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Evaluation of Coronary Blood Flow in Exercise-induced Acute Myocardial Infarction by Biomicroscopy

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Abstract: With the development of modern science and technology, ultrasound biomicroscopy has been widely used in biological research. With the increasing number of patients with acute myocardial infarction, it is very important to observe and analyze the coronary blood flow of acute myocardial infarction. The purpose of this study was to evaluate the coronary blood flow in exercise-induced acute myocardial infarction (AMI) by using a biomicroscope. The method used in this study is to construct three different coronary artery bypass grafting models. The solid thrombus samples in the dehydration tank were put into the aspirate, and the precipitate was separated by centrifugation. Soak in 10% neutral formalin solution for 4 hours and send to the Department of pathology within 24 hours. The thrombus was dehydrated with xylene and embedded in paraffin block. Along the central horizontal section, there were at least 5 consecutive sections of each specimen with a thickness of 5 μ M. after he staining, the specimens were observed under a microscope. The results showed that the proportion of white thrombus in less than 4 hours was significantly higher than that in 4 to 7 hours and more than 7 hours (61.2% vs. 19.4%, 19.4%, $P < 0.01$), and the proportion of mixed thrombus in 4 to 7 hours was significantly higher than that in less than 4 hours and more than 7 hours (52.6% vs. 29.0%, 18.4%, $P < 0.05$). It can be concluded that there is no significant statistical difference in the effect of different types of thrombus on acute myocardial infarction, but the white thrombosis group has a certain improvement trend. This study provides a reliable method for the diagnosis of biological heart diseases.

1. Introduction

Ultrasonic biomicroscope (UBM) is a kind of ultra-high frequency ultrasonic diagnostic device used in clinic. The detection frequency is 50 ~ 100MHz, and the resolution is 20-60 μM. The highest detection depth and resolution can be obtained through various frequency detection. This combination is a new type of ultrasonic device designed for anterior visual examination. With high

frequency and high resolution, not only the 2D meridian image of the anterior eye can be clearly displayed, but also the distance and angle can be detected quantitatively. UBM can clearly see arteries, red blood cells, white blood cells, some proteins and other structures. Therefore, UBM can fully observe the anatomical structure of the anterior eye. This is very important for the diagnosis and etiology of biological heart disease.

Due to the occurrence of Bragg atherosclerosis in the inner wall of coronary artery, stenosis and / or artery occlusion occur, which limit or completely cut off the blood supply of myocardium, which leads to angina pectoris, myocardial infarction and other clinical related severe myocardial ischemia. Moreover, the disease is increasing. When atherosclerotic stenosis occurs, the stenotic artery will further affect the blood circulation, thus increasing the degree of arterial stenosis. Therefore, the factors of blood circulation dynamics are related to the occurrence and pathogenesis of coronary atherosclerosis, and their important role is recognized by the academic community.

In the research method of exercise-induced acute myocardial infarction coronary artery bleeding. The role of Stojic I on N-methyl-D-aspartate receptor (NMDA-R) in the heart is unclear. For these ionotropic glutamate receptors, both glutamate and glycine co agonists must be activated, which mainly allows the influx of calcium ions. The aim of his study was to investigate the effects of verapamil, a calcium channel blocker, and its combination with glycine and / or glutamate on cardiac function, coronary flow and oxidative stress in isolated rat hearts, or to investigate the potential activation of NMDA-R in isolated rat hearts. The Langendorff technique was used to perfuse the hearts of male Wistar rats in vitro. The cardiac dynamic parameters and coronary flow of verapamil and its combination with glutamate and / or glycine were measured. The biomarkers of oxidative stress, including thiobarbituric acid reactant, nitrite, superoxide anion radical and hydrogen peroxide, were determined by spectrophotometry. The parameters of systolic force and systolic blood pressure decreased the most in verapamil alone group, while the changes were the least in treatment group with all three test substances. In addition, the largest change in coronary blood flow was observed in the verapamil only group. His method was only tested on mice, but not convincing enough [1]. The purpose of Li Y study was to investigate the value of echocardiographic parameters in the evaluation of CSFP. His method included 79 patients with CSFP confirmed by coronary angiography and a control group with normal coronary flow. He corrected cTFC method to measure coronary flow velocity. The clinical and angiographic data were recorded and the parameters of coronary artery were evaluated by CFI echocardiography. The baseline characteristics of his two groups were similar. In his method, the moving image is not clear and the accuracy is not high [2]. Saito Y believes that dysfunction of coronary endothelium and circulation plays an important role in the pathogenesis of vasospasm angina (VSA). However, he lacked a complete understanding of the entire coronary circulation, including microvessels, in patients with VSA. He enrolled 32 patients with left descending coronary artery disease who underwent intracoronary acetylcholine (ACh) challenge test to diagnose ventricular septal defect. The positive diagnosis of ACh test was total / subtotal coronary stenosis with chest pain and / or ischemic ECG changes. He recorded the frequency and severity of angina at 1 and 3 months at baseline. He used thermal dilution method to evaluate the coronary circulation, and obtained the mean transit time (Tmn) at rest and hyperemia, coronary flow reserve and microcirculation resistance index. The process of his method is complex and its practicability is not strong [3].

This study first introduces the risk factors of acute myocardial infarction, including age, gender, smoking, family history, hyperglycemia, hyperlipidemia and so on. Then, the hydrodynamic calculation, wall shear stress and oscillatory shear index in arterial blood flow are explained. In this study, the inclusion criteria, exclusion criteria, treatment and observation of samples were described in detail. Through the experimental observation results, the coronary hemodynamics analysis, acute myocardial infarction thrombus type in the distribution of arterial blood flow analysis, coronary

artery microscopic observation analysis and acute myocardial infarction evaluation index specificity analysis. Conclusion the white blood clot group has a certain tendency to improve, which provides some data support for STEMI intracoronary drug therapy.

2. Exercise Acute Myocardial Infarction and Arterial Blood Flow

2.1. Analysis of Related Risk Factors of Acute Myocardial Infarction

Coronary heart disease is caused by a combination of multiple risk factors. Gender, age, smoking, family experience, hyperlipidemia, hyperglycemia, hypertension and so on are identified as the main risk factors. In the presence of risk factors, the relative risk of Athenian Roma arteriosclerosis would be doubled [3-4].

Although age has been confirmed as an irreversible risk factor for coronary heart disease, with the increase of age, cardiovascular disease will occur more and more. Therefore, this study selected young and middle-aged patients aged 30-75 years old with AMI. Provide guidance on long-term survival and quality of life. According to many studies at home and abroad, the prevalence of AMI in men is much higher than that in women, which is related to their work and life pressure, high-fat diet, drinking and smoking and other bad habits. In the Chinese study, the ratio of male to female AMI was 2.77:1, consistent with the majority of men (about 80%) in this study.

There was a strong hierarchical relationship between smoking and AMI risk. Now, certain components of cigarettes and their combustion gases are known to damage vascular endothelium, which can accelerate the formation and development of atherosclerosis, thus increasing the risk of MI. According to research, smoking may cause a sharp increase in thromboembolism. This is not related to the use of aspirin, but is targeted at the isohigh shear region of the microvessels. Smoking one to five cigarettes a day increases the risk of AMI by 38%. Therefore, aspirin can be excluded to reduce the risk by 20%, the beneficial effect of secondary prevention, and the 75% benefit of statin. This study completely suggests that more than half of patients with smoking experience are prone to AMI. If you stop smoking, the incidence of coronary heart disease (50%) and mortality will be greatly reduced. Smoking ban can reduce the mortality rate of coronary heart disease by about 36%. This is lower than aspirin (15%), beta blockers (23%), statin and other secondary prevention drugs for coronary heart disease. The mortality rate of category (29%) and ACEI (23%) decreased significantly [5-6].

Hypertension (HBP) and inadequate blood pressure management are associated with MI risk. Blood pressure starts at 110 / 75mmhg, and with the increase of 20 / 10mmHg, the risk of cardiovascular disease will double. Many studies have shown that proper control of hypertension can greatly reduce the risk of MI. DM significantly increases the risk of cardiovascular and cerebrovascular atherosclerosis. Patients with diabetes are characterized by a lack of chronic disease and typical symptoms, so the risk of myocardial infarction or cardiac death is significantly increased. Studies have shown that the risk of cardiovascular and cerebrovascular disease in DM patients is 2-10 times higher than that in non DM patients. This study shows that about 20% of patients have abnormal fasting blood glucose on admission [7].

More and more attention has been paid to overweight and obesity. Obesity itself is a risk factor for coronary heart disease. More importantly, it may directly or indirectly accelerate the production of CHD related to insulin resistance and DM. BMI has an independent effect on the occurrence of coronary heart disease. For every two units increased, the relative risk of coronary heart disease increased by 15.4%.

Dyslipidemia is closely related to the risk of AMI. LDL-C is the most important risk factor for coronary heart disease among lipid disorders. For every 1 mg / ml increase in LDL-C, the risk of coronary heart disease was increased by 1%. Multiple meta-analyses of statin lipid reduction

showed that for every 1 mmol / L LDL-C decrease, the risk of cardiovascular events decreased by 15-20%. This study confirmed that LDL-C is one of the risk factors of coronary heart disease [8-9].

2.2. Hydrodynamics Calculation in Arterial Blood Flow

(1) Vector equation

Navigation is the main basis of numerical simulation of fluid dynamics. Stokes equation a set of equations for liquid substances such as liquid and air. These equations determine the rate of change of momentum (force) and the change of pressure in a liquid, as well as the relationship between the viscous force acting inside the liquid (like friction force) and the dissipation of gravity [10]. The vector form of S equation is as follows:

$$\rho \frac{dv}{dt} = -\nabla p + \rho F + \mu \Delta v \tag{1}$$

(2) Fluid settings

Physiological blood is a viscoelastic suspension medium. A heterogeneous system consisting of tangible elements and plasma. The viscosity of blood depends on the concentration of red blood cells, deformability, agglutination and plasma viscosity. Non Newtonian fluids. However, in the current study of blood circulation dynamics, blood is generally considered as a Newtonian fluid with high viscosity, which is suitable for high flow shear rate. In the actual state, not only the physical exchange of blood vessels and blood, but also the heat exchange. However, the heat exchange can be ignored because of the stable simulation. According to the existing literature, the blood density was set at 1050kg / m3, and the kinematic viscosity was set at 0.0035Pa ·S. Reynolds number is the main criterion to distinguish laminar flow from turbulent flow. The calculation method is shown in the formula

$$\mathrm{Re} = \frac{\rho VD}{\mu} = \frac{VD}{v} = \frac{QD}{vA} \tag{2}$$

Here, V is the average flow rate, D is the diameter, μ is the hydrodynamic viscosity, V is the dynamic viscosity, ρ is the fluid density, Q is the volume flow rate, A is the cross-sectional area. According to this formula, the blood Re of this study is 578.9, which can be regarded as laminar flow. Therefore, the fluid in this study is laminar incompressible and adiabatic Newtonian fluid [11-12].

At this time, the blood vessel is movable. In order to prevent the calculation error caused by the free movement of the blood vessel, it is necessary to fix the blood vessel from the outside. Therefore, the inlet part of the container wall shell is fixed. The external wall of blood vessel was fixed, and the fixed position of three models was the same. The governing equation for solid materials can be derived from Newton's second law, which is as follows:

$$\rho_S \ddot{d}_s = \nabla \cdot \sigma_s + f_s \tag{3}$$

Here, ρs is the density of the solid, ds is the local acceleration vector, σs is the chemical tensor and fs is the volume force vector. Because of the use of unidirectional fluid solid continuum simulation, the data transmission is from the flow field to the solid analysis direction. Therefore, without considering the displacement, temperature and other complex preservation, the solid structure analysis and calculation on the boundary only need to give the flow field pressure.

(3) Wall shear stress

The wall shear stress (WSS) is the tangent resistance generated by the blood on the endothelial surface. This is a function of the blood flow velocity gradient near the endothelial surface. Its size is

proportional to blood flow and blood viscosity, and inversely proportional to the third power of radius. Many studies have shown that the wall shear stress is closely related to the pathological changes of blood vessels. The calculation formula is as follows

$$WSS = \tau_{\omega} = -\mu \frac{du}{dr} \tag{4}$$

(4) Oscillatory shear index

The vibration shear index is a dimensionless index, which is characterized by whether the wall shear stress vector changes direction in the whole center period. The calculation formula is as follows:

$$OSI = \frac{1}{2}\left(1 - \frac{\left|\int_0^T \bar{\tau}_{\omega} dt\right|}{\left|\int_0^T |\bar{\tau}_{\omega}| dt\right|}\right) \tag{5}$$

Where OSI is the vibration shear index, τω is the wall shear stress, and T is the duration. The vibration shear index ranges from 0 to 0.5. When the VSI is close to 0, it means that the direction of blood flow is basically unchanged and flows in the same direction. In addition, because the VSI is close to 0.5, there is no net blood flow in the same direction. High vibration shear index has a great influence on the long-term effectiveness of surgery.

3. Microscopic Observation of Coronary Artery Blood Flow

3.1. Experimental Materials and Instruments

Ultrasound biomicroscopy, 64 slice CT scanner, digital side effect angiography system, arterial sheath (vascular sheath group), guide line, angiography catheter, suction catheter 6f-zeek, export elevation, iodinated contrast agent. As shown in Figure 1, the ultrasound biomicroscope is shown.

Figure 1. Ultrasound biomicroscope

3.2. Inclusion Criteria

The diagnostic criteria of STEMI and confirmed patients: persistent chest pain symptoms: ischemic chest pain stories of 12 hours or less than 36 hours without relaxation symptoms, or combined with hemodynamic instability; ECG indicates myocardial dysfunction with two or more adjacent ST segments rising or more than 1mV, new left foot tumor, patients receiving emergency

PCI, Timi blood flow, etc. grade 0-1 or grade 2-3, The thrombus load is very high, and the drainage catheter leads to clear thrombus material.

3.3. Exclusion Criteria

Results: ischemic time is more than or equal to 36 hours; PCI after thrombolysis; emergency coronary artery bypass surgery; uncontrolled malignant hypertension (200 / 120mmHg, 1mHg = above 0.1133kPa); severe renal failure (presumptive linear spheroid filtration rate EGFR < 30ml; min-1-1-1-1949; 1.73m-2); malignant rhythm; severe liver dysfunction; incidental inflammatory diseases; malignant tumor; abnormal ECG (ECG analysis) may affect the left foot mass, pacemaker, etc. No clear thrombus material was drawn, and the sample size was too small to make paraffin specimen.

3.4. Specimen Treatment

Put a clear solid thrombus like suction liquid into the dewatering tank immediately and fix the foam like suction fluid through centrifugal precipitation. Blood samples from vampires. Immerse 10% in neutral formalin solution for 4 hours, and send it to pathology department for tissue treatment within 24 hours. He staining was used to observe and explain.

HE staining was used

(1) The sections were transferred to the epoxy bottle, soaked in the tissue, stained for 8-15 minutes, and slightly stained.

(2) In order to remove the oxygen phosphorus and floating color of the hippocampus, rinse the slices for 1-2 minutes.

(3) The sections were moved into the differentiation flask (1% hydrochloric acid alcohol) and differentiated from several seconds to tens of seconds.

(4) Put the slices into running water and rinse for 30-60 seconds.

(5) The slices were transferred to amicin solution and soaked for 2-5 minutes.

(6) Wash the slices with running water, wash the chlorophyll, and wipe off the excess pigment on the slide. After the stained sections are dehydrated and transparent, the neutral resin is installed and can be observed with a general optical microscope.

3.5. Specimen Observation

The specimens were interpreted by two pathologists and observed with 10 × 10 times optical microscope. The pathological report was published. Pathologists do not know the basic information and surgical characteristics of the patient. Classification of specimens [7,13,25]:

White thrombus: also known as thromboembolism or exudative thromboembolism. According to ultrasound biomicroscopy, it is mainly composed of platelets, excluding bright red blood cells and bright red ribbon cellulose.

Red thrombus: observed by ultrasound biomicroscope, many bright red fiber network structures can be seen. There are no nuclei, complete cellular structure, full of high density red blood cells.

Mixed thrombus: under ultrasound biomicroscopy, most of the bright red platelets did not damage the cell structure and formed branched or irregular coral like platelets (gray). There is a bright red, interwoven fibrous network full of platelet rays, there are many red blood cells without dark red blood cell structure (the naked eye is red). Fortunately, the ball looks like the edge of a platelet. Red blood cells resemble platelets / cellulose.

3.6. Statistical Methods

The statistical analysis of this study is SPSS17.0. The mean ± standard deviation (± s) was used for the measurement data conforming to the normal distribution, and M (P25-P75) for the median (quartile range) that did not conform to the normal distribution; t test was used to compare the mean values of two independent samples with dispersion and uniformity; the average comparison between multiple groups, the single use factor analysis of variance, and the comparison between groups identified by Q or LSD; the application of t-test was compared Uniform and dispersed nonparametric grade summation verification. The count data was expressed as constituent ratio (%), two groups were compared by two tests or Fisher's correct probability method, and chi square test of row * list was used by more than three groups. All the tests were bilateral, $P < 0.05$.

4. Analysis of Coronary Blood Flow in Exercise-Induced Acute Myocardial Infarction under Biomicroscope

4.1. Coronary Artery Hemodynamic Analysis

Based on the research objectives, three different models of coronary artery bypass grafting were constructed. The coronary artery of the three models was artificially set as 90% stenosis, and the stenosis site was the same. The three models were as follows: (1) A single coronary artery bypass graft model was established according to the location of coronary artery stenosis; (2) According to the location of coronary artery stenosis, the graft vessel was anastomosed to the side parallel to the bypass vessel. The graft vessel was SVG, and the diameter of SVG was set to be 5mm; (3) According to the location of coronary artery stenosis, the graft vessel and the grafted vessel were sutured vertically. The graft vessel was SVG, and the diameter of SVG was set to be 5mm.

(1) Coronary flow

The main purpose of coronary artery bypass grafting is to introduce sufficient blood flow into the distal end of coronary artery stenosis, so as to improve the blood supply of coronary artery. Therefore, it is necessary to know whether there is enough blood supply in the distal coronary artery after CABG. The flow at the exit of the coronary artery was calculated. As shown in Table 1, the flow of bypass vessels is shown.

Table 1. Bypass vessel flow

	Left circumflex 1 (kg/s)	Right circumflex 2 (kg/s)	Right crown (kg/s)
Model 1	0.000223	0.000186	0.000517
Model 2	0.000295	0.000215	0.000112
Model 3	0.000262	0.000137	0.000154

From the point of view of coronary flow, there is a certain difference between single vessel bypass operation and sequential bridge operation, but the overall difference is not big. The main difference was in the blood supply to the right crown. The blood supply of single bypass graft was significantly higher than that of sequential bridge.

(2) Coronary bridge flow

The blood flow in coronary artery bypass graft is one of the few parameters that can be measured directly during operation. Even to some extent, the index of this parameter is directly used as a sign of success or failure of operation. In different models, different cross sections of grafted bridge

vessels were selected and the flow through these sections was calculated. As shown in Table 2, the flow rates of different cross sections of grafted bridge vessels are shown in Table 2.

Table 2. Flow rates of different cross sections of grafted bridge vessels

	Cross section 1 (kg/s)	Cross section 2 (kg/s)	Cross section 3 (kg/s)
Model 1	0.000133	0.000277	0.000514
Model 2	0.000609	0.000104	
Model 3	0.000537	0.000147	

(3) Velocity streamline

The difference of blood flow in anastomotic site can be seen clearly in the streamline. The blood flow at the anastomotic site of a single bypass is directly perfused into the bypass vessel. The blood flow pattern is similar to that of the sequential bridge with parallel anastomotic stoma, and directly mixes with the blood in the bypass vessel to form a relatively regular flow. However, the blood flow of the sequential bridge at the anastomotic site is quite different. The blood flow direction of perfusion is vertical to the blood flow direction of the bypass vessel. Therefore, the blood flow in the bypass vessel interacts with the blood flow in the bridge vessel, forming complex fluid movement at the entrance, resulting in local blood flow obstruction and aggregation, and affecting the local area The blood flow was stable.

(4) Wall shear stress

Wall shear stress (WSS) is the tangential resistance of blood passing through the endothelial surface. It is a function of the blood velocity gradient near the endothelial surface. Its size is directly proportional to blood flow and blood viscosity, and inversely proportional to the cube of radius. Many studies have shown that wall shear stress is closely related to vascular lesions. As shown in Table 3, the wall shear stress distribution of the three different bypass operation methods is shown.

Table 3. Distribution of wall shear stress after three different bypass operations

	Low cut area (mm^2)	Total area (mm^2)	Percentage
Model 1	2328.369	2831.532	82.24%
Model 2	807.468	2013.636	40.11%
Model 3	916.326	1982.072	46.24%

It can be seen from Table 3 that the average wall shear stress of the single bypass bridge is 0.35Pa, that of the sequential bridge with parallel anastomoses is 1.45Pa, and that of the sequential bridge with vertical anastomoses is 1.26Pa. At the same time, the area and proportion of the low shear area (< 0.4Pa) of the wall shear stress of the three operation methods were calculated.

(5) Stress distribution of coronary artery

Stress refers to the interaction of internal forces on the unit area of an object when it deforms due to external forces (including elastic deformation and plastic deformation). By analyzing the stress distribution state of materials, the stress concentration of materials can be understood, and the fatigue degree of materials can be predicted. In this way, the operation plan can be optimized, the distribution area of high stress can be reduced, and the stress condition of bridge vessel can be optimized.

Normal equivalent stress is the fourth strength theory in material mechanics. Considering the whole distribution of stress, the fatigue condition of the material is judged. According to the

diagram, the normal equivalent stress of the three bypass methods is very low, which indicates that there is no excessive stress load on the graft vessel, and most of the stress load is distributed on the aorta, and there is no significant difference between the normal equivalent stress of the three bypass methods.

The results of wall shear stress show us several results: firstly, the average wall shear stress of sequential bridge is higher than that of single bridge; secondly, the low shear area exists in the bridge vessels of three different bypass operation methods, but the area product of low cut area of sequential bridge is smaller than that of single bridge. Compared with the results of wall shear stress of the two kinds of sequential bridges, the wall shear stress in the grafted vessels of sequential anastomosis was basically similar, and there was no significant difference. However, the distribution of wall shear stress around the anastomotic stoma is quite different from that around the anastomotic stoma through the distribution nephogram of wall shear stress.

4.2. Assessment and Analysis of the Distribution of Thrombus Types in Arterial Blood Flow in Patients with Acute Myocardial Infarction

The distribution of ischemic time in different types of thrombus was not normal. According to the distribution of thrombus types in different ischemic time periods, the proportion of white thrombus in $\leqslant$ 4H was significantly higher than that in 4-7h and > 7h (61.2% vs. 19.4%, 19.4%, $P < 0.01$), the proportion of mixed thrombus in 4-7h was significantly higher than that in $\leqslant$ 4H and > 7h (52.6% vs. 29.0%, 18.4%, $P < 0.05$), and that of red thrombus was 3 There was no statistically significant difference in the proportion of the three time periods (37.5%, 37.5%, 25.0%, $P > 0.05$). There were significant differences in the distribution of white thrombus and mixed thrombus in $\leqslant$ 4h, 4-7h and > 7h. Figure 2 shows the frequency distribution of white thrombus, Figure 3 shows the frequency distribution of mixed thrombus, and Figure 4 shows the frequency distribution of red thrombus.

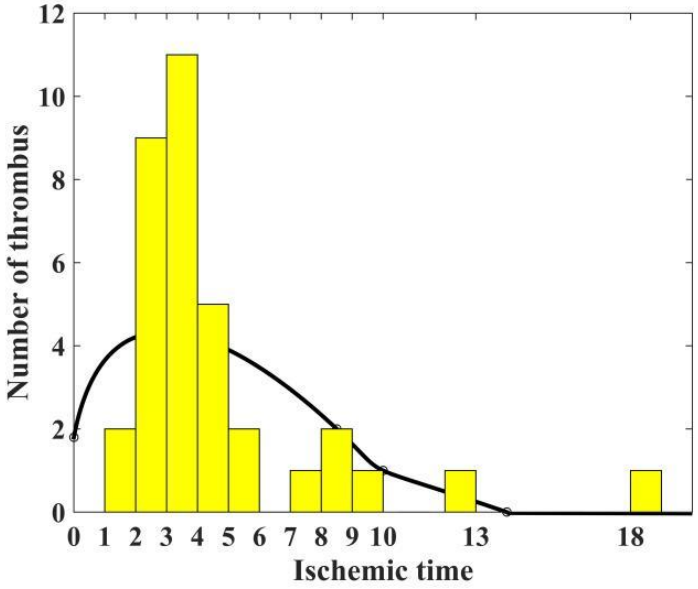

Figure 2. Frequency distribution of white blood clots

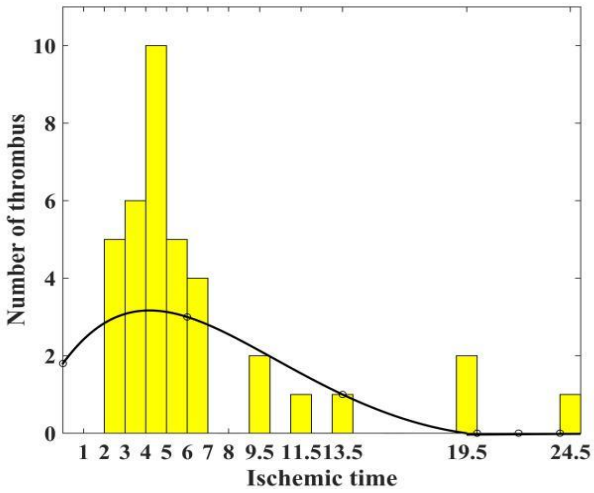

Figure 3. Frequency distribution of mixed thrombus

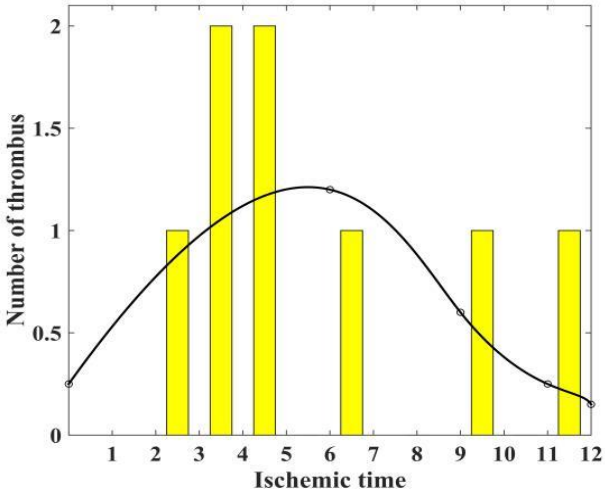

Figure 4. Frequency distribution of red thrombus

Table 4 shows the distribution of thrombus types in different ischemic time periods.

Table 4. Distribution of thrombus types in different ischemic time periods

Group	⩽4h	4-7h	>7h	X^2	P value
White thrombus(n=36)	22(61.13)	7(19.45)	7(19.45)	9.4833	0.0088
Mixed thrombus(n=38)	11(28.96)	21(53.64)	6(18.43)	8.6351	0.0133
Red thrombus(n=8)	3(37.51)	3(37.51)	2(25.01)	0.2217	0.8952

As can be seen from Table 4, similar results were found in the distribution of thrombus types at different ischemic times. There were significant differences in the distribution of thrombus types within 4 hours, mainly white thrombus. There were also significant differences in the distribution of

thrombus types between 4 and 7 hours, and mixed thrombosis was the main type. There was no significant difference in the distribution of thrombus types > 7h.

In Figure 2 to Figure 4, according to the frequency distribution chart of thrombosis types, the results showed that white thrombus was mostly distributed within 4 hours, suggesting that early thrombosis was mainly platelet thrombosis; mixed thrombosis was mostly distributed in 4-7 hours, suggesting that with the prolongation of ischemic time, coronary artery thrombosis developed and changed, and red blood cells increased continuously to form mixed thrombosis. The type of thrombus showed significant statistical significance at 4 h and 7 h.

The results of this study are slightly different from those of others. 80 cases of thrombus samples were analyzed and found that: according to the ischemic time, they were divided into < 3 h group, 3-6 h group and > 6 h group. In different time periods, there were significant differences in the distribution of three different types of thrombus ($P < 0.05$). The proportion of red thrombus in < 3 h group was significantly lower than that in other time group (52% vs 72% 70%,$P<0.05$). The distribution time of thrombus types in this study was slightly different.

Even in the > 6h group (n = 27), the red thrombus was still as high as 70%, which was not explained clearly in this paper. Thirdly, this study was aimed at patients with high thrombus load, and the previous study did not explain the risk factors, interventional data and thrombus load of patients with thrombus aspiration, which may affect the judgment of thrombus type. In addition, it should be pointed out that due to the relatively small number of samples in the two studies, the influence of sampling error cannot be ruled out. Moreover, at present, there are few such studies at home and abroad, and the classification of thrombus mostly depends on the naked eye classification or rough HE staining, so it is impossible to analyze the differences of thrombus components in detail. Therefore, the exact relationship between different types of thrombus and ischemic time needs to be clarified in clinical trials with larger samples.

4.3. Microscopic Observation and Analysis of Coronary Artery

Blood vessel itself is elastic material, so it will deform under the action of force. Generally, blood vessels have good elasticity, so the deformation of blood vessels is elastic deformation under normal conditions, and will change with the change of pressure. The size of deformation is related to the elastic properties of blood vessels. Generally, materials with better elastic properties are more likely to produce large deformation. The larger the deformation, the smaller the stiffness. Figure 5 shows the arterial blood flow, and Figure 6 shows the arterial blood flow under the ultrasound biomicroscope.

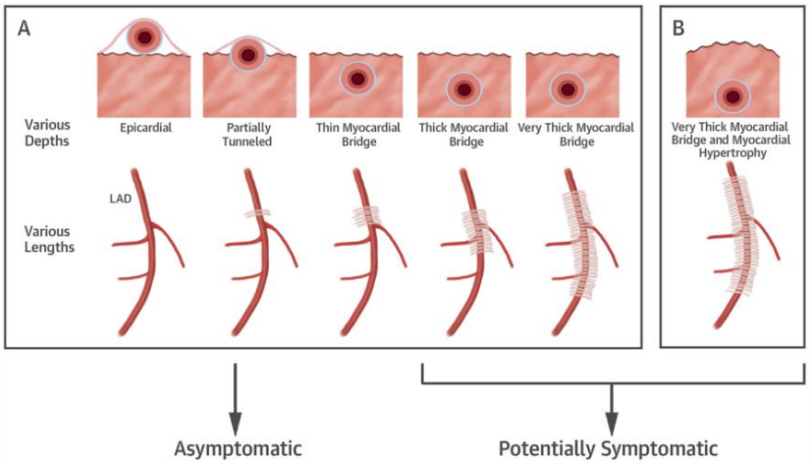

Figure 5. Arterial blood flow

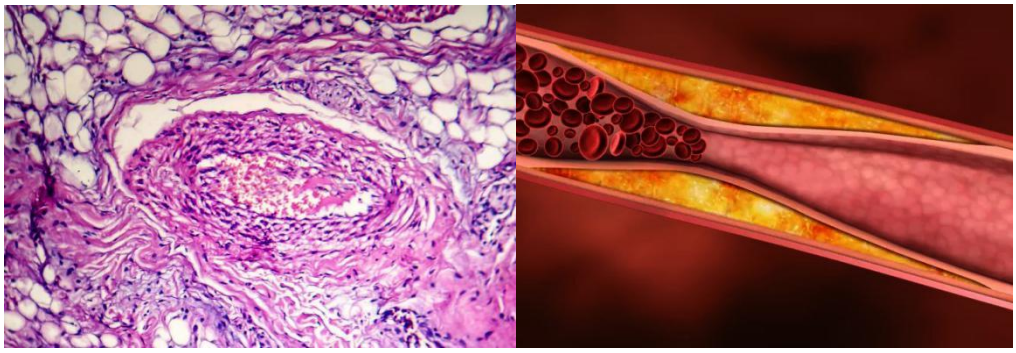

Figure 6. Arterial blood flow under ultrasound biomicroscope

It can be seen from Figure 5 and Figure 6 (Figure from www.baidu.com) that the aortic deformation distribution of the three surgical schemes is similar, and the larger type variable appears in the upper part of the port. The overall deformation of the vessels in single bypass is more uniform, while the deformation of the vessels around the anastomotic stoma of the two sequential bypass methods is slightly higher than that of the single bypass, and the deformation of the vessels around the anastomotic site of the two schemes is very small compared with other places.

4.4. Specificity Analysis of Evaluation Indexes of Acute Myocardial Infarction

The annular strain, radial strain and longitudinal strain of non transmural group and transmural group in patients with left ventricular segmental horizontal myocardial infarction: absolute value decreased in non transmural group and transmural group, and even reversed to reverse spectrum in transmural group. As shown in Figure 7, the longitudinal strain curve amplitude of apical segment of posterior wall in patients with myocardial infarction is shown.

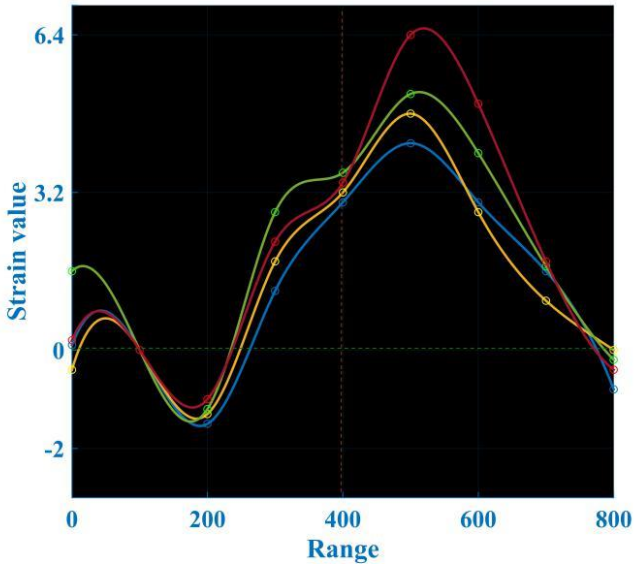

Figure 7. Longitudinal strain curve amplitude of posterior apical segment in patients with myocardial infarction

ROC can be used to identify acute myocardial infarction.

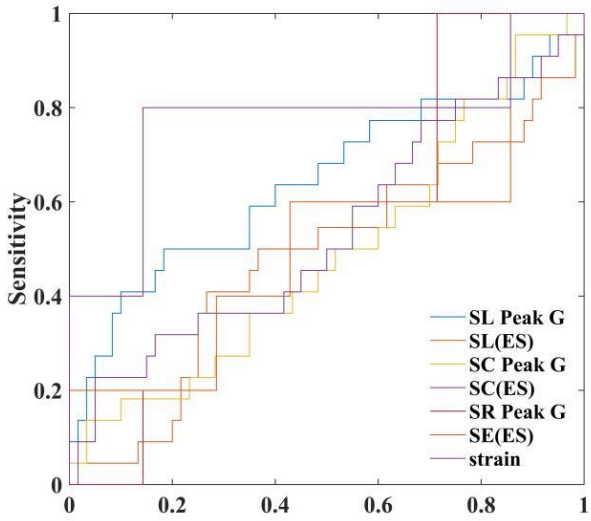

Figure 8. ROC curve pairs can identify the volume ratio of acute myocardial infarction in left ventricular anterior wall

It can be seen from Figure 7 and Figure 8 that integrating the significant indicators of long axis and short axis of each segment, and summarizing the area under the ROC curve, the analysis of ROC curve shows that the end diastolic wall thickness is the best index to judge the transmural myocardial infarction of left ventricular anterior wall apical segment and posterior septal apical segment, and the critical value of the former is 5.5mm The sensitivity and specificity of transmural myocardial infarction were 83.3% and 85.7%, respectively. The sensitivity of the latter was 100% when the critical value was 5.5 mm. The specificity was 61.5%. SC (ES) was the best index of left ventricular apical segment. The sensitivity was 100% when the critical value was -3.0800. The specificity was 94.4%. SL peak was the best index of apical segment of left ventricular septum. The sensitivity was 71.4% when the critical value was -5.4650. The specificity was 100%, Sr peak g was the best index of left ventricular posterior wall apical segment, and the sensitivity was 100% when the critical value was 12.2650. The specificity was 80%. SC peak g and SC peak were the best indexes of left ventricular inferior wall apex. The sensitivity was 100% when the critical value was -5.3200. The specificity was 88.8%.

5. Conclusion

Coronary artery thrombus aspiration is used clinically to enable patients to study coronary artery thrombosis clinically. On the basis of the analysis of the relationship between myocardial ischemia, the time of thrombosis and the type of myocardial infarction. Studies have shown that the onset time of white blood clot is more than 4 hours, usually in the anterior and inferior branches, mixed thrombosis symptoms for 4-7 hours, usually in the right coronary artery. There was no significant difference in myocardial extract, cardiac function and thrombus types after recovery. However, the white thrombus group has a certain tendency to improve the function. It provides specific data support for the treatment of myocardial infarction with partial elevation of coronary artery ST.

Because of the high recurrence rate and low long-term effectiveness of mitral valvuloplasty in patients with acute myocardial infarction (AMI) combined with moderate to severe MR, it is urgent to select appropriate treatment plan to reduce the recurrence rate of mitral valve after mitral valvuloplasty. The results of multiple linear regression analysis showed that AP and al-pm had an

effect on 50.5% of mitral regurgitation. In other words, the anteroposterior diameter and the anteroposterior diameter of mitral valvuloplasty have important influence on Mr. Appropriate clinical surgical treatment plan can be selected according to al-pm before operation.

At present, for the patients who participate in cardiac rehabilitation therapy after acute myocardial infarction, most studies show that the prognosis of moderate intensity and high intensity exercise is good, but there is little research on the exercise level of patients with heart failure after acute myocardial infarction. Some studies have shown that patients with chronic heart failure need to exercise at a low or medium level in order to improve their anti-exercise ability and have positive physiological effects. This study shows that compared with the initial low exercise metagroup, the middle exercise metagroup after cardiac rehabilitation training improves the exercise ability, quality of life, mortality and the incidence of cardiovascular activity in patients with heart failure after acute myocardial infarction. However, there was no statistical difference in LVEF between low and moderate exercise metabolizers after 2 years. This may be related to the aging of a few registered subjects and patients, which needs further investigation and research.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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