Tricuspid Insufficiency
A Study of Hemodynamics

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Most of the acquired tricuspid valve lesions are encountered in patients with mitral valvular disease. Tricuspid valve in those patients are mostly incompetent and the presence of this lesion affects the results of surgery for mitral valve disease. Preoperative diagnosis of tricuspid regurgitation, therefore, is an important factor not only for the decision of the method of operation but also for the forecast of the result of operation. However, the method to detect or to quantify the tricuspid regurgitation precisely is still under investigation. Fortunately the surgeons are able to detect and evaluate tricuspid regurgitation at the time of mitral valve surgery by inserting a finger into the right atrium.

The purpose of the present report is to compare the findings upon the tricuspid valve obtained at the time of surgery with the data of preoperative examinations. The results of thermodilution method utilized preoperatively as a quantitative means for the evaluation of tricuspid regurgitation is also reported compared with the operative findings.

MATERIALS AND METHODS

Fifty patients were found to have tricuspid valvular disease at the time of open mitral valve surgery before April 1973 in Osaka University Hospital. Mitral valve was incompetent in 28 and stenotic in the remaining 22 patients. The severity of tricuspid insufficiency (TI) in these patients were as shown in Table I. Twenty four patients with mitral stenosis (MS) and 16 patients with mitral insufficiency (MI), who had no associated tricuspid valve disease and underwent open mitral surgery, were investigated as a control.

RESULTS

More than 90 per cent of patients with TI showed atrial fibrillation whereas in about 50 per cent of the patients without TI sinus rhythm was found.

About 60 per cent of patients without TI and more than 80 per cent of patients with TI were functional class III or IV by the New York Heart Association Classification system. In patients with MS and TI, the severity of TI seemed to correlate with the severity of symptom as shown in Table I. In patients with MI and TI, there was

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Key Words:
Tricuspid insufficiency
Mitrval valve surgery
Pulmonary hypertension

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no such correlation.

In patients with MS, the mean left atrial pressures were higher in patients with TI than in patients without TI. This difference was not statistically significant in patients with MI as shown in Fig. 1.

In MS patients, the pulmonary arterial systolic pressures were also higher in patients with TI than in patients without TI, but no difference was noted in MI patients suggesting that the pulmonary hypertension is playing a large role in the development of TI in MS patients but not in MI patients.

Cardiac indices were larger in patients without TI regardless to the mitral valve lesion, being statistically significant in MI patients.

In MS patients, pulmonary vascular resistances were higher in patients with TI than in those
without TI. In MI patients, however, the difference was not significant.

There was no difference between the right atrial pressure in patients with MS and with MI. Mean right atrial pressure was higher in patient with TI than those in patient without TI regardless to the type of mitral valve lesion.

These right atrial pressures were reflected in the right atrial shadow in chest roentgenogram. Cardiothoracic ratios were higher in patients with
TI regardless to the type of mitral valve lesion.

The relationship between these hemodynamic data and the severity of TI palpated at the time of open mitral surgery were investigated. There was a tendency in left atrial pressure to increase when the severity of TI increased. However, pulmonary arterial systolic pressure did not relate to the severity of TI. Both cardiac output and pulmonary vascular resistance had no relationship with the severity of TI.

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On the contrary, the mean right atrial pressure had an indistinct tendency to increase with the increase in severity of TI. Cardiothoracic ratio in chest roentgenogram showed the closest relationship with the severity of TI both in patients with MS and with MI as shown in Fig. 2. In MS patients, about 90 per cent of patients associated with TI had the cardiothoracic ratio greater than 60 per cent. In MI patients, about 90 per cent of patients associated with TI had the cardiothoracic ratio of more than 65 per cent.

Thus the cardiothoracic ratio, left and right atrial pressures were related to the severity of TI. Cardiac index in patients with MI and pulmonary arterial pressure and pulmonary vascular
arterial systolic pressure and the cardiac index were investigated in these two groups of patients. In MS patients, 82 per cent with TI had a cardiac index less than 2.5 l/m²/min and in 72 per cent of them pulmonary arterial systolic pressures were higher than 50 mm Hg, as shown in Fig. 3. In patients without TI, only 45 per cent had a cardiac index less than 2.5 l/m²/min and in only 20 per cent of them pulmonary arterial systolic pressures were higher than 50 mm Hg.

In MI patients, however, no such relation between pulmonary arterial systolic pressure and cardiac index was found regardless to TI as shown in Fig. 4.

**DISCUSSION**

Besides the organic change of the tricuspid valve leaflets, pulmonary hypertension, dilatation of tricuspid valve ring and atrial fibrillation are considered as the causes of tricuspid incompetence. From the data reported, pulmonary hypertension are considered to be one of the major cause for TI in MS patients. In MI patients, however, pulmonary hypertension is not considered to be a major cause of TI.

Tricuspid valve ring measured at the time of open heart surgery was on an average 3.1 finger breadth in patients with MS and was on an average 3.6 finger breadth in patients with MI. It is suspected that the enlargement of the mitral valve ring might have played a role for the development of TI particularly in MI patients. It is obvious that the atrial fibrillation found in more than 90 per cent of patients with TI have had an effect on the development of TI.

Relationships were found between the presence or absence of TI and some of the hemodynamic data obtained. However, the relationships between the severity of TI and the hemodynamic data were not clear. The propriety of estimating the severity of TI with surgeon's finger at the time of surgery is to be discussed because of the above mentioned discrepancy.

Decision of the presence or absence of TI at the time of surgery seemed to be quite secure but the quantitative estimation with a finger could not be entirely reliable. It seems to be very difficult to estimate precisely the volume of regurgitant flow through various size of incompetent orifices. Moreover, the intensity of regurgitant flow may differ according to the degree of pulmonary hypertension and to the amount of cardiac output even with same amount of regurgitant volume. More precise
quantitative mean for the measurement of tricuspid regurgitation should be developed.

The authors are investigating the method to measure the tricuspid regurgitation by means of thermodilution technique. Up to the present time 12 patients underwent the preoperative evaluation of tricuspid insufficiency by means of thermodilution technique. In 8 patients in whom no TI was detected with thermodilution technique preoperatively no TI was palpated during surgery. In all 4 patients in whom TI was detected with thermodilution technique before operation, regurgitation was found to be corresponding to the preoperative evaluation with thermodilution. For the practical utilization of this technique as a preoperative quantitative means of TI further experiences are needed.

**Summary**

The relationship of the presence or absence and the severity of tricuspid insufficiency with the data of preoperative clinical and hemodynamic examinations were investigated in 50 patients with tricuspid insufficiency and in 40 patients without tricuspid insufficiency who underwent open mitral valve surgery.

The presence or absence of the tricuspid insufficiency correlated well with the data of preoperative clinical and hemodynamic examinations. The correlation between the severity of tricuspid insufficiency estimated by the surgeons at the time of surgery and the preoperative data were variable.

Pulmonary arterial hypertension was considered to be one of the cause for tricuspid insufficiency in patients with mitral stenosis but was not in patients with mitral insufficiency.

The utilization of thermodilution technique as the preoperative quantitative means for the tricuspid insufficiency was reported.

**REFERENCES**


