Survey of Assessment and MAnagement of CoRonary Heart Disease PaTients (SMART) in India

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Abstract

Objectives: Survey of Assessment and MAnagement of CoRonary Heart Disease PaTients was undertaken to describe profile and management pattern of adult Acute Coronary Syndrome (ACS) patients from presentation till discharge, in private tertiary care Indian hospitals.

Materials and Methods: This was an observational, prospective study. Based on standard criteria, patients were diagnosed to have ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI) or unstable angina (UA). For patients surviving till hospital discharge, demographic characteristics, medical history, time to hospital presentation, investigations, vascular interventions and medical management during the hospital stay were recorded.

Results: In total, 1340 patients with definitive ACS diagnosis and surviving their hospital stay were enrolled. Mean patient age was 58.7 years, 75% were males and 36.9% were diagnosed with STEMI, 8.9% with NSTEMI and 54.2% with UA. 41.9%, 35% and 18.4% patients reached hospital within 6 hours for STEMI, NSTEMI and UA respectively. Pre-existing hypertension and diabetes were observed less frequently in patients with STEMI (54.8%, 31.9%) than in NSTEMI (70.8%, 45.8%) or UA (64.2%, 41.5%). Aspirin, clopidogrel, nitrates, β-Blockers, angiotensin converting enzyme inhibitors and statins were used more frequently in NSTEMI than in STEMI or UA patients. Percutaneous trans-coronary angioplasty was performed more commonly in STEMI (64.2%) than in NSTEMI (41.7%) or UA (41.2%).

Conclusions: UA is the commonest and NSTEMI is the least common type of ACS observed in our study. We observed important differences in patient profile, time to hospital presentation, in-hospital acute pharmacological management and vascular interventions performed between the three different types of ACS.

Editorial Viewpoint

• This is a large study conducted in tertiary care centers in urban metropolitan cities in private set up.
• Major differences compared to previous studies are higher proportion of patients with hypertension as risk factor and lower proportion of STEMI amongst ACS.
• Trend of fewer patients reaching hospital within 6 hours is worrisome.

Acute Coronary Syndromes (ACS) represents the most common causes of mortality in patients with cardiovascular disease.

The central pathogenesis of ACS consists of fissuring or erosion of atheromatous plaque with superimposed platelet aggregation and thrombosis. This is complicated by micro-fragmentation and distal embolization with alterations in vascular tone and ultimately partial or complete occlusion of perfusion to affected myocardium. Clinical manifestations of ACS are dependent upon the severity of obstruction in the affected coronary artery, the presence or absence of collateral perfusion,

Introduction

Cardiovascular disease is projected to be the largest cause of morbidity and mortality in India by 2020.¹ Cardiovascular disease occurs in Indians 5-10 years earlier than in other populations around the world and the major effect of this peculiar phenomenon is on the productive workforce of the country aged 35-65 years.²

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and the volume and myocardial oxygen demand within the affected territory. Complete coronary occlusion in absence of collateral perfusion results in ST-Elevation Myocardial Infarction (STEMI), involving myocardial necrosis and accompanying increase in blood levels of sensitive enzyme markers. Transient or partial coronary occlusion results in Non-ST-Elevation Myocardial Infarction (NSTEMI), involving myocyte necrosis of a lesser extent and minor increase in blood levels of enzyme markers. Transient or partial increase in blood levels of sensitive enzyme markers. Unstable Angina (UA) is caused by partial coronary occlusion without rise in blood levels of myocardial enzyme markers.\(^3\)

The distinction between acute myocardial infarction and minimal myocardial injury is of immediate practical importance as emergency reperfusion treatment is indicated for acute infarction but not for the remainder of the ACS.\(^3\)

The Survey of Assessment and Management of Coronary Heart Disease Patients (SMART) study was undertaken to describe any differences in patient profile and in-hospital management practices between different types of ACS, in private tertiary care centres in India.

**Materials and Methods**

**Patients**

The study was conducted from January 2005 to December 2007 in eight private, tertiary care centres located in urban metropolitan cities and having advanced coronary care facilities. Approval from the local ethics committee was taken prior to study commencement and informed consent was obtained from each patient participating in the study. Patients were included in this study if they were \(\geq 18\) years old, were admitted for ACS as a presumptive diagnosis, survived till discharge from hospital and had \(\geq 1\) of the following at hospital presentation in addition to symptoms of ACS: electrocardiographic (ECG) changes consistent with ACS, serial increases in serum biochemical markers of cardiac necrosis, and/or documentation of cardiovascular disease. Patients with serious co-morbidities like advanced malignancy, end-stage renal disease; life-threatening infections etc. were excluded from this study. The qualifying ACS was not to be precipitated or accompanied by trauma or surgery. The demographic and baseline patient characteristics along with their medical history and duration of symptoms prior to hospital presentation were recorded in a case report form.

**Diagnosis**

Pre-established criteria of electrocardiogram changes (ST-segment deviation, T-wave inversion, Q-wave anomaly, new onset of left bundle branch block) and serial increases in serum biochemical markers of cardiac necrosis (creatinine kinase muscle brain [CK-MB], troponin) were employed at all study sites for classification of ACS into STEMI, NSTEMI or UA. STEMI was identified when new ST-segment elevation was \(\geq 1\) mm or new left bundle branch block (LBBB) in the ECG had one or more positive cardiac biochemical marker of necrosis. Presence of one or more positive cardiac biochemical marker of necrosis without new ST-segment elevation on the ECG suggested NSTEMI, while UA was identified by the absence of both ST-segment elevation on the ECG and serum biochemical markers indicative of myocardial necrosis.

**Statistical Analysis**

Data realization was performed to compute observed frequency of parameters like gender, type of ACS, risk factors, usage of standard medications at different time points (before admission, at admission and at discharge) and type of revascularization procedure. Age of patients (<40, 40-70 and >70 years) and duration of symptoms prior to presentation at hospital (<6, 6-12, 12-24 and >24 hours) were presented as categorical variable. The comparisons for all these parameters were made between the three patient types of STEMI, NSTEMI and UA. All tests were two-sided and considered significant at 0.05. The statistical analysis was performed using SPSS 17.0.

**Results**

In total, 1340 patients with a definite diagnosis of ACS and surviving till discharge from hospital were enrolled. This included 494 (36.9%) patients with STEMI, 120 (8.9%) with NSTEMI and 726 (54.2%) with UA.

**Baseline Characteristics**

About 75% of the study patients were male. While mean age of the total study patients was 58.7 ± 14.8 years, 7.2% were aged <40, 76% aged between 40 and 70 and 16.7% were aged 70 years. STEMI was the most common diagnosis in the age group of <40 years and UA was the most common diagnosis in other age groups. Significantly fewer patients with STEMI had diabetes (\(p<0.001\)) or hypertension (\(p<0.001\)) as known co-morbidities as compared to those with NSTEMI or UA.

**Time to Hospital Presentation**

Overall, 28.6% of ACS patients reached hospital within 6 hours, 9.2% in 6-12 hours, 14.8% in 12-24 hours and 41% after 24 hours of symptom onset. Significantly (\(p<0.001\)) higher proportion of STEMI patients reached hospital within 12 hours as compared with those having NSTEMI or unstable angina.

**Medication Usage Prior to Hospitalization**

Chronic usages of cardiovascular medications prior to hospital presentation have been summarized in Table 1. Overall frequency of these medications was consistent with known co-morbidities. \(\beta\)-blocker usage was significantly
more frequent in patients with NSTEMI as compared to patients with STEMI and patients with UA.

**Pharmacological management at hospital presentation**

Acute pharmacological management of patients at the time of hospitalization has been summarized in Table 2. Pharmacological management appeared to be most intense in patients with NSTEMI and least in patients with UA, as indicated by significant differences in drug usage frequency across classes.

**Therapeutic or Diagnostic Vascular Interventions**

Nature and frequency of various vascular interventions performed have been summarized in Table 3. Overall usage of fibrinolytics therapy was very low. Percutaneous trans-coronary angioplasty (PTCA) was performed significantly more commonly in patients with STEMI as compared to patients with NSTEMI or UA (p<0.0001)

**Medications Prescribed at Discharge**

Summary of medications prescribed at discharge from hospital has been presented in Table 4. In comparison to patient with STEMI, post-discharge pharmacological management appeared to be less intense in patients with UA as evidenced by significantly lower frequency of β-blocker, angiotensin converting enzyme inhibitors (ACEI) and statin prescription.

**Discussion**

Patient profile and management patterns of ACS patients in India have been described in past as well. SMART study differs from the previous such studies in being the only one involving private tertiary care hospitals exclusively. Key features and observations of these studies have been summarized in Appendix 1.

When compared to the results of previous three studies, characteristics of our study patients are similar in many aspects like mean age of ACS patients, proportion of male patients and prevalence of diabetes as a co-morbid condition. However, some important differences noted in our study include higher prevalence of hypertension as comorbid condition, lower proportion of STEMI patients and fewer patients reaching hospital within 6 hours of symptom onset. Important differences in in-hospital management of ACS patients noted in SMART study as compared to previous studies include less frequent usage of β-blockers and preference for PTCA over fibrinolytics as the reperfusion tool.

We noted some important differences amongst the STEMI patient group as compared to the NSTEMI and/or UA patient groups,
some of which are consistent with observations made in previous studies. The STEMI patients were younger in our study as well as in the study by Xavier et al.\textsuperscript{6} No age difference was observed between the STEMI and other ACS patient groups in other two studies.\textsuperscript{4,5} Proportion of males was significantly higher amongst STEMI patients as compared to NSTEMI patients in SMART (80.1\% vs. 74.1\%) as well as the previous three studies (79.0\% vs. 65.0\%; 77.3\% vs. 75.5\%; 81.5\% vs. 68.6%).\textsuperscript{4-6} In our study, presence of hypertension and diabetes as comorbid conditions was observed less frequently amongst STEMI patients (54.8\%, 31.9\%) as compared to NSTEMI (70.8\%, 45.8\%) and UA (64.2\%, 41.5\%) patients. This is consistent with observations reported by Misiriya et al.;\textsuperscript{4} where, the observed frequency of hypertension and diabetes in STEMI patients (29.0\%, 24.0\%) was significantly lower than that in NSTEMI/UA patients (47.5\%, 43.0\%). Similarly, the prevalence of hypertension and diabetes observed by Xavier et al.\textsuperscript{6} amongst STEMI patients (31.4\%, 26.9\%) was significantly lower than in NSTEMI patients (47.5\%, 35.8\%). However, while prevalence of diabetes was significantly lower; prevalence of hypertension was significantly higher in STEMI patients as compared to NSTEMI and UA patients.\textsuperscript{5}

In our study as well as in the study reported by Xavier et al.,\textsuperscript{6} STEMI patients had a shorter duration of symptoms before presenting to hospital.

With respect to differences in in-hospital medical management, β-blockers and statins/LLD were used significantly less frequently for STEMI patients (59.9\%, 76.3\%) as compared to NSTEMI patients (76.7\%, 85.8\%) in our study. This is consistent with the observations reported by Mohanan PP et al.\textsuperscript{5} (61.9\%, 67.6\% for STEMI; 67.6\%, 69.7\% for NSTEMI) and by Xavier Denis et al.\textsuperscript{6} (57.5\%, 50.8\% for STEMI; 61.9\%, 53.9\% for NSTEMI). However, Misiriya et al.\textsuperscript{4} reported more frequent use of β-blockers and statins/LLD in STEMI patients (80.5\%, 72.4\%) than in NSTEMI patients (77.6\%, 71.2\%).

Re-perfusion (fibrinolytics or Percutaneous transluminal coronary angioplasty [PTCA] or Coronary artery bypass grafting [CABG]) was attempted more frequently in STEMI patients as compared to NSTEMI and/or UA patients in SMART study as well as in the studies.\textsuperscript{5,6}

Possible reasons that may explain differences observed between SMART and previously reported studies include the facts that our study involved only private, tertiary care hospitals located in urban metropolitan cities and having advanced coronary care facilities. This may have bearing on the background health profile and risk factors of study patients, their socio-economic status, time taken to reach hospital and the inhospital care provided. This fact may also be considered a limitation of our study since the data does not represent medical care practice at large. Another limitation of our study is the fact we included only those ACS patients who survived

### Appendix 1: Comparison Indian ACS registries

<table>
<thead>
<tr>
<th>Setting</th>
<th>Misiriya KJR et al.\textsuperscript{4}</th>
<th>Mohanan PP et al.\textsuperscript{5}</th>
<th>Xavier Denis et al.\textsuperscript{6}</th>
<th>SMART</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1865</td>
<td>25748</td>
<td>20468</td>
<td>1340</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>58.3</td>
<td>60.4</td>
<td>57.5</td>
<td>58.7</td>
</tr>
<tr>
<td>Males</td>
<td>72.9%</td>
<td>77.4%</td>
<td>76.4%</td>
<td>75%</td>
</tr>
<tr>
<td>Co-existing diabetes</td>
<td>35.2%</td>
<td>37.6%</td>
<td>30.4%</td>
<td>38.3%</td>
</tr>
<tr>
<td>Co-existing hypertension</td>
<td>31.5%</td>
<td>48.4%</td>
<td>37.7%</td>
<td>61.3%</td>
</tr>
<tr>
<td>STEMI</td>
<td>55.9%</td>
<td>37%</td>
<td>60.6%</td>
<td>36.8%</td>
</tr>
<tr>
<td>Symptom duration before hospital presentation</td>
<td>STEMI: &lt;6 hours for 61.5% NSTEMI/UA: &lt;6 hours for 62.3%</td>
<td>&lt;6 hours for 71.1% NSTEMI/UA: &lt;4 hours for 33.3%</td>
<td>STEMI: &lt;6 hours for 41.9% NSTEMI/UA: &lt;8 hours for 18.5%</td>
<td></td>
</tr>
<tr>
<td>β-blocker usage</td>
<td>77.6%</td>
<td>65.8%</td>
<td>59.3%</td>
<td>55.8%</td>
</tr>
<tr>
<td>Statin/lipid lowering drug (LLD) usage</td>
<td>71.3%</td>
<td>70%</td>
<td>52%</td>
<td>69%</td>
</tr>
<tr>
<td>Re-perfusion modality</td>
<td>Coronary intervention: 4.0%</td>
<td>PTCA: 6.7%</td>
<td>PTCA: 7.5%</td>
<td>PTCA: 49.7%</td>
</tr>
<tr>
<td></td>
<td>Fibrinolytics: 68.9%</td>
<td>CABG: 1.4%</td>
<td>CABG: 2.9%</td>
<td>CABG: 6.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fibrinolitics: 24.7%</td>
<td>Fibrinolitics: 36.8%</td>
<td>Fibrinolitics: 4.4%</td>
</tr>
</tbody>
</table>

### Appendix 2: List of investigators and corresponding sites

- JPS Sawhney - Sir Gangaram Hospital, New Delhi
- Rajiv Rajput - Indraprastha Apollo Hospital, New Delhi
- Jairam Aithal - Hiranandani Hospital, Mumbai
- Deepak Tomar - Metro Heart Institute, New Delhi and Noida
- D B Pahlajani - Breach Candy Hospital, Mumbai
- Sanjay Tyagi - GB Pant Hospital, New Delhi
- R R Kasliwal - Escorts Heart Institute, New Delhi
- Pradeep Shetty - Narayana Hrudayala, Bangalore

Denis et al.\textsuperscript{6} (57.5\%, 50.8\% for STEMI; 61.9\%, 53.9\% for NSTEMI). However, Misiriya et al.\textsuperscript{4} reported more frequent use of β-blockers and statins/LLD in STEMI patients (80.5\%, 72.4\%) than in NSTEMI patients (77.6\%, 71.2\%).

Re-perfusion (fibrinolytics or Percutaneous transluminal coronary angioplasty [PTCA] or Coronary artery bypass grafting [CABG]) was attempted more frequently in STEMI patients as compared to NSTEMI and/or UA patients in SMART study as well as in the studies.\textsuperscript{5,6}

Possible reasons that may explain differences observed between SMART and previously reported studies include the facts that our study involved only private, tertiary care hospitals located in urban metropolitan cities and having advanced coronary care facilities. This may have bearing on the background health profile and risk factors of study patients, their socio-economic status, time taken to reach hospital and the in-hospital care provided. This fact may also be considered a limitation of our study since the data does not represent medical care practice at large. Another limitation of our study is the fact we included only those ACS patients who survived
till discharge.

Conclusion

UA is the commonest and NSTEMI the least common type of ACS observed in our study. We observed important differences in patient profile, time to hospital presentation, in-hospital acute pharmacological management and vascular interventions performed between the three different types of ACS.

References