The prevalence of coronary artery anomalies in Qassim Province detected by cardiac computed tomography angiography

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Background: **Coronary artery anomalies (CAAs) affect about 1% of the general population based on invasive coronary angiography (ICA) data, computed tomography angiography (CTA) enables better visualization of the origin, course, relation to the adjacent structures, and termination of CAAs compared to ICA.**

Objective: **The aim of our work is to estimate the frequency of CAAs in Qassim province among patients underwent cardiac CTA at Prince Sultan Cardiac Center.**

Methods: **Retrospective analysis of the CTA data of 2235 patients between 2009 and 2015.**

Results: **The prevalence of CAAs in our study was 1.029%. Among the 2235 patients, 241 (10.78%) had CAAs or coronary variants, 198 (8.85%) had myocardial bridging, 34 (1.52%) had a variable location of the Coronary Ostia, Twenty two (0.98%) had a separate origin of left anterior descending (LAD) and left circumflex coronary (LCX) arteries, ten (0.447%) had a separate origin of the RCA and the Conus artery. Seventeen (0.76%) had an anomalous origin of the coronaries. Six (0.268%) had a coronary artery fistula, which is connected mainly to the right heart chambers, one of these fistulas was complicated by acute myocardial infarction.**

Conclusions: **The incidence of CAAs in our patient population was similar to the former studies, CTA is an excellent tool for diagnosis and guiding the management of the CAAs.**

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Keywords: Coronary artery anomalies, Cardiac computed tomography, Prevalence

Introduction

The prevalence of coronary artery anomalies (CAAs) is reported to be 0.3% to 2% of the general population [1–3]. Asymptomatic CAAs are more common and have a better prognosis. Nevertheless, some of these anomalies are linked with symptoms such as syncope, chest pain, and sudden cardiac death [4,5]. CAAs include abnormalities of either number, origin course, termination, or structure of the coronary arteries [6]. CAAs

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are detected usually as incidental findings during invasive coronary angiography or at *postmortem* examination. Various imaging modalities are available for assessment of CAAs. Invasive coronary angiography cannot define CAAs in detail, especially with the complex anatomy. By contrast computed tomography angiography (CTA) is a noninvasive tool that permits a clear visualization of CAAs better than invasive coronary angiography. CTA has recently become the test of choice for diagnosing CAAs [7,8]. The aim of our study is to evaluate the prevalence of CAAs in the Qassim area using CTA.

Abbreviations

LMCA	Left Main Coronary Artery
LAD	Left Anterior Descending Artery
RCA	Right Coronary Artery
LCX	Left Circumflex Coronary Artery
CAF	Coronary Artery Fistula
CAA	coronary artery anomalies
CT	Computed Tomography
CTA	Computed Tomography Angiography
SV	sinus of valsalva
ECG	Electrocardiography

Patients and methods

A retrospective analysis of 2235 coronary CTA scans was performed in our center between 2009 and 2015 to identify patients with CAAs. Most of the patients were referred for evaluation of chest pain. Other indications included: evaluation of congenital heart disease; determining the three-dimensional anatomy of the CAAs detected by Invasive coronary angiography; evaluation before coronary artery bypass surgery; detection of coronary artery disease before noncardiac surgery; anatomic mapping before atrial fibrillation ablation; and excluding of coronary artery disease in patients with cardiomyopathy (Table 1). Patients with uncontrollable arrhythmia, previous allergic reaction to the iodinated contrast material, pregnancy, renal impairment (serum creatinine >3.0 mg/dL), and an inability to hold breath were excluded. The patients with CAAs were selected, and each CAA was reviewed for origin, course, relation to adjacent structures, and the termination of these anomalies. All patients had signed informed consent to be a part of this study. The study was approved by the ethics committee of Prince Sultan Cardiac Center Al-Qassim.

Data acquisition and reconstruction protocol

Using a dual-source 256 slice scanner (Siemens Flash Definition CT scanner; Siemens, Berlin, Germany), rotation time 280 ms, and GE Light Speed VCT 64 slice CT Scanner (GE Healthcare, Chicago, IL, USA), all imaging started with a scout image and then a calcium score scan with 3-mm slice thickness and prospective gating at 75% of the cardiac cycle. We used a 0.6-mm slice thickness and electrocardiography (ECG) gating with either prospective, retrospective during the breathing hold in inspiration for enhanced CTA scan, we used ECG-dependent tube current modulation of 40% to 75% of R–R internal in retrospective scanning to minimize radiation exposure. We used a *test bolus* technique with a 4-second delay time after the peak contrast enhancement of a region of interest in ascending aorta, using 15 mL of contrast agent (Xenetix 350; Guerbet, Roissy, France; 350 mg iodine/mL), then 20 mL normal saline. The CTA scan was performed by injecting of 75 mL of contrast and 45 mL of saline solution at a rate of 6 mL/s. Prior to CTA, all patients with a baseline heart rate of >65 beats/min received 5–20 mg of metoprolol intravenously. Sublingual nitroglycerin (0.5 mg) was given to all the patients during the scan unless contraindicated. Medium smooth kernels (B26f) were reconstructed for postprocessing using a Multimodality Workplace (Siemens Medical Solutions, Erlangen, Germany). The axial, coronal, sagittal, and oblique multiplanar reconstruction; thin-slab maximum intensity projection; and volume-Rendering images were reformatted. Different retrospective ECG-gated reconstruction temporal window settings (in retrospective scan), usually between 40% and 75% of R–R intervals in gated ECG were applied, and we did the reconstruction at 75% window in the prospective ECG gated scans.

Table 1. Indications for computed tomography angiography.

Indication	*n* (%)
All patients	2235 (100)
Atypical chest pain	1947 (87.1)
Non cardiac chest pain	99 (4.42)
Typical chest pain	15 (0.67)
Before coronary artery bypass surgery	35 (1.56)
Before atrial fibrillation ablation	44 (1.96)
Congenital heart disease	13 (0.58)
Before noncardiac surgery	18 (0.8)
Syncope	5 (0.22)
Coronary artery anomalies	9 (0.4)
Other indications	50 (2.2)

Results interpretation

CTA images were interpreted independently by two cardiologists who had at least 6 years' experience in cardiac CTA. The origin, course, relation to adjacent structures, termination, branches, and

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