk factor of MI” and “risks factor of Myocardial Infarction” to collect a corpus of 28 studies on MI.

All 28 studies were analyzed by conducting Meta-Analysis technique which matches with the inclusion criterion. It was ensured that only case control, cohort and cross sectional studies published from 1990 to 2015 on the subject MI have been taken for analysis. One of the delimitations of the study was the language of the selected research studies; as only those research studies were collected which used English as a language of their publication.

From the identified studies and respective populations characteristics of the studies were recorded which were as follows: author’s name, years of publication, study design (case control study, cohort and cross sectional studies), sample size, Country of Origin, RR and OR of MI associated with socio-economic and demographic factors with their standard error.

In this study, separate Meta-analysis was performed on each risk factor of MI. All statistical analyses were performed with comprehensive Meta-analysis software version 2.0. Odds Ratio (OR) was used as effect size that reflected the magnitude of the association between different factors and the risk of MI in each study. Odds ratios with their corresponding 95% confidence intervals (CI’s) were calculated from the summary data provided. In the selected articles, researchers calculated a weighted average of odds ratio with weights being the inverse of variance of odds ratio. In the presence of heterogeneity, random effects models were used (rather than fixed effects models) to obtain pooled effect estimates across studies. Heterogeneity among the studies was studied by the inspection of Q statistic and I² statistic.

Results

Initially 325 studies which followed the primary inclusion criteria were identified through different sources. Then these studies were further scrutinized at different stages and the major portion of identified studies was excluded on the basis of; irrelevant material, inconsistency with the objectives of Meta-analysis, poor reporting, quality of work and lack of statistical data (detail is given in Flow Chart 1). Twenty eight (28) different studies were identified as potentially relevant for analysis, in the selected data of research studies 6 were

Flowchart 1: Objectives of Meta-analysis, poor reporting, quality of work and lack of statistical data.
This case random effects model has been used to pool the studies of each factor.

The pooled estimate for gender is 1.391 with 95% confidence interval of 1.140 to 1.697. It depicts a significant association between gender and MI. It means males have 1.391 times more risk of developing MI as compared to females. The pooled estimate for family history of MI is 3.206 with 95% confidence interval of 2.064 to 4.981. The pooled estimate (OR=3.206) indicates a highly significant connection between family history of MI and risk of MI. It portrays that the persons who have a positive family history of MI have 3.206 times more risk of MI as compared to those who do not have family history of MI. The pooled

<table>
<thead>
<tr>
<th>Study Number</th>
<th>Years of publication</th>
<th>Type of study</th>
<th>Country</th>
<th>No. of cases/ Exposed</th>
<th>No. of control/Not exposed</th>
<th>OR (95% C.I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>1992</td>
<td>Case control</td>
<td>Italy</td>
<td>801=A 115=B</td>
<td>976=A 130=B</td>
<td>0.928</td>
</tr>
<tr>
<td>30</td>
<td>1994</td>
<td>Case control</td>
<td>Italy</td>
<td>542=A 72=B</td>
<td>705=A 87=B</td>
<td>0.928</td>
</tr>
<tr>
<td>31</td>
<td>1994</td>
<td>Case control</td>
<td>Italy</td>
<td>801=A 115=B</td>
<td>976=A 130=B</td>
<td>0.929</td>
</tr>
<tr>
<td>32</td>
<td>1998</td>
<td>Case control</td>
<td>Argentine</td>
<td>156=A 180=B</td>
<td>228=A 218=B</td>
<td>0.829</td>
</tr>
<tr>
<td>33</td>
<td>1999</td>
<td>Case control</td>
<td>Seattle and Washington,</td>
<td>494=A 224=B</td>
<td>1546=A 590=B</td>
<td>0.842</td>
</tr>
<tr>
<td>29</td>
<td>2000</td>
<td>Case control</td>
<td>Czech Republic</td>
<td>279=A 79=B</td>
<td>938=A 1048=B</td>
<td>3.946</td>
</tr>
<tr>
<td>34</td>
<td>2001</td>
<td>Case control</td>
<td>New Jersey</td>
<td>440=A 210=B</td>
<td>1269=A 1721=B</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>2001</td>
<td>Case control</td>
<td>Argentine</td>
<td>734=A 205=B</td>
<td>727=A 222=B</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>2005</td>
<td>Cohort</td>
<td>Pakistan</td>
<td>88=A 212=B</td>
<td>95=A 111=B</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>2005</td>
<td>Case control</td>
<td>Spain</td>
<td>50=A 22=B</td>
<td>39=A 38=B</td>
<td>2.21 (1.13-4.33)</td>
</tr>
<tr>
<td>38</td>
<td>2006</td>
<td>Case control</td>
<td>Japan</td>
<td>1353=A 572=B</td>
<td>1595=A 684=B</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>2007</td>
<td>Cohort</td>
<td>Pakistan</td>
<td>56=A 144=B</td>
<td>132=A 368=B</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>2007</td>
<td>Case control</td>
<td>Canada</td>
<td>10528=A 8825=B</td>
<td>85034=A 107787=B</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>2007</td>
<td>Case control</td>
<td>Iran</td>
<td>120=A 80=B</td>
<td>123=A 77=B</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>2007</td>
<td>Cohort</td>
<td>Germany</td>
<td>Total 159, 120 males and 39 females</td>
<td>10342 males and 16453 females</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>2007</td>
<td>Case control</td>
<td>Costa Rica</td>
<td>786=A 103=B</td>
<td>965=A 202=B</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>2008</td>
<td>Cross sectional</td>
<td>Jordan</td>
<td>128=A 55=B</td>
<td>1465=A 1435=B</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>2009</td>
<td>Cohort</td>
<td>Sweden</td>
<td>34=A 19=B</td>
<td>780=A 880=B</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>2009</td>
<td>Cohort</td>
<td>Mexico</td>
<td>1.64 (0.93-2.92)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Characteristics of the studies of which discussed gender as a Risk factor of MI. Event A: male; Event B: female.

Table 2: Characteristics of the studies which described education level as a risk of Myocardial Infarction. Event A: less than 10 years education and risk of myocardial infarction. Event B: greater than 10 years' education and risk of myocardial infarction.
Table 3: Characteristics of the studies which discussed family history as a risk factor of MI. Event A: have family history of MI Event B: don’t have family history of MI.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Number of studies</th>
<th>Pooled estimate and 95% C.I and its p-value (Random Effect Model)</th>
<th>Q – statistic with p-value I²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>19</td>
<td>1.391 (1.140-1.697), (0.001)</td>
<td>321.976, (0.000) 94.399</td>
</tr>
<tr>
<td>Family history</td>
<td>8</td>
<td>3.206 (2.064-4.981), (0.000)</td>
<td>91.975, (0.000) 92.389</td>
</tr>
<tr>
<td>Education</td>
<td>8</td>
<td>1.552 (1.132-2.128), (0.006)</td>
<td>42.829, (0.000) 83.656</td>
</tr>
</tbody>
</table>

Table 4: Pooled estimates for gender, education and family history.

Figure 1: Summary statistic and forest plot of the studies on gender associated with risk of MI.

Figure 2 shows that the odds ratios of all the eighth studies are greater than 1 but six studies are significant and also shows that three studies [14-16] have the same effect like the overall estimate and remaining 5 studies have different effect.

Figure 3 shows that the odds ratios of the seven studies are greater than 1 but four studies are significant and also shows that two studies [17,18] have same effect like the overall estimate and other 5 other studies have different effect.

Discussion

The results of present Meta-analysis indicate that socioeconomic (Education) and demographic (Gender and Family History) factors play a significant role in the developing of MI. This study estimate (OR=1.391) shows that men have greater chance of developing MI as compared with women.
This relationship is consistent with the studies previously conducted in Asian countries as well as in the developed countries [8-10]. A study conducted in India [20] showed the risk of developing MI three times more among males as compared with the females. An Interheart case control study conducted in the 52 countries of the world has also shown that the women had experienced their first MI on the average nine years later than the men in all the different regions of the world [16].

The point estimate (OR=3.206) for Family History indicates that the person who have a strong family history of MI have greater chance of developing MI as compared with those persons who don't have a family history of MI. A study [21], on the behalf of GISSI-EFRIM, investigates the association between family history of MI and risk of AMI [22-25]. These mentioned studies have reported that Family history of heart disease was a significant and independent risk factor of MI.

In the present study the point estimate (OR=1.552) for education indicates that less educated persons have greater risk of developing MI as compared with the highly educated persons. This relationship is consistent with studies previously conducted in different regions of the world [13,16,18,26]. A study [27] describes a Meta-analysis study on the socioeconomic position and incident of AMI. It also shows that education level was strongly associated with the risk of developing MI. The risk of developing MI was greatest in individuals with only an elementary school education as compared to higher level education [28]. Personal education and parental education were also strongly associated with the risk of developing MI [29-40].

Conclusion

This study has mainly focused on the relationship of gender, education and family history with risk of MI. The study has used past researches which contain relevant data on these three selected factors [41-52]. On the basis of Meta-analysis, this study has concluded that the male are at a more risk in having MI as compared with the females. Similarly low income or low socioeconomic status also have associations with the status of MI. Family history of the heart disease is also an important risk factor in causing this fatal diseases.

Acknowledgment

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References


