Research Article

Prevalence, Assessment and Clinical Outcome in Cardiovascular Disease: Impact of Gender Disparities

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Abstract

Epidemiologic and clinical research suggests important gender-related differences in the prevalence, presentation, management and outcomes of Coronary Heart Disease (CHD) patients. Adequate data is not documented for Indian population where prevalence of CHD is high. An observational, single-centric, study was conducted from January 2008 to December 2010 on 10450 consecutive patients visiting a tertiary care centre, Ahmedabad, Gujarat, India with complains related to cardiovascular disease. Of these 6867 patients had CHD as confirmed by angiographic investigations. Treatment options were Coronary Artery Bypass Grafting (CABG)/Percutaneous Transluminal Angioplasty (PTCA)/medical therapy as per cardiologist's discretion and patient's choice. Among 6867 patients, 5678 were males while 1189 were females with a mean age of 57.02±11.79 and 56.24±11.76 years ($p = 0.01$), respectively. As compared to males, females had higher prevalence of hypertension, diabetes, obesity and family history of CHD ($p<0.01$), while males had higher prevalence of smoking ($p<0.0001$). CHD was more prevalent in post-menopausal women as compared to pre-menopausal women ($p<0.0001$).Invasive treatment options like CABG (12.42% vs. 18.45%, $p<0.0001$) and PTCA (40.73% vs. 45.04%, $p=0.001$) were used less often to treat females (vs. males), where medical therapy (46.83% vs. 36.49%, $p<0.0001$) was the preferred treatment option irrespective of the contributing risk factors/extent of CHD. Clinical outcomes were worse in females as compared to male CHD patients at 3 years follow up. Major gender-related differences in contributing risk factors and treatment options prevail in Indian CHD patients.

Keywords: Coronary heart disease; Risk factors; Gender difference

Abbreviations

CHD: Coronary Heart Disease; CABG: Coronary Artery Bypass Grafting; PTCA: Percutaneous Transluminal Angioplasty; ACS: Acute Coronary Syndrome; MACE: Major Adverse Cardiac Event; BP: Blood Pressure

Introduction

In 2020, 2.6 million Indians are predicted to die of Coronary Heart Disease (CHD) which will constitute 54% of all cardiovascular disease deaths [1]. According to the recent update of American Heart Association guidelines (2011), disparities in CHD presentation and management relate to variability's in presentation, health beliefs, cultural values and preferences, and patients' inability to communicate symptoms in a language other than their own, among other factors [2]. Lacks of recognition of CHD in women because of differences in clinical presentation are of particular relevance, because it contributes significantly to delay improper diagnosis, inadequate treatment and adverse outcomes [3]. For example, women are twice as likely to die of a myocardial infarction [4] and have a less favorable long-term survival as compared with men. Further, it has been suggested that women have smaller coronary arteries than men, and are twice as likely to die as a result from Coronary Artery Bypass Surgery (CABG) and are more likely to need repeat revascularization [5]. Gender differences among patients with Acute Coronary Syndrome (ACS) are fueled by beliefs that biological differences influence the pathogenesis of CHD and patients' response to medical therapies. It appears that women present with CHD in general about 10 years later than men, but after menopause the prevalence and mortality from CHD increase and overall rates become similar to men [6].

Despite the substantial risk of developing or dying from CHD, studies reveal that women with CHD or risk factors are less likely than men to receive recommended therapies [7]. Gender differences in the management of ACS with invasive strategy have been described in both observational and randomized clinical studies [8,9]. It has been suggested that women are less likely to undergo reperfusion therapy when they present with ACS [10]. It has also been shown that women receive cardiac procedures such as cardiac catheterization, Percutaneous Transluminal Coronary Angioplasty (PTCA) and CABG less than men [11-15].

There is lack of data on gender disparity with regard to CHD in India. Western states of India viz. Gujarat, Maharashtra and Rajasthan are economically advanced with high family earnings, socioeconomic status and education as compared to other Indian states. This study was designed to determine gender differences in CHD risk factors, and most importantly in the treatment options availed by men and women presenting with CHD in a tertiary care hospital.

Methods

This was an observational study enrolling consecutive 6867 cardiovascular disease patients out of 10450 patients of either gender

Table 1: Patient characteristics, vitals and associated risk factors.

Variables	Males N(%)	Females N(%)	Total N(%)
No. of subjects	5678(82.69)	1189(13.31)	6867(100)
Subjects less than age 50 years	1631(28.72)	303(24.43)	1934(28.16)
Subjects more than age 50 years	4047(71.27)	886(74.56)	4933(71.83)
Age(years: mean ± SD)	57.02±11.79	56.24±11.76	56.63±11.77
BMI (kg/m²)			
Normal(20-25)	4187(73.62) 906 (76.19)	5093 (74.16)	
Overweight (25-29.9)	1143 (20.09)	180 (15.13)	1323 (19.26)
Obese (≥ 30)	348 (6.11)	103(8.66) §	451 (6.56)
Vitals (mean ± SD)			
Pulse (b/min)	73.32±10.72	75.79±10.69	74.56±10.7
Systolic BP (mm Hg)	122.24±18.08	124.82±18.38	123.53±18.2
Diastolic BP (mm Hg)	75.71±9.64	75.06±10.3	75.39±9.97
Risk factors			
Hypertension	1971 (34.69%)	492 (41.38%)‡	2463 (35.85%)
Diabetes	1473 (25.93%)	331 (27.84%)‡	1804 (26.26%)
Family-History-of-Early-onset-CHD	708 (12.46%)	120 (10.09%)	828 (12.05%)
Smoking	985 (17.34%)¶	5 (0.96%)	990 (14.40%)

¶ $p < 0.0001$; § $p < 0.001$; ‡ $p < 0.05$.

Abbreviations: CHD: Coronary Heart Disease; BP: Blood Pressure

(age >18 years; pregnant/lactating women were excluded) visiting a tertiary centre in Gujarat, India from January 2008 to December 2010.Study evaluation criteria included gender based demographic data, risk factors like hypertension, diabetes, obesity, family history and smoking and vital signs. Data were collected of the treatment option (PTCA,CABG,medical therapy)undertaken. Primary clinical outcome measures were death, Major adverse cardiac event (MACE),revascularization and rehospitalization at 3 years. The protocol was approved by an independent ethics committee (Reg. #: ECR/206/Inst/GJ/2013) and written consent was taken for enrolled subjects.

For statistical analysis, continuous variables including age are presented as mean±SD. The categorical data, including CHD risk factors, coronary procedures performed and clinical outcomes are presented by frequency and percentage of patients. Statistical methods used for analysis were t- test, chi-square test and p value <0.05 was considered statistically significant. All analysis was performed using graph pad prism version 5.04.

Results

A total of 10,450 consecutive subjects visited the centre with complaints related to CHD. Of these 6867 depicted CHD (males: 5681(82.69%); females:1189 (13.31%)) as confirmed by coronary angiography and other investigations. Prevalence of hypertension, diabetes, obesity and family history of CHD were higher in female CHD patients as compared to male patients with similar average mean age. Table 1 depicts patient characteristics, vitals and associated risk factors.

Patient characteristics in Post-menopausal women

Amongst women (n=1189) prevalence of CHD was higher in post-menopausal women (n=764) as compared to pre-menopausal women (n=425) with higher prevalence of hypertension (32.7%vs. 6.2%, $p<0.0001$), diabetes (21.7% vs. 4.5%, $p<0.0001$), obesity (13.5% vs. 4.0%, $p<0.0001$), and associated family history of CHD (5.8% vs. 0.2%, $p<0.0001$) (Figure 1).

Treatment options

Although treatment options were recommended by cardiologists, patient's opinion contributed significantly to treatment selection which was significantly influenced by the treatment expenses. Patients underwent CABG (20.19%), PTCA (35.54%) or medical therapy (44.25%). Male patients underwent CABG (21.72% vs. 12.87% female patients), or PTCA (37.11% vs. 28.09 %,) more often as compared to female patients. A higher percentage of female patients (59.04% vs. 41.17%, $p<0.0001$) received medical therapy (Table 2).

Clinical outcomes

Primary clinical outcome measures were death, Major adverse cardiac event (MACE), revascularization and hospitalization at 3 years. Female patients exhibited higher death (p<0.05)and MACE

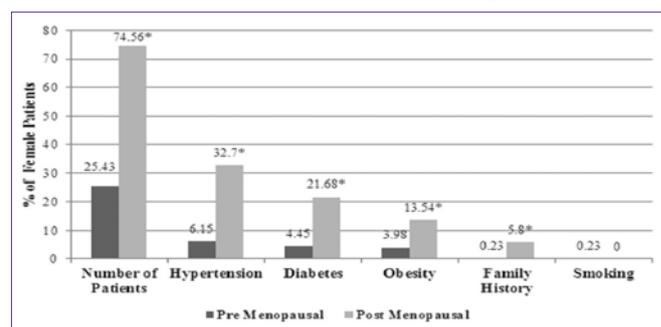**Figure 1:** Characteristics in post menopausal women.

Table 2: Treatment undertaken by CHD patients.

Treatment undertaken	Males N=5678	Females N=1189	Total N=6867	pvalue
CABG	1234 (21.72%)	153 (12.87%)	1387(20.19)	0.014
PTCA	2107 (37.11%)	334 (28.09%)	2441(35.54)	0.0017
Medical Therapy	2337 (41.17%)	702 (59.04%)	3039(44.25)	<0.0001

Abbreviations: CHD: Coronary Heart Disease; CABG: Coronary Artery Bypass Grafting; PTCA = Percutaneous Transluminal Angioplasty

Table 3: Clinical outcomes at 3 years.

Outcome measures	MalesN(%)	FemalesN(%)	TotalN(%)
Death	308(5.43)	86(7.26)	394(5.73)
MACE	220(3.88)	55(4.63)	275(4.0)
Revascularization	82(1.44)	18(1.53)	100(1.45)
Rehospitalization	226(3.99)	30(2.53)	256(3.73)

Abbreviation: MACE: Major adverse cardiac event

percentage as compared to males, although rates of hospitalization were higher in males as compared to females (Table 3).

Discussion

Numerous studies have examined gender difference in presentation, diagnosis, treatment and outcome among patients with ACS [16,17]. However, there are only few studies on gender disparity in the prevention, treatment and management of CHD in India .In the present study conducted on 10,450 consecutive patients, number of male patients visiting the centre were higher compared to females (83.7% vs. 16.3%,$p<0.0001$) a phenomena relating to under representation of females for health care. This observation is similar to the INTERHEART study conducted in 52 countries, including India, wherein 76% of enrolled patients were males [18]. It is known that when female patients present with chest pain, they are more likely to complain of vague symptoms as compared to male patients [19]. This difference may account for fewer female patients being referred to cardiologists for subsequent diagnostic procedures and therapeutic recommendations [20]. This under-referral of female patients for stress testing and coronary angiography has been shown in patients presenting with stable angina [21] or ACS [22].

In the present study, prevalence of risk factors, including hypertension, diabetes, obesity and smoking contributed to CHD. These data are again similar to the results of the INTERHEART study that showed smoking, lipids, hypertension, diabetes and obesity account for about 80% of the population-attributable risk for acute myocardial infarction in almost all countries [18]. In the present study, hypertension, diabetes and family history were more prevalent in female patients, unlike smoking which was much higher in male patients. It is unclear whether menopause associated higher prevalence of CAD would eventually result in an incidental death in women [23]. In the present study, prevalence of CHD was higher in post-menopausal women with higher percentage of contributing risk factors.

Amongst treatment options, interventional expensive options including CABG and PTCA were opted more often in male patients as compared to female patients where medical therapy was the preferred treatment option. These results are in concordance with the report that compared to men, high-risk women with ACS undergo less coronary angiography, angioplasty, and CABG surgery [22]. GRACE

registry also showed that women were less likely to undergo PTCA (65% vs. 68%, *P<0.001*) [16]. This preferred treatment with CABG and PCI in men most likely represents a societal bias for aggressive therapy in favor of men, perhaps because they are often the bread winners and decision makers.

In the Euro Heart Study, women with chronic stable angina and proven coronary artery disease had a twofold greater risk of death or myocardial infarction compared to men [23]. Clinical outcome of Indian female CHD patients are worse as compared to their male counterparts as revealed by a higher percentage of death and MACE in the present study.

Study limitations

The results are of a single centre study. Socioeconomic and educational status of the subjects were not accounted, which are important parameters affecting treatment options. Cost effectiveness of the study was not analyzed and clinical outcomes were not analyzed as per the treatment option availed by the patients.

Conclusion

Gender related differences with regard to extent of coronary artery disease and subsequent treatment options prevail in Indian CHD patients. Expensive treatment like CABG and PTCA are opted more often in males as compared to females were medical therapy appears to be the preferred option irrespective of the contributing/confounding factors. Clinical outcome in terms of death and MACE are higher in female CHD patients as compared to males. Further studies relating the treatment option with readmission or ongoing angina or mortality at large would aid in defining guidelines for Indian patients.

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