

## Dumping Syndrome on Echocardiography

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Cardiac function at dumping syndrome was assessed by means of echocardiography. Dumping syndrome was introduced by oral intake of 300ml of 15% dextrose in patients who underwent total gastrectomy with some discomfort after taking food orally. The parameters of stroke volume (SV) cardiac output (CO) ejection fraction (EF), velocity of circumferential fiber shortening (VCF), posterior wall excursion (PWE) were compared between dumper and non-dumper patients. During an attack of dumping syndrome, cardiac function was markedly depressed. It was a reflection of decreased SV, CO and VCF. It is our conviction that the underlying causative mechanism influences on reducing circulatory blood volume due to sequestration of extracellular fluid into the intestinal lumen.

### INTRODUCTION

Dumping syndrome is one of the unpleasant complications after gastrectomy. The preventive operation for dumping syndrome is now widely recommended to make the emptying time prolonged.<sup>1)-4)</sup> The operations of either Billroth I or jejunal interposition method have selectively been applied when sub- or total gastrectomies are performed. Considerable emphasis with respect to causative mechanism of dumping syndrome has been placed on a vasomotor symptom and sequestration into the intestinal lumen, which cause abdominal distension, association with inhibited secretions of neurotension, enteroglucagon and vasoactive peptide. As a result of dumping syndrome, systemic hemodynamic changes may ensue. The purpose of this study is to clarify the changes in cardiac function and hemodynamics with regard to dumping syndrome.

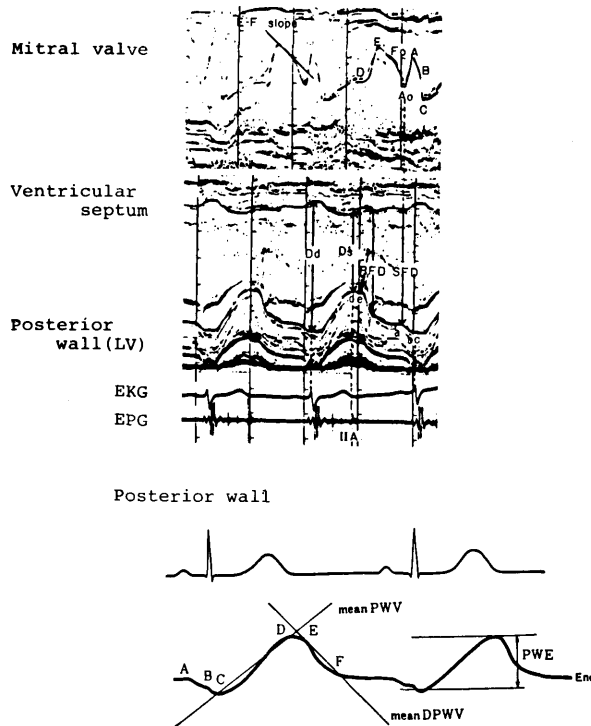
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## MATERIAL AND METHOD

The 10 patients who underwent total gastrectomies for gastric cancers were selected, in whom diversions of digestive tracts were made by jejunal interposition in 5 and Roux-en-Y in the remainder. These 10 patients have experienced palpitations, sweating, weakness, dyspnea, flushing nausea, abdominal cramps, belching, vomiting, diarrhea and rarely syncope separately or in combination with varying variety of the severity. The other 10 patients without any complaint of dumping syndrome were randomly selected during the same period operated on as the dumper patients eligible for this study.

Cardiac function and hemodynamics were assessed by means of echocardiography using SONOLAYER-S-SSH-60A, Thshiba, PSB 37A (3.7MHZ) as a probe. The parameters in regard with hemodynamics were calculated by the following equations. The parameters in regard with hemodynamics were calculated by the following equations. stroke volume (SV)= Dd-Ds, cardiac output (CO)= SV×HR, ejection fraction (EF)= SV/Dd= 1-Ds/Dd, velocity of circumferential fiber shortening (VCF)= (Dd-Ds)/(cm/sec). posterior wall excursion (PWE) and posterior wall velocity (PWV) PWE/ejectiontime measured as indicated in Fig. 1.



**Fig. 1.** Echocardiogram, showing the parameters calculated in relation to assessment of cardiac function and hemodynamics.

In these patients, dumping syndrome was introduced by taking 300ml of 15% dextrose and the variations of hemodynamics on the basis of assessment by echocardiography were analysed at 15 and 30min.

And also the parameters obtained by echocardiography from the other 10 non-dumper patients following total gastrectomy were compared.

## RESULT

Various hemodynamic parameters obtained by echocardiogram were compared as shown in Fig. 2.

The result of this study indicated that the function of the left ventricle in dumper was impaired when compared with that in non-dumper. A decrease in SV, EF and Vcf was indicative of impaired function of the left ventricle. The force of contraction of the left ventricular wall was weakened at dumping syndrome which was sufficient to reduce SV. The values of PWE, PWV and CO were uniformly reduced in dumper than those in non-dumper. The heart rate in dumper had concomitantly become increased with some degree of systemic hypotension.

According to the operative procedure of diversion of the digestive tract, it was clearly indicated that a procedure by jejunal interposition method enabled the values of various parameters to minimize their changes rather than that by Roux en Y method as shown in Fig. 3. A jejunal interposition method to reconstruct after total gastrectomy was of great help to preserve the left ventricular function rather than a Roux en Y method.

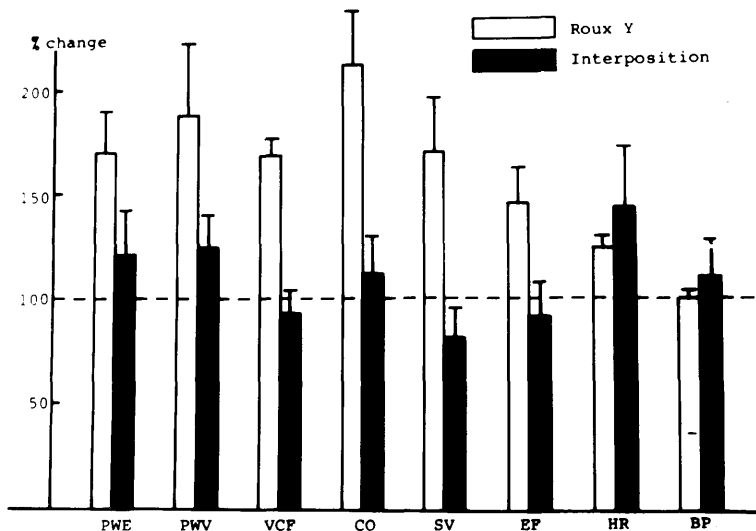
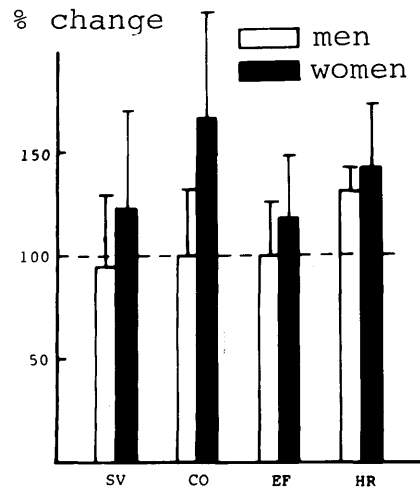
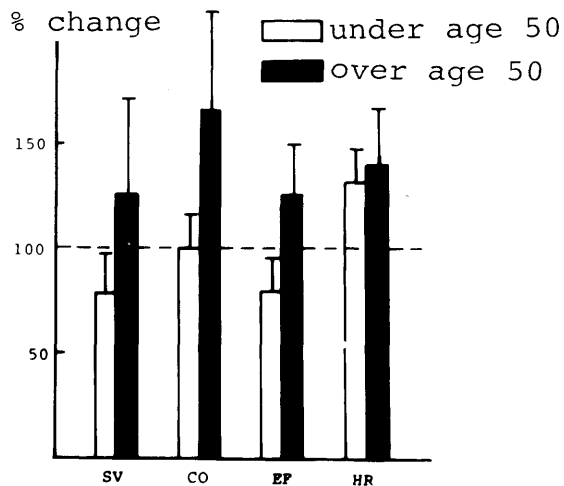


Fig. 2. Cardiac function at 15min following dumping syndrome induced by 15% dextrose oral intake.



**Fig. 3.** Relationship between cardiac function and sex at dumping syndrome.



**Fig. 4.** Relationship between cardiac function and age at dumping syndrome.

According to the patient's age operated upon, the values of many parameters obtained by echocardiography from the patients under 50 years of age varied less than those over 50 as indicated in Fig. 4. It was clarified that higher age over 50 years affected the left ventricular.

As for the difference between sexes, men were less influenced on the left ventricular function associated with dumping syndrome than women as shown in Fig. 5.

## DISCUSSION

Dumping syndrome is named by Mix<sup>5)</sup> in 1922 and it has been noted that rapid emptying time of food to the small intestine causes a specific clinical sign such as palpitation, sweating, weakness, dyspnea, flashing, nausea, abdominal cramps, belching, vomiting, diarrhea and syncope separately or in combination.<sup>1)-6)</sup> These severity of complaints vary in each case. As usual, such trouble makes a rule for the dumper patients to worry about occurrence of the complaints immediately after taking food. Consequently the patients intend to restrict their oral intake in spite of aggravating undernutritional states. It is well known that dumping syndrome is based on rapid emptying and passing of food through the upper GI tract. They cause abdominal distension and sequestration in the intestinal lumen which have led to a decrease in circulatory blood volume. Furthermore, it is assumed that humoral regulation plays a key role in occurrence of this distress.<sup>7)-9)</sup> It is no doubt that inhibition of the levels of neurotension, enteroglucagon and vasoactive peptide take an important part in causing dumping syndrome<sup>10)</sup> as well as abnormal intestinal mobility<sup>11)</sup> and glucose absorption which results in acceleration of glucose emptying.<sup>12)</sup>

In this present study, cardiac function by means of echocardiography was evaluated in patients with dumping syndrome following total gastrectomy, introducing it by oral intake of 300ml of 15% dextrose. It is ascertained that hemodynamic changes in reduced SV and CO with tachycardia and systemic hypotension were main clinical manifestations and the cardiac dysfunction of weakened contraction of left ventricular wall was demonstrated. Such an abnormal finding was transient and easily returned to the normal.

It is suggested that these findings depend on sequestration of body water into the intestinal lumen due to hyperosmotic load, partly attributable to vasomotor paralysis. Attenuated contraction force of the left ventricular wall may be attributed to reduced left ventricular filling pressure secondary to decreased CO. It is reasonable to consider that a main cause of decreased CO is due to accumulation and shift of extracellular fluid into the intestinal lumen by hyperosmotic overload.

The mechanism of the shift of extracellular fluid is complex. Various leading factors can be considered in terms of abnormal intestinal mobility, vasomotor paralysis, rapid glucose absorption, inhibited secretion of regulatory peptide such as neurotension and enteroglucagon. The results based on the echocardiographic examination in this study provided the left ventricular failure indicated by attenuated contraction of the left ventricular wall with tachycardia and slight systemic hypotension, probably secondary to reduced circulatory volume and CO. These changes were much more pronounced in women rather than in men as well as in older patients over 50 years of age rather than under 50. It is of interest to emphasize that dumping syndrome is more likely to be severe in female and older patients from the standpoint of cardiac function.

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