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Original Article / Özgün Makale

Evaluation of coronary artery anomalies using 128-Slice computed tomography

128 kesitli bilgisayarlı tomografi kullanılarak koroner arter anomalilerinin değerlendirilmesi

Mustafa Kayan,[1] Turhan Yavuz,[2] Mehmet Munduz,[1] Yasin Türker,[3] Ahmet Yeşildağ,[1] Mustafa Etli,[2] Ergun Ceylan,[1] Selçuk Yaşar[1]

Departments of [1]Radiology, [2]Cardiovascular Surgery, Medical Faculty of Süleyman Demirel University, Isparta, Turkey; [3]Department of Cardiology, Medical Faculty of Düzce University, Düzce, Turkey

Background: In this study, we aimed to investigate the efficacy of a 128-slice computed tomography (CT) device in detecting anatomical variations and anomalies of coronary arteries and to compare the results obtained with literature data.

Methods: Totally, 83 patients (58 males, 25 females; mean age 53.7±10 years; range 31 to 80 years) with suspected or known coronary artery disease who underwent evaluation using the 128-slice CT in our clinic between February 2009 and December 2010 were retrospectively analyzed. All images were evaluated in terms of anatomic variation and anomaly by a radiologist with expertise in cardiovascular radiology. Continuous variables were expressed as arithmetical mean ± standard deviation (SD), while categorical variables were expressed as percent (%). Statistical analysis was performed using descriptive statistical tests.

Results: The rate of right dominance, left dominance and co-dominance was 80.7%, 8.4% and 10.8%, respectively. It was observed that the conus artery originated from the right sinus valsalva at a rate of 16.86% and from the right coronary artery (RCA) at a rate of 83.1%. It was found that sinus node artery (SNA) originated from the RCA at a rate of 77.1%, from the circumflex (Cx) artery at a rate of 18.1%, from the left main coronary artery (LMCA) at a rate of 2.4% and from the right sinus valsalva at a rate of 2.4%. Ramus intermedius was present in 30.12% of the patients. Coronary artery anomaly was observed in 48 patients (57.8%). of them, 1.2% had absence of LMCA, 6% had commissural origin, 1.2% had coronary hypoplasia, 4.8% had anomalous of contralateral sinus origin, and 43.3% had myocardial bridging.

Conclusion: The 128-slice CT device is a non-invasive method which provides reliable, detailed and correct information for detecting variations and anomalies of coronary arteries. We believe that the 128-slice CT is of higher value in diagnosis and surgical therapy of coronary artery anomalies.

Key words: Angiography; anomaly; computed tomography; coronary vessels; diagnosis.

Amaç: Bu çalışmada 128 kesitli bilgisayarlı tomografinin (BT) anatomik koroner arter varyasyonlarını ve anomalilerini saptamadaki etkinliği araştırıldı ve elde edilen bulgular literatür verileri ile karşılaştırıldı.

Çalışma planı: Şubat 2009 - Aralık 2010 tarihleri arasında kliniğimizde 128 kesitli BT ile değerlendirilen, şüpheli veya bilinen koroner arter hastalığı olan 83 hasta (58 erkek, 25 kadın; ort. yaş 53.7±10 yıl; aralık 31-80 yıl) retrospektif olarak incelendi. Tüm görüntüler, kardiyovasküler radyoloji alanında uzman bir radyolog tarafından anatomik varyasyon ve anomali açısından değerlendirildi. Sürekli değişkenler aritmetik ortalama ± standart sapma (SS) ile ifade edilirken, kategorik değişkenler yüzde (%) ile ifade edildi. Tanımlayıcı istatistiksel testler ile istatistiksel analiz yapıldı.

Bulgular: Sağ dominans, sol dominans ve kodominans oranı sırasıyla %80.7, %8.4 ve %10.8 idi. Konus arterin %16.86 oranında sağ sinüs valsalvadan ve %83.1 oranında sağ koroner arterden (sağ KA) köken aldığı gözlemlendi. Sinüs nod arterin (SNA) %77.1 oranında sağ KA'dan, %18.1 oranında sirkumfleks (Cx) arterden, %2.4 oranında sol ana koroner arterden (sol ana KA) ve %2.4 oranında sağ sinüs valsalvadan köken aldığı belirlendi. Hastaların %30.12'sinde ramus intermedius mevcuttu. Kırk sekiz hastada (%57.8) koroner arter anomalisi saptandı. Bu hastaların %1.2'sinde sol ana KA noksanlığı; %6'sında komissural köken; %1.2'sinde koroner hipoplazi; %4.8'inde kontralateral sinüs köken anomalisi ve %43.3'ünde miyokard köprüsü mevcuttu.

Sonuç: 128 kesitli BT, koroner arter varyasyonlarının ve anomalilerinin saptanmasında güvenilir, ayrıntılı ve doğru bilgi sağlayan invaziv olmayan bir yöntemdir. 128 kesitli BT'nin koroner arter anomalilerinin tanı ve cerrahi tedavisinde yüksek öneme sahip olduğu kanısındayız.

Anahtar sözcükler: Anjiyografi; anomali; bilgisayarlı tomografi; koroner damarlar; tanı.

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Correspondence: Mustafa Kayan, M.D. Süleyman Demirel Üniversitesi Tıp Fakültesi Radyoloji Anabilim Dalı, 32260 Isparta, Turkey.
Tel: +90 505 - 935 35 39 e-mail: drkayan32@hotmail.com

The limitations in slice imaging methods due to the mobility and small diameter of coronary arteries have now been overcome with the introduction of new-generation multislice computed tomography (MSCT), making innovative, state-of-the-art coronary artery studies possible. Similar to the advances in MSCT, the significance of coronary computed tomography (CT) angiography, a non-invasive modality, for assessing the coronary artery, has been gradually increasing. The origin and course of the coronary artery along with its variations and anomalies, the normal anatomy of the heart, the main vasculature originating from the heart, and the cardiac chambers can now be examined in detail with coronary CT angiography.

Technological advances enabling the evaluation of the coronary artery with new-generation MSCT (16 detectors or more) include the increased number of detectors, the ability to simultaneously obtain multiple images in conjunction with electrocardiography (ECG), the thickness of the thin slice, the rapid gantry rotation, the increased temporal and spatial resolution values, the ability to create new reformatted images using scanned data, and the ability to make evaluations on each plane using raw images.[1,2] In addition, radiologists now have more experience in reading images on normal anatomy with regard to anatomic variations and their cross-sectional images, which leads to better diagnostic accuracy.[3] In this study, we aimed to assess the efficacy of the 128-slice CT device in detecting variations and anomalies of the coronary artery and to compare the resultant data with the literature.

PATIENTS AND METHODS

Coronary CT angiography examinations of 83 patients (58 males, 25 females; mean age 53.7±10 years; range 31 to 80 years) with suspected or known coronary artery disease conducted in our clinic between February 2009 and December 2010 were retrospectively evaluated in terms of coronary artery variations and anomalies. Data regarding the demographics and clinical characteristics of the patients was recorded, and approval of the ethics committee for the study was obtained.

Selection of patients and preparation

Patients with contraindications after the coronary CT angiography examination as well as those with known allergies against contrasting agents, renal dysfunction (serum creatinine >1.5 mg/dl), respiratory difficulties, poor overall health status, hyperthyroidism, and epilepsy were excluded from the study. In addition, patients who demonstrated a contraindication toward the use of beta (β)-blockers (left ventricular ejection fraction <30%, history of bronchial asthma, Raynaud's syndrome, and atrioventricular conduction block) and those who were pregnant were also not included.

Patients were informed to strictly adhere to the regime of their current medications (if any) and avoid eating for at least six hours in order to prevent vomiting and related complications which might occur due to the administration of the contrast bolus agent during the imaging procedure. The consent of the patients was obtained afterwards.

All patients did respiration exercises in order to ensure regular and rhythmic respiration (holding breath for a mean of 10 seconds), to make the patients feel comfortable before the imaging, and to increase adaptation to the examination. Patients unable to hold their breath and those with arrhythmia were also excluded from the study. The blood pressure and pulse rates of all patients were measured. Patients with a heart beat per minute >80 beats were administered an oral β-blocker (propranolol 40 mg). Cases receiving a β-blocker for any reason were administered regular doses before the imaging. The pulse rates of the patients were checked at 30-minute intervals, and when the heart rate was under 80 beats, sublingual nitroglycerin was given to cause optimal dilatation in the coronary arteries. Each patient was later placed into the gantry in the supine position. A venous access with a 20-G branula was performed in the antecubital vein in the right upper extremity. In order to avoid sudden panic, which sometimes occurs, and the resultant increase in pulse and arrhythmia, patients were informed about the feeling of heat diffusing throughout the whole body starting from the arm, where the contrasting agent was administered, and were told about the need for micturition caused by the administration of the contrast bolus agent. Patients were re-reminded before the imaging session was started that staying immobile throughout the imaging and adhering to the instruction of "hold your breath" was important to ensure the quality and safety of the examination.

Computed tomography examination

The coronary CT angiography examination was performed using a 128-slice CT device (Definition AS, Siemens Medical Solutions, Forchheim, Germany). Although the examination period varied depending on the case, it was performed in mean periods of five heartbeats. During the examination, ECG-controlled tube current modulation was used. All examinations were performed with standard imaging protocol. Imaging parameters included collimation of 0.6 mm, a gantry rotation time of 300 ms, tube voltage of 120 kV, 200 mAs, and a field of view (FOV) of 120-220 mm. A device detector may achieve isotropic resolution of

128x0.33 mm using 64 sequential 0.6-mm elements and 128 independent data collection channels, and the pitch value was automatically adjusted by the device depending on the heart rate.

Scenographic images covering the carina and the base of heart were obtained in order to determine the region to be scanned before the imaging was started. Later, ECG-recorded helical images, which involved the whole heart from the carina to the base of heart, were acquired during insprium. In cases requiring bypass examination, craniocaudal sections ranging from the thoracic entry to the diaphragm were obtained. The mean 64 ml contrasting agent containing a high iodine concentration (≥350 mg/mL) was administered at a rate of 5 ml/sec using an automated syringe. Following the administration of the contrasting bolus agent, 40 ml serum was administered at a rate of 5 ml/sec in order to involve the contrast agent in dead spaces (line, antecubital vein, and right heart) and to decrease artifacts which might arise from the contrast agent in the right heart. An automated Stellant dual syringe kit (Medrad, Indianola, Pennsylvania, USA) was used to administer the contrast agent and saline.

The bolus tracking method was used for imaging, although this may vary depending on the patient. A 150 Hounsfied unit (HU) triggering value was adopted for region of interest (ROI), and the contrast bolus agent was inserted into the center of the ascending aorta in accordance with the heart rate, which was being monitored by the ECG device. Following infusion of the contrasting agent and saline, sections were obtained from this level at one-second intervals, and the imaging was performed with a mean delay time of five to seven seconds when the predetermined triggering value (150 HU) was reached. There were no complications during the successfully completed coronary CT angiography procedures.

Evaluation and interpretation of images

Throughout the imaging period, the heart rate and ECG tracing were retrospectively recorded. The images obtained were then transferred to the LEONARDO workplace (Siemens Medical Solutions, Forchheim, Germany) and analyzed. For evaluation of coronary arteries, reconstruction images were created at percentage value with minimum movement. In addition to axial images, each coronary artery was evaluated using reconstruction images obtained with multiplanar reconstruction (MPR) and maximum intensity projection (MIP) methods as well as the volume rendering technique (VRT). In our study, reconstruction percentages corresponding to 35-40% in ECG tracing were largely used for the right coronary artery (RCA), and reconstruction percentages corresponding to 70% were more commonly used for the circumflex (Cx) coronary artery. A radiologist with expertise in the field of cardiovascular radiology analyzed all images.

In the examination of the coronary arterial system, variations and anomalies were evaluated. Following the determination of the dominant coronary arterial system, characteristics of the main coronary arteries, such as origination point and course, were examined.

The concept of dominance is not related to the artery supplying the larger section of the heart, but it refers to the artery supplying blood to inferolateral section of the left ventricle. Usually, the dominant artery is the posterior descending artery (PDA).[4] In our study, right dominance was considered if the PDA and posterior left ventricular branches originated from the RCA, and left dominance was considered if they originated from the Cx. Codominance was acknowledged if the posterior descending artery originated from the RCA and the posterior left ventricular branches originated from the Cx.

Angelini's classification of coronary artery disease anomalies includes the origination point and course anomalies, anomalies on the anatomy of the coronary arteries, anomalies in the coronary artery ends, and abnormal collateral vessels.[5] In our study, we used this classification system to examine any coronary artery anomalies found in the patients.

Statistical analyzes

Statistical analysis of the study was performed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) version 13.0 software program. Continuous variables were expressed as arithmetical mean ± standard deviation (SD), and categorical variables were expressed as a percentage (%).

RESULTS

The mean heart rate of patients ranged from 50 beats/min to 92 beats/min (mean 67.7±9.0). Of 83 cases, right dominance was observed in 67 patients (80.7%), left dominance in seven (8.4%), and codominance in nine (10.8%). The conus artery originated from the right sinus valsalva in 14/83 cases (16.86%), and it had an RCA origin in the remaining 69 cases (83.1%). The sinus node artery (SNA) originated from the RCA in 64 cases (77.1%), the Cx in 15 cases (18.1%), the left main coronary artery (LMCA) in two cases (2.4%) and the right sinus valsalva in two cases (2.4%). The arterial structure between the LAD and Cx arteries when the LMCA divides into three branches rather than two immediately following the origin point is referred to

as the ramus intermedius branch, the most common variation seen in the LMCA. In our study, this variation was observed in 25 of 83 cases (30.12%) (Figure 1). The prevalence of coronary artery variations found in our study, the number of patients, and the percentages are given in Table 1.

Coronary artery anomalies were observed in a total of 48 cases (57.8%). One case (1.2%) had no LMCA, LAD, or Cx but had outflows with separate ostia from the left sinus valsalva due to the absence of the LMCA. In all cases in which the coronary arteries originated from the sinus valsalva between the aortic annulus and sinotubular junction, no low or high outflow was observed. Commissural origination was observed in a total of five cases (6%), including the RCA in four cases and the Cx originating from the contralateral coronary sinus in one case. In two cases (2.4%), the Cx had a retroaortic course with thin calibration due to originating from the right sinus valsalva. In one case (1.2%), the RCA had a left sinus valsalva origin and interarterial course (Figure 2), and in another case (1.2%), the RCA had a commissural origin from the posterior sinus valsalva. In one case (1.2%), there was hypoplasia starting 1 cm distal to the origination point of the RCA and lying along the atrioventricular sulcus.

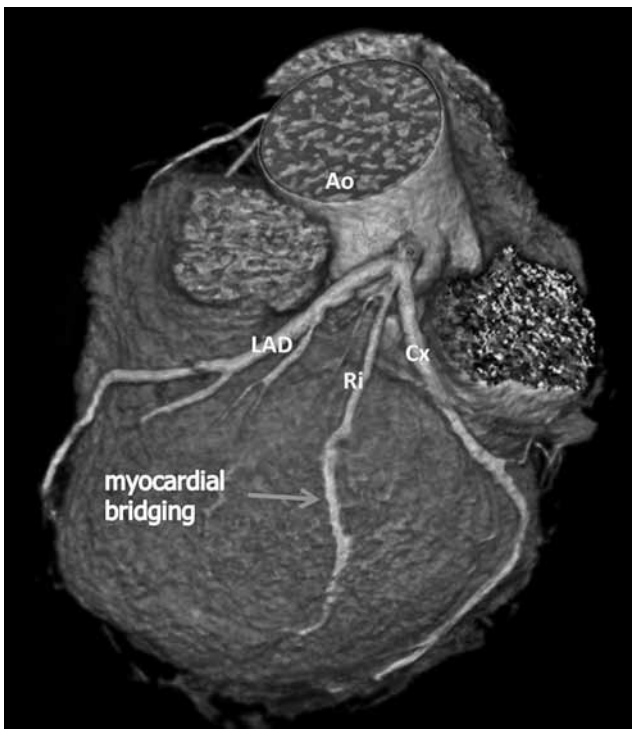

Figure 1. The ramus intermedius branch variation originating between the left anterior ascending artery and the circumflex artery along with myocardial bridging are observed in 3D CT angiographic imaging. LAD: Left anterior descending artery; Cx: Circumflex artery; Ri: Ramus intermedius; Ao: Aorta.

Myocardial bridging, which is defined as the course of coronal arteries within the myocardium and is normally epicardial in nature, was observed in 36 of 83 cases (43.3%) in 53 segments (Figure 3). It was found in one segment in 22 cases (26.5%), in two segments in 15 cases (18%) and in three segments in one case (1.2%). Myocardial bridging was most frequently observed in the mid-distal segment of the LAD and the first obtuse marginal (OM-1) branch of the Cx. In a case with right dominance (1.2%), the PDA originated before the acute marginal artery branch of the RCA and was located along the interventricular sulcus with a course in the posteroinferior section of the right atrium rather than the atrioventricular sulcus. The prevalence of coronary artery anomalies found in our study, the number of patients, and the percentages are given in Table 2.

Moreover, the 12^{th} segment in nine of 83 cases (22.9%) had an origin at a point less than 5 mm to the Cx origin level, and the 12^{th} and 14^{th} segments originated from the Cx at the same level in two cases (2.4%). The ninth and 10^{th} segments originated from the LAD at the same level in three cases (3.6%). In one case (1.2%), a left ventricular aneurysm measuring 1.3x1.2 cm was observed inferior to the mitral valve and was considered to be congenital.

DISCUSSION

Larger areas can be scanned within a shorter time with new-generation MSCT devices due to the significant increase in scanning rates, thus movement artifacts arising from respiratory function can be remarkably reduced. The coronary CT angiography examination time is 45-65 seconds in four-detector devices and 20 seconds in 16-detector devices. The combination of a high scanning rate with thin slice thickness and increased longitudinal resolution allows for higher

Table 1. The prevalence of anatomic variations of coronary arteries, and the percentages of patients

	n	%
Dominance		
Right	67	80.7
Left	7	8.4
Co-dominance	9	10.8
Conus artery		
Right coronary artery origin	69	83.1
Right sinus of valsalva	14	16.9
Sinus nod artery	64	77.1
Right coronary artery origin	2	2.4
Left main coronary artery origin	2	2.4
Right sinus of valsalva	15	18.1
Circumflex artery origin	25	30.12

Figure 2. Left coronary sinus origin and retroaortic course of the RCA in posterior left oblique projection is observed in 3D CT angiographic imaging. Ao: Aorta; Cx: Circumflex artery; LAD: Left anterior descending artery; LMCA: Left main coronary artery; RCA: Right coronary artery.

Figure 3. Myocardial bridging is observed the in mid-section of the left anterior descending artery in the coronal maximum intensity projection computed tomography angiographic imaging. LAD: Left anterior descending artery.

quality three-dimensional (3D) images.[1,6] In our study, the mean examination time with 128-slice CT was around five seconds.

Based on the increases in the scanning rates of new-generation CT devices, discussions about CT angiography procedures and using less contrasting agents have increased. The amount of contrasting agent in four-detector devices is 160 cc while it can be reduced down to 80 cc in 64-detector devices. In our study, the mean amount of contrasting agents used in coronary CT angiography examinations was 64 cc, and this amount, which was less than the values which have been defined in the literature, reduced both the costs and the possibility of developing nephropathy. Many anatomical regions can be scanned in thin slice thickness courtesy of multi-detector high quality reformatting as well as multi-projection volume reformatting, and 3D reconstructions can be made with the acquired isotropic images.[7,8] The detector of the 128-slice CT device used in our study can create a 128x0.33 mm isotropic

Table 2. The prevalence of coronary artery anomalies, the number and percentage of patients

	n	%	
Coronary artery origin and course anomalies			
The absence of left main coronary artery	1	1.2	
Exits abnormally (commissural exit with normal sinus valsalva)	5	6	
Opposite coronary sinus exit			
Circumflex artery originated right sinus of valsalva	2	2.4	Retroaortic cruise
Right coronary artery originated left sinus of valsalva	1	1.2	Interarterial course
Right coronary artery originated posterior sinus of valsalva	1	1.2	
Coronary artery anomalies related to their anatomy			
Coronary hypoplasia	1	1.2	
Myocardial bridging	36	43.3	53 segment
Showing anomalous origin from right coronary artery and abnormal course PDA	1	1.2	

PDA: Posterior descending artery.

resolution using its 64 sequential 0.6-mm elements and 128 independent data collection channels. In all cases, it is mandatory to evaluate all source images on an axial plane. However, two-dimensional or 3D images on different planes can be created using methods of surface shaded display (SSD), MPR, MIP, or VRT with the use of special computer software packages. For 3D display of a coronary arterial tree, the most commonly used technology is VRT. Displaying 3D anatomic images using two-dimensional axial images can be useful for the detection of some anomalies and variations. It is especially beneficial for displaying the complex anatomies of tortuous coronary arteries.[9,10] In addition to the examination on the axial plane, 3D examination is preferred for revealing missed details and ensuring easier adaptation to the anatomy and pathology.

There is no marked consensus on codominance in the literature, and some authors have stated that it should be considered if the PDA and the posterior left ventricular branches jointly supply blood to the inferolateral section of the posterior septum.[11,12] In various studies, the rate of right dominance, left dominance, and codominance was reported as 80-85%, 7-9% and 5-8%, respectively. In our study, right dominance was found in 67 cases (80.7%), left dominance in seven cases (8.4%), and codominance in nine cases (10.8%). In our study, the rates of right and left dominance were comparable with the literature, but the higher codominance rates can be explained by the fact that there was no marked consensus on codominance of the coronary arteries. In another study, the high rate of codominance was similar to what was found in our study (9.1%).[3] The conus artery may not only originate from the RCA but also from the right sinus valsalva via a separate orifice.[13] In our study, this occurred in 14 cases (16.86%) and it originated from the RCA in the remaining 69 cases (83.1%). The has been reported to originate from the first several millimeters of the RCA at a rate of 60% and from the proximal Cx at a rate of 40%.[13,14] In our study, it was observed that the SNA originated from the RCA in 64 cases (77.1%), from the Cx in 15 cases (18.1%), from the LMCA in two cases (2.4%) and the right sinus valsalva in two cases (2.4%). Our findings agreed with the literature which has reported that the most common point of origin for the SNA is the RCA.

The LMCA normally divides into the LAD and Cx branches. Sometimes there may be the variable of a third branch visible between the CAD and Cx. This is referred to as the ramus intermedius variation. This branch is one of most common variations observed in the left coronary arterial system with an incidence rate of 33%.[3,15] In our study, the ramus intermedius variation was found in 25 cases (30.12%), which was comparable with the literature.

Although the absence of an LMCA has no negative hemodynamic influence or clinical significance, the lack of knowledge about this anomaly is important regarding the procedural difficulty in catheterization, and it allows for the possibility of misdiagnosis.[16] For example, in the absence of an LMCA, a completely normal LAD and Cx can be incorrectly interpreted as stenotic if the LMCA filling cannot be observed. Such errors do not occur when using coronary angiography methods performed with MSCT. Therefore, it is important to know that such anomalies exist before performing an invasive procedure for the left coronary arteries.[17,18] The absence of the LMCA has been reported at around 0.41-0.52% in several studies,[16-18] but Cademartiri et al.[19] reported an incidence rate of 3.3%. In our study, the absence of the LMCA in combination with the associated origin of the LAD and Cx from the left sinus valsalva via separate ostiums was observed in only one case (1.2%). The incidence rate for the absence of the LMCA in our study was comparable to the data found in the literature.[3,15]

Coronary arteries originating 1 cm away from the sinotubular junction are referred to as normal, those 1 cm distal are referred to as high, those closer than 5 mm to the aortic valve commissure are referred to as commissural, and those 1 cm below the commissure are referred to as low origin. Normally, coronary arteries originate from the sinus valsalva, and optimal perfusion of the coronary beds is ensured in the diastole. Although perfusion hemodynamics may be compromised in abnormal originations, they do not cause significant clinical problems unless the anomalies have extremely high or low origins.[20,21] In our study, high or low origin was not found. Commissural origination was observed in a total of five cases (6%), including the RCA in four cases without any clinical particularities and the Cx from the contralateral coronary sinus in one case.

Contralateral sinus origin of coronary arteries is a serious problem. Four types of this anomaly have been defined: *(i)* the LMCA originating from the right coronary sinuses (0.09-0.11%), *(ii)* the RCA originating from the left coronary sinus (0.03-0.17%), *(iii)* the LAD or Cx originating from the right coronary sinus (0.32-0.67%), and *(iv)* the RCA, LMCA, or any of their branches originating from the coronary sinus.[22,23] When coronary CT angiographies performed with new-generation MSCT devices were compared with invasive methods, it was found that they were superior in detecting coronary anomalies.[24] Koşar et al.[3] reported in their series consisting of 532 cases that the incidence

of anomalous contralateral sinus origin of the coronary artery was 1%. In our study, this was observed in a total of four cases (4.8%). In one case (1.2%), the RCA had a commissural origin from the posterior sinus valsalva, in two cases (2.4%), the Cx originated from the right sinus valsalva with a thin calibrated and retroaortic course, and in one case (1.2%), the RCA had a narrow angle origin from the left sinus valsalva with an interarterial course. When those rates are compared with the ones in the literature, the rates in our study are higher. One reason for this is that the 128-slice CT is highly sensitive for detecting variations and anomalies while another reason might be related to the low number of cases in our study.

The condition in which the coronary arteries, normally via an epicardial course, tunnel into the myocardium is referred to as myocardial bridging. The incidence rates for this have been reported as 0.5-2.5% in invasive coronary angiographies while the rates are higher (3.5-8.5%) in four- and 16-slice CT angiographies. In general, this does not cause a noteworthy symptom, but it may rarely result in acute myocardial infarction (MI), arrhythmia, or even sudden death. However, in arrhythmic patients with angina, myocardial bridging should be eliminated.[3,22,23] As it was mentioned above, we observed in the current study that myocardial bridging was observed in a total of 53 segments in 36 cases (43.3%) one segment in 20 cases (26.5%), two segments in 15 cases (18%), and three segments in one case (1.2%). Myocardial bridging was most frequently observed in the mid-distal segment of the LAD and the OM-1 branch of the Cx. Our study revealed that MSCT is remarkably more efficient in detecting myocardial bridging relative to invasive angiography. When the rate of myocardial bridging reported in our study is compared with the literature, the highest rate reported to date demonstrates that the 128-slice CT device is highly efficient in detecting this variation.[3,22,29]

The hypoplastic coronary arteries are characterized by a short lumen diameter and small diameter vascular structure relative to the myocardial area being fed due to the incomplete development of one or more branches. This condition should be considered when the Cx does not advance to the mid-section of the posterior atrioventricular sulcus at the lateral aspect of the heart. It is important since it may cause sudden cardiac death. While coronary hypoplasia has not been observed or defined in several studies on coronary anomalies and variations, the incidence rate was reported as 0.17%.[3,9,25] In our study, we found it in only one case (1.2%).

Most coronary artery anomalies are incidentally found (81%), and they do not pose a significant threat to myocardial perfusion, but a small portion of them are comprised of potential malignant pathologies which may result in sudden death and myocardial ischemia. Considering that 12% of the sudden deaths with a cardiac origin in the young population (under 30 years old) are due to coronary artery anomalies, the significance of correctly identifying coronary anomalies or variations increases.[20] Invasive coronary angiography does not provide in-depth information, and information on the origin of anomalies is limited.[26] With regard to the new-generation MSCT devices, the ability to obtain detailed information about all of the above mentioned factors as well as its low radiation dosage relative to invasive angiography, the opportunity to use less of a contrasting agent, and its non-invasive approach increasingly supports the use of the technique.

In conclusion, the 128-slice CT offers detailed and correct information on anatomical structure and variations and anomalies of the coronary arteries. The coronary CT angiography can be used as an alternative to percutaneous invasive procedures or preoperative catheter angiography for coronary arteries, and it may also be used as a superior reference method in some cases.

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