Evaluation of the Aorta and its Main Branches in Patients with Coronary Artery Ectasia. A Magnetic Resonance Imaging Study

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Ectatic coronary arteries may coexist with aneurysms in other arterial beds due to a possible systemic pathogenic mechanism. The diagnosis of those aneurysms may be delayed because of their non-typical clinical manifestations, a situation that may be threatening to a patient's life. The aim of our paper is to study the aorta and its major branches using magnetic resonance imaging (MRI) in ten patients with ectatic coronary arteries in order to exclude the presence of other aneurysms. The diagnosis of four aneurysms in these three patients, proving to be life saving, indicates that further testing is necessary in order to best evaluate other patients with ectatic coronary arteries.

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Coronary arteries ectasias are considered, in their majority, a variation of the manifestation of atheromatous disease. Similar aneurysmal lesions may be encountered in other vascular networks too, since the factors contributing to the creation of ectatic lesions are probably systemic.

The presence of aneurysmal lesions in main arterial branches with a usually asymptomatic course may be a life threatening condition for the patient due to the possible sudden rupture of the aneurysms.

Magnetic resonance imaging is a particularly reliable imaging technique which is harmless to the patient since there is no radiation emitted and it has special applications in the investigation of large vessels such as the aorta and its branches.

The aim of our study is the investigation of eventual co-existence of aneurysmal lesions of the aorta and its branches in patients who have already been diagnosed with ectatic coronary artery disease and the follow-up of the course of such patients.

Case reports

The material of our study consisted of ten patients (9 men and 1 woman) with ectatic coronary arteries who underwent consecutive coronary angiograms in the Hemodynamic Laboratory, due to clinically diagnosed coronary artery disease.

International literature, defines as ectatic the lesions of the coronary arteries with a diameter of at least 1.5 times larger than the diameter of the adjacent normal segment of the coronary artery. We defined the stenoses of more than 50% of the coronary artery lumen as atheromatous lesions.

All patients underwent magnetic resonance imaging for the evaluation of the aorta (thoracic and abdominal) and its endocranial branches. The selection of magnetic resonance imaging as an imaging method is especially reliable and harmless due to the lack of radiation emission. For each patient, we recorded the risk factors for coronary artery disease as well as the possible presence of

heart dysfunction. Patients followed the suggestions for further treatment, depending on the catheterization and MRI findings. We then followed up the patients for a period of approximately two years (26±7 months).

Our patients were mainly men (9 men and 1 woman) and the mean age was 51±14 years. The age ranged from 38 to 78 years.

As far as the known risk factors for coronary artery disease were concerned, in our group of patients we observed that 7/10 were smokers (70%), 5/10 were hypertensive (50%), 7/10 presented hyperlipidemia (70%), 1/10 had diabetes mellitus (10%) and 3/10 reported positive family history for coronary artery disease (30%). Seven out of our ten patients had at least two risk factors (70%).

The clinical diagnosis upon hospital admittance and coronary angiography, was unstable angina in 3/10 patients (30%), acute myocardial infarction in 4/10 patients (40%) and atypical symptoms in 3/10 patients (30%). At the same time, 2/10 patients (20%) presented permanent atrial fibrillation while 1/10 (10%) presented acute pulmonary edema upon hospital admission.

Coronary angiography revealed atheromatous and ectatic lesions of the coronary arteries. More specifically, significant atheromatous lesions (stenosis >50%) were present in 8/10 patients (80%). The three major coronary arteries presented approximately the same percentages of disease (RCA 40%, LAD 40%, LCX 50%). Also, ectatic lesions were approximately equally represented in the three major coronary arteries (RCA 80%, LAD 70%, LCX 60%) with a slight predominance of the right coronary artery. The mean left ventricular ejection fraction, was 53% (Table 1).

From the imaging control of the aorta and its branches, using MRI, we observed one intracranial aneurysm (10%), one thoracic aortic aneurysm (10%) and two abdominal aortic aneurysms (20%).

Instructions given to the patients for the management of the findings, following the heart catheterization as well as the MRI, included conservative treatment and follow-up for 7/10 (70%) patients, coronary angioplasty for one patient (10%) and surgical treatment for 2/10 (20%) patients, (Table 2).

More analytically: Patient No. 2, fifty-two years old, had one-vessel coronary artery disease (LCX), three ectatic coronary arteries as well as an abdominal aorta aneurysm (transverse diameter less than four centimeters). We suggested conservative treatment of the coronary artery disease as well as conservative treatment and follow-up of the abdominal aneurysm.

Patient No. 4, forty-years old, had one-vessel coronary artery disease (LCX) and three ectatic coronary arteries and underwent circumflex artery angioplasty.

Patient No. 6, thirty-nine years old, had two-vessel coronary artery disease (LAD, RCA), two ectatic coronary arteries (LAD, RCA) as well as an aneurysm of the brain's basilar artery. We suggested conservative treatment of the coronary artery disease and embolization of the intracranial aneurysm that was successful.

Patient No. 9, seventy years old, had one-vessel coronary artery disease (LCX), one ectatic coronary artery (LCX) as well as an aneurysm both in the thoracic as well as in the abdominal aorta. We suggested surgical treatment of the coronary artery disease as well as of the thoracic aortic aneurysm at the same time, that was successfully carried out, together with conservative management and follow-up of the aortic aneurysm.

All patients had a mean follow-up of 26±7 months. Among ten patients only one was hospitalized for acute myocardial infarction (patient of case No. 4, who had three ectatic coronary arteries and was submitted to circumflex artery angioplasty),

Table 1. Clinical characteristics of patients and results of heart catheterization.

Risk factors					Diagnosis				Ectatic vessels			Atheromatous vessels			EF
S	H	DM	CH	FH	SA	UA	AMI	NT	LAD	LCX	RCA	LAD	LCX	RCA	
7 70%	5 50%	1 10%	7 70%	3 30%	0 0%	3 30%	4 40%	3 30%	7 70%	6 60%	8 80%	4 40%	5 50%	4 40%	53%

S=Smoking, H=Hypertension, DM=Diabetes Mellitus, Ch=Cholesterol, FH=Family History, SA=Stable Angina, UA=Unstable Angina, AMI=Acute Myocardial Infarction, NT=Non-Typical Symptoms, EF=Ejection Fraction.

Table 2. MRI results of the aorta and its intracranial branches, suggestions for further management, treatment and outcome.

N/Gender (Age)	Thoracic Aorta MRI	Abdominal Aorta MRI	Brain MRI	Recommendation	Long-Term outcome
1/M (57)	No	No	No	Conservative	Good
2/M (52)	No	Aneurysm	No	Conservative	Good
3/F (38)	No	No	No	Conservative	Good
4/M (40)	No	No	No	PTCA	AMI
5/M (45)	No	No	No	Conservative	Good
6/M (39)	No	No	Aneurysm	Surgical	Good
7/M (44)	No	No	No	Conservative	Good
8/M (78)	No	No	No	Conservative	Good
9/M (70)	Aneurysm	Aneurysm	No	Surgical	Good
10/M (64)	No	No	No	Conservative	Good
Total	1/10 (10%)	2/10 (20%)	1/10 (10%)	2/10 (20%): Surgical 1/10 (10%): PTCA	9/10 (90%): Good

while the remaining nine patients did not present any early or late complications.

Discussion

In their majority, coronary arteries ectasias constitute a form of atheromatous etiology coronary artery disease. They appear in the form of dilatations, either diffused or localized, in one or more coronary arteries. Their incidence is very low and ranges between 1.1%-5.3% depending on the center conducting the study as well as on the origin of the material (heart catheterizations or autopsy preparations)[1-4].

The etiology of ectatic coronary arteries may also be congenital, due to viral (infective endocarditis) or immunological causes (Kawasaki disease), while a new cause has been identified lately, the iatrogenic one, which is due to the increased number of invasive techniques applied by cardiologists in the last few years (angioplasty - atherectomy)[5-6]. The atheromatous disease may be considered a possible cause of the ectatic lesions for the patients of this study, since significant atheromatous stenoses co-existed in a high percentage of our patients (80%), while atheromatous stenoses also co-existed in the remaining patients, which however were not significant. None of the patients reported a history of infection or of an immunological disease in the past.

The clinical presentation of the disease may be typical with angina-type complaints that may evolve into acute myocardial infarction while several times the persisting atypical symptomatology delays the diagnosis[2,6,7]. The majority of our study patients, were admitted to hospital due to acute coronary syndrome (unstable angina and acute myocardial infarction), while the rest presented atypical symptomatology that could, however, lead to a diagnostic examination of the coronary arteries. It would be worth examining why two of the younger patients presented permanent atrial fibrillation and whether this is related to the ectatic coronary vessels.

The slow blood flow and the increased diameter of the coronary arteries predispose to the creation of thrombi while the deficient vascular wall, due to the loss of thickness of the tunica media, may less often lead to dissections[3,5,8].

The presence of ectatic lesions in the coronary arteries that will be subjected to angioplasty causes doubts regarding the safety of the method and the probability of dissections. Small research series have shown that no complications appear when the distance of the ectatic lesion from the angioplasty site is equal or greater than the size of the balloon that will be used[9-10]. Only one patient in our study had indications for angioplasty. This patient did not present any early complications but approximately thirty months following angioplasty, he was hospitalized with the diagnosis of a non-Q wave acute myocardial infarction. His refusal to undergo a new coronary arteriography does not allow us to totally blame the coronary artery that was subjected to angioplasty (circumflex artery).

The pathogenetic mechanisms that are responsible for the creation of ectatic lesions of atheromatous origin seem to include:

a. the prestenotic dilatation of the vascular wall on co-existing stenosis,

b. the pre-existing (congenital) lesion of the tunica of the vascular wall and its dilatation, even under the exertion of normal pressures,

c. the significant impact of hypertension on the vascular wall[1,11].

It has been found that MMP-1, MMP-2 and MMP-9 metalloproteinases, collagenases that fragment the ground substance of the vascular wall, present a positive correlation with the increased diameter of the coronary arteries[12].

It can be logically assumed that a common pathogenesis mechanism in the form of collagenase or protease of increased activity, that primarily involves the tunica media of the vessel, may act systemically, creating aneurysmal lesions in other arterial networks aside of the coronary one, adding to the effect of atheromatosis. This assumption is supported by reports of several cases of co-existence of ectatic coronary arteries and ventricular aortic aneurysms[13-14] together with baccate intracranial aneurysms[15-17].

The presence of aneurysms in the aorta is not a particularly rare phenomenon since almost 5% of men above sixty years of age present an abdominal aortic aneurysm. The ratio of men - women is approximately 5:1. Intracranial aneurysms account for 0.5%-1%[18].

The main etiology of aneurysms is atheromatosis that renders the vascular wall thinner and less strong, rendering it susceptible to the exertion of intraluminal pressures. The significant role of hypertension and hyperlipidemia is obvious[18].

Aortic aneurysms may develop along its whole length. In their majority they are found in the abdominal aorta and in particular under the renal arteries, often extending to the iliac arteries. They are usually spindle-shaped and less often bag-shaped. Intracranial aneurysms are seen at the bifurcation points of the arteries, particularly in the sub-arachnoid area. The basilar artery is not a usual site of aneurysm identification (percentage 8%-10%)[18]. Symptoms in the presence of aneurysms are usually not severe. Patients usually described them as a deep feeling of continuous ache that reflects on the back. However, aneurysms often rupture without warning symptoms. Aortic aneurysm rupture, although rare when the aneurysm diameter is less than 5 cm, often constitutes a fatal complication[18]. The diagnosis is made through CT scan, MRI and angiography as well as through the angiographic imaging of the aorta and its branches. The latter is an aggressive method and is preferable when we need to investigate a potential thrombus, as well as to pre-operatively assess the aneurysm. The management of aneurysms is invasive and includes the selection between the surgical method and the application of an intravascular stent at the site of the aneurysm. The surgical management of a ruptured aneurysm entails a particularly high peri-operative risk[18].

Magnetic resonance imaging and its complementary magnetic angiography constitute imaging, diagnostic, non-invasive methods that are based on the creation of a magnetic field. Magnetic angiography is particularly useful for the imaging of the vessels' anatomy and the diagnosis of lesions such as aneurysms. It is accurate for vessels with a diameter exceeding four millimeters. The fact that both methods do not involve radiation emission renders them safe for the patients. They are highly accurate, fast and reliable, while their main disadvantage is the high cost that does not allow for their use as a first choice in investigating a patient[18].

In our study we proceeded to the imaging, of ten patients with ectatic coronary arteries with the help of the aorta and intracranial aortic branches magnetic imaging. Our findings, one thoracic aorta aneurysm, two abdominal aorta aneurysms and one aneurysm of the basilar brain artery, in combination with the presence of ectatic coronary arteries, although not statistically significant due to the limited number of patients examined, are indicative of the assumption that a common systemic pathogenesis mechanism may act on the vascular wall, regardless of the location of the lesions. One could argue that the co-existence of the above was fortuitous or anticipated, however both the age of the three patients who presented such aneurysms (39, 52 and 70 years old, respectively), as well as the plethora of findings in such a small sample of patients, does not allow us to attribute it to chance. The answer of course can be given only by a large study, which will search the possibility of increased incidence of aneurysm in other arterial networks in patients with ectatic coronary arteries.

Of course, the cost and the usual lack of a typical clinical presentation often lead to delayed diagnosis of aneurysms. However, the diagnostic concept of the clinician in the case of atypical symptomatology and the

characteristic image of ectatic coronary arteries might lead to the prompt further examination of such patients in order to exclude life-threatening conditions.

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