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CLINICAL PROFILE AND OUTCOMES IN YOUNG PATIENTS OF ST ELEVATION MYOCARDIAL INFARCTION

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ABSTRACT

Background: *India is a developing region with having a substantial young population. Coronary artery disease poses a great economic burden and puts a significant population at risk. The purpose of this study was to assess the burden of young ST-elevation MI (STEMI) patients, their clinical profile and Outcome.*

Result: *Young ST-elevation myocardial infarction comprised 9.4% (n=89) of the total of 943 patients of ST-elevation myocardial infarction. The mean age was 35.42 ± 4.55 years and 97.8% were male. 19.1% of the patients were very young (≤ 30 years). Smoking (46.1%) was the prevalent risk factor. Single vessel disease was present in 73.0% and the left anterior descending artery was the culprit in 72% of the patients.*

In hospital mortality was 2.25%. In a mean follow-up of 51 ± 23 months (43 of 89), 16.3% of patients had a recurrence of angina. 9.3% presented with acute coronary syndrome, repeat intervention was done in 7% of patients. There was no further mortality. Only 77% reported a good quality of life.

Conclusion: *STEMI in young Indians comprises a significant proportion of the total STEMI patients and is predominantly a disease of the male population. Smoking is the main risk factor and LAD is the most common culprit vessel involved. The short-term and long outcome is good but there is a significant recurrence of events on follow-up, repeat intervention is not uncommon and a significant proportion report less than optimal quality of life.*

Keywords: *Young ST elevation myocardial infarction, Primary percutaneous intervention, Left anterior descending artery*

BACKGROUND

India has one of the largest proportions of the population in the younger age groups in the world. It's 28.71% of the population is in the age group of 25 – 44 years (Census of India, 2011). This population is a population at risk, quite evident from the fact that cardiovascular disease contributes to 20.6% mortality in the age group of 30-44 years (Census of India, 2011). Valvular and congenital heart disease may be responsible for quite a portion of this risk burden but there is no doubt that coronary artery disease (CAD) is a major contributor. South Asians are not only prone to CAD but tend to have a more severe disease at an early age than their western counterparts (Enas & Mehta, 1995; Sharma & Ganguly, 2005). In a study done in the UK, first MI was noted to occur on an average of 5 years earlier, and its occurrence before age 40 was 10-fold higher in Indians than in Caucasians (Hughes et al., 1989). In the CREATE – India ACS registry (Xavier et al., 2008), STEMI comprised 61% of the total acute coronary syndrome (ACS) patients, ACS patients were younger, presented late and only a minority underwent PCI compared to patients in the multinational GRACE registry (Avezum et al., 2005) in which STEMI was present in 34% of the ACS patients.

So there is no doubt that Indians suffer from a more malignant form of CAD that too at an early age and if we see the data on revascularization it is very disappointing (Xavier et al., 2008). It is expected that the actual mortality and morbidity in the general population due to STEMI would be much more than what has been reported in some registries. There is a further paucity of data regarding what proportion of STEMI patients in India are young patients, what is the burden of disease? The morbidity and mortality and how they fare after a primary percutaneous intervention (PCI). Studies are needed to look into the risk factors for early CAD events and also profile of such young patients who present as the most serious form of CAD i.e. STEMI. In this context, we did this study to look into the clinical profile and outcomes in young Indian STEMI patients undergoing primary PCI. It is expected that the outcomes would be better than the population in general.

METHODS

This is an observational single-center retrospective study with one-time cross-sectional follow- up. We included consecutive patients ≤ 40 years (defined as young STEMI) who presented with acute STEMI and underwent primary PCI from December 2010 to December 2016 at our center. In-hospital database was searched for patient details and in-

hospital outcomes. Clinical background, risk factors, angiographic findings, acute results of primary PCI, and in-hospital outcomes were evaluated. At least more than 1 year of outcome was assessed based on questioner asked through telephonic communication and hospital records. We evaluated for adverse outcomes as any angina, ACS, acute MI, repeat revascularization, stroke and death (Table 2).

We also assessed the general quality of life (QOL) through the EQ-5D 3 level version (EQ-5D-3L). 7 EQ-5D-3L descriptive system comprises the following 5 dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has 3 levels: no problems, some problems, extreme problems. The respondents were telephonically asked to indicate his/her health state and their answers ticked in the box against the most appropriate statement in each of the 5 dimensions. Answer to all the five dimensions as 'no problem' qualified as good QOL, any answer as 'extreme problem' to any of the 5 dimensions qualified as poor QOL and rest were taken as average QOL. We also inquired about any lifestyle intervention adopted after the initial cardiac event, like quitting smoking or dietary adjustment or any form of exercise. Results were expressed as mean ± 1 SD and percentages were required.

RESULTS

From December 2010 to December 2016, a total of 943 patients of STEMI patients underwent primary PCI, age ranging from 24 years to 91 years, of them 192 patients were female (20.36 %). Of the total 943 patients of STEMI, we found 89 patients who qualified as young STEMI patients (≤40 years). They comprised 9.4% of the total STEMI patients during the study period. The demographic and angiographic profiles have been described in Table 1.

TABLE 1

PROFILE OF YOUNG STEMI PATIENTS.

Demographic Profile of Young STEMI Patients ≤ 40 years	
Total Young STEMI Patients	89 (9.4% of total 943)
Mean age	35.42 ± 4.55 years (range 24-40 years)
Male	97.8%
Risk Factors	
Smoking	46.1%
DM	9.0%
HTN	14.6%
Family history of CAD	19.1%
Angiographic profile	
SVD	73.0%
DVD	22.5%
TVD	2.3%
Culprit vessel	
LAD	71.9%
RCA	14.6%
LCX	10.1%
LM	2.3%

The mean age was 35.42 ± 4.55 years (range 24 - 40 years) and 87 out of 89 patients (97.8%) were male. 19.1% of the patients (n=17) were very young (≤ 30 years). The commonest risk factor was smoking (46.1%) followed by family history (19.1%), HTN (14.6%) and DM (9.0%). Single vessel disease (SVD) was present in 73.0%, double vessel disease (DVD) in 22.5% and triple vessel disease (TVD) in 2.3% of the young STEMI patients.

Left anterior descending artery (LAD) was the most common culprit vessel involved and accounted for 71.9% (n=64), followed by right coronary artery (RCA) that was the culprit in 14.6% (n=13) and left circumflex artery (LCX) in 10.1% (n=9) of the patients. Left main artery (LM) as culprit vessel was found in 2 patients and 1 patient had a large first diagonal involvement. There were two in-hospital deaths (2.25%); both were the left main thrombosis patients. 95.5% of the patients underwent PCI with drug-eluting stents (DES) and rest 4.5% (n=4) underwent balloon angioplasty. One patient had IABP related complication (external iliac artery dissection) and one patient had femoral puncture site complication (pseudoaneurysm). There were no other major in-hospital events noted. Follow up could be achieved of 43 of the 89 patients (48.3%). At a mean follow-up of 51 ± 23 months, 16.27% of patients (n=7) had a recurrence of angina. Of them, 9.30% (n=4) presented with ACS among whom 1 had MI. Repeat revascularization was done in 6.97% of patients (n=3) and the rest were managed medically. There was no further mortality recorded (Table 2). 76.74% of the patients reported living good QOL rest reported average quality. Regarding lifestyle measures, 76.74% of the patients reported adopting some lifestyle measures and about 66.67% of the previous smokers had quit smoking (Table 2).

TABLE 2

OUTCOMES

In Hospital (n=89)	
Adverse events + Mortality	4.50% (n=4)
Repeat revascularization	0%
Stent thrombosis	0%
Mortality	2.25% (n=2)
Longterm outcomes (n=43)	
Mean follow up period	51 ± 23 months
Recurrence of angina	16.27%(n=7)
Acute coronary syndrome	9.30% (n=4)
Repeat revascularization	6.98% (n=3)
Mortality	0 %
Quality of life (QOL)	
Good	76.74%
Average	23.36%
Poor	0%
Life style measures	
Lifestyle intervention	76.74%
Smoking cessation	66.67%

DISCUSSION

The studies evaluating MI in young as often used an age cut-off of 40 to 45 years to include cohorts, and some even have included those ≤ 50 years (Fournier et al., 1996; Doughty et al., 2002; Singh et al., 2017). Considering the demographic profile of India we decided to include cohorts with age ≤ 40 years in our study. The prevalence of CAD in younger subjects is difficult to establish accurately since it is frequently a silent process, but insights may be drawn from an autopsy study in young subjects (age 15 to 34 years) (McGill Jr et al.,). In this autopsy study, an advanced lesion was present in 20% of men and 8 % of women aged 30 to 34; significant lesion in LAD (≥40%) was present in 19% and 8%, respectively. As far as data on the frequency of MI in young, the Framingham Heart Study reported an incidence of 12.9/1000 in men 30 to 34 years old and 5.2/1000 in women 35 to 44 years old over a 10-year follow-up (Kannel & Abbott, 1984). In the Global Registry of Acute Coronary Events (GRACE) study, the reported prevalence of young acute coronary syndrome (ACS) was 6.3% (Avezum et al., 2005).

There is limited data on young Indian patients with MI and almost no data regarding the prevalence or incidence of STEMI in young subjects. There are two studies (Fournier et al., 1996) and the other "The University of Michigan experience" (Doughty et al., 2002) that report the percentage of young MI among all MI patients as 4% and 10%, respectively. Our study was a study on STEMI, the most serious form of MI in terms of mortality and morbidity. In our study, young STEMI comprised 9.4%(n=89) of the total 943 STEMI patients admitted during the study period and among them, there were just two female patients of young STEMI, both were 38 years old (prevalence of 2.25 %). No doubt Indians tend to have proportionally more STEMI than else were, (Mahmood et al., 2012) so going by our study, it may be concluded that we have a very significant population of young people at risk. Alarmingly among the 89 young patients of STEMI, 19% of the patients were very young, less than or equal to 30 years individuals. The youngest patient was 24 years old and died of LM disease.

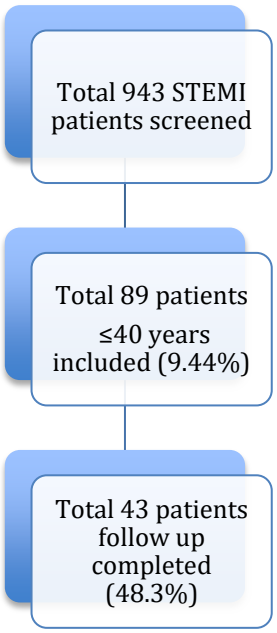
Coming to the issue of MI in the young female population, in two series of patients with CAD at ≤40 years of age, women comprised 5.6 and 11.4 percent of the patients (Fournier et al., 1996; Cole et al., 2003). A study in the Indian population reported only one of the 124 consecutive young STEMI patient as a female and another study on young MI, reported 10% of patients as female (Bhardwaj et al., 2014; Sricharan et al., 2012). So it's evident that though ACS may not be uncommon in a young female, what we can conclude from our study and some other studies that STEMI in young is a disease of the predominantly male population and young females are protected to a great extent.

The Inter-heart study had concluded that conventional risk factors as known today, like abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, etc. are the factors associated with MI in almost all geographical regions (Yusuf et al., 2004). But when we consider young patients of CAD there is irrefutable data that signify smoking as the most common risk factor of ACS. Studies have reported smoking as a risk factor in 60-92% of the young subjects (Sricharan et al., 2012; Yusuf et al., 2004; Weinberger et al., 1987; Kanitz et al., 1996). The other conventional risk factors may not be so common in the younger population as shown in our study where smoking was present in 46.1% of the patients followed by a family history of CAD (19.1%), hypertension (14.6%), and diabetes (9%) (Yunyun et al., 2014; Pais et al., 1996). The relatively less prevalence of smoking in our cohorts maybe because of non-disclosure due to social reasons. Cigarette smoking accelerates CAD and also results in atherosclerotic plaque becoming more vulnerable to rupture and thrombosis as a result of the infiltration of inflammatory cells and the presence of tissue factor in atherosclerotic plaque (Shah, 2003). The data signifies that smoking cessation may

prevent most if not all of the MI occurring in young adults. To further this point one of the likely reasons for very few STEMI in young female patients as reported in our study and other studies mentioned above, may be relatively less prevalence of smoking among females in India. It may be an additional factor apart from the protective effects of estrogen in preventing atherosclerosis (Wenger et al., 1986). On the contrary, there are some studies, which report a strong association between smoking and MI even in young females (Dunn et al., 1999; Gramenzi et al., 1989).

Also, in our study, 28% of the patient were non-smoker, non-diabetic, and non-hypertensive and were not having any family history of CAD. These patients may be having dyslipidemia (we did not have data on lipid profile to evaluate) or other unknown risk factors (genetic) in isolation or combination responsible for an early acute coronary event. Add to it 19.1 % of patients had strong family history indicating genetic predisposition.

Regarding culprit vessel involved in young STEMI, in general, studies report LAD to be the most common but some studies also report RCA as the most common culprit vessels but universally it is the proximal segment of these vessels most commonly involved (Bhardwaj et al., 2014; Kern et al., 2013; Wang et al., 2004). In our study, LAD was the predominant culprit vessel, which was almost 5 times more commonly involved than RCA, which was the second most common vessel to be involved. Studies linking the propensity of atherosclerosis to a particular coronary arterial segment have established the role of wall shear stress (WSS) as a local mechanical factor responsible for atherogenesis. And it is the proximal left coronary artery (LCA) tree regions where atherosclerosis frequently occurs, as these are regions of low WSS, especially opposite flow dividers (Soulis et al., 2006). There are these "hot spots" within the proximal third of the coronary arteries especially in the LAD; acute coronary occlusions leading to STEMI tend to cluster predictably. The constant stretching, compression, bending, and flexion that occur with each cardiac cycle can cause weakening of the fibrous cap of an atherosclerotic lesion over time, leading to its failure (Wang et al., 2004; MacIsaac & Topol, 1993; Shah, 1996). Multiple mechanical and hemodynamic stresses in addition to the pro-thrombotic and pro-inflammatory effects of smoking may explain the clustering of thrombo-occlusive lesions in proximal LAD. Single vessel involvement was more common as expected but almost one-third of the cohorts had more than single vessel involved, indicating the systemic nature of the atherosclerotic process in at-risk young individuals.



In the era of primary PCI, in-hospital mortality is much lower than ever in history (Vasiljević et al., 2008; García-García et al., 2017). Studies have reported mortality as low as 2.51 % to 4.1 % in the general population of STEMI receiving primary PCI as the reperfusion strategy (García-García et al., 2017; Cretu et al., 2015). We recorded an in-hospital mortality of 2.25% (n=2) in young STEMI, slightly lower than what has been reported in the above studies in general. Both our mortalities were patients in cardiogenic shock owing to LM thrombosis. In the follow-up period, we did not record any further mortality, but CAD events were not so uncommon. 16.3% of patients during follow-up had a recurrence of angina and the majority presented as ACS needing repeat revascularization in 7% of the patients. It is assuring that we did not record further mortality but going by the fact that by being young, they have to live more life years at risk of repeated CAD events and possible death (Johansson et al., 2017).

Another positive aspect of our study was the evaluation of QOL and lifestyle measures inculcated after. This is often a neglected aspect in clinical studies as the usual emphasis is more on objective endpoints. We looked into this aspect and found that though the majority enjoy a good QOL, there is a significant population not returning to the same life as before. Further studies are needed to look into this aspect and to work on measures to improve QOL after MI. It was heartening to find that MI occurrence proves to be a sufficiently strong motivation for young patients to adopt a healthy lifestyle and even quit smoking.

There are limitations in our study like we do not have a control group; some of the data like ejection fraction, Killip status at presentation, and lipid profile were not available. And about 52% of the patients could not be followed up.

CONCLUSION

Despite the above-mentioned limitations, we can conclude that STEMI, particularly in young Indians, is predominantly a disease of the male population and LAD is the most common culprit vessel involved. It contributes to a significant proportion of the total STEMI burden. More than single vessel disease and/or complex lesion is not so uncommon in young Indian patients presenting as acute STEMI. Smoking is the most common risk factor but there may be a role of genetic or other unknown risk factors in isolation or combination responsible for an early acute coronary event. The prognostic outcome is generally excellent in terms of mortality but recurrent CAD events requiring repeat interventions are also not uncommon. Though the majority enjoy good QOL afterward, a significant population has some impairment in their QOL. It was noted in our study that one-fifth of our patients was ≤ 30 years, so we propose that screening for CAD and CAD risk factors should start very early, as early as 20 years old, particularly in Indians.

ABBREVIATIONS

STEMI: ST elevation myocardial infarction**;** MI: Myocardial infarction**;** CAD: Coronary artery disease**;** ACS: Acute coronary syndrome**;** TVD: Triple vessel disease**;** DVD: Double vessel disease**;** SVD: Single vessel disease**;** LM: Left main artery**;** LAD: Left anterior descending artery**;** LCX: Left circumflex**;** RCA: Right coronary artery**;** PCI: Percutaneous intervention**;** DES: Drug eluting stents**;** QOL: Quality of life

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