Myocardial Gas Metabolism*

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This report presents an analysis on the relationship between the myocardial gas metabolism and some hemodynamic parameters.

Materials and Methods

Five normal subjects, fifteen cases of coronary sclerosis without anginal attack, thirteen cases of angina pectoris, twenty-three cases of myocardial infarction were studied. In cases of myocardial infarction more than three weeks after the initial attack were elapsed at the time of study.

Coronary sinus, right heart and trans-septal left heart catheterization were performed. Coronary blood flow was measured by the N₂O method. Oxygen- and carbon dioxide tension of blood were measured by polarography, and content of oxygen and carbon dioxide of blood were measured by the method of van Slyke and Neill. pH of blood were determined by pH meter.

Results and Discussion


Blood of coronary sinus represents the condition of left ventricular myocardium. Therefore, oxygen-and carbon dioxide-tension and pH of coronary sinus blood were studied. CO₂ tension and pH of coronary sinus blood (PC₅0₂, pHcs) were correlated with that of arterial blood (Paco₂, pHa) respectively. Lower limit of normal coronary blood flow in our laboratory was 67 cc/100g/min., so materials were divided into two groups, i.e. group A and group B (Table 1). No marked differences were seen in PCSO₂ and pHcs between two groups. In group B some showed elevated PCSO₂. In both groups some cases of angina pectoris and myocardial infarction showed low pHcs. No marked difference in myocardial RQ was seen between two groups. From these results CO₂ tension and pH of left ventricular myocardium were considered to be correlated with that of arterial blood. Decreased coronary blood flow did not change these correlations.

No definite correlation were seen between oxygen tension of coronary sinus blood and that of arterial blood. Decreased oxygen tension of coronary sinus blood and elevated myocardial oxygen extraction coefficient were seen in cases of angina pectoris and myocardial infarction, but they were not seen in other cases. No marked differences were seen in oxygen tension of coronary sinus blood (PCO₂) and myocardial oxygen extraction coefficient (MOEC) between group A and B (Fig. 1). No marked differences

Table 1

<table>
<thead>
<tr>
<th>Group A</th>
<th>Coronary blood flow ≥ 67 cc/100g/min.</th>
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<tbody>
<tr>
<td>Group B</td>
<td>Coronary blood flow ≤ 67 cc/100g/min.</td>
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<tr>
<td>Group A'</td>
<td>Left atrial mean pressure ≤ 11 mmHg</td>
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<tr>
<td>Group B'</td>
<td>Left atrial mean pressure &gt; 11 mmHg</td>
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</tbody>
</table>

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were seen in PCO₂ and MOEC between a group without left heart failure (group A') and a group with left heart failure (group B'). These data suggest that hypoxia of left ventricular myocardium (coronary insufficiency) was found frequently in cases of angina pectoris and myocardial infarction. Coronary blood flow, oxygen tension of arterial blood did not change these relationships. No direct correlation was found between coronary insufficiency and left heart failure.

2. Myocardial oxygen consumption.

Sarnoff reported that myocardial oxygen consumption (MOC) showed a good correlation with tension time index (TTI). Sonnenblick reported that MOC correlated well with the velocity of myocardial contraction.

In our experiments a correlation was found between MOC and TTI except in a few cases with marked hypertension or hypotension. On induced hypoxia (12% O₂ inhalation) or exercise test the correlation between MOC and TTI was maintained in normal subjects, while in some cases of myocardial infarction or coronary sclerosis the correlation was completely destroyed.

The indices which represent velocity of left ventricular contraction such as mean systolic ejection rate, peak value of dp/dt of left ventricular pressure curve, mean circumferential shortening rate, were not considered to have a definite correlation with MOC.

**Summary**

1. Carbon dioxide tension and pH of left ventricular myocardium were dependent on that of arterial blood.

2. Hypoxia of left ventricular myocardium was seen in cases of angina pectoris and myocardial infarction, but it was not seen in other cases. Coronary blood flow, left heart failure, oxygen tension of arterial blood did not change these relationships.

3. TTI was considered to have a correlation with myocardial oxygen consumption. However, in some cases of myocardial infarction and coronary sclerosis the correlation was destroyed during hypoxia or exercise test.

4. The indices which represent the velocity of left ventricular contraction did not show a definite correlation with myocardial oxygen consumption.

**REFERENCES**


