ORIGINAL ARTICLE

Study of Percutaneous Coronary Intervention in Patient with Coronary Artery Disease at Tertiary Care Teaching Hospital

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Abstract:

Background: The interventional treatment option for the coronary artery disease has recently gained popularity. This study was intended to elaborate Percutaneous Coronary Intervention (PCI) and coronary angiographic profile in patients with coronary artery disease. *Material & Methods:* This was a retrospective study conducted over one year period. The patients with significant Coronary Artery Disease (CAD) by angiogram were included in this study. The p value < 0.05 was considered as statistically significant. *Results:* Total 135 patients with CAD were enrolled with mean age of 59.65±10.32. Total 59.24% of males and 40.74% of females underwent Percutaneous Transluminal Coronary Angioplasty (PTCA) (p=0.00234). Total 67.40% of patients had hypertension, 48.75% of male patients had history of tobacco consumption, 27.5% of males and 21.81% of females had Type 2 Diabetes Mellitus (T2DM), 58.75% of males and 43.63% of females had dyslipidemia, 33.75% of males and 23.63% of females had obesity, 33.75% of males and 30.90% of females had metabolic syndrome. Total 41.25% of males and 45.45% of females had affection of Left Anterior Descending (LAD) (p=0.0207), 18.75% of males and 20% of females had Left Circumflex (LCx) lesion or Right Coronary Artery (RCA). Total 10% of males and 9.09% of females had LAD and LCX lesion. Total 7.5% of males and 9% of females had affection of LAD+ RCA. Among 22.5% of males and 16.36% of females received bare metal stents and 77.5% of males and 83.62% of females received drug eluting stents. The case fatality rate was 1.41%. *Conclusions:* Study highlights the burden of modifiable coronary artery disease risk factors like, hypertension, obesity and metabolic syndrome undergoing PTCA. Male patients outnumbered with most common coronary artery lesion being LAD. Our findings suggest that favorable outcomes, matching the international data can be achieved in a rural hospital setting.

Keywords: Coronary artery disease, PTCA, coronary angiogram, metabolic syndrome, Hypertension

Introduction:

The incidence of Coronary Artery Disease (CAD) has dramatically increased and is a leading cause of morbidity and mortality in India during the last three decades. The rate of coronary heart disease has raised from one per cent in 1960 to 14 per cent in 2011 among urban population of India. During the past 3 decades, CAD rates have doubled in India. The genetic predisposition and acquisition of traditional risk factors at a rapid rate as a result of urbanization seem to be the major cause. Despite tremendous advances in cardiac care the world over, more and more patients continue to die from heart diseases or live with significant

morbidity. The rate of coronary heart disease among Indians, particularly the youth, is almost twice as high as compared to Westerners [1]. The treatment of stable CAD (stable angina) includes anti-anginal medication, medication to modify atherosclerosis and aggressive treatment of causative risk factors. Those patients with stable CAD who have symptoms refractory to medical treatment usually require coronary angiography to be followed by either percutaneous or surgical revascularization. In 1980's, with advent of Percutaneous Transluminal Coronary Angioplasty (PTCA) and coronary artery stents in 1990's, there has been a shift towards less invasive modality for revascularization. The prevalence of CAD is increasing in India and there is an exponential need for interventional procedures. Percutaneous Coronary Interventions (PCI) directed at severely stenotic lesions are highly effective in relieving angina. The major interventional treatment options for CAD are PCI, which includes mainly Percutaneous Transluminal Coronary Angioplasty (PTCA), and Coronary Artery Bypass Graft (CABG) surgery. Current data show that more than 90% of PTCA procedures use stents [2, 3] So far there are few studies about CAD undergoing PTCA in India. The present study was aimed at finding out the demographic and angiographic profile of patients with coronary artery disease undergoing PCI.

Material and Methods:

This study based on case-paper analysis and was conducted over one year duration from January 2013 to December 2013. The patients with significant CAD by angiogram of both genders were included in this study. Detailed physical examination was done. The detailed history about risk factors and Electrocardiogram (ECG) of all patients was taken. *Inclusion criteria:* Patients known to have suffered myocardial infarction, having typical angina or ECG changes on exertion or having undergone coronary angioplasty or coronary artery bypass surgery were labeled to have CAD. *Exclusion criteria:* Patient with triple vessel disease requiring CABG, renal failure and patient not willing for the procedure were excluded from present study. Present study was approved by Ethical committee KIMS Karad. Written and informed consent from patient and relatives were obtained before enrolling patient in the study. Two dimensional transthoracic Echocardiography and Doppler examination was done after hospitalization to assess the global left ventricular function and any regional wall motion abnormality. *Coronary artery angiogram:* Angiographic assessment of coronary lesions was done by standard protocol. Coronary angiography in multiple views was performed by standard technique to judge both the extent and severity of disease. Significant CAD was considered to be present if at least 70% or more was severe reduction in the diameter of major epicardial coronary arteries i.e. Left Anterior Descending (LAD), Left Circumflex (LCx) or Right Coronary Artery (RCA) and their branches; or 50% or more Luminal Narrowing of the Left Main Coronary Artery (LMCA) was observed. Patients were classified as having Single-Vessel Disease (SVD) and Double-Vessel Disease (DVD) accordingly.

Presence of significant CAD in LMCA was classified as double vessel disease (DVD). Coronary angiography showing ≥ 50% stenosis in any of the coronary vessels was considered as CAD [4, 5] (Fig.1).

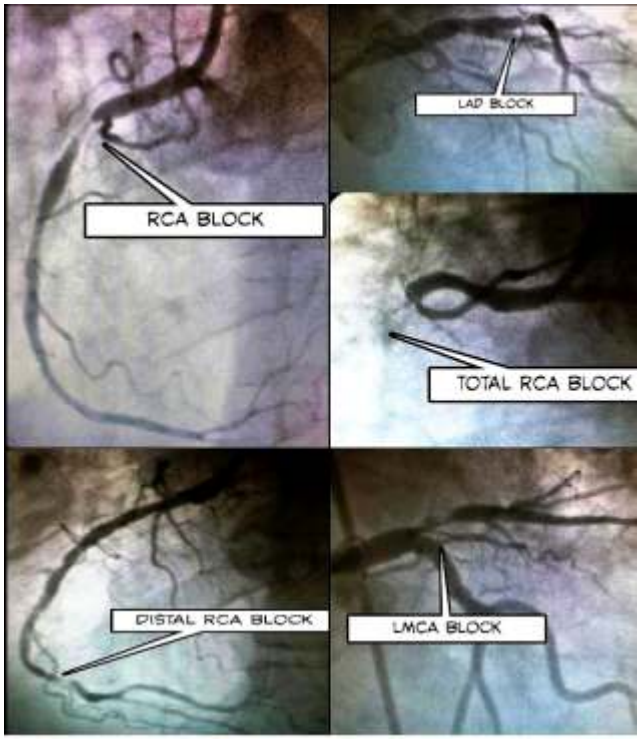

Fig.1: Various Anatomical Coronary Artery Lesions on Coronary Angiogram

Percutaneous Intervention (PCI) of the infarct-related artery was performed by using a variety of guiding catheters, guide wires and low-profile balloons. Fully trained cardiologists performed the procedures of PCI in the present cohort. The vast majority of interventions were performed via the radial artery. All patients received 5000–10,000 units of intravenous heparin, aspirin 300 mg and clopidogrel (loaded with 300–600 mg at the operator's discretion, followed by 75 mg per day). Coronary stenting, glycoprotein (GP) IIb/IIIa inhibitor and intracoronary nitroprusside and adenosine use were at the discretion of the operators. Stent size selection was primarily based on visual assessment of vessel size and lesion length. All patients received aspirin indefinitely and clopidogrel 75 mg daily for a minimum of 1 or 6 months for bare-metal and drug-eluting stents, respectively[5]. Metabolic syndrome was defined according to the new International Diabetes Federation (IDF) definition. According to the IDF, for a person to be defined as having Metabolic syndrome must have: Central obesity (defined as waist circumference ≥ 90 cm for South Asian men and ≥ 80 cm for South Asian women) plus any two of the following four factors [6]. Triglyceride (TG) level: >150 mg/dL (1.7 mmol/L), or specific treatment for this lipid abnormality; HDL cholesterol: <40 mg/dL (1.0 mmol/L) in males and <50 mg/dL (1.3 mmol/L) in females, or specific treatment for this lipid abnormality, blood pressure: systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg, or treatment of previously diagnosed hypertension, fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L), or previously diagnosed Type 2 Diabetes Mellitus (T2DM).

Statistical Analysis:

Clinical data, angiographic findings and type of PCI intervention was recorded in data entry sheet and analyzed by Statistical Software Package (SPSS) trial version, 14. Mean standard deviation, percentage and chi-square test. The 'p' value < 0.05 was considered as statistically significant.

Results:

Total 135 patients with CAD underwent PTCA with mean age of 59.65(±10.32). Of total 135 patients 80 (59.24%) were male patients with mean age 62.5 (±8.9) years and 55 (40.74%) female patients with mean age of 56.14 (±9.7) years underwent PTCA with predominance of male population (p=0.00234) (Table 1).

Table 1: Demographic Profile of Patients Undergoing PTCA

Patients	Mean Age ± S.D	Percent
Male (N=80)	62.50 ± 8.9	59.24
Female (N=55)	56.14 ± 9.7	40.74
Total (N=135)	59.65 ± 10.3	

**p=0.0023*

All procedures in the present study were done by radial artery route. Of total 135 patients with CAD undergoing PCI 91(67.40%) had hypertension as a risk factor for CAD. Of total 80 male patients who underwent PTCA for significant CAD, 57 (71.25%) had Hypertension (HTN) and of total of 55 female patients 34 (61.81%) had hypertension. There was no statistically significant difference in prevalence of HTN in male and female group (p=0.2506). Compared to all other risk factors for CAD, HTN was the most common and prevalent risk factor in both genders (p <0.001). Of total 135 patients with CAD 45(33.33%) had history of tobacco consumption as a risk factor for CAD. Of total 80 male patients who underwent PTCA for significant CAD 39 (48.75%) had history of tobacco consumption as compared to 6 (10.90%) out of 55 female patients. Tobacco consumption was the most significant risk factor in male population compared to female population in present study (p<0.001). Total 22(27.5%) male and 12 (21.81%) females had T2DM as a risk factor for CAD (p=0.4548). Total 47(58.75%) male and 24(43.63%) females had dyslipidemia as a risk factor for CAD (p=0.083). Total 27(33.75%) male and 13(23.63%) females had obesity as a risk factor for CAD (p=0.206). Total 11(13.75%) male and 7(12.72%) females had family history as a risk factor for CAD (p=0.8636). Total 34(42.5%) male and 13(23.63%) females had sedentary life style as a risk factor for CAD (p=0.02378). Total 27(33.75%) male and 17(30.90%) females had metabolic syndrome (MeTS) as a risk factor for CAD (p=0.7293) (Table 2) (Fig.2).

Table 2: Conventional Risk Factor Profile in Patients Undergoing PTCA

Variable	Male	Percent	Female	Percent	Total	Percent	p value
Hypertension	57	71.25	34	61.81	91	67.40	0.2506
Tobacco	39	48.75	6	10.90	45	33.33	<0.001
Diabetes mellitus	22	27.5	12	21.81	34	25.18	0.4548
Dyslipidemia	47	58.75	24	43.63	71	52.59	0.083
Obesity	27	33.75	13	23.63	40	29.62	0.206
Family history	11	13.75	7	12.72	18	13.33	0.8636
Sedentary Life style	34	42.5	13	23.63	47	34.81	0.0237
METS	27	33.75	17	30.90	44	32.59	0.7293

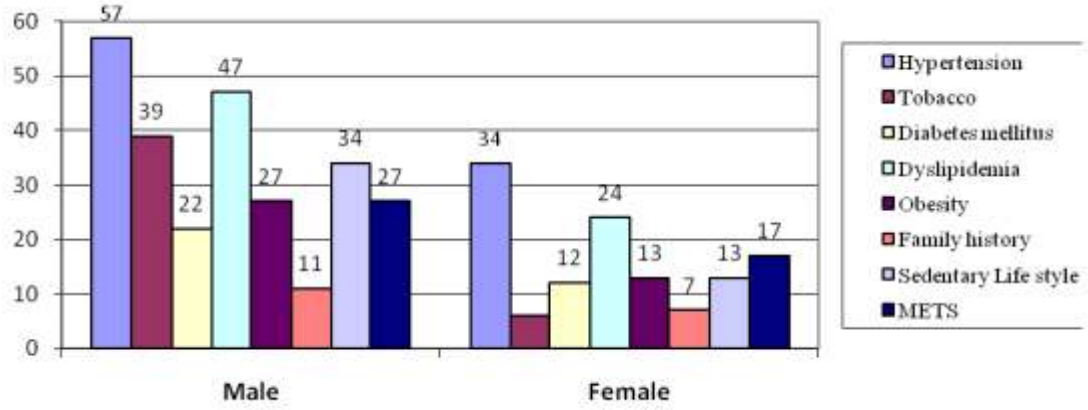

Fig.2: Conventional Risk Factor Profile in Patients Undergoing PTCA

Gender wise distribution of affected epicardial vessel is given in Table 3. There was no statistically significant difference in SVD or DVD affection among the two genders. LAD was most common vessel involved either SVD or in combination with other arteries. (Table 3) (Fig. 3).

Table 3: Showing Distribution Various Epicardial Vessels Involved on Coronary Angiography

	CAD lesion	Male (N=80)	Mean ± SD Age	Percent	Female (N=55)	Mean ±SD Age	Percent	Total	P value
1	**LAD(S) [p=0.0207]**	33	57.82 ±10.45	41.25	25	56.12 ± 9.76	45.45	58	0.627
2	**LCX (S)**	15	59.53 ±11.87	18.75	11	62.0 ± 9.65	20	26	0.856
3	**RCA (S)**	9	55.33 ±8.78	11.25	8	53.85 ± 11.98	14.54	17	0.570
4	**LAD +LCX (D)**	8	59.44 ±13.19	10	5	55.27 ± 9.07	9.099	13	0.860
5	**LAD+ RCA (D)**	6	64.12 ±12.14	7.5	3	59.54 ± 8.79	5.45	9	0.639
6	**RCA+LCX (D)**	6	61.40 ±11.67	7.5	2	63.0 ± 11.5	3.63	8	0.350
7	**LMCA+RCA(D)**	3	64.12 ±9.23	3.75	1	57.0	1.81	4	0.504
	Total	80	62.34 ±52.33	100	55	58.45 ± 65.0	100	135	

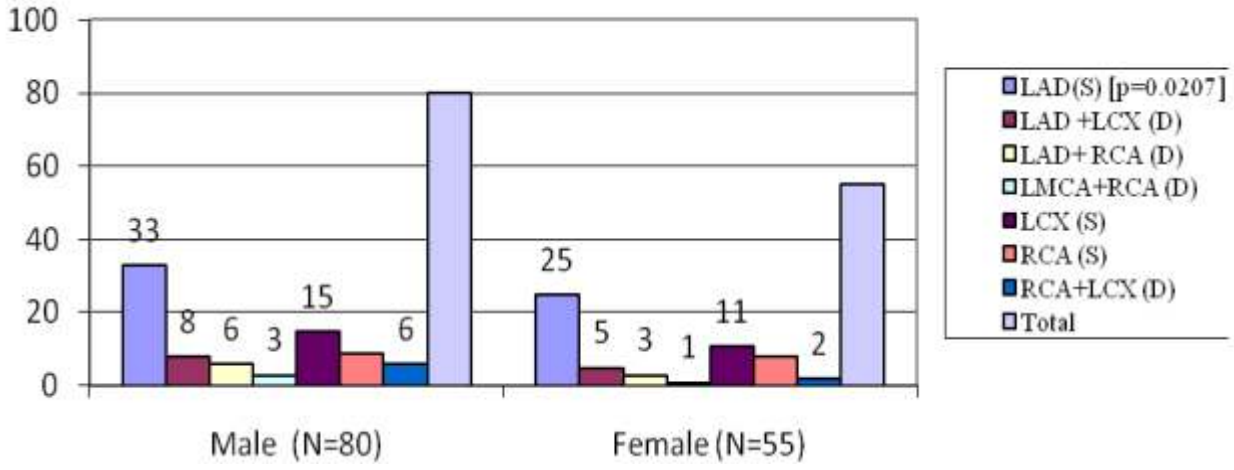

Fig.3: Distribution Various Epicardial Vessels Involved on Coronary Angiography

Table 4: Age Wise Frequency Distribution of Various Coronary Arteries Involved in Males and Females

Age group	LAD(S)		LAD+ LCX (D)		LAD+ LCX (D)		LMCA+ RCA (D)		LCX(S)		RCA (S)		RCA+ LCX (D)		Total	
years	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
40-45	5	3	1	1	0	0	0	0	2	2	2	2	1	0	11	8
46-50	7	4	1	1	1	1	0	0	3	2	1	1	1	0	14	9
51-55	5	4	2	1	1	0	1	0	2	1	1	1	0	1	12	8
56-60	7	5	1	0	2	0	1	1	3	3	2	1	1	0	17	10
61-65	5	4	1	2	2	1	1	0	3	1	2	3	1	1	15	12
66-70	4	5	2			1	0	0	2	2	1	0	2	0	11	8
Total	**33**	**25**	**8**	**5**	**6**	**3**	**3**	**1**	**15**	**11**	**9**	**8**	**6**	**2**	**80**	**55**

The frequency distribution for different age groups with various vessels involved in angiography is shown in Table 4. In total of 18(22.5%) males and 9(16.36%) females during PTCA bare metal stent (BMS) was used. Total 64(77.5%) males and 46(83.62%) females during PTCA drug eluting stent (DES) was used (Table 4). Total 133 patients were discharged within one week of PTCA and one male and one female patient succumbed within 48 hours of PTCA with double vessel disease with a case fatality rate of 1.41%. Single ('p'=0.0207) [LAD (S), LCX (S) and RCA (S)] as well as double vessel [LAD + LCX (D), LAD+ RCA (D), LMCA + RCA (D) and RCA+LCX (D)] diseases were significantly more in patients with age ≥ 45 years in both gender with 'p' <0.0045 (male: 'p' < 0.0023; female: <0.0042). (Table 6) (Fig. 4).

Table 5: Interventional, Angiographic Disease and Outcome Profile of Patients Undergoing PTCA

Variable	Male (N=80)	Percent	Female (N=55)	Percent	Total (N=135)
BMS (n=25)	18	22.5	9	16.36	27
DES (n=110) [p <0.001]	64	77.5	46	83.62	110
SVD (n=101) [p <0.001]	57	56.43	44	43.56	101
DVS (n= 34)	23	67.64	11	32.35	34
Single stent (n=101) p<0.002	57	56.43	44	43.56	101
Double stent : (n= 34)	23	67.64	11	32.35	34

Bare Metal Stent (BMS), Drug Eluting Stent (DES), Double Vessel Diseases (DVD), Single Vessel Diseases (SVD)

Table 6: Angiographic Lesion in Patients with Age < 45 and ≥ 45 Years

Coronary artery lesion	Male <45	Percent	Male ≥ 45	Percent	Female <45	Percent	Female ≥ 45	Percent	Total	Percent
'p'	< 0.0023			<0.0042		<0.0045				
LAD(S) [p=0.0207]	5	15.15	28	84.84	3	12	22	88	58	42.96
LAD+LCX (D)	1	12.5	7	87.5	1	20	4	80	13	9.62
LAD+RCA (D)	0	0	6	100	0	0	3	100	9	6.66
LMCA+RCA (D)	0	0	3	100	0	0	1	100	4	2.96
LCX(S)	2	13.33	13	86.66	2	18.18	9	81.81	26	19.25
RCA (S)	2	22.22	7	77.77	2	25	6	75	17	12.59
RCA+LCX (D)	1	16.66	5	83.33	0	0	2	100	8	5.92
Total	11	13.75	69	86.25	8	14.54	47	85.45	135	100

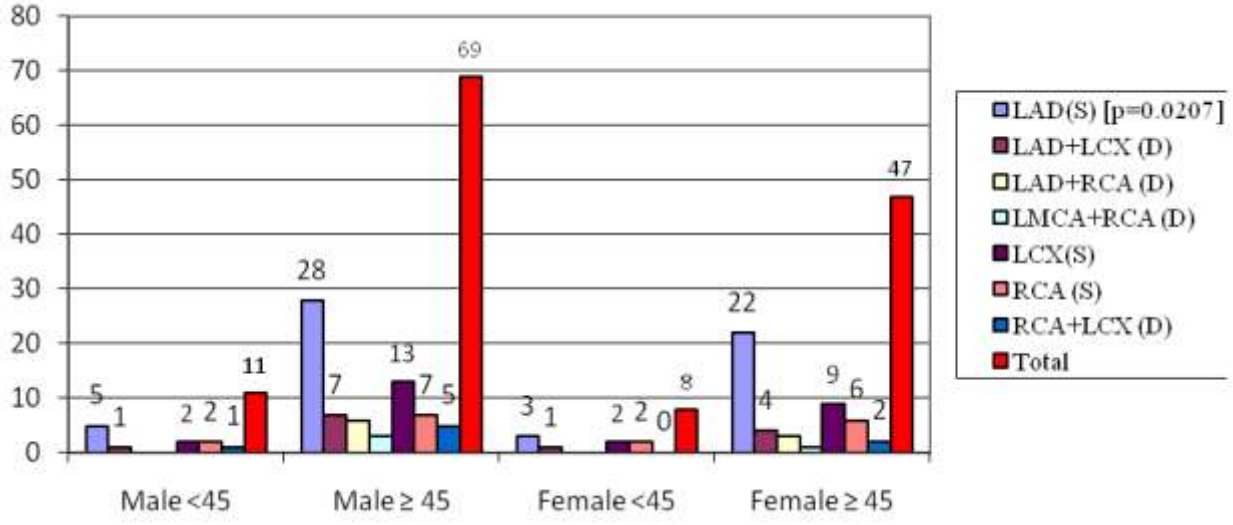

Fig.4: Age Distribution of Angiographic Lesion in Patients

Discussion:

In the last two decades, there is a revolutionary change in the treatment of coronary artery disease. Through advances in equipment and technical skills, percutaneous coronary intervention (PCI) is being applied to increasingly more complex patients and lesions. In particular, coronary stenting has emerged as an effective strategy to prevent recurrence after PCI. However, restenosis in the stented segment remained a major issue in coronary stenting. The recent introduction of Drug-Eluting Stents (DES) has dramatically reduced restenosis rates compared with Bare Metal Stent (BMS) use. As a result, there has been a very rapid worldwide shift in the treatment of coronary stenosis from BMS to DES, including in most Asian countries. The prevalence of coronary artery disease has increased considerably in Asian countries over the past several decades as a result of shifts toward a more "westernized" lifestyle [7]. We have compared results of our data of CAD patients undergoing PTCA with various studies from India and overseas (Table 7).

Table 7: Salient Features of Various Studies of PCI and Comparison with Present Study

Study year	Age [mean/SD and gender	Vessel involved	Modifiable CAD Risk factors	Non-modifiable CAD risk factors	Stent used DES/BMS	Success of PTCA	Mortality
Sharma *et al* [1](1990)	NM	LAD	NM	NM	NM	NM	NM
Dave *et al* [3] (1991)	NM	SVD	HTN: 52.9 %, DM: 44.3 %, Obesity: 58.3 %	NM	NM	NM	NM
Uddin *et al* [15](2004)	NM	NM	DM, HTN, smoking dyslipidemia	Family history	NM	NM	NM
Gera *et al* [11] (2004)	M:74%; F:26% [52.3 ± 6.8]	SVD:85% DVD:14%	HTN,DM, Smoker	NM	NM	NM	3.6%
Tewari *et al* [4](2005) younger	NM	SVD	Dyslipidemia Smoking	<45 year	NM	NM	NM
Chen *et al* [14] (2007)	NM	NM	NM	NM	NM	99.2%	10.7%,
Xavier *et al* [8](2008)	57.5 ±12.1	NM	DM:30.4% HTN: 37.7% smokers: 40.2%	NM	NM	NM	NM
Shaikh *et al* [9](2009)	M:80%; F:20% 55.4 ± 11.7	LAD:55.7%	DM:38.5% HTN:57%	>45 years	NM	97%.	NM
Koh *et al* [13] (2011)	NM	NM	NM	NM	NM	NM	11.4%

Sriharibabu *et al* [19] (2012)	NM	SVD: 38.4% DVD: 47.6%	DM, HTN, overweight/obesity: 28% [MeTS]				
Rajasekhar *et al* [10] (2013)	54.5 ± 11.5	NM	NM	NM	NM	NM	3.6%
Ramakrishnan e*t al* [16] (2013)	< 40: 13.6%; Male :74.1%	SVD 66.7% Multi-vessel:30.5% LAD 49.1%	NM	> 45 years	81.1% DES	NM	0.92%.
Prasad *et al* [12] (2014)	NM	NM	NM	NM	NM	NM	1.41%
Ashwal A *et al* [20] (2015)	35.3 year mean, 93% male	SVD [70.1%]	DM, HTN	>45	NM	NM	NM
Present study	Male: 62.50 ± 8.9, Female: 56.14 ± 9.7, *p=0.0023*	SVD LAD(S), Male: 41.25%, Female:45.45 %, SVD:n=101, DVS: n= 34	HTN: 67.40%, Tobacco: 33.33%, DM: 25.18%, Dyslipidemia:52.59%, Obesity:29.62%, Sedentary Life style: 34.81%, MeTS: 32.59%	Age>45years Family history: 13.33%, Male: 59.24%	DES: n=110, BMS : n=25 [p <0.001]	100%	1.41%

NM: Not Mentioned, HTN: Hypertension, DM: Diabetes Mellitus, SVD: Single Vessel Disease, DVD: Double Vessel Disease

In our study majority of population was ≥ 45 years, with LAD [SVD] was most common single vessel involved in both genders. Similarly Sharma *et al* have analyzed <40 and >40 years groups and found that, LAD coronary artery was the most frequently involved vessel in both the groups [1]. Similar findings have been reported by various studies [3, 4, 9, 11, 15, 16, 19, 20]. Current study highlights the burden of modifiable coronary artery disease (CAD) risk factors. Hypertension has been the most prevalent risk factor in both genders (male: 71.25% and female: 67.40%). Substantial numbers of patients have DM (25.18%), tobacco consumption (33.33%), dyslipidemia (52.59%) obesity (M: 33.75%, F: 23.63%), metabolic syndrome (M: 33.75%, F: 30.90%) and sedentary habits (M: 42.5%, F: 23.63%) undergoing PTCA. These coronary artery disease risk factor are reported by various researchers. [3, 4, 8, 9, 11]. In present study single vessel was more often affected in age less than 45 years. Similarly Tewari *et al* have reported, single vessel involvement more commonly in younger age group. The younger cohort had more atherogenic lipid profile, higher prevalence of smoking and more frequent single vessel disease [4]. Xavier *et al* have reported mean age of CAD patients was 57.5 (SD 12.1) years [8]. Similarly in

our cohort majority of patients undergoing PTCA have been age of ≥ 45 years (M: 86.25%; F: 85.45%) with mean age of 62.5 (±8.9) years in male and 56.14 (±9.7) in females. In current study HTN has been the most prevalent CAD risk factor in both group (p <0.001) affecting commonly LAD (p=0.0207). One male and one female patient succumbed within 48 hour of PTCA with double vessel disease with case fatality rate of 1.41%. Similarly Shaikh *et al* have reported procedural success of 97% and 5.8% case fatality rate with mean age of 55.4 ± 11.7 years predominated by male population. [9]. Rajasekhar *et al* have reported PTCA patients with in-hospital mortality of 20 (3.6%) [10]. In our study DES was used in majority *(*64 male and 46 female) of the patients with 100% success rate, while Gera et al used BMS stent in all patients with a failure rate of 3% [11]. At our set up we did On-time in 123 (91.11%) patients and primary PTCA was done in off-time (primary PTCA) in 12 (8.88%) patients. Siva Prasad *et al* stated that, the results of Off-time and On-time primary PCI are well comparable and Off-time PCI is as safe as On-time PCI despite of various limitations[12]. We have observed 1.41% overall case fatality rate which significantly less than reported by Koh *et al* (11.4%) [13]. Chen *et al* quoted in-hospital mortality rate of 10.7%, which is high compared to our case fatality rate of 1.41% [14]. In the present cohort the success rate of PTCA was 98.6 % similarly Chen *et al* have quoted success rate of 99.2% in PTCA [14]. Similar to our findings Uddin *et al* have studied with age < 40 year and > 40 year patient with coronary artery disease and found that, older patients have more diabetes and hypertension (*modifiable risk factor*) and younger patients have been with family history of premature coronary artery disease (*non-modifiable*) with similar incidence of smoking and dyslipidemia (modifiable) [15]. Similar to our demographic and coronary artery vessel involvement, Ramakrishnan *et al* have quoted 13.6% PTCA in patients with age < 40 years and predominated by male patients with 2/3rd had single vessel disease (66.7%) affecting LAD. Similar to our study, Ramakrishnan *et al* have used total 81.1% drug eluting stents (DES) with very low in-hospital mortality of 0.92% [16]. In our study majority of patients received drug-eluting stents which are more than other studies [*17, 18].* Sriharibabu *et al* and Ashwal *et al* have quoted similar demographic, risk factor and vessel affection distribution to our study [19, 20]. Salient features of various studies on PCI with their comparison with present study are shown in table 7. Primary PCI as a preferred method of reperfusion strategy needs to be practiced more often in our part of the world. Over the last several years, the field of interventional cardiology has demonstrated the superiority of primary PCI over thrombolytic therapy in the management of acute STEMI. Lack of primary PCI facility and capability in majority of centres globally in general and in India in particular is a major drawback. It is also a more expensive therapeutic strategy. There are infrastructures constraints in developing country, non availability of PCI facility round the clock, and some centres may not be achieving the ideal door to balloon time or first medical contact to balloon time are the major limitations for PCI. Another major constrain and

limitations is the distance to travel from non-PCI capable centre to PCI-capable centre. The management of Acute Coronary Syndrome (ACS) should focus on rapid diagnosis, risk stratification, and institution of therapies that restore coronary blood flow and reduce myocardial ischemia.

Conclusions:

Current study highlights the burden of modifiable Coronary Artery Disease (CAD) risk factors, and urgent steps are to be taken to adopt healthy life style and to control risk factors. In the present study on CAD, male patients have outnumbered with age ≥ 45 years in both genders. Hypertension has been the most prevalent risk factor in both genders. Substantial numbers of patients had obesity, metabolic syndrome and sedentary habits undergoing PTCA. The success rate of PTCA was significantly good with very low case fatality rate. The most common coronary artery lesion in both genders was LAD. The increase in disease and availability of facilities has resulted in dramatic change prevalence from only medical treatment to invasive treatment including PCI. Our findings suggest that favorable outcomes, matching the international data can be achieved in our patients with PTCA in a rural hospital setting, despite all associated limitations.

Limitations of the study:

The sample size is relatively small, and large periodic studies are needed to validate these results. The present study has highlighted the only significant CAD undergoing PTCA and not all patients with CAD.

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