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Original Article

256-Slice Computed Tomography in the Diagnosis of Coronary Artery Disease in Patients Presenting With Aortic Dissection Between 2011 and 2014 and the Influence of Concomitant Coronary Artery Disease on in-Hospital Mortality

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ABSTRACT

Background: In recent years, noninvasive methods have replaced angiography in the diagnosis of aortic dissection and concomitant coronary artery disease (CAD). Computed tomography (CT) angiography allows the assessment of CAD in this setting.

Methods: In this retrospective study, we investigated the incidence of CAD in patients presenting with type A or B aortic dissection between 2011 and 2014 as assessed by CT angiography and the influence of concomitant CAD and coronary artery bypass grafting (CABG) on the in-hospital outcomes of these patients.

Results: Ninety-one patients (67% male) were included in this study. Thirty-five (38.5%) patients had concomitant CAD on their CT angiography, and coronary artery ectasia was observed in 17 (18.7%) patients. Sixty-seven (73.6%) patients underwent surgery for their aortic dissection. Concurrent CABG was performed in 22 (62.8%) patients, who had significant coronary stenosis on coronary CT angiography. Mortality was significantly higher in the patients who had concomitant CAD. (Sixty-seven percent of the patients with CAD died; $P<0.001$.) The total in-hospital mortality rate was 29.7% (n =27). Mortality was higher in the patients with more severe CAD in terms of 2- and 3-vessel diseases, and CABG was significantly associated with higher mortality.

Conclusions: Nowadays, invasive coronary angiography is infrequently performed in acute type A aortic dissection due to delay in surgery and increase in the risk of rupture. Multi-slice coronary CT angiography is a good alternative modality for the diagnosis of aortic dissection and CAD simultaneously with acceptable accuracy. ***(Iranian Heart Journal 2016; 17(2):25-29)***

Keywords: Aortic dissection ■ Coronary artery disease ■ 256-slice coronary CT angiography

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Aortic dissection (AD) is a condition with high mortality.[3] Coronary artery disease (CAD) risk factors may be seen in patients with AD.[1,3] Therefore, patients with AD may have concomitant CAD and their clinical outcome may exacerbate.[2,4] The incidence of CAD in AD has been reported to be between 25% and 35% in different studies.[5,7,8,9]

For many years, there has been a debate as to whether or not perform coronary angiography in the setting of AD. Some studies have shown the potential survival benefits of preoperative coronary angiography in patients with type A dissection. On the other hand, some other studies have demonstrated no remarkable benefits derived from coronary angiography. In fact, the latter studies have found coronary angiography to be associated with higher mortality due to delay in surgery.[9,10,11]

Computed tomography (CT) angiography allows the assessment of CAD in this setting. CT angiography is noninvasive and can be done simultaneously with aortic evaluation.

In this study, we investigated the incidence of CAD in patients presenting with type A or B AD as assessed by CT angiography and the influence of concomitant CAD and coronary artery bypass grafting (CABG) on the in-hospital outcome of these patients.

METHODS

In this retrospective study, the hospital records of patients admitted with a diagnosis of AD between 2011 and 2014 were reviewed. The inclusion criterion was any type of AD (A or B, acute or chronic) in which the coronary artery anatomy was defined by 256-slice coronary CT angiography. The exclusion criteria comprised any patient with postoperative dissection (CABG and aortic valve replacement) and coronary artery involvement due to dissection flap propagation down the coronary artery.

The demographic data, treatment plans, and in-hospital mortality were recorded from hospital documents. All CT angiographic results were reviewed, and data regarding AD and the coronary artery anatomy were recorded. The diagnosis, treatment, and classification of AD were based on the American College of Cardiology's guidelines for the diagnosis and management of patients with thoracic AD. Chronic AD was defined as the presence of an AD > 2 weeks' duration.[5] CAD was defined as the presence of ≥ 50% stenosis in any coronary artery on CT angiography.[6] The final decision to perform concurrent CABG was based on the coronary CT angiography report and intraoperative inspection and palpation.

The study was approved by the Research and Ethics Committee of Rajaie Cardiovascular, Medical, and Research Center.

Statistical Analysis

IBM SPSS Statistics, version 19.0 for Windows (IBM Corp., Armonk, NY, USA), was used for all statistical analyses. The categorical variables are expressed as numbers and percentages and the quantitative variables as means (SDs). The quantitative variables were compared using the Student *t*-test. The χ^2 test and the Kruskal–Wallis tests were employed to compare the categorical data. A $P < 0.05$ was considered significant.

RESULTS

Ninety-one patients (67% male) were included in this study. The mean and SD of age was 66.2 ± 7.7, between 40 and 81 years. Forty-seven (51.6%) patients had acute AD: 40 patients were diagnosed as type A and 7 patients as type B. Most of the patients with type B (70%) had chronic AD. Table 1 shows the baseline characteristics of the study population.

Table 1. Baseline characteristics of the study population (N=91)

Characteristics	*P*
Age, mean(SD)	66.2 (7.7)
Sex, n (%)	
Female	30 (33)
Male	61 (67)
Left ventricular ejection fraction, mean(SD)	42.6 (5.6)
Aortic dissection type, number (%)	
Type A	68 (75)
Type B	23 (25)
Aortic dissection chronicity, n (%)	
Acute	47 (52)
Chronic	44 (48)

Incidence of Coronary Artery Disease

Thirty-five (38.5%) patients had concomitant CAD on their CT angiography, and coronary artery ectasia was observed in 17 (18.7%) patients. Table 2 depicts the incidence of concomitant CAD in the patients with acute and chronic type A and type B dissection. The patients were more commonly had single-vessel disease (15.4%); however, 12.1% and 11% of the study population had 2- and 3-vessel diseases, respectively. Thirty-two percent of the patients with acute AD and 21 (48%) patients with chronic AD had CAD.

Table 2. Incidence of CAD on computed tomography angiography of the patients based on the type of aortic dissection

Dissection Type	Total Number	CAD (n)	Percentage
Acute type A	40	11	28.9
Chronic type A	13	14	46.6
Acute type B	7	3	42.8
Chronic type B	31	7	43.7
All-type dissection	91	35	38

CAD, Coronary artery disease

Surgical Treatment for Aortic Dissection

Sixty-seven (73.6%) patients underwent surgery for their AD. CABG was performed in 22 (24.2%) of them (Table 3). Concurrent CABG was performed in 22 (62.8%) patients, who had significant coronary stenosis on coronary CT angiography (n = 35). The final decision to perform concurrent CABG was based on the coronary CT angiography report and intraoperative inspection and palpation. Among the patients with CAD, CABG was performed in 8 (36.4%) patients with single-vessel disease, 7 (31.8%) patients with 2-vessel disease, and 7 (31.8%) patients with 3-vessel disease.

Table 3. Prevalence of the surgery types in the different types of aortic dissection

Dissection Type	Total Number	Surgery	Percentage Surgery/ Total	Concurrent CABG	Percentage Surgery + CABG/Total
Acute type A	38	37	40.6	7	7.7
Chronic type A	30	23	25.3	9	9.9
Acute type B	7	2	2.2	1	1.1
Chronic B	16	5	5.5	5	5.5
Total	91	67	73.6	22	24.2

CABG, Coronary artery bypass grafting

Mortality in the Study Group

The total in-hospital mortality rate was 29.7% (27 patients). Twenty (22%) patients who underwent corrective surgery and 7 (7.7%) patients on supportive medical treatments died during their hospital admission ($P = 0.9$) (Table 4). Mortality was significantly higher in the patients who had concomitant CAD. (Sixty-seven percent of the patients with CAD died; $P < 0.001$.) The mortality was higher in the patients with more severe CAD, in terms of 2- and 3-vessel diseases, and CABG was significantly associated with a higher mortality rate ($\chi^2 = 6.4$, $df = 2$; $P = 0.04$). There was a significant association between the number of grafts in CABG and mortality ($P = 0.05$).

Table 4. Percentage of mortality according to the different types of surgery and dissection types

Disease Type	Total Number	Mortality (n)	Mortality / Total (%)	Concurrent CAD-Mortality	Percentage	Concurrent Surgery-Mortality	Percentage
Acute A	38	13	14.3	7	7.7	12	13.2
Chronic A	30	10	11	8	8.8	6	6.6
Acute B	7	3	3.3	2	2.2	2	2.2
Chronic B	16	1	1.1	1	1.1	0	0
Total	91	27	29.7	18	19.8	20	22

CAD, Coronary artery disease

DISCUSSION

AD is an uncommon but potentially life-threatening illness.[2,5] Routine coronary angiography is not recommended before surgery for acute type A and has not been associated with improvement in clinical outcomes.[5,9,14,15] Contrast-enhanced CT is the modality most commonly drawn upon for evaluating AD with sensitivity and specificity of 98% to 100%.[5] Multi-slice high-definition CT scan allows a simultaneous diagnosis of AD.[9,11]

Lawrence and colleagues reported that the prevalence rates of concomitant CAD and acute and chronic AD were 34.8% and 42.9%, respectively, as assessed via coronary angiography. The incidence of CAD in AD has been reported to range between 25% and 35% in different studies.[5,9,12,13] We found that the incidence rates of concomitant CAD on 256-slice coronary CT angiography of the patients with acute and chronic type A and type B dissection were 28.9%, 46.6%, 42.8%, and 43%—respectively—with an overall incidence rate of 38.4%.

Concurrent CABG was performed in 22 (62.8%) patients, who had significant coronary stenosis on coronary CT angiography (n=35). The mortality was higher in the patients with more severe CAD in terms of 2- and 3-vessel diseases, and CABG was significantly associated with a higher mortality rate.

Study Limitations

Coronary CT angiography is feasible in patients with stable heart rhythms capable of breath-hold for 20 seconds. Image quality is degraded by irregular rhythms, motion artifacts, and severe coronary calcification—which diminish diagnostic accuracy. In 256-slice CT, breath-holding time is reduced and the entire heart can be covered in a single rotation with a temporal resolution of 135 ms and spatial resolution of 0.625.[12] Emerging methods drawing upon high-definition CT with a spatial resolution of approximately 0.3 mm may overcome some of these limitations.[5] According to a previous study, CAD directly affected the perioperative morbidity and mortality.[8] One limitation of note in the present study is its relatively small sample size. Moreover, the absence of the modality of choice for CAD detection to enable us to compare the results with coronary CT angiography results is another drawback of significance. In the current study, the final decision to perform concurrent CABG was based on the coronary CT angiography report and intraoperative inspection and palpation. Concurrent CABG was performed in 22 (62.8%) patients, who had significant coronary stenosis on coronary CT angiography (n=35). The mortality was higher in the patients with more severe CAD with respect to 2- and 3-vessel diseases, and CABG was significantly allied to a higher mortality rate in this group.

CONCLUSIONS

Nowadays, invasive coronary angiography is infrequently performed in AD (acute type A) due to delay in surgery and increase in the risk of rupture. Multi-slice coronary CT angiography is a good modality for the

diagnosis of AD and CAD simultaneously with acceptable accuracy.

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