ABSTRACT

Aims: The goal of this study was whether we could clinically anticipate the extent of CAD and whether we could determine the frequency of less common angina radiation in the population of stable angina group. We hypothesized that the extent of angina radiation (AR) may be related to ischemic burden.

Methods: One hundred (100) consecutive patients referred for coronary arteriography were divided into 2 groups according to anginal radiation. The patients were divided into 2 broad categories. Those whose anginal discomfort limited to chest and back were assigned to group 1. If the anginal radiation was more widespread, then those patients were placed in group 2.

Results: Forty-four (44) patients who had AR limited to chest and back radiation were classified to group 1. Fifty-six (56) were in more extensive radiation and were classified as group 2. In group 2, there were 15 patients whose AR extended to lower jaw, wrists or head. We labeled these 15 patients as remote radiation. Although group 1 and 2 differed clinically, no differences existed in the distribution of CAD. However, the 15 patients with remote AR had high sensitivity for multi-vessel CAD; but specificity was only 50%.

Conclusions: Extensive radiation of anginal discomfort does not necessarily reflect diffuse disease of coronary vessels. However, if anginal discomfort reaches the lower jaw, wrists and head, it carries high sensitivity (93%) for multi vessel CAD. The radiation to remote sites constitute 15% of patients referred for coronary arteriography.

Key words: Anginal radiation, coronary artery disease, unstable angina

INTRODUCTION

When coronary artery disease (CAD) presents as unstable angina, its radiation is either limited to chest and back or more wide spread. We hypothesized that the extent of angina radiation (AR) may be related to ischemic burden. Thus, multivessel CAD (with some exceptions) should be more frequent in patients with more extensive AR. After clinical categorization, all patients underwent coronary arteriography. We tabulated the results of the two groups vis-à-vis the extent of CAD. Thus, the goal of this study was whether we could clinically anticipate the extent of CAD. And secondly, if we could determine the frequency of less common angina radiation in the population of stable angina group.

MATERIALS AND METHODS

In one hundred (100) consecutive patients referred for coronary arteriography, the anginal radiation was carefully assessed. If AR was limited to chest and back, patient was assigned to group I. Beyond chest and back such as shoulders and/or arms, the angina radiation pattern would place him/her into Group II. There were 44 patients in Group I and 56 patients in...
Group II. The most remote sites of angina radiation were to lower jaws, wrists, and/or head. Naturally, these patients were in Group II and they totaled 15 [Tables 1 and 2].

Demographics such as age, sex, and body mass index (BMI) were recorded for all patients [Table 1]. Traditional risk factors for CAD such as hyperlipidemia, hypertension, diabetes, and smoking were noted for all [Table 3]. We also inquired if the patient had previous CAD such as myocardial infarction (MI), previous angioplasty (PCI), or coronary artery bypass surgery (CABG) [Table 4]. Other clinical parameters such as dyspnea, palpitation, and syncope were tabulated in both groups.

### Table 1: Characteristics of the groups

|                      | Group 1 | Group 2 | p     |
|----------------------|---------|---------|-------|
| Number of patients (n=100) | 44      | 56      |       |
| Mean age±SD          | 56±11.4 | 54.2±8.2| 0.65  |
| Males (n=68)         | 42      | 26      |       |
| Females (n=32)       | 2       | 30      |       |
| Number of overweight/obese | 21/9    | 17/32   | 0.02  |

The data on BMI were unavailable in 4 patients divided equally among the groups. BMI in: Overweight: 27.7±1.4/Obese: 36.0±5.8. BMI: Body mass index, SD: Standard deviation

### Table 2: Remote anginal radiation among 15 patients

| Sites          | Group 1 | Group 2 | p     |
|----------------|---------|---------|-------|
| Lower jaw      | 3       | 3       |       |
| Head           | 2       | 4       |       |
| Wrists (left wrist 8) | 10      | 12      |       |

Some patients had radiation to more than one remote site. There were 15 patients with 19 area of radiation

### Table 3: Risk factors and anginal radiation

| Category     | Total | Group 1 | Group 2 | P     |
|--------------|-------|---------|---------|-------|
| Smoking      | 38    | 22      | 16      | 0.028 |
| Hypertension | 67    | 27      | 40      | 0.239 |
| Dyslipidemia | 60    | 23      | 37      | 0.165 |
| Diabetes     | 68    | 26      | 42      | 0.092 |

### Table 4: History of myocardial infarction, percutaneous coronary intervention, or coronary artery bypass surgery

|                     | Total | Group 1 | Group 2 | p     |
|---------------------|-------|---------|---------|-------|
| MI (n=27)           | 11    | 16      | 0.7     |
| PCI (n=22)          | 10    | 12      | 0.9     |
| CABG (n=6)          | 2     | 4       | 0.2     |

MI: Myocardial infarction, PCI: Percutaneous coronary intervention, CABG: Coronary artery bypass surgery

### Table 5: Coronary artery stenoses in Groups I or II

|                     | Total (%) | Group I (%) | Group II (%) |
|---------------------|-----------|-------------|--------------|
| Normal coronaries    | 6 (6)     | 0           | 6 (10.7)     |
| Single-vessel disease| 22 (22)   | 8 (18.2)    | 14 (25)      |
| Double-vessel disease| 29 (29)   | 15 (34.1)   | 14 (25)      |
| Triple-vessel disease| 43 (43)   | 21 (47.7)   | 22 (39.3)    |

We checked the files for the ejection fraction, and diastolic dysfunction. Exertional, rest, and/or postprandial angina were noted for all patients. Table 2 shows the number of patients with remote angina, i.e., to lower jaws, wrists, and head.

Coronary arteriography was done through the right radial artery in the majority of cases (91). Coronary artery disease was either limited to one or two significant lesions on one coronary artery (single-vessel [1-V] disease) or spread more extensively (multivessel disease). Significant lesions of the left main stem coronary artery were ≥50% and other vessels were ≥70%. Location (proximal, mid, or distal) of significant lesions on coronary vessels, and presence or absence of coronary collaterals were also noted.

In table 5, the number of normal coronaries and patients with single, double or 3-V disease are delineated for both groups.

All the parameters and presence of collaterals were mentioned for all and were compared by Student t-test and level of significance was 0.05.

### RESULTS

The patients were divided into 2 broad categories. Those whose anginal discomfort was limited to chest and back were assigned to Group I. If the anginal radiation was more widespread, then those patients were placed in Group II.

Table 1 shows the number of patients with single, double or 3-V disease were 42 (25) in Group II. However, syncope (5 of 6 patients) were in Group I.

Table 3 reveals that smokers comprised 50% of Group I patients, whereas this percentage was less (28.6%) in Group II (P = 0.03). Other risk factor percentages were not significantly different in both groups. Other clinical symptoms were palpitation (10/12 patients) and dyspnea (28 of 37 patients) were in Group II. However, syncope (5 of 6 patients) were in Group I.

No differences were detected between the groups as regard to MI, PCI, or CABG [Table 4]. Similarly, angina whether exertional (75% Group I vs. 79% Group II), rest (16% vs. 20%), or postprandial (4.5% vs. 12.5%, respectively) did not differentiate the group in regard to AR. Obviously there were overlap among anginal states.

The angiographic findings were divided up as dominance of right versus left coronary artery and presence of collaterals. Also, each individual coronary
artery was divided into proximal, mid, and distal segments.[1]

Other than the main coronary vessels, major branches such as diagonal branch of Left anterior descending artery (LAD) and obtuse marginal branch of circumflex artery were marked comparatively. After individual lesions were compared, the sum total of 2-V or 3-V CAD was determined. The only parameter that was statistically dissimilar was presence of significantly diseased diagonal and/or obtuse marginal branches in Group II.

Collaterals were present in four patients; 2 in each group. If side branch disease was present (i.e., diagonal and/or obtuse marginal), the patient was more likely in Group I.

Although 14 or 15 patients with remote AR had 2-V or 3-V CAD, yet there were other patients with similar coronary findings without extensive or remote angina radiation. Thus double or triple vessel disease was unexpectedly dissociated from his/her AR [Table 5]. On the other hand, patients with normal vessels or single disease had higher AR.

DISCUSSION

Ever since the description of angina by William Heberden in 18th century,[2] nothing further was added to the topic of AR. Our interest stemmed from two referred cases from dentist office with lower jaw discomfort. Both had 3-V CAD. The third patient who had aortic stenosis did not have additional CAD. It turned out that jaw pain is rather rare. We ascertained that jaw and head discomfort were both rare [Table 2]. Wrist pain was more frequent. All three radiational sites were given the designation of remote AR which was present in a total of 15 patients in 19 radiation sites were lumped together with 41 other patients (Group II) whose discomfort also radiated to back, shoulders, and neck. The question arose as to whether this variation in the AR pattern was a reflection of 6th fetal dermatome innervations.

Alternatively, it may be due to ischemic manifestation. In searching this situation, we divided 100 consecutive patients into limited radiation (Group I) or more extensive radiation (Group II). Ages were similar in both groups. More males (63%) were in Group I. Percentage-wise, more smokers were in Group I. Other risk factors were similarly present in both. Left ventricular ejection fraction and diastolic dysfunction were comparable in both groups. Also, previous CAD manifestations (MI, PCI, or CABG) were not different among the two groups. Catheterization of the 100 patients did not show differences among left and right dominance. Collateral flow existed in 4 patients; 2 in each group. There were 6 patients who had normal (non-obstructive) coronary arteries (all in Group II) [Table 5]. Single, double or triple vessel disease were not dissimilar statistically.

Of the 15 patients with remote AR, there were 14 patients who had double or triple vessel disease. However, no statistical difference existed comparing Group I and Group II. We conclude that remote anginal radiation is sensitive but not specific for multivessel CAD. Coming to our hypothesis, extensive is no different than limited radiation for MVD detection. The exception is for the uncommon patients, with remote angina radiation that reflects multivessel CAD, even though it is not very specific. The implication of this finding is that history of remote angina radiation when present in patients obviates the need for further testing before coronary arteriography. We also conclude that the extent of radiation of angina pain is not related to ischemia of the left ventricle.

CONCLUSION

Extensive radiation of angina discomfort does not necessarily reflect diffuse disease of coronary vessels. However, if angina discomfort reaches the lower jaw, wrists, and head, it carries high sensitivity (93%) for multivessel CAD. The radiation to remote sites constitutes 15% of patients referred for coronary arteriography.

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Conflicts of interest
There are no conflicts of interest.

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