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# Anatomical-Clinical Investigations of Variations of the Human Coronary Arteries

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## Abstract

Variations of the human coronary arteries have always attracted the attention of many researchers. A review of the literature shows that variations can cause ischemic heart disease or sudden cardiac death.

The aim of the investigations was to examine the existence and clinical significance of variations of the human coronary arteries. Special attention has been focused on myocardial bridging of the coronary arteries and coronary arteriovenous fistula.

Our investigations were carried out on the human hearts at the Department of Anatomy and on patients at the Cardiology Department of University Clinical Centre in Sarajevo.

Using the method of dissection and coronary angiography we established the existence of variations of the coronary arteries (variations of origin, distribution) on the human hearts without macroscopic visible changes as well as on patients with ischemic changes (angina pectoris, myocardial infarction, congenital cardiovascular malformation etc.).

We established the higher incidence of ischemic changes on patients with variations of coronary arteries.

**Key words:** coronary arteries, variations, ischemia, dissection, angiography.

## Introduction

Coronary variations are frequently findings in patients with macroscopic visible changes on coronary arteries as well as in patients with normal coronary circulation. However, certain variations are associated with myocardial ischemia or infarction, heart failure, and sudden death. For this reason, variations of the human coronary artery are a matter of clinical interest to pathologists and internists recently also to heart surgeons and roentgenologists and an object of theoretical interest to morphologists and physiologists.

Our investigations objective was to examine the existence of variations of the coronary arteries on the human hearts without macroscopic visible pathological changes as well as on patients with ischemic changes on the hearts (angina, myocardial infarction, congenital cardiovascular

malformations). Special attention has been focused on the myocardial bridging of the coronary arteries and coronary arteriovenous fistula.

Variations of the human coronary arteries have been studied by many authors: Hadžiselimović, Karahan, Hunh, Hasanović, Somanath, Trejo Gutierrez, Channer and others.

## Material and methods

Our investigations were carried out using 30 human hearts from the Department of Anatomy. Additional data on hearts with signs of coronary disease were obtained in cooperation with the Cardiology Department of the Clinical Centre in Sarajevo. Two methods were applied in our investigations: dissection and coronary angiography.

By the method of dissection, blood vessels of the human hearts were carefully shown, and then myocardial bridges on the coronary branches were assessed.

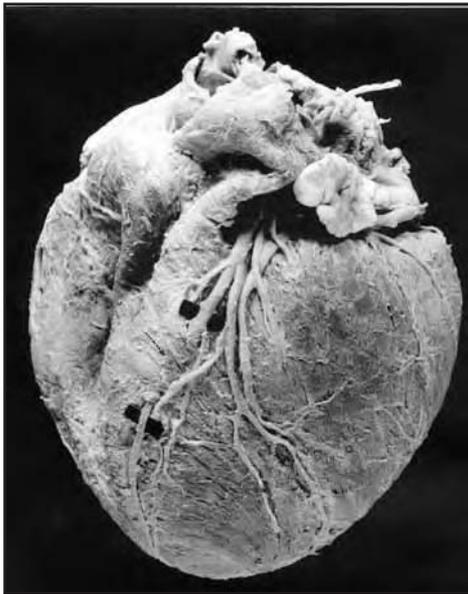
We also applied coronary angiography method. A catheter was inserted into the femoral artery. We used the catheters of Judkins for the right coronary artery and for the left one, as well. Omnipaque was introduced as a contrast and then both arteries were X-rayed in two radiographic projections: RAO (right anterior oblique) and LAO (left anterior oblique).

Using this method, we explored the existence bridges on coronary arteries, and coronary arteriovenous fistulas and others.

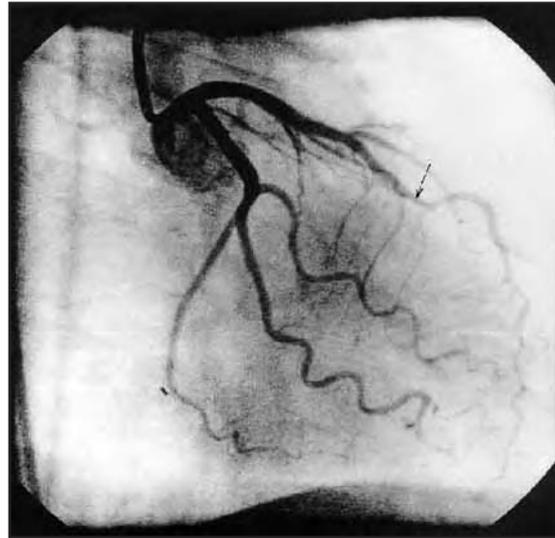
## Results

On the 10 human hearts (33.3%) without visible pathological changes, the existence of the myocardial bridges on the left anterior descending branch is established (Figure 1).

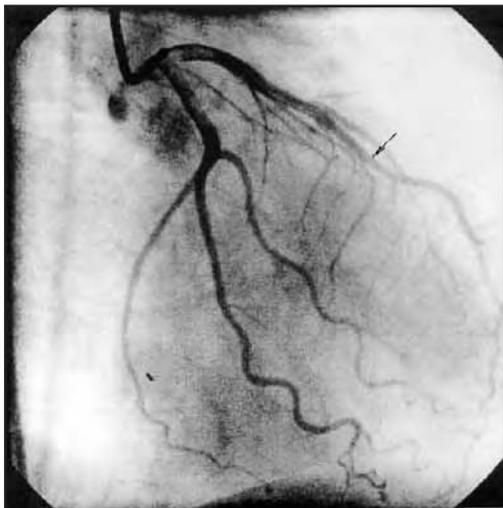
The coronary angiograms of 30 patients were analysed to find out the incidence of myocardial bridges and its significance as regards myocardial ischemia. Eight of these (26.6%) were found to have myocardial bridges. The highest incidence of myocardial bridges we found on the left anterior descending branch, although myocardial bridges were established on the circumflex branch of the left coronary artery, and at the end on the right coronary



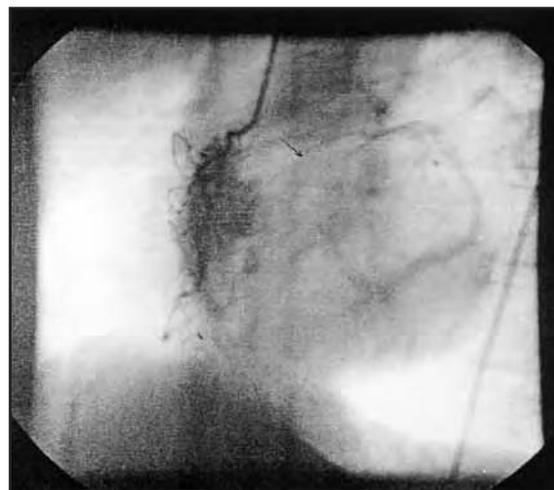
**Figure 1** Myocardial bridge on the left anterior descending branch of the left coronary artery (dissection)



**Figure 2a** RAO: left coronary arteriogram showing systolic narrowing typical of myocardial Bridging on the left anterior descending branch



**Figure 2b** RAO: left coronary arteriogram (diastole)



**Figure 3** LAO: right coronary arteriogram showing arteriovenous fistula between right coronary artery and coronary sinus

artery. Myocardial bridges covering arterial branches of the second and third order are less frequent. Right coronary artery was dominant in all patients with myocardial bridges.

Systolic narrowing typical of myocardial bridging on the left anterior descending branch and changes in diastole are indirect signs of myocardial bridges (Figure 2a and 2b).

Their ages ranged from 45-72 years. Diagnoses were dif-

ferent: chronic stable angina and atypical angina, arterial hypertension, diabetes type I, and anaemia. Anamnestic findings shows anginal pain, high arterial pressure and smoking.

Echocardiogram shows reduced diastolic function and RTG of the heart shows cardiovascular shadow arteriosclerotic configuration. By applying cardiac catheterisation we found myocardial bridges in proximal and distal segment LAD, but others parameters were normal. All patients with bridges were treated conservatively

with good relief of symptoms. Using the coronary angiography method, we established the existence of arteriovenous fistula in two cases (6.6 %) (Figure 3).

Our patients were with different diagnoses: angina stable, arterial hypertension, hiatal hernia, cholelithiasis, status post myocardial infarction. As well as in diagnoses we found anginal pain, myocardial infarction easier and signs of ischemic disease. Echocardiogram and cardiac catheterisations were normal except visible AV fistula. In a case with AV fistula dominant artery was left coronary artery.

Arteriovenous fistulas are more frequent creates of the right coronary artery and its branches. AV fistulas were incidental findings and patients were treated conservatively.

## Discussion

Our investigations showed the existence of coronary variations (myocardial bridges, AV fistulas). The highest incidence of myocardial bridges we found on the proximal segment of the left anterior descending branch, less frequent on the circumflex branch and right coronary artery as authors (Hadžiselimović, Hasanović, Chaner, Karahan). There is not direct relationship between the myocardial bridges of coronary arteries and myocardial

infarction, but the higher incidence of myocardial infarction in cases with a bridged anterior descending branch was shown to be statistically significant. Myocardial bridges contribute to the pathogenesis of myocardial infarction in cases with the left dominant type of coronary artery, and right coronary artery but less frequent. The deleterious effect of myocardial bridges can be already noted at early developmental stages of atherosclerosis (Somanath, 1989).

## Conclusion

Thus the myocardial bridges act as an adverse morphologic factor promoting the development of a predilection site (*locus minoris resistentiae*) in the arterial segment proximal to the bridge, where the sclerotic process manifests itself more distinctly.

In all cases with variations we established ischemic changes on the heart.

In fact, early diagnosis of coronary variations is very important in cardiology for adequate treatment of patients and for application adequate therapy.

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