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Case report ■

Multislice Computed Tomography (MSCT) Application in the Diagnosis of Coronary Artery Disease

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SUMMARY

Coronary computed tomography angiography (CTA) is the first non-invasive imaging technique that allows the evaluation of the lumen and walls of the coronary arteries. The sensitivity in defining significant stenosis (>50% caliber reduction) is 93% for the evaluation of single vessels. This is a method for determination of the so-called Calcium score. With a coronary artery calcium (CAC) score >400, the incidence of coronary episodes rises ten-fold. The method can also be used in the evaluation of bypass patency.

The first case report shows a patient with irregular heart rhythm and chest pain. After 24h, the holter ECG monitoring and stress echocardiography test, multi-slice computed tomography (MSCT) examination were performed, excluding thus the coronary disease. The second case report presents a patient who, after coronary artery by-pass grafting, had a positive exercise test. MSCT examination showed the occlusion of three grafts and arteria coronaria dextra.

While coronary MSCT is still an emerging technology, in the next decade, undoubtedly, it will become a major cardiovascular imaging option.

Key words: multi-slice computed tomography, coronary arteries, predictive value

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INTRODUCTION

Computed tomography (CT) is a radiological, non-invasive technique of high sensibility for detecting minimal differences in tissue density. Tomography is a method of digital geometric processing that generates the 3D images of the interior of the object being recorded with X rays. Using a multislice imaging approach together with specialized and dedicated software, computed tomography angiography (CTA) "freezes" the cardiac movement, thereby acquiring static images of the rapidly moving heart (1).

Coronary CTA is the first non-invasive imaging technique that allows the evaluation of the lumen and walls of the coronary arteries, which is a particular advantage in determining the atherosclerotic burden in these arteries. The sensitivity in defining significant stenosis (>50% caliber reduction) is 93% for the evaluation of single vessels and even higher on a per patient basis (2). Not surprisingly, the sensitivity with 64-slice systems is much higher than that of the 16-slice systems (83 vs. 93%), a difference that may also be related to methodological improvements (3).

The clinical relevance of CT in patients with atherosclerosis of the coronary arteries is that non-calcific, non-stenosing fibrolipidic plaques, which do not require interventional procedures, can be accurately identified. This is, also, a method for the determination of the so-called Calcium score. With a coronary artery calcium (CAC) score (Agatston score) >400, the incidence of coronary episodes rises ten-fold (4). The method can also be used in the evaluation of bypass patency. Multislice computed tomography (MSCT) scanning was introduced into the diagnostic assessment of acute chest pain in emergency patients. The technology is used to obtain an anatomic assessment of the coronary arteries, which may allow a quick diagnosis and early patient discharge. MSCT may also help in identifying patients with other serious conditions, including aortic dissection and lung embolism (5).

CASE REPORT No 1

A 62-year-old female patient, D.P., was admitted to the Institute "Niška Banja" for the first time on October 15, 2007 due to irregular heart rhythm and chest pain.

She had the following cardiovascular risk factors: hypertension, dyslipidemia, positive familiar anamnesis, mental stress. The patient had been diagnosed with hyperthyroidism in 1976 and hypothyroidism in 2006. The 24h-holter ECG monitoring showed the following results: 6043 VES, 13436 SVES and 28 couple VES without changes on ST-segment. Repeated exercise test was performed in 2005 and again in 2006 when it

was negative for myocardial ischemia. The previous therapy (propafenone and after that mexiletin), which was prescribed by cardiologist, did not yield the expected results. Amiodarone therapy was successful, but the same was excluded because of its effects on the thyroid gland. Because of the frequent chest pain (however, without ECG changes) and frequent ventricular ectopic beats, coronary angiography was recommended by a cardiologist. The patient did not accept to undergo coronarography, and because of that she was admitted to the Institute for the further examination.

The exercise stress echocardiography test performed at the Institute was negative for myocardial ischemia. Because of frequent chest pain in anamnesis accompanied with supraventricular and ventricular ectopic beats, MSCT was recommended by cardiologist in the Institute. She accepted the procedure as it was a non-invasive technique. MSCT of the coronary blood vessels showed a normal coronary status, as well as normal functional heart examination parameters (EF=58%, EDV=161 ml, ESV=67 ml). Agatston calcium score was zero.

During a follow-up period of one and a half year, the patient felt well, not having any of the previous symptoms. She was again admitted to the Institute in 2009 because of irregular heart rhythm. The exercise stress echo test was again negative for myocardial ischaemia. She was discharged from the Institute with the following medical therapy: Verapamil 80 mg twice a day, Enalapril 10 mg once per day, Hydrochlorothiazide 25mg once in every three days, Acetylsalicylic acid 100 mg per day, Levothyroxine sodium 100 mcg per day and control 24-monitoring holter ECG was indicated.

CASE REPORT No 2

A 67-year-old male patient, V.A. was admitted to the Institute "Niška Banja" for the first time in June, 2008 after quadruple coronary artery by-pass grafting (CABG).

The operation was performed on the 4th of February, 2008. After the operation, he had no chest pain. He had the following cardiovascular risk factors: dyslipidemia, a prior history of smoking.

The exercise test performed in the Institute was positive for asymptomatic myocardial ischemia, and invasive diagnostic procedure was indicated at discharge.

The patient was readmitted to the Institute in July, 2009. In the meantime, MSCT examination was performed, which showed that three out of the four grafts were occluded, as well as ACD (Figure 1).

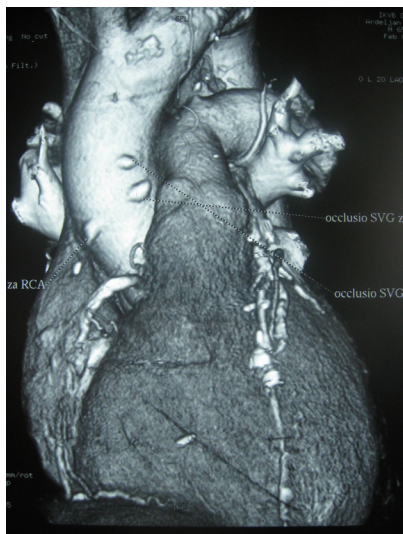


Figure 1. MSCT image of showing the occlusion of the grafts

After that, he was sent to another ergometric test, which was, again, positive for myocardial ischemia. During his stay in the Institute he had no typical chest pain, but was complaining of fatigue. He was discharged from the Institute with the following medical therapy: Bisoprolol 2.5 mg per day, Isosorbidmononitrat 40 mg per day, Trimetazidin 35 mg twice a day, Acetylsalicylic acid 100 mg per day, Ramipril 2.5 mg per day and Simvastatin 10 mg per day and a recommendation for myocardial revascularization.

At the end of 2009, we contacted the patient and were able to get his medical documents. We learned that his cardiologist recommended the coronarography, which was done on the 20th of October, 2009 and had the same finding as the MSCT previously showed. After that, the recanalization of the ACD was performed with the implantation of Taxus stent 2.5x32 mm.

DISCUSSION

The first case report showed that significance of negative predictive value is very important from a clinical point of view; in fact, it defines the ability of coronary CTA to determine whether the vessels are normal, i.e., free of atherosclerotic involvement. However, in most cases, very high-quality images are obtained and important therapeutic decisions based directly on these images can be made, thus limiting the use of catheter coronary angiography to more complex cases, interventional procedures, or in the immediate preoperative phase, in patients in whom a new revascularization procedure is planned. The most interesting result in prior studies was a negative predictive value of >97%, much better than that reported for any other non-invasive diagnostic test (6).

In addition, as shown in case No 2, one of the major advantages of MSCT examination is that it is a non-invasive diagnostic approach, which is desirable in patients with bypass grafts as they are at high risk for complications arising from invasive angiography (7). With newer equipment, the sensitivity in the diagnosis of CABG occlusion is 100% and in the evaluation of stenosis - over 96%.

CONCLUSION

Coronary CT angiography is rapidly changing the patient-care algorithms used to detect coronary artery disease, as well as the approach we take in risk-factor assessment. While coronary MSCT is still an emerging technology, because of its high informative value and non-invasive approach, it is expected to become a major cardiovascular imaging option in the next decade.

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PRIMENA MULTI-SLAJS KOMPJUTERIZOVANE TOMOGRAFSKE ANGIOGRAFIJE (MKTA) U DIJAGNOZI KORONARNE ARTERIJSKE BOLESTI

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Sažetak

Koronarna kompjuterizovana tomografska angiografija (CTA) je prva neinvazivna imidžing tehnika koja omogućava evaluaciju lumena i zida koronarnih arterija. Senzitivnost u definisanju značajnih stenoza (>50% redukcija kalibra) je 93% za evaluaciju pojedinačnih arterija. Ovo je metoda za determinisanje tzv. Kalcijum (Ca) skora. Sa Ca skorom koronarne arterije >400, incidence koronarnih epizoda desetostruko se povećava. Metoda takođe može biti korišćena za evaluaciju prohodnosti by pass-a.

Prvi prikaz je slučaj bolesnika sa nepravilnim srčanim ritmom i bolovima u grudima. Nakon 24h EKG holter monitoringa i stres ehokardiografskog testa, obavljen je Multi-slajs kompjuterizovan tomografski (MSCT) pregled koji je isključio koronarnu bolest. Drugi prikaz je slučaj bolesnika koji je nakon operacije aortokoronarnim by pass-om imao pozitivan ergometrijski test. MSCT pregled je pokazao okluziju tri grafta i desne koronarne arterije.

Dok je koronarna MSCT još uvek tehnologija u razvoju, bez sumnje će u sledećoj dekadi postati glavna kardiovaskularna imidžing opcija.

Ključne reči: multi-slajs kompjuterizovana tomografija, koronarna arterija, predikativna vrednost