# Clinical Presentation and Predictors of Acute Coronary Syndrome: A Cross Sectional Study

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## ABSTRACT

**Introduction:** Acute coronary syndrome (ACS) is an umbrella term for conditions when ischemia to the heart muscles is prolonged and not immediately reversible. Depending on its clinical presentation, prompt management is required. The objective of this study was to explore the clinical profiles and predictors of mortality among patients diagnosed with ACS.

**Methods:** A hospital based prospective cross sectional study was conducted among 200 patients at Nobel Medical College Teaching Hospital from 15 April 2020 to 15 March 2021. Total enumeration technique was used. Data was collected using specifically designed proforma, and analyzed on SPSS version 23. Mean, standard deviation, Chi square and Odds Ratio (OR) was calculated. P value <0.05 was considered statistically significant.

**Results:** Majority of therespondents were in the age group 56-65 years with mean ±SD (62.9± 10.6) years. Chest pain (p= 0.003), Nausea (p=0.024), Dyslipidemia (p=0.000), HDL (p=0.000), and Hypertension (p=0.03) had statistically significant differences between male and female. Breathlessness (p=0.013, OR 3.7), syncope (p=0.021, OR 3.6), time of onset (p=0.004), increased LDL (p=0.023, OR 3.1), ventricular tachycardia (p=0.003, OR 7.6) and conservative management approach (p=0.000, OR 7.5) has statistically significant differences in terms of patient's outcome.

**Conclusion:** Male patients had significantly increased clinical presentation. The strongest predictors of mortality were male sex, breathlessness, syncope, increased time of onset of pain, increased LDL, ventricular tachycardia and conservative management.

**Keywords : Acute Coronary syndrome; Clinical presentation; Predictors; Risk factors.**

## INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of premature deaths globally and account for 43% of deaths in low and 41% of deaths in middle income countries.[1] In Nepal, cardiovascular diseases contribute to about a third of total deaths; with half of the CVD deaths occurring among people 70 years or younger. Ischemic heart disease was the predominant CVDs.[2] Acute coronary syndrome (ACS) is an umbrella term for conditions when ischemia to the heart muscles is prolonged and not immediately reversible.[3,4] It includes the spectrum of clinical conditions ranging from unstable angina (UA) to non ST-segment elevation myocardial infarction (NSTEMI) and ST-segment elevation myocardial infarction (STEMI).[4,5] Depending on the clinical presentation of ACS, prompt management with Coronary angiography (CAG), Percutaneous Coronary Intervention (PCI), thrombolytic therapy and close monitoring on a well-equipped Cardiac care unit (CCU) are required.[6] The modifiable known risk factors of ACS are hypertension, diabetes, high low density lipoprotein cholesterol, smoking, air pollution, obesity and a sedentary lifestyle. The non-modifiable known risk factors include genetic factors, age, gender, race, and a lower

socioeconomic status.[2,4,7] Emerging data demonstrate sex-specific differences in patients presenting with ACS.[8,9] The objective of this study was to find the clinical presentation and predictors of acute coronary syndrome.

## METHODS

A hospital based prospective cross sectional study was carried out among 200 patients diagnosed with acute coronary syndrome admitted in the cardiac unit at Nobel Medical College Teaching Hospital from 15 April, 2020 to 15 March, 2021 Total enumeration technique was used to enroll all the patients presented during study period. Specifically designed pro forma was used to collect information on socio-demographic history such as age, sex, measurement of systolic and diastolic blood pressure, presence of risk factors such as history of smoking, dyslipidemia, diabetes and hypertension, laboratory values such as lipid profile, renal function test, electrolytes (sodium, potassium), haemoglobin, ECG, echocardiography, coronary angiography and management and outcome of patients. Dyslipidemia was defined as the presence of any of given parameters: patients on lipid lowering drugs or total cholesterol >240 mg/dl, triglycerides (TG) >150 mg/dl, low-density lipoprotein >130 mg/dl, and high-density lipoproteins (HDL) <50 mg/dl for female and <40 mg/dl for male. Hypertension was defined as Systolic blood pressure ≥140 mg/dl and diastolic blood pressure ≥90 mg/dl. Typical chest pain refers to chest, arm, or jaw pain described as dull, heavy, tight, or crushing and atypical chest pain refers to epigastric or back pain or pain that is described as burning, stabbing, or characteristic of indigestion.

The collected data was entered in the Microsoft excel sheet and transferred to SPSS version 23 for further analysis. Mean and standard deviation was calculated. Chi-square was used to find the association. Odds ratio was calculated to estimate the risk. P value <0.05 was considered statistically significant.

## RESULTS

The maximum numbers of patients were in the age group 56-65 years (35%) followed by 46-55 years (22.5%) with mean ± SD of 62.9 ± 10.6 years. The age range from 25-35 and 36-45 years are seems to be more fewer than others age groups which can describe that the persons suffering from the acute coronory heart disease are more among the higher age groups ranging from the 50 above. From the results that the occurance of ischemic heart disease or cardio vascular disease starts its involvement mainly from the 45 years and more. The age group of lower age was seems to be more healthier. More than half of the patients were male 67 Percent (Table 1).

### Table 1: Socio-demographic characteristics of patients (n=200)

| Age (In Years) | Frequency (%) |
|---|---|
| 25-35 | 4(2) |
| 36-45 | 3(1.5) |
| 46-55 | 45(22.5) |
| 56-65 | 70(35) |
| 66-75 | 55(27.5) |
| 76-85 | 20(10) |
| 86-95 | 3(1.5) |
| Mean ±S.D | 62.9± 10.6 |
| Sex | |
| Male | 134(67) |
| Female | 66(33) |

Male patients had presence of higher proportion of clinical features than female such as typical chest pain (69.2% versus 30.8%), referred pain (68.9% versus 31.1%), breathlessness (69% versus 31%), sweating (65.8% versus 34.2%) nausea (80% versus 20%), syncope (66.7% versus 33.3%) and palpitation (68.6% versus 31.4%). Male patients had higher increased systolic and diastolic blood pressure (68.6% and 66% respectively) than female. The time of onset of pain was within 6-12 hours (71.2%), <6 hours (69.7%) and >12 hours (60.3%) in majority of male while most female patients had their pain in the onset of > 12 hours (39.7%) followed by <6 hours (30.5%) and 6-12 hours (28.8%) time onset. Moving towards the ECG findings among males right bundle branch block (RBBB), left bundle branmch block (LBBB) and Bradycardia was the major problems. The territory involved among the 200 patients was anterior wall, lateral wall, inferior wall and posterior wall. STEMI was present in 66.3% males and 33.7% female patients. Out of 10 patients with NSTEMI, 7 were males and 3 were females. In 12 patients diagnosed with unstable angina, 9 were males and 3 were females. The male patients had higher proportion of known risk factors compared to females such as smoking habit (71.8% versus 28.2%), dyslipidemia (51% versus 49%), high cholesterol (69.6% versus 30.4%), low HDL (67.2% versus 32.8%). Contributing risk factors like history of diabetes mellitus (64.6% versus 35.4% female) and hypertension (75.3% versus 24.5%) both were higher in males than females. Conservative management was done in 62.5% males and 37.5 % female patients. PCI was performed in 68.7% males and 31.3% females. Chronic obstructive pulmonary disease (COPD) seems to be equal in both male and females among 12 patients. The comorbidities in male are higher where chronic kidney disease, pulmonary edema, heart failure and acute kidney injuries are the major factors. The other details are in (Table 2).

**Table 2: Clinical presentation, comorbidities, risk factors, management and mortality of ACS patients**

| Clinical presentation | Male Frequency(%) | Female Frequency(%) |
|---|---|---|
| Typical chest pain (n=182) | 126 (69.2) | 56(30.8) |
| Atypical chest pain (n=18) | 8(44.4) | 10(55.6) |
| Referred pain (n=132) | 91(68.9) | 41(31.1) |
| Sweating (n=155) | 102(65.8) | 53(34.2) |
| Breathlessness (n=84) | 58(69) | 26(31) |
| Nausea (n=50) | 40(80) | 10(20) |
| Syncope (n=24) | 16(66.7) | 8(33.3) |
| Palpitation (n=15) | 10(66.7) | 5(33.3) |
| Higher Systolic Blood Pressure (SBP) (n=70) | 48(68.6) | 22(31.4) |
| Higher Diastolic Blood Pressure (DBP) (n=50) | 33(66) | 17(50) |
| **Time of onset**<br><6 hours (n=66)<br>6-12 hours (n=66)<br>>12 hours (n=68) | <br>46(69.7)<br>47(71.2)<br>41(60.3) | <br>20(30.5)<br>19(28.8)<br>27(39.7) |
| **ECG findings** | | |
| Arrythmia (n=2)<br>Atrial fibrillation (n=5)<br>Ventricular Tachycardia (VT) (n=8)<br>Left Bundle Branch Block (LBBB)(n=4)<br>Right Bundle Branch Block (RBBB) (n=1)<br>Bradycardia (n=3)<br>Complete Heart Block (CHB) (n=9) | 1(50)<br>4(80)<br>6(75)<br>1(25)<br>1(100)<br>3(100)<br>7(77.8) | 1(50)<br>1(20)<br>2(25)<br>3(75)<br>0<br>0<br>2(22.2) |
| **Territory involvement**<br>Anterior wall (n=104)<br>Inferior wall(n=80)<br>Lateral wall(n=8)<br>Posterior wall(n=8) | <br>77(74)<br>48(60)<br>5(62.5)<br>4(50) | <br>27(26)<br>32(40)<br>3(37.5)<br>4(50) |
| **Types of acute coronary syndrome (ACS)**<br>STEMI (n=178)<br>NSTEMI (n=10)<br>Unstable angina (n=12) | <br>118(66.3)<br>7(70)<br>9(75 | <br>60(33.7)<br>3(30)<br>3(25) |
| **Comorbidities**<br>Chronic obstructive pulmonary disease (COPD) (n=12)<br>Chronic kidney disease (CKD) (n=28)<br>Recurrent angina (n=5)<br>Heart failure (n=30)<br>Pulmonary edema (n=20)<br>Mitral regurgitation (n=8)<br>Shock (n=7)<br>Acute kidney injury (AKI) (n=24)<br>Stroke (n=3) | <br>6(50)<br>23(82.1)<br>4(80)<br>20(66.7)<br>16(80)<br>6(75)<br>5(71.4)<br>16(66.7)<br>3(100) | <br>6(50)<br>5(17.9)<br>1(20)<br>10(33.3)<br>4(20)<br>2(25)<br>2(28.6)<br>8(33.3)<br>0 |
| **Known risk factors**<br>Smoking habit (n=78)<br>Dyslipidemia (n=104)<br>High cholesterol (n=46)<br>Low HDL (n=58)<br>High LDL (n=58)<br>Diabetes Mellitus (n=79)<br>Hypertension (n=89) | <br>56(71.8)<br>53(51)<br>32(69.6)<br>39(67.2)<br>20(34.5)<br>51(64.6)<br>67(75.3) | <br>22(28.2)<br>51(49)<br>14(30.4)<br>19(32.8)<br>38(65.5)<br>28(35.4)<br>22(24.7) |
| **Management**<br>Conservative management (n=56)<br>Percutaneous Coronary Intervention (n=144) | <br>35(62.5)<br>99(68.7) | <br>21(37.5)<br>45(31.3) |
| Mortality(n=17) | 15(88.2) | 2(11.8) |

## Table 3: Association of clinical characteristics with sex of ACS patients (n=200)

| Variables | | Male (n=134) (%) | Female (n=66) (%) | P value | Odds Ratio | 95% CI |
|---|---|---|---|---|---|---|
| **Age** | High risk* | 62(63.3) | 36(36.7) | 0.27 | 0.78 | 0.39-1.29 |
| | Low risk* | 72(70.6) | 30(29.4) | | | |
| **Chest pain** | Typical | 126(69.2) | 56(30.8) | 0.033 | 2.8 | 1.05-7.5 |
| | Atypical | 8(44.4) | 10(55.6) | | | |
| **Nausea** | Yes | 40(80) | 10(20%) | 0.024 | 2.8 | 1.1-5.1 |
| | No | 94(62.7) | 56(37.3) | | | |
| **Breathless-ness** | Yes | 58(69) | 26(31) | 0.6 | 1.2 | 0.6-2.1 |
| | No | 76(65.5) | 40(34.5) | | | |
| **Referred pain** | Yes | 91(68.9) | 41(31.1) | 0.4 | 1.3 | 0.6-2.39 |
| | No | 43(63.2) | 25(36.8) | | | |
| **SBP** | Normal | 86(66.2) | 44(33.8) | 0.73 | 0.89 | 0.48-1.67 |
| | High | 48(68.6) | 22(31.4) | | | |
| **DBP** | Normal | 101(67.3) | 49(32.7) | 0.86 | 1.06 | 0.5-2.1 |
| | High | 33(66) | 17(34) | | | |
| **Smoking** | Yes | 56(71.8) | 22(28.2) | 0.23 | 1.4 | 0.78-2.6 |
| | No | 78(63.9) | 44(36.1) | | | |
| **Dyslipidae-mia** | Yes | 53(51) | 51(49) | 0.000 | 0.2 | 0.09-0.37 |
| | No | 81(84.4) | 15(15.6) | | | |
| **Cholesterol** | High | 32(69.6) | 14(30.4) | 0.67 | 1.2 | 0.57-2.4 |
| | Normal | 102(66.2) | 52(33.8) | | | |
| **HDL** | Low | 20(34.5) | 38(65.5) | 0.000 | 0.13 | 0.6-0.25 |
| | Normal | 114(80.3) | 28(19.7) | | | |
| **LDL** | High | 39(67.2) | 19(32.8) | 0.96 | 1.02 | 0.5-1.95 |
| | Normal | 95(66.9) | 47(33.1) | | | |
| **Diabetes** | Yes | 51(64.6) | 28(35.4) | 0.5 | 0.8 | 0.45-1.5 |
| | No | 83(68.6) | 38(31.4) | | | |
| **Hypertension** | Yes | 67(75.3) | 22(24.7) | 0.03 | 2.0 | 1.08-3.7 |
| | No | 67(60.4) | 66(33.9) | | | |
| **Management** | Conservative | 35(62.5) | 21(37.5) | 0.39 | 0.76 | 0.39-1.45 |
| | PCI | 99(68.8) | 45(31.3) | | | |
| **Mortality** | Yes | 15(88.2) | 2(11.8) | 0.05 | 4 | 0.9-18.2 |
| | No | 119(65) | 64(35) | | | |

*High risk*- *age between 40 and 60 years and Low risk: Ages of ≤39 and ≥61 years*

Chest pain (p= 0.003), Nausea (p=0.024), Dyslipidemia (p=0.000), HDL (p=0.000) and Hypertension (p=0.03) had statistically significant differences between male and female. The odds of mortality is four times higher in male than females but there were no statistically significant differences (p=0.05). There was no statistically significant difference between male and female in terms of their age, systolic blood pressure, diastolic blood pressure, breathlessness, referred pain, smoking habit, cholesterol level, Diabetes and management of ACS (Table 3).

**Table 4: Predictor of mortality in acute coronary syndrome (ACS) (n=200)**

| Variables | | Outcome (n=200) | | P value | Odds Ratio | 95% CI |
|---|---|---|---|---|---|---|
| | | Death Frequency(%) | Alive (n) Frequency(%) | | | |
| **Age** | High risk | 6(6.1) | 92(93.9) | 0.24 | 0.5 | 0.2-1.5 |
| | Low risk | 11(10.8) | 91(89.2) | | | |
| **Sex** | Male | 15 (11.2) | 119(88.8) | 0.052 | 4 | 0.9-18.1 |
| | Female | 2(3) | 64(97) | | | |
| **Breathlessness** | Yes | 12(14.3) | 72(85.7) | 0.013* | 3.7 | 1.2-10.9 |
| | No | 5(4.3) | 111(95.7) | | | |
| **Syncope** | Yes | 5(20.8) | 19(79.2) | 0.021* | 3.6 | 1.1-11.3 |
| | No | 12(6.8) | 164(93.2) | | | |
| **Referred Pain** | Yes | 5(3.8) | 127(96.2) | 0.001* | 0.12 | 0.1-0.5 |
| | No | 12(17.6) | 56(82.4) | | | |
| **Time of onset** | <6 hour | 2(3) | 64(97) | 0.004* | Not applicable | |
| | 6-12 hours | 3(4.5) | 63(95.5) | | | |
| | >12 hours | 12(17.6) | 56(82.4) | | | |
| **LDL value** | Normal | 8(5.6) | 134(94.4) | 0.023* | 3.1 | 1.1-8.4 |
| | High | 9(15.5) | 49(84.5) | | | |
| **Ventricular tachycardia** | Yes | 3(37.5) | 5(62.5) | 0.003* | 7.6 | 1.6-35.2 |
| | No | 14(7.3) | 178(92.7) | | | |
| **Diabetes** | Yes | 7(8.9%) | 72(91.1) | 0.89 | 1.1 | 0.4-2.9 |
| | No | 10(8.3) | 111(91.7) | | | |
| **Hypertension** | Yes | 7(7.9) | 82(92.1) | 0.77 | 0.8 | 0.3-2.4 |
| | No | 10(9) | 101(91) | | | |
| **Management** | Conservative | 12(21.4) | 44(78.6) | 0.000* | 7.5 | 2.5-22.7 |
| | PCI | 5(3.5) | 139(96.5) | | | |

*'*' Indicates the statistically significance at 95% CI*

Breathlessness (p=0.013), syncope (p=0.021), referred pain (p=0.001), increased time of onset (p=0.004), increased level of LDL (0.023), ventricular tachycardia (p=0.003) and conservative management (p=0.000) has statistically significant increased mortality in patient's outcome. Patient's age, sex and risk factors like diabetes; hypertension did not have statistically significant difference in outcome of patients (Table 4).

## DISCUSSION

We conducted a cross sectional study among 200 patients with acute coronary syndrome with the objective to identify the clinical characteristics and predictors of mortality. In our study more than two third (67%) were male patients. This was similar to the other studies in Nepal where the majority of patients were males.[2,8,10] Our finding supports the existing literature that acute coronary syndrome is predominantly higher in male population than females. The major risk factors present in our study were dyslipidemia, hypertension, diabetes and smoking (104, 89, 79 and 78 patients respectively). A difference was observed in another study where smoking was the major risk factor followed by hypertension, diabetes and dyslipidemia.[10] Male patients had a higher proportion of all the known risk factors present compared to females in our study. Nearly every four in

five male patients (71.8%) had smoking habits while compared to females (28.2%). This finding is similar to a study conducted in Manmohan Cardiothoracic Vascular and Transplant Center (MCVTC) Kathmandu, where the majority of males had smoking habits compared to females (63.7% versus 38.2%).[10] Dyslipidemia (51%) versus 49%) was higher in males than females in our study. But in contrast to our study, dyslipidemia was seen significantly higher in females (22.5%) compared to males (11 %)[10] Contributing risk factors like history of Diabetes (64.6% versus 35.4%) and hypertension (75.3% versus 24.5%) both were higher in males than females in our study. Traditional risk factors explain that women with ACS are older, and are more likely to have diabetes, hypertension and congestive cardiac failure than men which is in contrast to our study findings.[11] Our study could not find any sex specific significant differences among males and females with smoking, ages and diabetes history while the existing literature suggests that women with diabetes have four fold increased risk of having MI while men have 2.5 times and with smoking 3.3 times increased risk compared to males (1.9 times) and so does the outcome also.[12,13] The presence of risk factors like diabetes, hypertension, smoking, dyslipidemia had no significant differences in patients outcome as death and alive in our study. The variations might be due to the cultural context and variations in study settings also. We enrolled diseased patients from hospitals and the majority of patients were from lower risk age groups. The presence of typical chest pain was the dominant clinical symptom in our study and it was 2.8 times more common in males than females. The odds of having nausea were also 2.4 times more common in male than females. Similar findings were observed in other studies which mention that males had typical chest pain and the majority of women reported atypical chest pain.[8,14,15] Almost three fourth male patients (71.2%) were admitted in hospitals within the time of 6-12 hours since the onset of pain and while most female patients (39.7%) were admitted since the time of onset of pain of >12 hours in our study. There was increased mortality with increasing time of onset of pain in our study. Existing literature mentions that perception of chest pain is an important survival mechanism in patients with ACS, alerting the need for urgent medical care.[14] A study even mentions that describing chest pain as typical and atypical could delay the management and thus increases risk of premature death especially in females.[8]

The presence of other clinical features such as increased systolic blood pressure, increased diastolic blood pressure, breathlessness, and referred pain between males and females had no statistically significant differences in our study, though the values were higher among males. Majority of patients had anterior wall involvement (104 patients) followed by an inferior wall (80 patients) in anterior wall (74%) while female patients had inferior wall involvement (40%). STEMI was the commonest presentation in our study (178 patients) in which two thirds (66.3%) were male and 33.7% were female. Out of 10 patients with NSTEMI, 7 were males and 3 were females. In 12 patients diagnosed with unstable angina, 9 were males and 3 were females. Similar to our study, both male and female patients had STEMI (62.8% and 52% respectively) commonest types.[10] In a study from western part of Nepal, Lumbini Medical College and Teaching Hospital, also the commonest presentation was STEMI 20 patients (50%) followed by NSTEMI 14 (35%) and UA 6 (15%).[16]

The overall mortality was 8.5% (17 patients) where male patients had four times higher mortality than female patients in our study. In a study from Eastern Nepal, hospital mortality was 14% for all patients with ACS, and 17% for the patients with STEMI.[17]

Patients with symptoms of breathlessness had 3.7 times and with syncope 3.6 times death outcomes in our study. The increased LDL value has 3.1 times increased risk of death and with ventricular tachycardia it was 7.6 times higher. Patients with conservative management were 7.5 times more likely to die than those with PCI in our study. Our study findings support the existing literature and suggest that patients with classic symptoms representing the signs of ACS should not be ignored.[17] It also suggests that timely recognition of symptoms, prompt treatment and availability of onsite angiography and angioplasty/PCI reduces the risk of death among ACS patients.[3] Our study has some limitations. Since it is a hospital based study it does not represent the general population. We observed the presence of limited known risk factors. Other known risk factors like obesity, genetic causes and dietary factors were not included. Details mentioning the vessel's involvement and biomarkers such as cardiac enzymes were not included in this study. We recommend conducting a community based sex and age specific comparative studies in a large scale to support the existing findings.

## CONCLUSION

Male patients had significantly increased clinical presentation. The strongest predictors of mortality were male sex, breathlessness, syncope, increased time of onset of pain, increased LDL, ventricular tachycardia and conservative management. Among both of the sexes the more vulnerable gender tends to be male occuring the heart failure, chronic kidney dieseas and pulmonary edema. Female tends to have lower level of HDL and diabetes milletus and hypertension.

# REFERENCES

1. Dagenais GR, Leong DP, Rangarajan S, Lanas F, Lopez-Jaramillo P, Gupta R, et al. Variations in common diseases, hospital admissions, and deaths in middle-aged adults in 21 countries from five continents (PURE): a prospective cohort study. 2020 ;395 (10226):785–94.

2. Bhattarai S, Aryal A, Pyakurel M, Bajracharya S, Baral P, Citrin D, et al. Cardiovascular disease trends in Nepal – An analysis of global burden of disease data 2017.2020;30.

3. Kumar A, Cannon CP.Acute coronary syndromes: diagnosis and management, part I. Mayo Clin Proc.2009;84(10):917–38.

4. American Heart Association. Acute Coronary Syndrome [Internet]. www.heart.org. 2015.

5. Wright RS, Anderson JL, Adams CD, Bridges CR, Casey DE Jr, Ettinger SM, et al. 2011 ACCF/AHA Focused Update of the Guidelines for the Management of Patients With Unstable Angina/ Non-ST-Elevation Myocardial Infarction (Updating the 2007 Guideline): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation.2011;123(18):2022–60.

6. Smith SW, Whitwam W. Acute coronary syndromes. 2006 Feb;24(1):53–89.

7. Arslanian-Engoren C, Patel A, Fang J, Armstrong D, Kline-Rogers E, Duvernoy CS, et al. Symptoms of men and women presenting with acute coronary syndromes.2006;98(9):1177–81.

8. Cader FA, Banerjee S,Gulati M. Sex Differences in Acute Coronary Syndromes: A Global Perspective. J Cardiovasc Dev Dis. 2022 Jul 27;9(8).

9. Nguyen HL, Goldberg RJ, Gore JM, Fox KAA, Eagle KA, Gurfinkel EP, et al. Age and sex differences, and changing trends, in the use of evidence-based therapies in acute coronary syndromes: perspectives from a multinational registry. Coron Artery Dis. 2010;21(6):336–44.

10. Shakya A, Jha SC, Gajurel RM, Poudel CM, Sahi R, Shrestha H, et al. Clinical characteristics, risk factors and angiographic profile of acute coronary syndrome patients in a tertiary care center of Nepal. 2019. p. 27–32.

11. Ten Haaf ME, Bax M, Ten Berg JM, Brouwer J, Van't Hof AW, van der Schaaf RJ, et al. Sex differences in characteristics and outcome in acute coronary syndrome patients in the Netherlands. 2019 (5):263–71.

12. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. 2004;364(9438):937–52.

13. Njolstad I, Arnesen E, Lund-Larsen PG. Smoking, serum lipids, blood pressure, and sex differences in myocardial infarction. A 12-year follow-up of the Finnmark Study. 1996;93(3).

14. Akinkuolie AO, Mora S. Are there Sex Differences in Acute Coronary Syndrome Presentation? A Guide through the Maze. 2013 11;173(20).

15. Canto JG. Symptom Presentation of Women with Acute Coronary Syndromes. 2007;167;2405.

16. Chhetri B, Paudel M, Dhungana S, S.Clinical profile of patients with acute coronary syndrome in Lumbini Medical College and Teaching Hospital: A prospective study. 2013 Dec 30;6(1):48–55.

17. Shreshta NR, Basnet S, Bhandari R, Acharia P, Karki P, Pilgrim T, et al. Presentation and outcome of patients with acute coronary syndromes in eastern Nepal. 2011 ;141:13174.