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Original Article

Comparison of Cardiac Wall Thicknesses and Coronary Artery Obstructions Between Deaths Resulting From Acute Myocardial Infarction and Deaths From Other Causes

Akut Miyokard Enfarktüsü Sonucu Ölenler ile Başka Nedenlerle Ölenler Arasında Kalp Duvar Kalınlıkları ve Koroner Arter Tıkanıklıklarının Karşılaştırılması

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ABSTRACT

Objective: The risk factors for myocardial infarction (MI) can be separated into three general categories: non-modifiable factors, modifiable risk factors, and lifestyle. This study aimed to investigate whether or not there was any effect of cardiac wall thickness and coronary artery obstructions on acute MI.

Methods: In this retrospective study of histopathological examinations of autopsies, two groups were formed. The first contained 28 cases diagnosed with acute MI and the second 28 cases with no heart pathology and the cause of death was reasons other than heart disease. The subjects in the two groups were similar in age, height, weight, and body mass index. The groups were compared in terms of the left and right ventricular wall thicknesses and the degree of obstruction of the right, left, anterior descending, and circumflex coronary arteries.

Results: The mean left ventricular wall thickness was 1.461±0.2767 cm in the acute MI group and 1.386±0.2460 cm in the control group, with no statistically significant difference found between the two groups (p=0.289). A statistically significant difference in the degree of obstruction of the coronary arteries was found between the groups.

Conclusions: Although the mean cardiac wall thickness was greater in the acute MI cases, no statistically significant difference was found between the two groups.

Keywords: Autopsy, acute myocardial infarction, sudden death, cardiac wall thickness, heart weight

ÖZ

Amaç: Akut miyokard enfarktüsünde (MI) risk faktörleri 3 kategoriye ayrılır. Değiştirilemeyen risk faktörleri, değiştirilebilir risk faktörleri ve yaşam tarzı ile ortaya çıkabilen risk faktörleridir. Bu çalışmada kalbin duvar kalınlıkları ve koroner arter tıkanıklıklarının akut MI üzerinde bir etkisinin olup olmadığı araştırılmıştır.

Yöntemler: Retrospektif olarak yapılan çalışmada otopsilerin patolojik incelemesinde akut MI tanısı almış 28 olgu ile ölüm nedeni kalp hastalığı olmayan ve kalp patolojisi tespit edilmeyen 28 olgu seçildi. İki grup oluşturuldu. Ağırlık, boy, vücut kitle indeksi ve yaş iki grup için de yakın olacak şekilde yapıldı. Sol ve sağ ventrikül duvar kalınlıkları ve sirkumfleks, ön inen, sağ ve sol koroner damaraların tıkanıklık dereceleri karşılaştırıldı.

Bulgular: Sol ventrikül duvar kalınlığı akut MI grubunda ortalama 1,461±0,2767, kontrol grubunda ise 1,386±0,2460 olup istatistiksel olarak anlamlı değildi (p=0,289). Koroner arter tıkanıklıklarının derecelerinin de iki grup arasında farklı idi ve bu farkta istatistiksel olarak anlamlıydı.

Sonuçlar: Kalbin duvar kalınlıkları ortalamaları, akut MI olgularında daha yüksek olsa da gruplar arasında anlamlı istatistiksel fark saptanmamıştır.

Anahtar kelimeler: Otopsi, akut miyokard enfarktüsü, ani ölüm, duvar kalınlıkları, kalp ağırlığı

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INTRODUCTION

Acute myocardial infarction (MI) is defined as myocardial cell death associated with ischemia that develops as a result of prolonged oxygen insufficiency. Atherosclerotic processes are generally found in the pathogenesis of acute MI. The diagnosis of acute MI in surviving cases is made via electrocardiography, elevated levels of biochemical markers of myocardial necrosis, and imaging tests. In autopsy cases, the diagnosis of acute MI is made via macroscopic and microscopic examinations[1]. The risk factors for MI can be separated into three general categories: non-modifiable factors, modifiable risk factors, and risk factors that can emerge later with the individual's lifestyle[2].

The best-known disease characterized by increased left ventricular wall thickness is hypertrophic cardiomyopathy (HCM). When HCM is not accompanied by another heart disease or systemic disease, there is an autosomal dominant pattern in the genetic infrastructure. Generally in the left ventricle, and less often in the right ventricle, there is cardiomyopathy characterized by increased diffuse or focal wall thickness. This is the most common genetic cardiovascular disease. It is estimated that approximately 600,000 people are affected in the USA, and the estimated prevalence in the general population is 1:500 (0.2%)[3-6].

Myocardial ischemia associated with coronary artery disease is an established pathophysiological characteristic of HCM[7]. When compared with the better-understood mechanisms of left ventricular output pathway obstruction and diastolic dysfunction, myocardial ischemia associated with epicardial coronary disease has been accepted as an insignificant component of the HCM disease process[8-11].

There are studies in the literature related to epicardial coronary artery disease in patients with HCM. Accompanying epicardial coronary artery disease has been shown to be present in 20% of adult HCM patients. Although acute MI in HCM has been previously described in the literature, the data on the outcomes of acute MI in patients with HCM seem to be limited[12-14].

Recently, an increase in heart weights and wall thicknesses has been observed with increasing obesity rates. This study aimed to investigate whether or not there was any effect of the left ventricular wall thickness and coronary artery narrowing on acute MI. On the hypothesis that an increase in the left ventricular wall thickness, in particular, would have an effect on the development of acute MI, data on HCM characterized by left ventricular wall thickness were discussed in the study.

MATERIALS and METHODS

This study was approved by the Scientific Research and Publication Ethics Committee (Health Sciences Non-Interventional Clinical Research Ethics Committee) of Inonu University (decision no: 2018/21-26, dated 20.11.2018). Permission was also received from the Ministry of Justice and Forensic Medicine Institute Directorate (decision no: 2018/982, dated 25.12.2018).

A retrospective examination of the records of autopsies performed in the Forensic Medicine Institute of Malatya Forensic Medicine Group Directorate was conducted between 2018 and 2019. As a result of histopathological examinations in the records, cases diagnosed with acute MI were selected and cases of death that was not a result of any heart disease and were not determined with any cardiac pathology. Thus, two groups were formed. To minimize factors that could affect the heart's size, the groups were formed with equal gender distribution. The acute MI group cases were selected randomly, and when forming the control group, the cases were selected to be very similar to the acute MI cases in terms of age, height, weight, and body mass index (BMI). The groups were compared in terms of the left and right ventricular wall thickness, and the degree of obstruction of the right, left, anterior descending, and circumflex coronary arteries.

The samples of the cases selected in both groups were restained and reexamined. The histopathological evaluations of the prepared samples were performed by a pathologist working in the Pathology Laboratory of the TC Forensic Medicine Institute (Figure 1-4). The stenosis of the length of the coronary artery lumen diameter was divided into four, and the percentage of stenosis was given; e.g., if 1/4 of the lumen was narrowed, the stenosis was evaluated as 25%.

Statistical Analysis

In the power analysis applied, taking α=0.05 and 1- (power)=0.80, it was calculated to be necessary to include at least 28 cases in each group for a 0.3-cm mean difference in the left ventricular thickness in the comparison of cardiac wall thicknesses and valve measurements between cases of death from acute MI and cases of death from other causes. Data obtained in the study were analyzed statistically using IBM SPSS version 21.00. Conformity of the data to the normal distribution was assessed using the Kolmogorov-Smirnov test and the Shapiro-Wilk test. The t-test was used in the comparisons of independent groups of data with a normal distribution and the Mann-Whitney U test was used for data not showing a normal distribution.

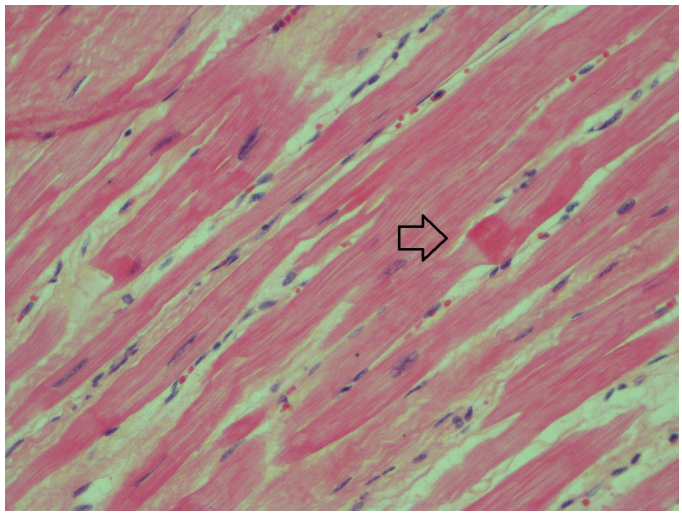

Figure 1. Acute MI: pathology appearance consistent with 4-10 hours (H&E, ×100).

MI: Myocardial infarction, H&E: Hematoxylin and eosin staining

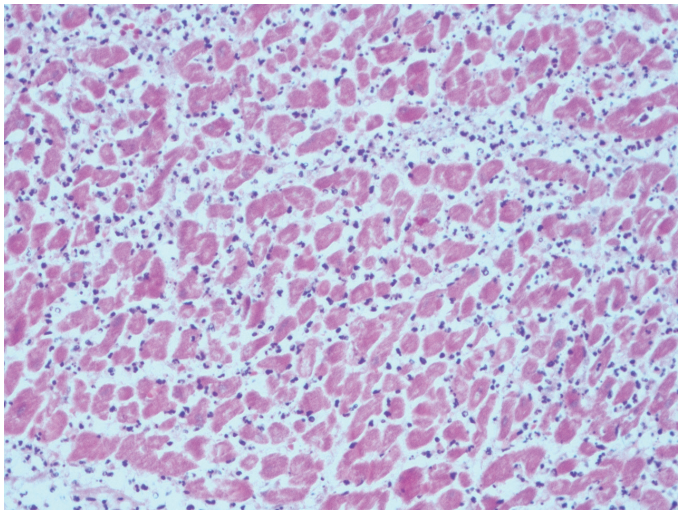

Figure 2. Acute MI: pathology appearance consistent with 1-3 days (H&E, ×100).

MI: Myocardial infarction, H&E: Hematoxylin and eosin staining

RESULTS

Each of the groups comprised 23 males and 5 females of similar age, height, weight, and BMI. The mean age was 51±21 years in the acute MI group and 50±20 years in the control group. The mean weight and height were 171±11 cm and 77±15 kg, respectively, in the acute MI group, and 170±11 cm and 76±17 kg, respectively, in the control group. The mean BMI was 27±7 kg/m^2 in the acute MI group and 26±6 kg/m^2 in the control group (Table 1).

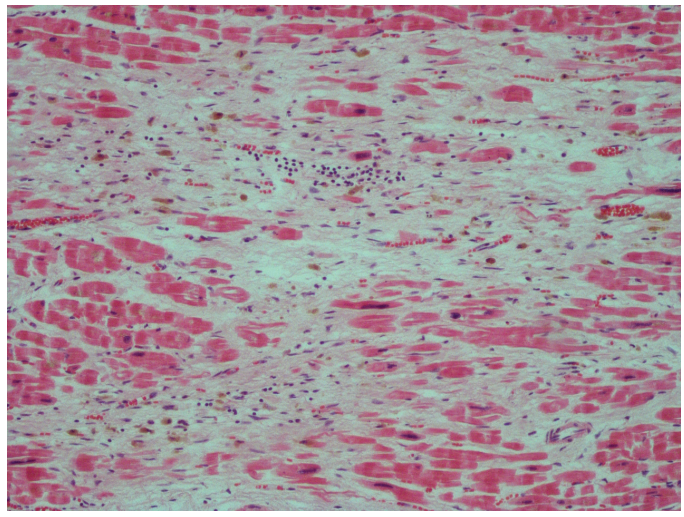

Figure 3. Acute MI: pathology appearance consistent with 7-10 days (H&E, ×100).

MI: Myocardial infarction, H&E: Hematoxylin and eosin staining

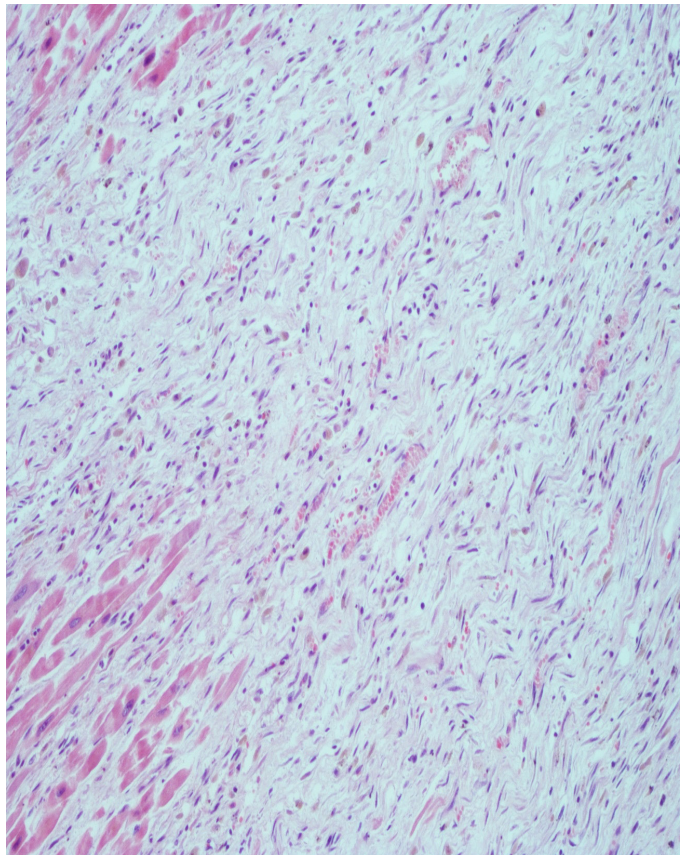

Figure 4. Acute MI: pathology appearance consistent with 10-14 days (H&E, ×100).

MI: Myocardial infarction , H&E: Hematoxylin and eosin staining

Comparisons of Wall Thickness Measurements

The mean left ventricular wall thickness was 1.461±0.2767 cm in the acute MI group and 1.386±0.2460 cm in the control group. The difference between the two groups was not statistically significant (p=0.289). The median thickness was 0.4 cm, minimum 0.2 cm, maximum 0.6 cm in the acute MI group. In the control group, the median thickness was 0.3 cm, minimum 0.2 cm and maximum 0.7 cm. No statistically significant difference was found between the two groups (p=0.171).

Comparisons of the Degree of Coronary Artery Obstruction

In the comparisons of the percentage of obstruction of the right and left coronary arteries, the left anterior descending, and circumflex coronary arteries between the two groups, median with minimum and maximum values were calculated as the data did not show a normal distribution. The differences between the groups were statistically significant (Table 2).

DISCUSSION

Myocardial ischemia associated with coronary vascular disease is a known pathophysiological characteristic of HCM[15]. An increase in the ventricular wall thickness leads to heart problems through several routes, from the transmission system to the narrowing of the coronary arteries by the muscles. Although myocardial ischemia associated with epicardial coronary artery disease is an insignificant component of the HCM disease process, whether an increase in left ventricular wall thickness is associated or not with acute MI is an area that has not yet been fully clarified[16]. To the best of our knowledge, the current study is the first in the literature on this subject. The compensation mechanisms (revascularization) that develop because the left ventricular wall thickness increases over time prolong the survival time of individuals after acute MI. Therefore, the fact that this study was conducted on autopsy cases constitutes its main limitation.

There has been shown to be accompanying epicardial coronary artery disease in 20% of adult HCM patients, and it has been reported that HCM cases can develop MI[17-22]. The results of this study showed that although the left ventricular wall thickness was greater in the acute MI group than in the control group, the difference was not statistically significant. This absence of statistical significance was thought to be due to the study being conducted on an autopsy series.

In a previous study on living patients, there was a greater probability of MI in patients with HCM than in patients without HCM (p<0.001)[23]. It is thought that in that study, which was found to be in parallel with the current study, the result was found to be statistically significant as it was conducted on living subjects.

Coronary artery stenosis has been reported to be among the known risk factors for acute MI[24]. In the current study, the rate of coronary artery obstruction was found to be higher in the acute MI group than in the control

Table 1. Sociodemographic data of the cases.

	Mean age	Mean height	Mean weight	BMI average
Acute MI	51±21	171±11	77±15	27±7
Control	50±20	170±11	76±17	26±6

MI: Myocardial infarction, BMI: Body mass index

Table 2. Comparisons of the degree of coronary artery obstruction.

		Median	Minimum	Maximum	p
Right coronary artery	Acute MI	0.00%	0%	90%	0.053
	Control	0.00%	0%	50%	
Left anterior descending artery	Acute MI	25%	0%	90%	0.015
	Control	0.00%	0%	50%	
Circumflex artery	Acute MI	0.00%	0%	70%	0.021
	Control	0.00%	0%	40%	
Left coronary artery	Acute MI	10%	0%	70%	0.046
	Control	0.00%	0%	50%	

*The stenosis of the length of the coronary artery lumen diameter was divided into four, and the percentage of stenosis was given; e.g., if 1/4th of the lumen was narrowed, the stenosis was evaluated as 25%. MI: Myocardial infarction

group, which is consistent with findings reported in the literature.

CONCLUSION

In conclusion, the results of this study demonstrated that although the left ventricular wall thickness was greater in the acute MI group than in the control group, the difference was not statistically significant. When the percentages of coronary artery stenosis were examined, these rates were found to be significantly higher in the acute MI group than in the control group, as expected. It can be considered that the lack of statistical significance despite the higher values of left ventricular wall thickness in the acute MI group than in the control group was due to the fact that this study was conducted on an autopsy series and the revascularization in the hypertrophic muscle cells had started before the MI. With new studies on living patients, more statistically significant data could be obtained.

Ethics

Ethics Committee Approval: This study was approved by the Scientific Research and Publication Ethics Committee (Health Sciences Non-Interventional Clinical Research Ethics Committee) of Inonu University (decision no: 2018/21-26, date: 20.11.2018). Permission was also received from the Ministry of Justice and Forensic Medicine Institute Directorate (decision no: 2018/982, date: 25.12.2018).

Informed Consent: The study does not require patient consent.

Peer-review: Externally and internally peer-reviewed.

Author Contributions

Concept: I.A., M.O., O.C., E.T.S., Design: I.A., M.O., O.C., E.T.S., Data Collection and/or Processing: I.A., Analysis and/or Interpretation: I.A., M.O., Literature Search: I.A., M.O., O.C., E.T.S., Writing: I.A., M.O., O.C.

Conflict of Interest: The authors have no conflict of interest to declare.

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