

Serum cholesterol values in acute myocardial infarction patients at King Chulalongkorn Memorial Hospital

Suchat Suppaitiporn*

Suppaitiporn Su. Serum cholesterol values in acute myocardial infarction patients at King Chulalongkorn Memorial Hospital. Chula Med J 2002 Dec; 46(12): 963 - 73

Background : To determine whether serum cholesterol levels of Thai patients with acute myocardial infarction at King Chulalongkorn Memorial Hospital. Whether the gender difference in the demographics, serum cholesterol, triglyceride, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and other risk factors.

Methods : We reviewed the history and laboratory data of each patient diagnosed with acute myocardial infarction at the hospital. The variables included demographics, risk factors; diabetic, hypertension, smoking, hyperlipidaemia, family history of coronary heart disease, serum total cholesterol levels, triglyceride level, low-density lipoprotein (LDL) level, high-density lipoprotein (HDL) level. The data analysis was performed by SPSS v.10.0. We examined data from acute myocardial infarction patients who were admitted between January to December 2001.

Results : The mean total cholesterol was 219.66 mg/dl whereas abnormal high total cholesterol level (>240mg/dl) was about 32.4 % in male and 40.5 % in women. The mean triglyceride level was 147.08 mg/dl and abnormal high triglyceride level (>200 mg/dl) was 11.9% in male and 14.9% in female. The mean LDL cholesterol level was 146.56 mg/dl and abnormal high LDL (>190 mg/dl) was 18.4 % in male and 19 % in female. The mean HDL was 43.68 mg/dl. Female patients were about 6 years older than male (mean 64.11 compared to 58.37)(p value < 0.05) but less likely smoking (p value < 0.01).

* Department of Out Patients, King Chulalongkorn Memorial Hospital

Female also had higher serum cholesterol level, LDL, HDL, except in triglyceride level. Both gender serum lipid levels declined by ages. We found only one positive evidence in family history of coronary heart disease. 18.4 % in male and 26.2 % in female of acute myocardial infarction patients had LDL - cholesterol level < 100 mg/dl. The mean LDL in 1 risk factor was 128.71 mg/dl in male and 143.55 mg/dl in female ; 2 risk factors were 131.93 mg/dl -137.37 mg/dl (in male and female); > 2 risk factors were 127.33 mg/dl -129.76 mg/dl (in male and female).

Conclusion : *The harmful of smoking in risk factor raising the LDL-C level. Lipid profile in our study patients were not so high. Mean LDL in men were 143.79 mg/dl and women 154.08 mg/dl, Triglyceride in men were 153.09 mg/dl women were 130.76 mg/dl; But not statistic significant difference except in HDL; women were higher than men 49.59 mg/dl and 41.50 mg/dl respectively. The data suggest that recommendation of the National Cholesterol Education Program (NCEP), Third Adult Treatment Panel) (ATPIII) to reduce of low – density – lipoprotein cholesterol (LDL-C) to < 100 mg/dl may not safe for prevent of acute myocardial infarction because about 20 % of our patients still had acute myocardial infarction; Despite LDL-C level < 100 mg/dl. We should emphasize the importance of an assessment of absolute coronary heart disease (CHD) risk based an all risk factors rather than simply the serum cholesterol concentration. Whatever the degree of risk at which lipid-lowering drug therapy is recommended, all of the recommendations depend for their clinical CHD risk in individual patients.*

Keywords : *Serum cholesterol, Acute myocardial infarction, Risk factor.*

Reprint request : Suppapatiporn Su. Department of Out Patients, King Chulalongkorn Memorial Hospital, Bangkok 10330, Thailand.

Received for publication. September 15, 2002.

สุชาติ ศุภปิติพร. ระดับไขมันในเลือดของผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลันที่มารับการรักษา
ที่โรงพยาบาลจุฬาลงกรณ์. จุฬาลงกรณ์เวชสาร 2545 ๕.ค; 46(12): 963 - 73

วัตถุประสงค์ : เพื่อศึกษาระดับไขมันในเลือดของผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลัน และเพื่อ
ศึกษาปัจจัยที่มีความสัมพันธ์กับโรคหัวใจขาดเลือดเฉียบพลัน ได้แก่ ปัจจัยส่วน
บุคคล โรคทางกายที่มีอยู่และปัจจัยเสี่ยงอื่น ๆ กับระดับไขมันในเลือดขณะ ที่เข้า
มารับการรักษาโรคหัวใจขาดเลือดเฉียบพลันที่โรงพยาบาลจุฬาลงกรณ์

วิธีการ : ได้เก็บข้อมูลย้อนหลังของผู้ป่วยโรคหัวใจขาดเลือดเฉียบพลันที่รับไว้ใน
โรงพยาบาลจุฬาลงกรณ์ รวมถึงตัวแปรต่าง ๆ ได้แก่ ปัจจัยส่วนบุคคล ปัจจัยเสี่ยง
ต่าง ๆ เบาหวาน ความดันโลหิตสูง สูบบุหรี่ ไขมันในเลือดสูง ประวัติครอบครัว
ที่มีโรคหัวใจขาดเลือด รวมถึงระดับของไขมันต่าง ๆ ในเลือด ในช่วงเดือน
มกราคมถึงเดือนธันวาคม 2544 จำนวนทั้งสิ้น 156 คน ข้อมูลดังกล่าวรวบรวม
และวิเคราะห์ด้วย SPSS V10.0 โดยวิธีสถิติเชิงพรรณนา

ผลการศึกษา : ระดับคอเลสเตอรอลเฉลี่ยในเลือดของผู้ป่วยเท่ากับ 219.66 มก/ดล ขณะที่
จำนวนของผู้ป่วยที่มีระดับคอเลสเตอรอลในเลือดสูงกว่า 240 มก/ดล ในผู้ป่วย
ชายมี 32.4 % ผู้ป่วยหญิงมี 40.5 % ระดับไตรกลีเซอไรด์เฉลี่ยในเลือดเท่ากับ
147.08 มก/ดลและที่ระดับสูงกว่า 200 มก/ดล มีอยู่ 11.9 %, 14.9 % (ชาย - หญิง)
ระดับ LDLเฉลี่ยเท่ากับ 146.56 มก/ดล ส่วนระดับ LDL สูงกว่า 190 มก/ดลมีอยู่
18.4 %, 19.0% (ชาย - หญิง) ระดับ HDL เฉลี่ยเท่ากับ 43.68 มก/ดล ผู้ป่วย
หญิงมีอายุเฉลี่ยมากกว่าผู้ป่วยชายประมาณ 6 ปี (เฉลี่ย 64.11 กับ 58.37 ปี)
(P value <0.05) ผู้ป่วยหญิงมีระดับไขมันในเลือดสูงกว่าผู้ป่วยชายในทุกชนิด
ของไขมันยกเว้นไตรกลีเซอไรด์ และระดับไขมันในเลือดจะลดลงตามอายุที่มาก
ขึ้น พบมีเพียงข้อมูลเดียวเท่านั้นที่มีประวัติทางครอบครัวที่เป็นโรคหัวใจขาดเลือด
นอกจากนี้พบว่าผู้ป่วยชาย 18.4 % ผู้ป่วยหญิง 26.2 % มีระดับ LDL ในเลือด
น้อยกว่า 100 มก/ดล ระดับ LDL เฉลี่ยร่วมกับผู้ป่วยที่มี 1 ปัจจัยเสี่ยงเท่ากับ
128.71, 143.55 มก/ดล (ชาย, หญิง) ร่วมกับ 2 ปัจจัยเสี่ยงเท่ากับ 131.93,
137.37 มก/ดล (ชาย, หญิง) ร่วมกับ 3 ปัจจัยเสี่ยงเท่ากับ 127.33 - 129.76 มก/ดล
(ชาย, หญิง)

สรุป : การสูบบุหรี่เป็นปัจจัยเสี่ยงต่อโรคหัวใจขาดเลือดและสัมพันธ์กับระดับ LDL สูงขึ้น ข้อมูลที่ศึกษาสรุปได้ว่าระดับไขมันในเลือดเฉลี่ยของผู้ป่วยโรคหัวใจขาดเลือดไม่สูงมากนัก กล่าวคือ ระดับ LDL ในผู้ป่วยชาย 143.79 มก/ดล ผู้ป่วยหญิง 154.08 มก/ดล ไตรกลีเซอไรด์ในผู้ป่วยชาย 153.09 มก/ดล ผู้ป่วยหญิง 130.76 มก/ดล ไม่แตกต่างกันในทางสถิติ ยกเว้น HDL ผู้ป่วยหญิงจะสูงกว่าคือ 49.59 มก/ดล ผู้ป่วยชาย 41.50 มก/ดล ($p = 0.029$)

ถึงแม้ว่าเราจะรักษาให้ระดับไขมันในเลือด LDL น้อยกว่า 100 มก/ดล ก็ไม่แน่ว่าจะไปว่าจะปลอดภัยจากโรคหัวใจขาดเลือด เพราะจากข้อมูลที่ได้พบว่ามีผู้ป่วยหัวใจขาดเลือดถึงประมาณ 20% ที่มีระดับ LDL น้อยกว่า 100 มก/ดล แต่ยังเป็นกล้ามเนื้อหัวใจขาดเลือดเฉียบพลัน เพราะฉะนั้นแล้วจึงควรจะต้องรักษาปัจจัยเสี่ยงอื่น ๆ ให้ครอบคลุมมากที่สุด ไม่ใช่แค่ลดระดับไขมันในเลือดเท่านั้น

สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Recent clinical trials⁽¹⁻⁴⁾ have demonstrated that LDL-lowering therapy reduces overall mortality, coronary mortality, major coronary events, coronary artery procedures and stroke in persons with established CHD. LDL cholesterol level of <100 mg/dl is optimal; therefore, ATPIII specifies an LDL cholesterol level of <100 mg/dl as the goal of the therapy for secondary prevention. This goal is supported by clinical trials with both clinical and angiographic end points and by prospective epidemiological studies. The same goal should be applied for persons with CHD risk equivalents. When persons are hospitalized for acute coronary syndromes or coronary procedures, lipid measures should be taken on admission or within 24 hours. These values can guide the physician on initiation of LDL-lowering therapy before or at discharge. Adjustment of therapy may be needed after 12 weeks hospitalization.^(1,5)

In Thailand, coronary artery disease is one of the leading causes of death in adults and in the first-tenth rank of admission in general medicine wards. There have been several reports on acute MI in this country during the last decade.⁹⁻¹⁷ However, only little epidemiological data have become available and non have directly related to acute myocardial infarction in Thai men compared with women in the aspect of serum total cholesterol level, LDL, triglyceride, HDL. The present study describes gender differences in demographics, risk factors (diabetes, hypertension, smoking, family history of CHD), and serum of total cholesterol, triglyceride, LDL, HDL in patients with acute myocardial infarction admitted to King Chulalongkorn Memorial Hospital in January to December, 2001.

Materials and methods

The data presented was taken from patients who were admitted at King Chulalongkorn Memorial Hospital, classified as acute myocardial infarctions according to the tenth version of the international classification of disease (ICD10) in January to December, 2001. The inclusion criteria were patients who were hospitalized for acute myocardial infarction and had lipid measures taken on admission or within 24 hours after admission. Risk factors included age, hypertension, the use of antihypertensive drug and the presence of diabetes mellitus, cigarette smoking or prior family history of CHD were reviewed.

The data analysis was performed by SPSS version 10.0. Differences in demographic data and total serum cholesterol, triglyceride, LDL, HDL levels and risk factors between men and women with acute myocardial infarction were examined, using t-test for continuous variables and Chi-square tests for categorical variables.

Results

During the period of the study, there are 156 acute myocardial infarctions occurred and meet the criteria of study; they were 114 males and 42 females. The mean age of the female patients was 64.1 years old, and the male was 58.4 years old. The female patients were about 6 years older than their male counter parts with statistical significance ($p < 0.05$). Both of the male and the female have no significant difference in their risk factors which included diabetic, hypertension, hyperlipidaemia and family history of coronary heart disease, except smoking (Table 1).

Table 1. Demographics in selected characteristics in patients with acute myocardial infarction.

	Male (n=114)	Female (n=42)	P value
Mean age (years)	58.4	64.1	<0.05
< 45 years	17 (14.9 %)	4 (9.5 %)	
45 – 54 years	22 (19.3 %)	3 (7.2 %)	
55 – 64 years	35 (30.7 %)	13 (30.9 %)	
> 65 years	40 (35.1 %)	22 (52.4 %)	
Diabetic	32 (28.0 %)	16 (38.1 %)	ns
Hypertension	35 (30.7 %)	14 (33.3 %)	ns
Smoking	51 (44.7 %)	5 (11.9 %)	<0.01
Hyperlipidemia	20 (17.5 %)	13 (30.9 %)	ns
Family history of CAD	1 (0.9 %)	1 (2.4 %)	ns

CAD, coronary artery disease; ns, not statistically significant.

The mean serum total cholesterol, triglyceride, low-density lipoprotein (LDL), high-density lipoprotein (HDL) were 219.66, 147.08, 146.56 and 43.68 mg/dl, respectively (Table 2).

The proportion of abnormal LDL (> 190 mg/dl) was about 18.4 % in male and 19 % in female and female was higher than male (Table 3). It is important to recognize that 18.4 %-26.2 % (male and female) that occurred in this study had LDL level < 100 mg/dl. HDL cholesterol levels in female were higher than

male at all ages; most of the patients had HDL levels < 40 mg/dl (51.8 % in male and 26.2 % in female). Most of the patients had triglyceride levels < 200 mg/dl, ranged 85.1 % - 88.1 % (male and female). In mean of serum lipid levels, compared male to female at all age groups, female had higher serum lipid levels except triglyceride; male had higher triglyceride levels than female 153.09 to 130.76 mg/dl, respectively (Table 4).

Table 2. Descriptive statistics of Serum Total Cholesterol, Triglyceride, Low-density lipoprotein, High-density lipoprotein in acute myocardial infarction in King Chulalongkorn Memorial Hospital between Jan – Dec 2001.

	TC	TG	LDL	HDL
Mean (mg/dl)	219.66	147.08	146.56	43.68
Std Dev	54.76	79.37	52.21	14.35
Minimum	110.00	40.00	32.60	7.00
Maximum	560.00	642.00	464.00	119.00

Std Dev, standard Deviation; TC, total Cholesterol; TG, Triglyceride; LDL, Low-density lipoprotein; HDL, High-density lipoprotein.

Table 3. Classification of acute myocardial infarction to serial lipid levels by gender.

Level of lipid	Male (%)		Female (%)	
	N = 114	(%)	N = 42	(%)
TC (mg/dl)				
< 200	38	(33.0)	15	(35.7)
200 – 239	39	(34.2)	10	(23.8)
240 – 275	29	(25.4)	13	(31.0)
> 275	8	(7.0)	4	(9.5)
TG (mg/dl)				
<150	71	(62.3)	30	(71.4)
150 – 199	26	(22.8)	7	(16.7)
200 – 500	16	(14.0)	5	(11.9)
> 500	1	(0.9)	0	(0.0)
LDL (mg/dl)				
< 100	21	(18.4)	11	(26.2)
100 – 129	20	(17.5)	5	(11.9)
130 – 159	33	(28.9)	8	(19.0)
160 – 190	19	(16.7)	10	(23.8)
> 190	21	(18.4)	8	(19.0)
HDL (mg/dl)				
< 40	59	(51.8)	11	(26.2)
40 – 49	34	(29.8)	15	(35.7)
50 – 60	9	(7.9)	9	(21.4)
> 60	12	(10.5)	7	(16.7)

TC, total cholesterol; TG, triglyceride; LDL, low-density lipoprotein; HDL, high-density lipoprotein.

Table 4. Comparison of mean (\pm standard deviation) serum lipid level between male and female.

Lipid profile	Mean (mg/dl) \pm standard deviation		P value
	Male (n = 114)	Female (n = 42)	
Total cholesterol	215.92 (46.34)	229.83 (72.61)	0.28
Triglyceride	153.09 (88.14)	130.76 (44.99)	0.20
Low - density lipoprotein	143.79 (45.42)	154.08 (67.39)	0.34
High - density lipoprotein	41.50 (14.04)	49.59 (13.65)	0.029*

*, statistically significant.

Abnormal high total serum cholesterol level (>240mg/dl) was about 32.4-40.5 % (male and female), but abnormal triglyceride level (>200mg/dl) was 11.9-14.9%(female and male), abnormal LDL(>190mg/dl) was 18.4 -19.0 %(male and female). We found no significant difference in the mean serum lipid between male and female, except HDL level, i.e, female had higher level than male.

The mean LDL level in patients with 1 risk factor was 128.71 mg/dl in male, and 143.55 mg/dl in female; 2 risk factors: the mean LDL level was 131.93 mg/dl in male, and 137.37 mg/dl in female; >2 risk factors: the mean LDL was 127.33mg/dl in male, and 129.76 mg/dl in female. There were no significant gender difference in LDL levels and risk factors (Table 5).

Table 5. Classification of mean low - density lipoprotein and numbers of risk factors in both male and female.

Number of risk factor	Type of risk factors	Mean of LDL in male (mg/dl)	Mean of LDL in female (mg/dl)
1	HT	130.32 (n = 35)	160.90 (n = 14)
	Smoking	145.87 (n = 51)	126.04 (n = 5)
	Dyslipidemia	135.06 (n = 20)	171.50 (n = 13)
	FH	90.80 (n = 1)	122.80 (n = 1)
	DM	141.48 (n = 32)	136.50 (n = 16)
	Mean of 1 risk factor	128.71	143.55
2	DM + HT	122.34 (n = 10)	132.40 (n = 6)
	DM + Smoking	146.36 (n = 11)	173.80 (n = 1)
	HT + Smoking	161.37 (n = 9)	118.40 (n = 3)
	HT + Dyslipidemia	125.22 (n = 9)	196.63 (n = 6)
	Dyslipidemia + Smoking	145.50 (n = 8)	80.20 (n = 1)
	FH + Smoking	90.80 (n = 1)	122.80 (n = 1)
	Mean of 2 risk factors	131.93	137.37
	> 2 risk factors	127.33 (n = 9)	129.76 (n = 5)

HT, Hypertension; DM, Diabetic millitus; FH, Family history of coronary heart disease.

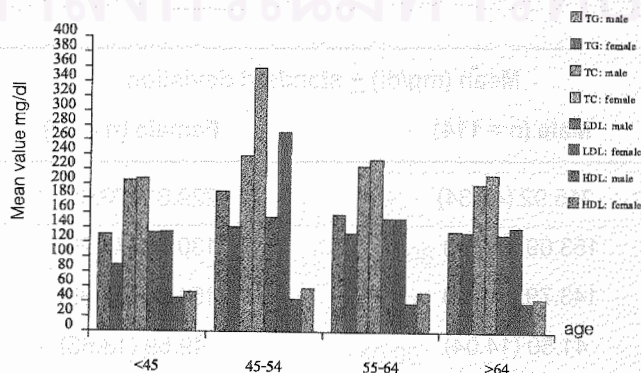


Figure 1. Age trends in lipoprotein cholesterol fractions between male and female.

Discussion

In Framingham study cohort, those who had elevated serum total cholesterol >275 mg/dl had an increased risk of adverse outcomes whether health or with CHD. Compared with persons with cholesterol levels < 200 mg/dl the risk ratios for the patients with elevated cholesterol levels were 3.8 for re-infarction, 2.6 for CAD mortality and 1.9 for overall mortality. The prevalence of cholesterol levels >240 mg/dl in persons who had sustained myocardial infarction was 35-52 % in men and 66 % in women, but 20 % of myocardial infarctions occurred in people who had cholesterol levels <200 mg/dl. The average levels of serum total cholesterol and low density lipoprotein (LDL) cholesterol was 225 mg/dl and 150 mg/dl, respectively, at which CAD events occurred in men were below the levels recommended for treatment according to the guidelines of the National Cholesterol Education Program. In women, these levels were only slightly above the guideline levels. The average cholesterol levels at which CAD events occurred were substantially higher in women than men and decreased with age.^(6,7)

Mean values for serum total cholesterol :- Lipoprotein cholesterol and triglyceride levels for various age, sex, race, and ethnicity groups from the first phase of the findings of The National Health and Nutrition Examination Survey (NHANES 3) showed that the mean serum total cholesterol levels of both men and women, was 126 mg/dl and increased with each succeeding age group until 54 years, therefore the mean level was declining. The mean HDL cholesterol levels were 51 mg/dl and relatively constant across the age groups for both men and women. The overall mean LDL cholesterol level for adults was 128 mg/dl. Men

had a higher mean level than women. Also, concerning the mean serum triglyceride, men had a higher mean serum level compared to women, 143 mg/dl to 126 mg/dl.

In the same way, we can study The Air Force/Texas Coronary Atherosclerosis Prevention Study (AFCAPS/TexCAPS);⁽⁴⁾ targeted a cohort of generally healthy middle-aged and older men and women with average TC and LDL-C levels and with below-average high-density lipoprotein cholesterol (HDL-C) levels. The primary end point analysis was the incidence of first acute major coronary events, defined as fatal or nonfatal myocardial infarction, unstable angina or sudden cardiac death. The inclusion of unstable angina was a unique feature of this study; its inclusion as a primary end point reflects the increasing frequency of unstable angina as the initial presentation of CHD in United States.⁽⁸⁾

Corresponding to our last study, this study showed⁽¹⁰⁾ that female patients were older than male and had less chance of smoking. The prevalence of the definitely abnormal cholesterol levels (>240mg/dl) in the original Framingham Study cohort was about 30-45 % this is also found in our study. It is important to recognize that 18.4-26.0 % of the patients had LDL cholesterol level < 100 mg/dl, considered safe levels according to the NCEP and ATP3 guideline. These data suggest that other factors may play significant roles in the pathogenesis of acute myocardial infarction in Thai patients. They may be attributed to personality stress or life style. We found only 1 incidence in this study that showed a positive family history of coronary artery disease in first degree relatives, unlike the European and the American who were found in 62-76 %, 17 positive family history of coronary artery

disease. On the other hand, this information may also allow us to assume that we had no emphasis to ask family history on our eastern life style.

Among other risk factors and LDL cholesterol levels, the mean LDL level with 1 risk factor was 128.71-143.55 mg/dl, that was under the goal of treatment (LDL<160 mg/dl); 2 risk factors: mean LDL level was 131.93-137.37 mg/dl that was over the goal of treatment (LDL<130 mg/dl), and over 2 risk factors: mean LDL level was 127.33-129.76mg/dl; they were in the same way, these mean that we must have to be more aggressive to manage the patients who have multiple risk factor to reach the LDL goal of treatment.

Surprisingly, we found the male who smoking had high LDL level than other risk factors, but there was no significance in statistics. Therefore, it is important to encourage patients to quit smoking and change his/her life style.

Conclusion

The harmful of smoking in risk factor raising the LDL-C level. Lipid profile in our study patients were not so high. Mean LDL in men were 143.79 mg/dl and women 154.08 mg/dl, Triglyceride in men were 153.09 mg/dl women were 130.76 mg/dl; But not statistic significant difference except in HDL; women were higher than men 49.59 mg/dl and 41.50 mg/dl respectively. The data suggest that recommendation of the National Cholesterol Education Program (NCEP), Third Adult Treatment Panel (AATPIII) to reduce of low – density – lipoprotein cholesterol (LDL-C) to < 100 mg/dl may not safe for prevent of acute myocardial infarction because about 20 % of our patients still had acute myocardial infarction. Despite LDL-C level < 100 mg/dl. We should emphasize the

importance of an assessment of absolute coronary heart disease (CHD) risk based on all risk factors rather than simply the serum cholesterol concentration. Whatever the degree of risk at which lipid-lowering drug therapy is recommended, all of the recommendations depend for their clinical CHD risk in individual patients.

References

1. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert panel on Detection, Evaluation, and Treatment of high blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001 May 16; 285(19): 2486 - 97
2. Stamler J, Daviglius ML, Garside DB, Dyer AR, Greenland P, Neaton JD. Relationship of baseline serum cholesterol levels in 3 large cohorts of younger men to long-term coronary, cardiovascular, and all-cause mortality and to longevity. JAMA 2000 July 19; 284(3): 311 - 8
3. Stamler J, Stamler R, Neaton JD, Wentworth D, Daviglius ML, Garside D, Dyer AR, Liu K, Greenland P. Low-risk factor profile and long-term cardiovascular and noncardiovascular mortality and life expectancy: findings for 5 large cohorts of young adult and middle-aged men and women. JAMA 1999 Dec 1; 282(21): 2012 - 8
4. Downs JR, Clearfield M, Weis S, Whitney E, Shapiro DR, Beere PA, Langendorfer A, Stein EA, Kruyer W, Gotto AM Jr. Primary prevention of acute coronary events with lovastatin in men and women with average cholesterol levels: results of AFCAPS/Ten CAPS. Air Force/

- Texas Coronary Atherosclerosis Prevention Study. *JAMA* 1998 May 27; 279(20):1615 - 22
5. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). *Lancet* 1994 Nov 19; 344(8934): 1383 - 9
6. Kannel WB. Range of serum cholesterol values in the population developing coronary artery disease. *Am J Cardiol* 1995 Sep 28; 76(9): 69C - 77C
7. Wong ND, Wilson PW, Kannel WB. Serum cholesterol as a prognostic factor after myocardial infarction: the Framingham Study. *Ann Intern Med* 1991 Nov 1; 115(9): 687 - 93
8. Corti MC, Guralnik JM, Salive ME, Harris T, Ferrucci L, Glynn RJ, Havlik RJ. Clarifying the direct relation between total cholesterol levels and death from coronary heart disease in older persons. *Ann Intern Med* 1997 May 15; 126 (10): 753 - 60
9. Durrington PN, Prais H, Bhatnagar D, France M, Crowley V, Khan J, Morgan J. Indications for cholesterol-lowering medication: comparison of risk- assessment methods. *Lancet* 1999 Jan 23; 353(9149): 278 - 81
10. Sangwatanaroj S, Indrabhakti S, Srimahachota S, Boonyaratavej S, Suthichaiyakul T. Gender differences in demographics, treatment and outcome of Thai patients with acute myocardial infarction at King Chulalongkorn Memorial Hospital. *Chula Med J* 2000 Oct; 44(10): 749 - 58
11. Goldberg RJ, O'Donnel C, Yarzebski J, Bigelow C, Savageau J, Gore JM. Sex differences in symptom presentation associated with acute myocardial infarction: a population- based perspective. *Am Heart J* 1998 Aug; 136 (2): 189 - 95
12. Wong CC, Froelicher ES, Bacchetti P, Gee L, Selby JV, Lundstrom R, Swain B, Truman A. In a managed care setting, are there sex differences in the use of coronary angiography after acute myocardial infarction ?. *Am Heart J* 1998 Mar; 135 (3): 435 - 42
13. Thongkong M. Acute myocardial infarction, Sawan Pracharak Hospital. *Bull Dept Med Serv* 1984 Nov; 9(11): 805 - 10
14. Yipingtsoi T, Yoon N, Ongsakul P, Pongpaew C, Yipintsoi S. Myocardial infarction in Southern Thailand. *J Med Assoc Thai* 1984 Oct; 67 (10): 535 - 40
15. Chaithiraphan S, U-Kos PN, Laothavorn P, Watanachai K, Kochaseni S. Acute myocardial infarction: a collaborative study of 1,541 cases from four medical centers in Thailand. *J Med Assoc Thai* 1984 Jul; 67 (7): 382 - 90
16. Chaithiraphan S, Ngamukos P, Watanachai K. Acute myocardial infarction at young age. A collaborative retrospective study of 55 cases from three medical centers in Thailand. *Intern Med* 1985 Jan - Mar; 1 (1): 1 - 6
17. Hochman JS, Tamis JE, Thompson TD, Weaver WD, White HD, Van de Werf F, Aylward P, Topol EJ, Califf RM. Sex, clinical presentation, and outcome in patients with acute coronary syndromes. Global Use of Strategies to Open Occluded Coronary Arteries in Acute Coronary Syndromes IIb Investigators. *N Engl J Med* 1999 Jul 22; 341(4): 226 - 32