Prevalence, Treatment, and Control of Chest Pain Syndromes and Associated Risk Factors in Hypertensive Patients

Katharine H. Hendrix, Susan Mayhan, Daniel T. Lackland, and Brent M. Egan

Background: Prevalence of chest pain syndromes (CPS)—chest pain, angina pectoris, chronic angina, and preinfarction angina/intermediate coronary syndrome (ICS)—among hypertensive patients and medical management of these disorders in primary care are not well defined.

Methods: The Hypertension Initiative primary care database with 72,508 hypertensives was analyzed to characterize prevalence and management of CPS. Patients with more than one CPS were categorized by the most severe diagnosis.

Results: Eleven percent of hypertensives had a CPS. Of these patients, 66% (5284) were diagnosed with chest pain only, 15% (1204) with angina, and 19% (1508) with ICS. More men than women were diagnosed with angina (18% v 4%) and ICS (21% v 10%). More women than men were diagnosed with chest pain only (86% v 61%). African Americans received more chest pain diagnoses (18% v 4%), similar angina diagnoses (14% v 16%), and slightly fewer ICS diagnoses (15% v 22%) than whites. Most striking, women and African Americans with CPS received fewer medications than men and whites, both overall and within diagnostic categories. Prescription rates differed more by gender (male/female) than by ethnic group (white/African American) for angiotensin-converting enzyme inhibitor, diuretics, aspirin, statins, and nitrates. Hypertensives with CPS received more medications and achieved better risk factor control than non-CPS hypertensives, but the majority remained above goal levels.

Conclusions: Primary care physicians treat cardiovascular risk factors relatively aggressively in hypertensives with CPS. However, substantial numbers of these patients do not reach goal levels. Demographic differences in treatment represent opportunities to reduce disparities. Am J Hypertens 2005;18:1026 –1032 © 2005 American Journal of Hypertension, Ltd.

Key Words: Hypertension, chest pain, cardiovascular risk, disparity.

Coronary heart disease is the single leading cause of death in both men and women in the United States. Chronic angina is the most common manifestation of this disease and affects an estimated 6,800,000 American adults. Although ~30% of patients with sudden onset angina experience spontaneous remission or become asymptomatic with treatment, 7% have a nonfatal myocardial infarction (MI) in the first year and 4% die. Patients with chronic angina, compared to an age-matched cohort, are at threefold increased risk of developing unstable angina, MI, or sudden cardiac death within 2 years of presentation. Even with standard therapy, patients experience an average of two episodes of chest pain per week and 62% describe their quality of life as fair or poor.

Studies find demographic differences in the diagnosis and treatment of patients with coronary heart disease. One study found ethnicity and gender influence how primary care physicians manage chest pain patients with African Americans and women receiving the fewest treatments and interventions. Although angina is reportedly more common in women than men (4.3% v 2.7%), chest pain among women may not be fully investigated leaving their angina undiagnosed for longer periods.
Case identification in primary care is generally difficult as, after examination, many patients presenting with chest pain do not meet diagnostic criteria for ischemic heart disease. Failure to adequately diagnose angina among women is particularly alarming, as chest pain more often precedes MI in women than in men and the fatality rate for acute MI in women is greater than in men (32% vs 27%).

Recent data from the prospective, randomized, multicenter Trial of Invasive Versus Medical Therapy in Elderly patients found significantly worse outcomes among women than men with chronic angina. In the 6-month outcome period, more women experienced MI than men (11% vs 7%) and both death from all causes and death from MI were higher in women than in men (9.9% vs 3.5% and 19% vs 9%). This study also found that antiangina therapy in patients ≥75 years old was similarly effective for reducing chest pain and improving quality of life in men and women.

Most previous studies have focused only on patients with angina (angina pectoris or chronic angina). This research included other chest pain syndrome (CPS) diagnoses such as chest pain and acute coronary syndrome. These broader criteria capture a larger patient pool, possibly more accurately representing patients at high risk for adverse cardiovascular events. Because some chest pain diagnoses do not arise from cardiovascular causes, patients within each diagnostic category are compared by gender and ethnicity to illuminate differences in treatment and cardiovascular risk factor control by diagnostic group.

The prevalence and primary care management of CPS (ie, chest pain, angina pectoris, chronic angina, and intermediate coronary syndrome [ICS] or preinfarction angina) among hypertensive patients is not well studied. The purpose of the current study is to address this gap in the literature and to examine the potential impact of demographic factors on cardiovascular risk factor treatment and control.

Methods
Primary Care Sites
At the time of this study, the Hypertension Initiative database contained information on 72,508 patients with high blood pressure (BP) receiving health care at ~50 primary care practices from more than 200 providers in the Southeastern United States. Records were entered into the database through electronic medical record (EMR) download or, in sites without electronic medical record systems, by manual data entry of report cards completed at hypertensive patients’ appointments (~20% of records in the dataset). No records from paper card entries were included in this analysis as detailed diagnosis data are not available from them. Patients with hypertension were identified upon download of each practice’s EMR into the Hypertension Initiative database by computerized queries for ICD-9 diagnosis codes for hypertension and confirmed by searching text diagnosis fields and problem lists for terms such as hypertension, HTN, high blood pressure, and HBP.

All data monitoring and review procedures were approved by the Office for Research Protection and Integrity at the Medical University of South Carolina to ensure patient confidentiality safeguards were in place and that the study complied with the Health Insurance Portability and Accountability Act.

Study Population
The population of hypertensive patients with documented diagnoses of chest pain or angina (angina pectoris and chronic angina) or ICS (including preinfarction angina) was identified by querying the database for records with ICD-9 codes and for text/written diagnosis terms. For this study, patients were assigned to the “Chest Pain” group if a computerized search of their electronic medical record found: 1) one of three ICD-9 codes specific to chest pain (ie, 786.50, 786.51, 786.59); or 2) the more general ICD-9 code for chest pain (786.5) with cardiac origin, confirmed by a text field search.

Patients were assigned to the “Angina” group if a computerized search of their electronic medical record found one of four ICD-9 codes pertaining to angina (ie, 413, 413.0, 413.1, or 413.9). A confirmatory text field search for terms containing the word “angina” was also conducted. We note that although the three-digit code (413) is technically invalid, it does appear in “real-world” primary care records downloaded into the Hypertension Initiative database.

Finally, patients were assigned to the “ICS” group if a computerized search of their electronic medical record found ICD-9 code 411.1. A text field search was conducted for terms indicating severe, unstable, or progressively worsening angina represented by the ICS category including: acute coronary syndrome, unstable angina, preinfarction angina, and acute MI. Although “Intermediate Coronary Syndrome” is no longer used by cardiologists, for purposes of this study ICS was chosen to refer to an array of conditions representing greater cardiovascular compromise than garden-variety angina. Thus, patients at highest risk for serious events were included in the ICS category. The term acute coronary syndrome (ACS) was not used because this term carries more narrow diagnostic criteria than was intended for the category.

Patients with multiple diagnoses were categorized by the most severe (ie, ICS was more severe than angina, which was more severe than chest pain). For example, patients in the Chest Pain category had only a diagnosis of chest pain, whereas patients categorized as Angina had either been diagnosed with angina only or chest pain and angina.

Diabetes mellitus and dyslipidemia magnify cardiovascular risk and impact treatment and outcomes among hypertensive patients. Patients with these co-morbid conditions were analyzed for differences between those with
and without CPS. Identification of patients with concomitant lipid disorders or diabetes was based on a computerized search of patients’ medical records for: 1) ICD-9 codes related to diabetes (excluding gestational diabetes) and hypercholesterolemia; and 2) text fields and problem lists for terms such as diabetes, diabetes mellitus, insulin-dependent diabetes, DM, IDDM, NIDDM, hyperlipidemia, hypercholesterolemia, and dyslipidemia. Cases were confirmed by searching laboratory results for glycosylated hemoglobin (HbA1c) measurements ≥7% (diabetes) and LDL-cholesterol measurements ≥130 mg/dL (hypercholesterolemia).

Treatments among patients with and without a CPS diagnosis were compared by searching for prescriptions in 11 medication classes of interest: angiotensin-converting enzyme inhibitor (ACEI), angiotensin receptor blocker (ARB), beta-blocker (β-blocker), alpha-beta blocker (αβ-blocker), dihydropyridine calcium channel blocker (CCB-D), non-dihydropyridine calcium channel blocker (CCB-ND), diuretic, statin, vasodilator, nitrate, and aspirin (ASA).

Data Analysis

The analytical dataset was extracted from the overall database and exported to STATA (STATA Corporation, College Station, TX) for analysis to describe cardiovascular risk factor control and treatment in hypertensive patients with and without a CPS diagnosis. Groups were stratified by gender and ethnicity to illuminate possible disparities in diagnosis, treatment, and control patterns. Analyses compared proportions among the samples of interest using the normal theory method for testing binomial proportions, weighting each sample proportion by the number in the subset (n) and introducing a continuity correction in the numerator to better accommodate the number in the subset (n) and introducing a continuity correction in the numerator to better accommodate the normal approximation to the binomial. The key study variables were described as mean ± standard deviation or percent for all subjects with and without CPS and for groups based on gender and ethnicity. Because this is a descriptive analysis of a large sample, differences are described as percentages rather than P values, emphasizing clinical rather than statistical significance. Using P values to indicate significance in such a large sample is of limited value as all comparisons tend to appear statistically significant.

Results

Among 72,508 hypertensive patients in the Hypertension Initiative database, 7996 (11.0%) had a diagnosis of a chest pain syndrome (Table 1). Patients in each demographic group had similar mean age (years ± standard deviation) with CPS patients being slightly older as would be expected: CPS/non-CPS men = 64.8 ± 12.1/63.3 ± 14.0; CPS/non-CPS women = 61.8 ± 14.5/60.9 ± 15.1; CPS/non-CPS whites = 66.9 ± 10.3/63.7 ± 13.8; CPS/non-CPS African Americans = 64.8 ± 12.3/59.9 ± 14.2. Among patients with a CPS diagnosis, there were substantially more men than women (78.1% v 22%) and more whites than African Americans (56.5% v 27.3%) and this trend became more pronounced with increased severity of diagnosis (Table 1).

Among patients with a CPS diagnosis, 61% of men and 86% of women were diagnosed with Chest Pain only; 18.1% of men and 4.3% of women were diagnosed with Angina; and 21.4% of men and 10.0% of women were categorized as ICS. Regarding ethnicity and CPS: 61.9% of whites and 71.3% of African Americans had Chest Pain only; 21.7% of whites and 15.0% of African Americans were categorized as ICS; and 16.4% of whites and 13.7% of African Americans had Angina.

Both diabetes and dyslipidemia were more common in patients with CPS than in those without and dyslipidemia was substantially more common among those with CPS (Table 1). Diabetes and dyslipidemia were also more common in men than in women for both CPS and non-CPS groups. Dyslipidemia was diagnosed more often among

Table 1. Distribution of chest pain syndromes among hypertensive patients and proportion of each diagnostic category accounted for by racial, gender, and age groups

<table>
<thead>
<tr>
<th>Category</th>
<th>Chest Pain</th>
<th>ICS</th>
<th>Angina</th>
<th>All CPS</th>
<th>All Non-CPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (% of CPS pts)</td>
<td>5284 (66.0)</td>
<td>1508 (18.9)</td>
<td>1204 (15.1)</td>
<td>7996 (100)</td>
<td>64512</td>
</tr>
<tr>
<td>Male/female (n)</td>
<td>3778/1506</td>
<td>1336/172</td>
<td>1129/75</td>
<td>6243/1753</td>
<td>37057/27455</td>
</tr>
<tr>
<td>(%)</td>
<td>71.5/28.5</td>
<td>88.6/11.4</td>
<td>93.4/6.2</td>
<td>78.1/22.0</td>
<td>57.4/42.5</td>
</tr>
<tr>
<td>&lt;40 y (%)</td>
<td>2.3/1.8</td>
<td>0.3/0.1</td>
<td>0.6/0.1</td>
<td>1.7/1.2</td>
<td>3.1/3.4</td>
</tr>
<tr>
<td>40–59 y (%)</td>
<td>29.2/13.3</td>
<td>25.5/2.2</td>
<td>24.2/1.6</td>
<td>27.7/9.4</td>
<td>21.0/17.6</td>
</tr>
<tr>
<td>&gt;60 y (%)</td>
<td>40.0/13.5</td>
<td>62.8/9.2</td>
<td>68.9/4.6</td>
<td>48.6/11.3</td>
<td>33.4/21.5</td>
</tr>
<tr>
<td>C/AA (n)</td>
<td>2795/1557</td>
<td>978/328</td>
<td>741/299</td>
<td>4514/2184</td>
<td>26380/19633</td>
</tr>
<tr>
<td>(%)</td>
<td>52.9/29.5</td>
<td>64.7/21.8</td>
<td>61.5/24.8</td>
<td>56.5/27.3</td>
<td>40.9/30.4</td>
</tr>
<tr>
<td>&lt;40 y (%)</td>
<td>1.6/1.3</td>
<td>&lt;0.1/0.1</td>
<td>0.3/0.1</td>
<td>1.1/0.9</td>
<td>2.1/2.2</td>
</tr>
<tr>
<td>40–59 y (%)</td>
<td>20.6/14.0</td>
<td>46.6/14.9</td>
<td>14.6/8.2</td>
<td>22.9/12.8</td>
<td>14.0/14.1</td>
</tr>
<tr>
<td>&gt;60 y (%)</td>
<td>30.7/14.1</td>
<td>48.3/14.3</td>
<td>46.6/14.9</td>
<td>36.4/14.2</td>
<td>24.7/14.1</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>36.1</td>
<td>45.4</td>
<td>50.1</td>
<td>39.3</td>
<td>31.8</td>
</tr>
<tr>
<td>Dyslipidemia (%)</td>
<td>68.2</td>
<td>77.2</td>
<td>82.6</td>
<td>71.8</td>
<td>60.6</td>
</tr>
</tbody>
</table>

Chest pain = diagnosis of chest pain only; Angina = diagnosis of angina only or chest pain + angina; ICS = diagnosis of ICS only, ICS + chest pain, ICS + angina, or ICS + angina + chest pain; CPS = chest pain syndrome; pts = patients; C/AA = white/African American.
whites than African Americans in both CPS and non-CPS groups; however, diabetes was more common among African American patients in both groups (Table 1).

Medication treatments also differed by ethnicity, gender, and CPS or non-CPS status (Fig. 1). Men with CPS received substantially more medications than women with CPS, and, overall, CPS patients received more medications than non-CPS patients (Table 2).

Comparisons of CPS and non-CPS patients’ medications found differences in prescription rates of ≥10% for all medications of interest except ARBs and diuretics (Table 2). Comparing male and female CPS patients revealed differences of ≥10% in prescription rates for 8 of 11 medications (all except CCB-D, CCB-ND, and diuretics) (Table 2). When white CPS patients were compared to African-American CPS patients, differences in prescrip-

tion rates of ≥10% were found for 6 of the 11 medications of interest (Table 2).

Between male and female non-CPS patients there was a ≥10% difference in prescription rates for 5 of the 11 medications of interest including ARBs, β-adrenoceptor blockers, vasodilators, nitrate, and aspirin (Table 2). In both patients with and without a CPS diagnosis, men received substantially more medications than women including an absolute difference of 16% for β-adrenoceptor blocker, 25% for statin, and 28% for nitrate (Table 2).

Among patients both with and without a CPS diagnosis, whites received fewer ACEI and ARB prescriptions than African Americans: ACEI = 60% v 65% among CPS patients and 47% v 52% among non-CPS patients; ARB = 14% v 16% among CPS patients and 17% v 18% among non-CPS patients (Table 2). African-American patients also received more prescriptions for vasodilators, diuretics, β-adrenoceptor blockers, CCB-D, CCB-ND, ACEI, and ARB. Whites received substantially more ß-blockers (54% v 47% among CPS patients and 32% v 26% among non-CPS patients) and statins (60% v 49% among CPS and 39% v 31% among non-CPS patients) than African Americans (Table 2).

Because distribution of diagnoses differed between ethnic and gender groups, prescription rates for patients with the same CPS diagnosis were compared (Fig. 1) Among patients in the Chest Pain and Angina groups, men and whites received substantially more medications than women and African Americans (Fig. 1). Among patients with ICS, men and whites received more medication overall but women and African Americans did receive more prescriptions than their counterparts with Chest Pain and Angina (Fig. 1). There were ~30% differences between men and women in all diagnostic categories for aspirin use and ~8% differences in aspirin use between whites and African Americans (Fig. 1). Diuretic use was consistently higher among whites than African Americans and statin prescription rates were higher for men than women and for African Americans than whites overall (Fig. 1). Prescription rates for ACEI were also substantially disparate between men and women in all CPS categories. Prescriptions for these agents differed between whites and African Americans in all CPS categories except ICS where ACEI prescriptions were similar (Fig. 1).

Patients with CPS had a higher mean number of cardiovascular risk factors (BP >140/90 mmHg, HbA1c >7%, LDL-cholesterol >100 mg/dL) than those without CPS (1.98 ± 0.70 v 1.81 ± 0.73). All CPS groups (men, women, whites, and African Americans) had substantially better BP control rates than patients without CPS. However, control rates for diabetes and LDL-cholesterol were similar in patients with and without CPS (Fig. 2). Women and African Americans generally had worse risk factor control than men and whites.

Because a substantial proportion of the sample was Veterans Medical Center (VA) patients, an analysis of risk factor control was conducted excluding these patients. No

### Table 2. Treatments for hypertensive patients with and without CPS by gender and race (percent of each column group)

<table>
<thead>
<tr>
<th>Medication</th>
<th>All CPS/All Non-CPS (4.1/2.6)</th>
<th>M CPS/F CPS (4.3/5.1)</th>
<th>M Non-CPS/F Non-CPS (2.7/2.5)</th>
<th>C CPS-AA CPS (4.1/2.6)</th>
<th>C Non-CPS/AA Non-CPS (2.7/2.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACEI (%)</td>
<td>60.0/64.8</td>
<td>64.1/61.4</td>
<td>49.4/43.5</td>
<td>56.0/59.0</td>
<td>45.5/39.6</td>
</tr>
<tr>
<td>ARB (%)</td>
<td>13.9/11.8</td>
<td>11.7/12.4</td>
<td>14.2/11.4</td>
<td>12.6/8.4</td>
<td>21.5/20.9</td>
</tr>
<tr>
<td>B-Blocker (%)</td>
<td>49.6/28.5</td>
<td>53.0/37.4</td>
<td>53.9/41.5</td>
<td>49.6/37.4</td>
<td>47.5/31.7</td>
</tr>
<tr>
<td>CCB (%)</td>
<td>49.4/29.5</td>
<td>53.0/37.4</td>
<td>49.3/31.2</td>
<td>54.6/29.5</td>
<td>47.5/31.7</td>
</tr>
<tr>
<td>CCB-ND (%)</td>
<td>49.4/31.2</td>
<td>53.0/37.4</td>
<td>49.3/31.2</td>
<td>54.6/29.5</td>
<td>47.5/31.7</td>
</tr>
<tr>
<td>Diuretic (%)</td>
<td>49.4/31.2</td>
<td>53.0/37.4</td>
<td>49.3/31.2</td>
<td>54.6/29.5</td>
<td>47.5/31.7</td>
</tr>
<tr>
<td>Statin (%)</td>
<td>49.4/31.2</td>
<td>53.0/37.4</td>
<td>49.3/31.2</td>
<td>54.6/29.5</td>
<td>47.5/31.7</td>
</tr>
<tr>
<td>Nitrate (%)</td>
<td>56.0/23.5</td>
<td>47.5/19.3</td>
<td>47.5/19.3</td>
<td>47.5/19.3</td>
<td>47.5/19.3</td>
</tr>
</tbody>
</table>

* Within cell difference of ≥10%.
substantial changes in BP control rates between CPS and non-CPS groups or between ethnic and gender groups were found. However, after removing VA patients, African Americans without CPS had better HbA1c control than African Americans with CPS (36% vs 31%). Also, whites without CPS had better LDL-cholesterol control than whites with CPS (26% vs 33%). All other comparisons remained substantially unchanged.

Discussion

Distribution and prevalence of chest pain syndromes in this study differ from other estimates for several reasons. First, most other studies focus on angina only. Second, this study included only patients with hypertension. Third, although multiple diagnoses were included, specific criteria derived expressly from the patients’ medical records were used to identify and categorize cases. In contrast, publications such as the American Heart Association Statistical Update estimate prevalence using data from National Health and Nutrition Examination Survey (NHANES), a community-based survey relying on respondent self-report. For this study, primary care providers’ diagnoses determined to which diagnostic category patients would be assigned. This methodology was appropriate given that the study focused on differences in primary care provider diagnosis and treatment of patients with similar levels of cardiovascular risk.

Hypertensive patients with angina and ICS were more often older, men, white, and diabetic or dyslipidemic. They received more classes of cardiovascular medications than those diagnosed with Chest Pain only who were more often women and African American. Most hypertensive patients with a CPS diagnosis had been prescribed statins, aspirin, ACEI, and diuretics. About half had been prescribed a β-blocker. These data indicate that chest pain or angina are diagnosed in ~1 of 8 hypertensive patients in primary care and that providers are relatively aggressive in cardiovascular risk factor management.

That said, the analysis illuminates several areas for improvement. Women and African Americans were more often diagnosed with the vague, descriptive condition Chest Pain and were much less likely than white men to receive a more definitive diagnosis placing them in the Angina or ICS groups. Women also received substantially fewer medications than men with similar diagnoses. This supports previous studies suggesting patient ethnicity and gender may influence physician management of chest pain including follow-up testing for definitive diagnosis and prescribing medication.10

Women were also found to have similar rates of dyslipidemia to men but received significantly fewer prescriptions for statins. This is consistent with previous analyses indicating that women in the Hypertension Initiative data set were less likely to receive medication for diagnosed dyslipidemia.6 Because statins are a preferred treatment for dyslipidemia, this may explain why women also had significantly poorer LDL-cholesterol control than men and concurs with previous analyses.6,19 Further underscoring the utility of statins is the finding that treating dyslipidemia with these agents is associated with up to a 30% reduction in stroke.20 Failing to place eligible, hypertensive women on statin medication, therefore, dramatically increases their risk for cerebral vascular events.21 It is also noteworthy that only 14% of non-CPS women were treated with aspirin and that this percentage only increased to 25% among women with a CPS diagnosis.

The fact that there were few women with ICS (n = 168) and very few women with angina (n = 75) was something of a limitation in group analyses. However, differences were robust enough to indicate opportunities for improving care. This study suggests that greater treatment disparities exist between gender groups than between ethnic groups, although there is room for improvement in both minority categories.

Although primary care physicians are challenged to keep up with frequent changes in diagnostic and treatment guidelines, gender and ethnic disparities such as those found in this study persist. In addition, some of the most substantial differences were in prescriptions for well-established, first-line treatments.

The importance of controlling chronic stable angina cannot be overstated as death rates in women with chronic angina are higher than in men,3,4,16 and angina in women more often heralds a fatal acute MI than in men.2,13

The findings of lower rates of risk factor treatment and control among hypertensive women than men with CPS indicates a need for more aggressive management. However, this is likely to be challenging as women presenting to emergency departments with chest pain describe symptoms differently than men, which may contribute to differences in diagnosis and treatment.25 Patient self-management also contributes to hiding the full extent of symptoms from primary care providers resulting in delayed or missed referrals for further examination and diagnosis.23 Although differences in the details of an individual’s disease status related...
to gender and ethnicity may account for some of the observed differences, we believe vigilance, attention to prescribing habits, and greater willingness to add or titrate medications can begin making a difference in these health disparities.

References