Original Research Article

Clinical and Biochemical Profile of Patients of Acute Coronary Syndrome at Rural Tertiary Health Care Centre

Sidheshwar Virbhadrappa Birajdar[1], Giselle Reynold Dsilva[2*]

[1]Professor and Head, Department of Medicine,
Swami Ramanand Teerth Rural Government Medical College, Ambajogai, Maharashtra, India.
[2*]Assistant Professor, Department of Medicine,
Topiwala National Medical College and B.Y.L Nair Ch Hospital, Mumbai, Maharashtra, India.

ABSTRACT

Introduction: IHD causes more deaths and disability and incurs greater economic costs than any other illness in the developing world. CAD is the leading cause of death globally, where India has the highest burden. By studying the role of risk factors, we can enhance our ability to institute effective preventive and control measures, by early detection and management of modifiable risk factor. The present study is undertaken to study various conventional risk factors and clinical profile of acute coronary syndrome in a rural tertiary health care centre.

Methods: We conducted a hospital based observational, descriptive study comprising of 203 patients at Swami Ramanand Teerth Rural Government Medical College (S.R.T.R.GMC), Ambajogai who fulfilled the inclusion and exclusion criteria.

Results: Out of the total 203 cases maximum 63 cases were seen in the age group of 61 – 70 yrs. 163 were males and 40 were females. Maximum 126 i.e. 62.07% cases were of STEMI. Dyslipidemia was the most common risk factor seen in 122 cases i.e. 60.09%followed by smoking seen in 104 cases i.e. 51.23%.63 patients i.e.31.03% were hypertensive. 78 (38.42%) were diabetic and among them 52 i.e.66.66% were males and 26 i.e. 33.33% were females. Chest pain was found to be the most common symptom in 94.28% i.e. 191 cases followed by perspiration in 51.72%. Tachycardia was the most

common sign seen in 103 i.e.50.74%. 169 i.e. 83.26% recovered while the rest 34 cases i.e. 16.74% expired.

Conclusion: Prevalence of acute coronary syndrome is rising especially in the younger age groups even in the rural set up. Males were more affected than females. Dyslipidemia and smoking were the most common risk factors along with hypertension and diabetes mellitus. Elderly patients were more likely to present with atypical symptoms. The overall mortality was higher in the older age group.

Keywords: Acute Coronary Syndrome, Risk Factors, STEMI, IHD.

*Correspondence to:
Dr Giselle Reynold Dsilva,
Assistant Professor, Department Of Medicine,
Topiwala National Medical College & B.Y.L Nair Ch Hospital,
Mumbai, Maharashtra, India.

INTRODUCTION

IHD causes more deaths and disability and incurs greater economic costs than any other illness in the developing world.[1] Accordingto the National commission on Macroeconomics and Health, there would be around 62 million patients with CAD by 2015 in India, and of these, 23 million would be patients younger than 40 years of age.[2]

According to World Health Report 2002, CVDs will be the largest cause of death and disability by 2020 in India. The contributing factors for the growing burden of CVDs are increasing prevalence of cardiovascular risk factors especially hypertension, dyslipidemia, diabetes, overweight or obesity, physical inactivity and tobacco use. It is an area where major health gains can be made through the implementations of primary care interventions and basic public health measures targeting diet, lifestyles and the

environment.[3] Epidemiological studies have shown that "major" cardiovascular risk factors are age, male sex, hyperlipidemia, hypertension, diabetes, smoking habit, tobacco chewing, sedentary lifestyle, overweight and family history.[4] Young and old patients have different risk factor profiles, clinical presentations and prognosis.[5]

Some of the risk factors like cigarette smoking, high blood pressure, diabetes mellitus, stress, obesity, increased serum cholesterol are modifiable and others like age, sex and personality are immutable. The greater the number of risk factors present, the more likely one is to develop ischemic event.

The present study is undertaken to study various conventional risk factors and clinical profile of acute coronary syndrome in a rural tertiary health care centre.

MATERIALS AND METHODS

The present study carried out at a Swami Ramanand Teerth Rural Government Medical College (S.R.T.R.GMC), Ambajogai, over the period from October 2012 to October 2014 is a prospective observational study.

Inclusion Criteria

203 patients diagnosed as Acute Coronary Syndrome (ACS) based on clinical presentation, ECG findings and serum cardiac markers and aged ≥18 years who were admitted to the intensive care unit were included in the study.

Exclusion Criteria

Patients with coagulation disorders, collagen vascular diseases, thyroid disorders, valvular heart diseases and congenital abnormalities of heart were excluded from the study. Ethical clearance was obtained from the ethical committee of S.R.T.R. Government Medical College & Hospital.

Case definition

Patients presenting with potential symptoms of ACS were subjected to ECG and cardiac marker CPK MB finally diagnosed into one of the following three groups[6]:

1. ST-segment elevation (STEMI).
2. NSTEMI
3. Unstable angina

Assessment

Data was collected by taking proper history from patients and attendants, thorough clinical examination and relevant investigations. Data was recorded in preformed proforma. Clinical data mainly comprised of age, sex, history on presenting complaints, history of Diabetes Mellitus, hypertension or ischemic heart disease, history of smoking, personality and lifestyle, family history of premature ischemic heart disease or cerebrovascular accident. General examination including vital statistics and were noted. They were screened for obesity by body mass index (weight/height[2]). A detailed cardiovascular and Respiratory system examination was performed. All patients were subjected to necessary laboratory investigations.

All patients were treated according to their final diagnosis and were observed for short term in-hospital complications and treated accordingly.

RISK FACTOR ANALYSIS

All patients were subjected to relevant history, clinical examinations and investigations so as to define the conventional risk factors for IHD as following:

1. **Family history of IHD:** it is defined as patient with at least one parent with premature coronary heart disease: Male first degree relative<55 yrs or female first degree relative<65 yrs.[7]
2. **Smoking:** The smoking habit of the patients under study were classified as follows.

Smoker: One who has smoked at least one cigarette per day or more or equivalent quantity or who has smoked at this level upto a time not later than 3 months before the episode.

Ex- smokers: One who has smoked at the level defined above but has given up smoking later than 3 months before the episode. Non smokers: one who has never smoked at the levels indicated.[8]

3. **Obesity and Overweight:** obesity is defined as body mass index (BMI) (weight in kg divided by square of height in metres) of ≥30kg/m^2 and overweight as BMI between 25-29.9 kg/m^2.[7]
4. **Hypertension:** it is diagnosed when systolic blood pressure was ≥140 mm Hg and/ or diastolic blood pressure ≥90mm Hg or a person was a known hypertensive.[9]
5. **Dyslipidemia:** It is defined by the presence of either : high total cholesterol (≥200mg/dl) or high LDL cholesterol (≥130mg/dl)or low HDL cholesterol (<40mg/dl in males and <50mg/dl in females) or high triglycerides (≥150 mg/dl).[7]
6. **Diabetes Mellitus:** It is defined as fasting blood sugar level ≥126 mg/dl or post meal blood sugar level ≥200 mg/dl or presence of history of diabetes.[9]

Statistics: The data accrued on all IHD patients was tabulated in MS Excel software.

RESULTS

Age: Out of the total 203 cases maximum 63 cases i.e. 31.03% were seen in the age group of 61 – 70 yrs and minimum 5 cases i.e. 2.46% were seen in the age group of 81 – 90 yrs. The mean age was 56.2 yrs.

Distribution according to sex: Out of the total 203 cases 163 were males (80.29%) and 40 were females (19.71%).

Fig 1: Distribution of cases according to age
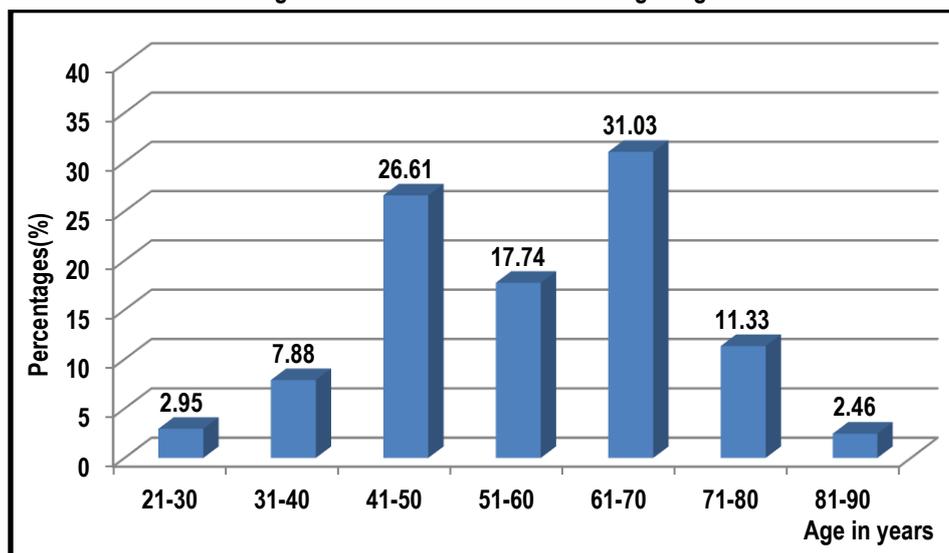
Fig 2: Distribution of cases according to sex

Distribution of cases according to Sex

Females, 19.71%

Males, 80.29%

- Males
- Females

Fig 3: Distribution of cases according to type of ACS

Distribution of cases according to Type of ACS

Percentages%

STEMI   NSTEMI   Unstable angina
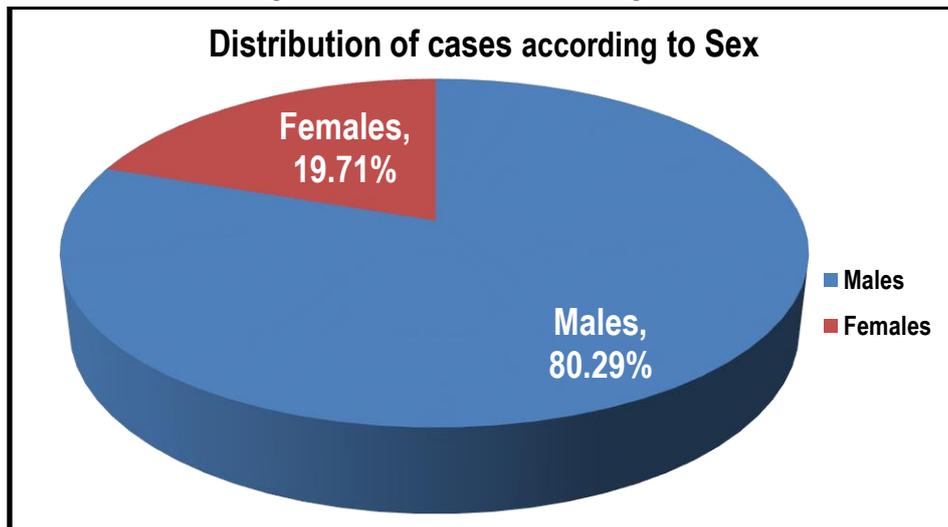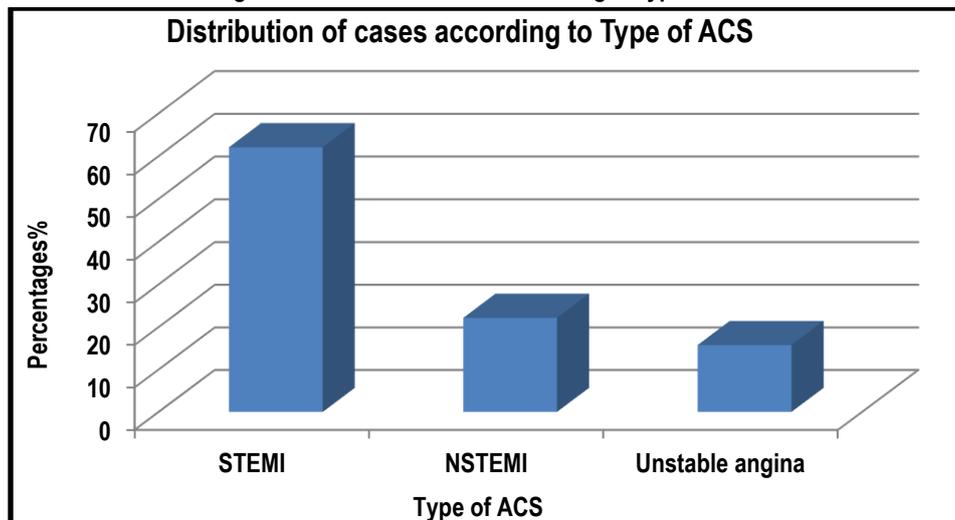
Type of ACS

Fig no 4: Distribution of cases according to dyslipidemia

Distribution according to dyslipidemia

Low HDL-Cholesterol — 53.69

High LDL-Cholesterol — 25.12

Hypertriglyceridemia — 40.89

Hypercholesterolemia — 36.95

Percentages%
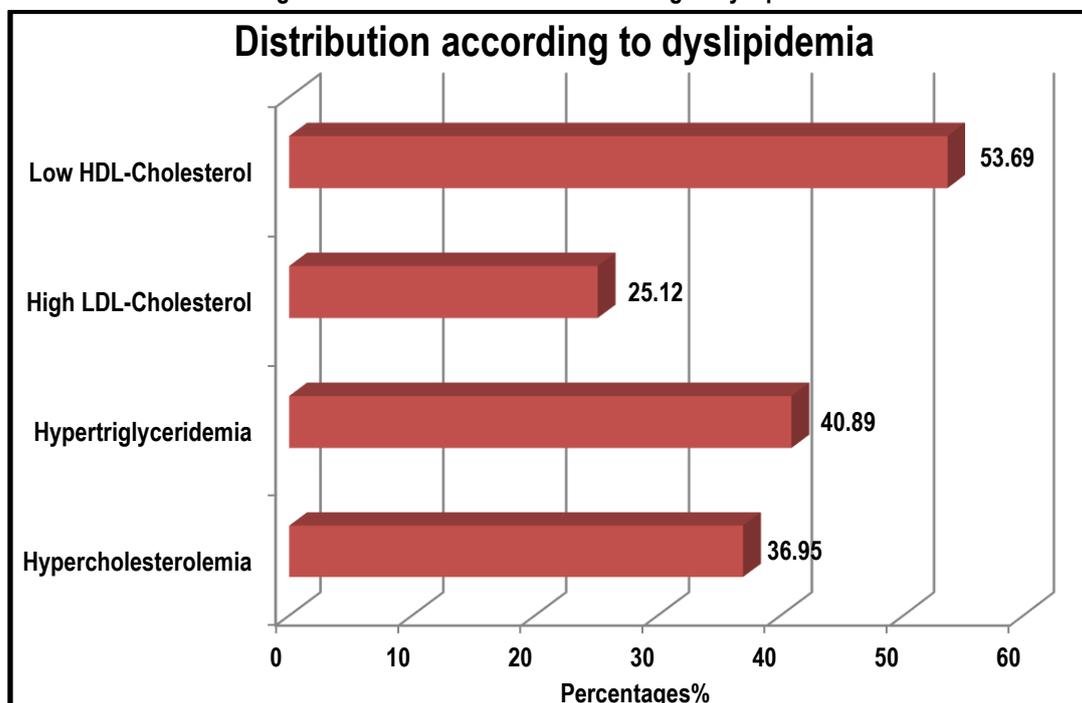
Distribution of Cases According to the Type of ACS: Out of total 203 cases, maximum 126 i.e. 62.07% cases were of STEMI while 45 i.e. 22.17% cases were of NSTEMI and minimum 32 i.e. 15.76% cases were of unstable angina.

Family history of IHD: Out of 203 cases 15 patients i.e.7.39% gave family history of ischemic heart disease.

Smoking and ACS: In this study 51.23% of patients were smokers and all of them were males. Thus 63.80% of males were smokers.

Alcohol consumption: In this study 54 out of 203 patients were alcoholic i.e.26.60%.

Distribution of cases according to dyslipidemia: The distribution of cases according to dyslipidemia was as follows: Hypercholesterolemia was noticed in 36.95% of patients. Hypertriglyceridemia was noticed in 40.89% of cases. High LDL-cholesterol was noticed in 25.12% and low HDL-cholesterol in 53.69% cases.

Table 1: Distribution of cases according to Blood pressure

Type	Males	Females	Total cases	Percentage%
Hypertensive	43(26.38%)	20(50%)	63	31.03
Normotensive	120(73.62%)	20(50%)	140	68.97
Total	163	40	203	100

Table 2: Distribution of cases according to BMI

BMI	Classification	No of cases	Percentage%
<25	Normal	159	78.33
25 – 29.9	Overweight	26	12.81
≥30	Obese	18	8.86
Total		203	100

Table 3: Distribution of cases according to the level of Activity

Groups	No of cases	Percentage%
Sedentary activity	85	41.87
Medium activity	56	27.59
Heavy activity	62	30.54
Total	203	100

Fig 5: Distribution Of Coronary Risk Factors

Distribution of coronary risk factors
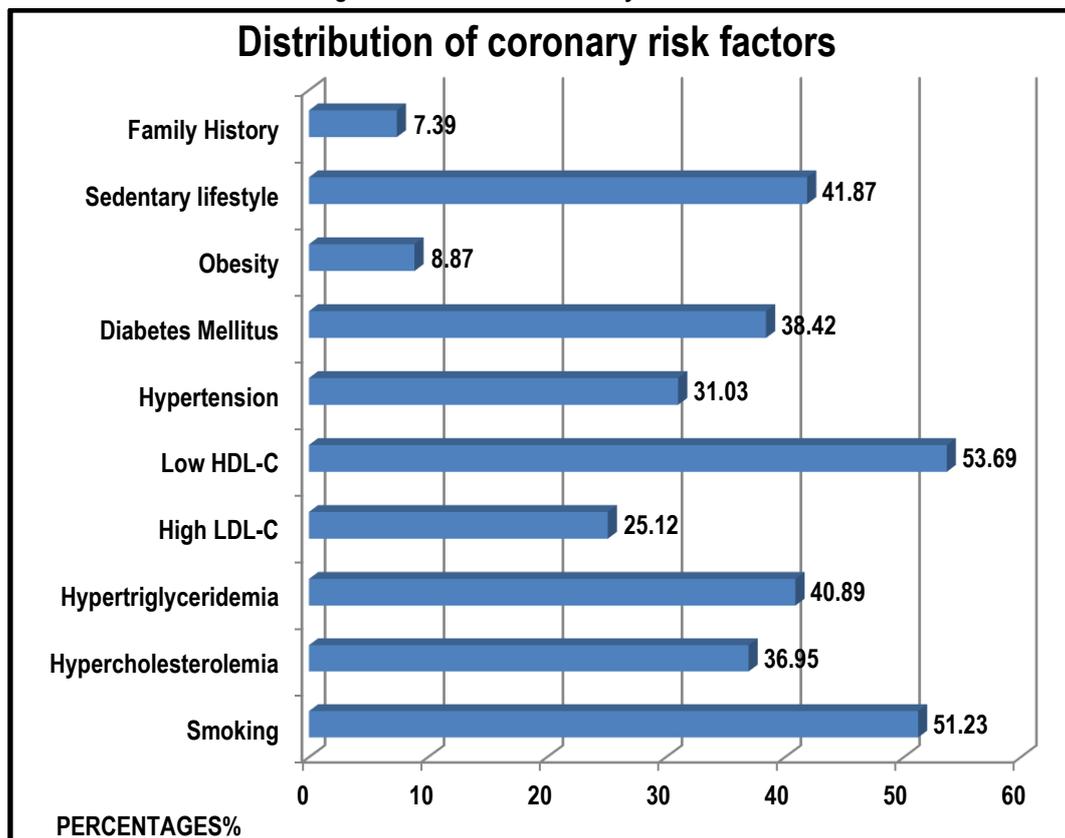
Fig 6: Presentation of cases according to symptoms

Presenting symptoms

Chest pain: 94.08
Perspiration: 51.72
Nausea…: 28.07
Breathlessness: 14.28
Palpitations: 10.34
Syncope: 3.45
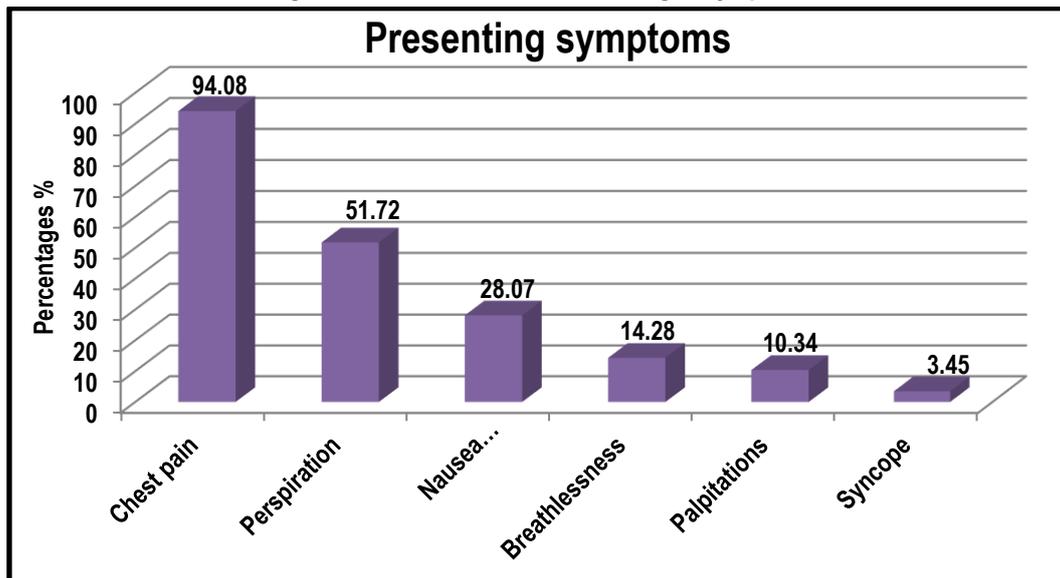
Figure 7: Presentation Of Cases According To Clinical Signs

Clinical Signs

Tachycardia: 50.74
Bradycardia: 10.34
Tachypnea: 21.18
Hypertension: 12.32
Hypotension: 9.85
Raised JVP: 7.39
Rales: 10.34

Fig 8: Complications Observed In Cases Of ACS

Complications

LVF: 15.27
Cardiogenic shock: 11.33
Arrhythmias: 7.88
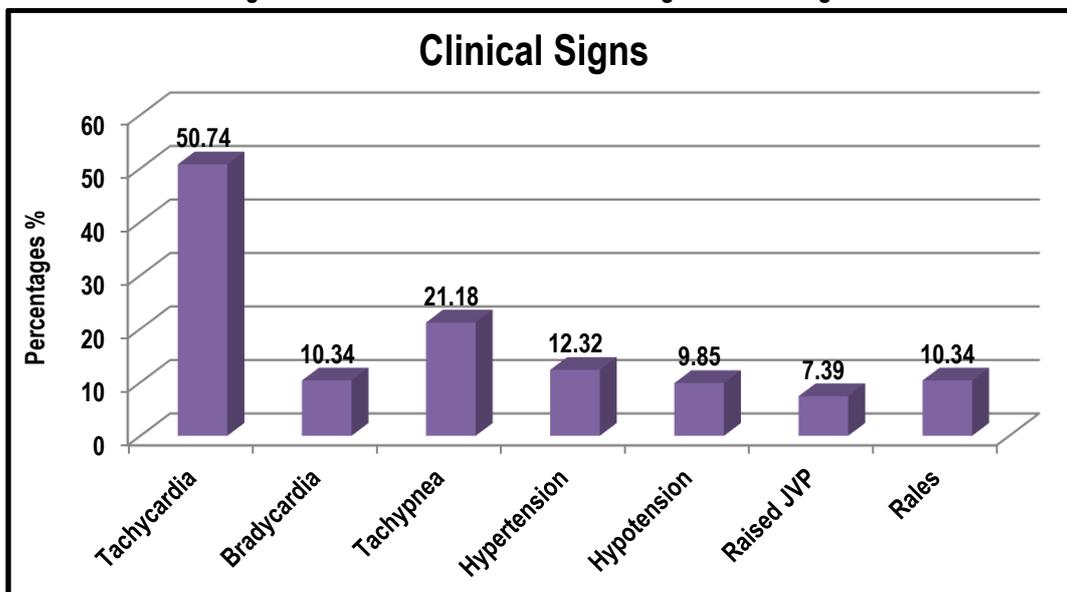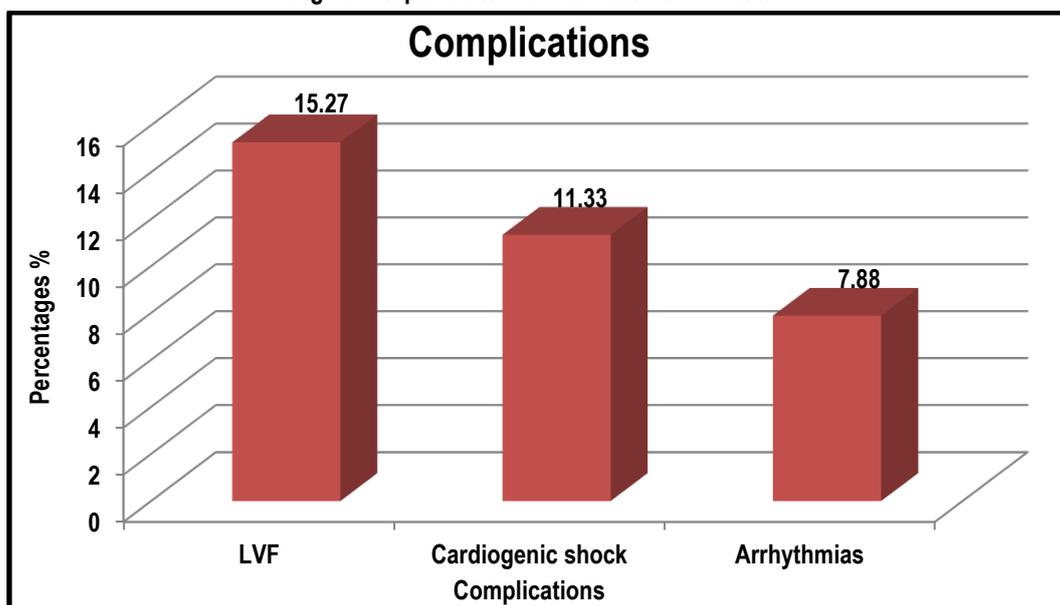
Fig 9: Mortality observed in cases of ACS
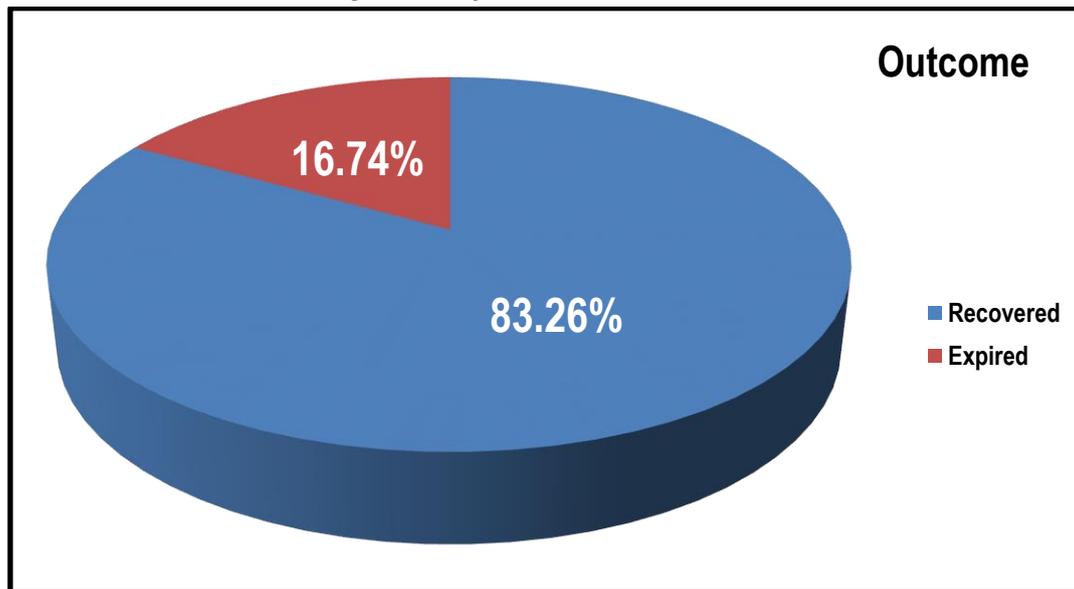
Hypertension and ACS: Out of 203 patients 63 patients i.e.31.03% were hypertensive. Out of these 43 were males and 20 were females.

Diabetes Mellitus and ACS: Out of 203 patients 78(38.42%) were diabetic and among them 52 i.e.66.66% were males and 26 i.e. 33.33% were females.

Obesity and ACS: In this study 8.86% patients were obese and 12.81% were overweight.

It was found that ACS was more common in patients with sedentary activity.

Distribution of coronary Risk Factors in this Study: Dyslipidemia was the most common risk factor seen in 122 cases i.e. 60.09% the commonest manifestation being low HDL-Cholesterol seen in 53.69% of cases followed by smoking seen in 104 cases i.e. 51.23%.

Clinical presentation of cases according to presenting symptoms: Chest pain was found to be the most common symptom in 94.28% i.e. 191 cases followed by perspiration in 51.72% i.e. 105 cases while syncope was the least common symptom seen in 3.45% i.e. 7 cases.

Clinical presentation according to Clinical Signs: Tachycardia was the most common sign seen in 103 i.e.50.74% of cases followed by Tachypnea in 43 i.e. 21.18% of cases while raised JVP was the least common seen in 7.39% of cases.

Complications Observed in cases of ACS: Most common complication was LVF seen in 31 i.e. 15.27% of cases followed by cardiogenic shock seen in 23 i.e. 11.33% of cases while arrhythmias was the least common complication seen in 16 i.e. 7.88% of cases.

Mortality observed in cases of ACS: Out of the total 203 cases 169 i.e. 83.26% recovered while the rest 34 cases i.e. 16.74% expired.

DISCUSSION

Distribution of cases according to age: In this study youngest patient was 27 years old the elder was 88 years old. In this study the mean age was 56.41 years. In this study 10.83 % of patients were below the age of 40 years. This correlates with the observation made by S.S.Kar, J.S.Thakur et al, (2010)[10] and H.S.

Wasir, A.K. Bharani et al, (1987).[11] In other studies, Uhl G.S. et al (1983) W.Foote et al (1974), Warren. S.E. et al (1982) only 3-10% of patients were young.[12-15]

Distribution of cases according to sex: In this study 80.29% patients were males and 19.71% were females. The male to female ratio was 4.07. H.S. Wasir and A.K. Bharani et al. reported male to female ratio as high as 11.5: 1.[11] In the study done by Prem Pais, S. Jayaprakash et al; at St. John's Hospital, Bangalore (1996), 95% of patients were male.[16]

Distribution of cases according to the type of ACS: In the present study out of all the 203 cases, 62.07% were of STEMI, 22.17% were of NSTEMI and 15.76% were of unstable angina. The findings were comparable with the studies carried out by the following: Tungsubutra W et al[9] who reported rates of STEMI, NSTEMI and UA in 67.3%, 19.3% and 13.4% cases respectively; Al-Halabi B, Hbejan K[17] who reported 59.25% of patients had STEMI, 22.96% had NSTEMI and 16.29% had unstable angina and Teixeira M et al[18] who reported the distribution of ACS as STEMI IN 69%, NSTEMI in 20% and unstable angina in 9%.

Family history: Family history of CAD was present in only 7.39% of patients in this study. However H.S.Wasir, A.K.Bharani et al observed family history of CAD in 38% of patients.[11] Chinmaya et al, observed family history of IHD in 21% of patients.[19] G.S.Wander and R.K.Gupta reported (1994) that family history of CAD was about 5.8% in their study.[20]

Smoking: Smoking is one of the major risk factor in this study. It is present in 51.23% of the cases and all are men. This correlates with the observation made by S.S.Kar, J.S.Thakur et al, where 41% of rural patients were smokers.[10] J.Kaur, K.Bains et al, found that 31% of their patients were smokers.[21] Dolder M.A and Oliver M.F, reported that smoking is the commonest risk factor in India.[22] R.Rastogi, SSL-Shivastava et al, have shown all the lipids except HDL-Cholesterol are higher in heavy smokers.[23] FGR fowkes had proposed increased serum fibrinogen concentration is responsible for increased incidence of IHD in smokers.[24] Study by Masaharulshira et al, showed that 90% of the AMI are smokers.[25]

Dyslipidemia: The overall prevalence of dyslipidemias in the present study was as follows. Hypercholesterolemia was observed in 36.95 % of patient in this study. This correlates with the

observation made by J.Kaur, K.Bains et al, (2006), where 31% of rural patients had hypercholesterolemia.[21] The Framingham study has shown that total serum cholesterol is a major risk factor.[26] Hypertriglyceridemia was noted in 40.89 % of the patients in this study. H.S.Wasir and A.K.Bharani et al, observed hypertriglyceridemia in 55% of cases.[11] High LDL cholesterol: 51(25.12%) patients had high LDL-cholesterol in this study. J.Kaur, K.Bains et al, (2006) reported high LDL-Cholesterol in only 6% of rural patients.[21] In a study by K.P.Mishra, S.Suresh et al, it is reported that LDL-C is an important risk factor along with total cholesterol and HDL-C for occurrence of atherosclerosis.[27] The anti-atherogenic role of HDL-C is well recognized and is independent of other coronary risk factor.[28] In this study a large number of patients (53.69%) showed low HDL-C levels. J.Kaur, K.Bains et al, (2006) reported low HDLCholesterol in 28% of their patients.[21]

Hypertension was present in 31.03% of the cases in this study. This correlates with the similar observations made by J.Kaur, K.Bains et al, and S.S. Kar, J.S. Thakur et al, who reported hypertension in 32% and 33% of rural patients respectively.[10,21] H.S.Wasir and A.K. Bharani et al, found hypertension in about 26% of patients.[11] Prem Pais and S. Jayaprakash et al, noticed hypertension in 19% of the patients.[16]

Diabetes Mellitus: Type II Diabetes mellitus was noticed in 38.42 % patients in this study. J. Kaur, K. Bains et al, reported diabetes in 22% of their patients.[21] H.S. Wasir and A.K.Bharani et al, noticed diabetes in 16% of patients.[11] G.S. Wander and Gupta. R.K. et al have noticed diabetes in 6.5% of patients.[29]

Obesity: Obesity is an independent coronary risk factor. In this study it has been observed that 8.87% of the patients are obese. This correlates with similar observations made by J.Kaur, K.Bains et al, and S.S.Kar, J.S.Thakur et al, who reported obesity in 7% and 11% of their rural patients respectively.[10,21] H.S.Wasir and A.K. Bharani et al, have found obesity in 15% of the patients.[11] Dolder M.A and Oliver M.F, noticed obesity in 19% of the patients.[22]

Physical activity: Sedentary (light) physical activity was noticed in 41.87% of the patients in this study. J. Kaur, K. Bains et al, observed sedentary activity in 84% of their patients.[21] G.S. Wander and R.K. Gupta et al, observed that only 11.7% of patients were sedentary.[11]

Clinical presentation of cases according to presenting symptoms: In the present study chest pain was the most common symptom seen in 94.08% of cases followed by perspiration (51.72%), nausea and vomiting (28.07%), dyspnea (14.28%), palpitations (10.34%) and syncope (3.45%). The present study findings were comparable with studies carried out in the following: Tambyah PA et al[33] who reported all but one were presented with severe gripping chest pain (97%) and associated symptoms included sweating (56%), nausea and vomiting (31%), dyspnea (22%) and giddiness (9%); Tungsubutra W et al[9] who reported presenting symptoms were chest pain (95.4%), dyspnea(14.2%) and syncope (4.4%).

Complications observed in cases of ACS: In the present study complications were found in 34.48% of cases. Most common complication was LVF seen in 15.27% cases followed by cardiogenic shock in 11.33% cases and arrhythmias in 7.88% cases. Choudhary L, Marsh J[30] concluded incidence of cardiogenic shock, stroke and left ventricular dysfunction is lower in young patients; Singh PJ et al[31] who reported complications during the course of MI were arrhythmia in 33.33%; LVF in 11.90% and cardiogenic shock in 2.3% and Teixeira M et al[32] who reported arrhythmias were the main complications of ACS.

Mortality observed in cases of ACS: In the present study mortality observed was 16.74%.Tambyah PA et al[33] (1996) reported 6.25% mortality; and Tungsubutra W et al[9] reported 7.4% mortality.

Thus most of the findings in this study co-relates with the similar study done on rural Indian patients by J.Kaur, K.Bains et al, [21] and S.S.Kar, J.S.Thakur et al.[10]

Smoking and Dyslipidemia were found to be most common risk factors which co-relates with previous studies. Overweight and obesity were also major risk factors found; could be because of modernization, change in feeding habits like preference to fast foods and oily items, dislike towards vegetables. Rapid urbanization has also changed the life style of people from hard work to sedentary life style.

Some studies showing variation regarding dyslipidemia and obesity from present study. Difference in prevalence could be explained by different feeding habits between the different population groups.

Family history of IHD was also found to be an important risk factor. Patients with family history of IHD tend to have familial aggregation of IHD due to combination of shared genetic, environmental and lifestyle (smoking, exercise, diet) factors and polygenic inherited risk characteristics.

Table 4: Comparision of risk factor profile in rural patients with CAD in this study to other Indian Studies.

Risk Factor	Present Study	J.Kaur, K.Bains et al, (2006)	S.S.Kar, J.S.Thakur et al, (2010)
Age <40 yrs.	10.83%		31%
>40 yrs	89.17%		69%
Male sex	80.29%		58%
Smoking	51.23%	31%	41%
Hypertension	31.03%	32%	33%
Diabetes	38.42%	22%	_
Obesity	8.87%	7%	11%
Hypercholesterolemia	36.95%	34%	_
Hypertriglyceridemia	40.89%	22%	_
High LDL-C	25.12%	6%	_
Low HDL-C	53.69%	28%	_

CONCLUSIONS

Prevalence of acute coronary syndrome is rising especially in the younger age groups. Males were more affected than females. This might be due to hormonal protection in premenopausal age and the different risk factor profile in females.ST elevation myocardial infarction was the main type seen. Dyslipidemia and smoking were the most common risk factors along with hypertension and diabetes mellitus. Elderly patients were more likely to present with atypical symptoms. The overall mortality was higher in the older age group.

REFERENCES

1. Antman EM, Selwyn AP, Loscalzo J. Ischemic Heart Disease. In Fauci AS, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J. editors. Harrison's Principles of Internal Medicine. Vol II. 18thed. New Delhi. The McGraw Hill Companies: 2012 p. 1998.

2. Clinical management guidelines for Coronary artery disease for National Programme for prevention and Control of Diabetes, Cardiovascular Disease and Stroke. Partners Department of Cardiology and Community Medicine, PGIMR, Chandigarh, India. Developed under the GOI-WHO Collaborative Programme 2008-2009.[http://whoindia.org/LinkFiles/NMH_Resources_CLINICAL_MAN AGEMNT_GIDELINES_FOR_CAD.pdf pg. 1-49.]

3. National Cardiovascular Disease Database.Sticker No: SE/04/233208 IC HEALTH. Manuscripts developed at the Scientific Secretariat of IC Health, New Delhi. Contributors: V.S.Ajay, Ruby Gupta, Jeemon Panniyammakkal, Vivek Chaturvedi, Dorairaj Prabhakaran, K Srinath Reddy. With support from Ministry of Health and Family Welfare, Government of India and World Health Organization.[http://www.whoindia.org/LinkFiles/NMH_Resources_Nn ational_CVD_database-Final_Report.pdf pg 1-41]

4. Pineda J, Marin F, Roldan V, Valencia J, Marco P, Sogorb F. Premature myocardial infarction: Clinical profile and angiographic findings. International Journal of Cardiology. (2008); 126: 127-129

5. Haque AFMS, Siddiqui AR, Rahman SM, Iqbal SA, Fatema NN, Khan Z. Acute coronary Syndrome in the young – Risk Factors and Angiographic pattern. Cardiovasc.j. 2010:2(2); 175-178.

6. Fauci AS, Braunwald E, Kasper DL, Longo DL, Hauser SL, Jameson JL et al. Harrison's principles of internal medicine, 17th Ed. New York: McGraw Hill Companies;2008:1527-44

7. 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) Final Report. National Heart, Lung, and Blood Institute National Institutes of Health NIH Publication No. 02-5215 Journal of American Heart Association. Circulation 2002; 106:3143.

8. Oliveira A, Barros H, Maciel MJ, Lopes C. Tobacco smoking and acute myocardial infarction in young adults. Preventive Medicine. (2007); 44: 311-316

9. Tungsubutra W, Tresukosol D, Buddhari W, Boonsom W, Sanguanwang S, Srichaiveth B. Acute coronary syndrome in adults: the Thai ACS Registry. J Med Assoc Thai. 2007 Oct; 90 Suppl1:81-90

10. S.S. Kar, J.S. Thakur et al; Risk factors for cardiovascular diseases. The National Medical Journal of India, 2010 Vol-23,206-9.

11. H.S.Wasir, A.K.Bharani, M.L.Bhatia et al; Correlation of risk factors withcoronary angiographic findings in patients of IHD; JAPI, 1987,Vol.36,No.7,483-87 pp.

12. Uhl G.S. Farell.P.W. et al; Myocardial infarction in young adults; risk factorsand natural history; Am. Heart. Journal, 1983,Vol. 105, 548-53.

13. Warren S.E.Vieweg W.V.R. et al: Myocardial infarction before age 36; Risk factor and angiographic analysis; Am. Heart. Journal, 1982;

49, 1600-3.

14. W.Foote, McCanty R. et al; CAD in young patients; Arteriographic andclinical review of 40 cases aged 34 and under; Am. Heart. Journal, 1974,Vol.87, 689-96pp.

15. Wallin J. Wedel H. et al; Myocardial infarction among men below aged 40years; British Heart Journal;1978,Vol 40; 783-88 pp.

16. Prem Pais, H.Gerstein, P.R.Nayak et al: risk factors for AMI in India- A case control study; Lancet, 1996, Vol. 358-63 pp.

17. Al-Halabi B, Hbejan K. Smoking Effect on Ischemic Heart Disease in Patients. J Cardiovasc Thorac Res. 2011; 2 (4): 1-5.

18. Teixeira M, Sa I, Mendes JS, Martins L. Acute coronary syndrome in adults. Rev Port Cardiol. 2010 Jun; 29(6): 947-55.

19. Mario Cirruzzi et al; Frequency of family history AMI in patients with AMI;Am. Heart. Journal, 1977,Vol. 80, 427-32pp.

20. G.S.Wander, R.K.Gupta et al; Epidemiology of CHD in rural Punjab population- Prevalence and correlation with various risk factors: Indian Heart J. 1994 Nov-Dec;46(6): 319-23.

21. J.Kaur, K.Bains et al; A study of risk factor profile of cardiovascular diseases in rural punjabi patients. Indian jou of public health, Vol 2; April-June 2006,97-100pp.

22. Martin A. Dolder, Michael F. Oliver et al; myocardial infarction in youngmen- Study of risk factors in 9 countries; BHJ, Vol.3493-503 pp.

23. R.Rastogi, S.S.L.Shrivasthava et al; Lipid profile in smokers; JAPI, 1986,Vol.37, No.12, 764-766 pp.

24. F.G.R.Fowkes et al; Aetiology of peripheral atherosclerosis, smoking, seems equally important; BMJ, 1989, Vol.5 242-43 pp.

25. Mario R. Maarit V.K. et al; Infection, inflammation and the risk of CHD; Circulation, 2000, Vol. 80, 427-32 pp.

26. W.B.Kannel, D.McGee et al; A general cardiovascular risk profile-Framingham study; Am. Journal of cardio, 1976,Vol. 38, 46-51pp.

27. K.P.Mishra, S.Suresh et al; Coronary artery disease in women; JAPI, feb2004, Vol. 50, 259-264 pp.

28. W.P. Castelli, T. Gordan et al; High density lipoprotein as a protective factor against coronary artery disease- Framingham study; Am. Journal of cardio,1977,Vol. 62, 707-14pp.

29. G.S. Wander, R.K. Gupta et al; Epidemiology of CHD in rural Punjab population-Prevalence and correlation with various risk factors; Indian Heart Journal, 1994. 46(6), 319-23.

30. Singh PJ, Singh G, Shergill CS, Arora P. Myocardial infarction in young – A study of 42 cases. JAPI. 2001; Vol. 49: p.32.

31. Woon WC, Lim KH. Acute Myocardial Infarction in the Elderly-The Differences Compared with the Young. Singapore Med J. 2003; 44(8); 414-418.

32. Choudhury L, Marsh J. Myocardial Infarction in Young Patients. Am J Med. 1999; 107:254-261.

33. Tambyah PA, Lim YT, Choo MH. Premature myocardial infarction in Singapore- Risk Factor analysis and clinical features. Singapore Med J 1996; 37: 31-33.