Hepatojugular Reflux: Useful in the Bedside Diagnosis of Tricuspid Regurgitation

ALAN S. MAISEL, M.D.; J. EDWIN ATWOOD, M.D.; and ARY L. GOLDBERGER, M.D.; San Diego, California

Using phonocardiography and auscultation, we ascertained the presence or absence of hepatojugular reflux and Carvallo's maneuver in three groups of 15 patients. The first group had isolated tricuspid regurgitation; the second, isolated mitral regurgitation; and the third was a control group with no murmurs. The specificity and sensitivity of hepatojugular reflux were 100% and 66%, and those of Carvallo's maneuver were 100% and 80%. All but 1 patient in our series had a positive response to one or the other maneuver (combined sensitivity, 93%). Thus, hepatojugular reflux is a useful adjunct to Carvallo's maneuver in the diagnosis of tricuspid regurgitation.

THE RISING INCIDENCE of right-sided endocarditis has been one of the factors leading to renewed interest in the diagnosis of tricuspid regurgitation. Although contrast echocardiography or right ventriculography will confirm the diagnosis, it is the suspicion of tricuspid regurgitation at the bedside that usually determines whether further diagnostic procedures are done. Rivero-Carvallo (1) reported that the systolic murmur of tricuspid regurgitation could be increased during deep inspiration. Carvallo's sign, however, has a sensitivity of approximately 61% (2). We report another maneuver, hepatojugular reflux, that may be useful in augmenting or even unmasking the murmur of tricuspid regurgitation.

Methods and Patients

The patient population consisted of three groups of 15 consecutive patients each. All patients were men with an average age of 46 (range, 18 to 74). The first group consisted of patients with tricuspid regurgitation, confirmed previously by either contrast two-dimensional echocardiography or right ventriculography. Patients with associated mitral regurgitation were excluded. Tricuspid regurgitation was associated with dilated cardiomyopathy in 7 patients and endocarditis of the tricuspid valve in 8 patients. The second group consisted of patients with isolated mitral regurgitation diagnosed by cardiac catheterization. The third group, a control group, was composed of patients having cardiac catheterization for evaluation who were without murmurs or other evidence of valvular disease.

Both hepatojugular reflux and Carvallo's maneuver were done in a quiet room with the patient resting in the supine position. Phonocardiograms were used to measure changes in murmur duration and intensity, and were obtained with a four-channel Elema-Schonander recorder at high and low frequency bands (25 to 400 Hz). In addition, two cardiologists subjectively graded changes in murmur intensity. In applying hepatojugular reflux, the examiner exerted firm, sustained pressure inward and cephalad below the right costal margin. Patients were requested to breathe normally so as to avoid an inadvertent Müller or Valsalva maneuver. A positive response was an increase in the intensity of a previously audible systolic murmur or induction of a new systolic murmur, which persisted for several cardiac cycles. This response was shown by a 50% or greater increase in the peak to peak amplitude of the murmur by phonocardiography and confirmed by at least a one-grade increase in murmur intensity, as judged by blinded observers. Carvallo's maneuver was recorded and evaluated in a similar fashion during deep inspiration.

Results

The results are shown in Table 1. Systolic murmur augmentation during hepatojugular reflux was present in 10 of 15 patients in the first group, but absent in all patients in the second and third groups, giving a specificity of 100% and a sensitivity of 66%. Carvallo's maneuver was positive in 12 of 15 patients in the first group and negative in all patients in both control groups, giving a specificity of 100% and a sensitivity of 80%. Of the 15 patients with tricuspid regurgitation, 14 had a positive response to one or the other maneuver, giving a combined sensitivity of 93%. Carvallo's maneuver was positive in 4 patients who had a negative response to hepatojugular reflux. Two patients who had a positive response to hepatojugular reflux had a negative response to Carvallo's maneuver. Both maneuvers were negative in only 1 patient. Hepatojugular reflux was positive in 7 of the 8 patients with tricuspid regurgitation caused by endocarditis (sensitivity, 87%), whereas Carvallo's maneuver was positive in 5 of the 8 patients with endocarditis (sensitivity, 62%).

Discussion

Hepatojugular reflux is a commonly used clinical test for detecting congestive heart failure (3). The first observation of the effect of abdominal compression on the filling of the neck veins was reported by Pasteur (4) in 1885 as a manifestation of tricuspid regurgitation. This observation went unnoticed until 1969 when Vitums and associates (5) reported that the maneuver was helpful in augmenting the murmur of tricuspid regurgitation, especially in conjunction with passive leg raising. The patients in this study, however, had only presumptive tricuspid regurgitation, and there was no indication of how changes in murmur intensity were measured. More recently, Gooch and associates (6) reported a series of patients

► From the Division of Cardiology, Department of Medicine, University of California; San Diego, California.

Table 1. Comparison of Carvallo's Maneuver and Hepatojugular Reflux in Diagnosing Tricuspid Regurgitation

	Patients with		Controls ($n = 15$)	Specificity	Sensitivity
	Tricuspid Regurgitation ($n = 15$)	Mitral Regurgitation ($n = 15$)			
	← n →			← % →	
Hepatojugular reflux	10	0	0	100	66
Carvallo's maneuver	12	0	0	100	80
Hepatojugular reflux or Carvallo's maneuver	14	0	0	100	93

with documented tricuspid regurgitation and compared the sensitivities of hepatojugular reflux and Carvallo's maneuver. However, as there were no control groups, inferences about specificity could not be made.

Although Carvallo's maneuver is commonly accepted as the most useful noninvasive way to augment the murmur of tricuspid regurgitation (7, 8), some investigators have questioned its usefulness, particularly in lesions of lesser severity (9, 10). In one study (9), Carvallo's sign was seen in only 5 of 32 patients with mild or moderate tricuspid regurgitation shown angiographically, but in 12 of 20 patients with more severe tricuspid regurgitation. Furthermore, studies validating Carvallo's maneuver have been criticized because of weaknesses in experimental design, including lack of control groups, failure to objectively quantify murmur changes, and presence of multiple murmurs. The present study was designed to minimize subjective bias. Cases of tricuspid regurgitation were documented by either two-dimensional echocardiography with contrast, or right ventriculography. Changes in murmur intensity were recorded by phonocardiography as well as by auscultation. Futhermore, two sets of control groups were studied, including one with no murmurs or valvular disease, and one with pure mitral regurgitation, the lesion most commonly confused with tricuspid regurgitation at the bedside.

Our findings suggest that hepatojugular reflux complements Carvallo's maneuver in the evaluation of patients with suspected tricuspid regurgitation. All but one patient in our series with tricuspid regurgitation had a response to one of the maneuvers (93% combined sensitivity). The patient in whom both Carvallo's maneuver and hepatojugular reflux were negative had end-stage cardiomyopathy with ascites and peripheral edema. As shown by the echocardiogram, the right ventricle was dilated and barely contracting. Carvallo's maneuver and hepatojugular reflux presumably augment the murmur of tricuspid regurgitation by increasing venous return to the right heart. However, a severely failing noncompliant right ventricle may not be able to accommodate the augmented venous return, blunting the efficacy of these maneuvers. This hypothesis is supported by Perloff (11) who reported that Carvallo's sign was absent when tricuspid regurgitation was accompanied by severe right ventricular failure.

Although the sensitivity of Carvallo's maneuver was greater than hepatojugular reflux in this study (80% as opposed to 66%), there may be several situations in which hepatojugular reflux proves to be the more effective test. In patients with tricuspid regurgitation secondary to endocarditis, hepatojugular reflux was present in seven of eight patients, whereas Carvallo's maneuver was positive in five of eight. Although the small number of patients precludes statistical comparison, it was our observation that the magnitude of tricuspid regurgitation was less in lesions produced early on by endocarditis as compared to cardiomyopathy. This observation suggests that hepatojugular reflux may be particularly useful in patients with milder degrees of tricuspid regurgitation. A second potential advantage of hepatojugular reflux over Carvallo's maneuver in patients with tricuspid regurgitation is in the setting of severe respiratory distress. In the present study, both patients with a positive response to hepatojugular reflux but a negative response to Carvallo's maneuver had marked respiratory compromise. One patient was a 23-year-old man who presented with fever, hypoxemia, and several infiltrates as seen on a chest roentgenogram, whose tachypnea precluded assessment of Carvallo's maneuvers. Hepatojugular reflux induced an increase in murmur intensity and subsequent echocardiography demonstrated a vegetation on the tricuspid valve with mild tricuspid regurgitation.

ACKNOWLEDGMENTS: The authors thank Miles Schwartz, M.D. for calling attention to the initial discovery of this maneuver by Pasteur (4).

Presented in part at the Fifty-Sixth Scientific Session of the American Heart Association, Anaheim, California, November 1983.

▶ Requests for reprints should be addressed to Alan Maisel, M.D.; Division of Cardiology, Department of Medicine, University of California, San Diego; San Diego, CA 92103.

References

1. Rivero-Carvallo M. Signo para el diagnostico de las insufficiencias tricuspideas. *Arch Inst Cardiol Mex.* 1946;**16**:531-40.
2. Rothman A, Goldberger AL. Aids to cardiac auscultation. *Ann Intern Med.* 1983;**99**:346-53.
3. Ducas J, Magder S, McGregor M. Validity of the hepatojugular reflux as a clinical test for congestive heart failure. *Am J Cardiol.* 1983;**52**:1299-1303.
4. Pasteur W. Note on a new physical sign of tricuspid regurgitation. *Lancet.* 1885;**2**:524.
5. Vitums VC, Gooch AS, Evans JM. Bedside maneuvers to augment the murmur of tricuspid regurgitation. *Med Ann DC.* 1969;**38**:533-6.
6. Gooch AS, Cha SD, Maranhao V. The use of the hepatic pressure maneuver to identify the murmur of tricuspid regurgitation. *Clin Cardiol.* 1983;**6**:277-80.
7. Rios JC, Massumi RA, Brepsman WT, Rajindra KK. Auscultatory features of acute tricuspid regurgitation. *Am J Cardiol.* 1969;**23**:4-11.
8. Leon DF, Leonard JJ, Lancester JF, Kroetz FW, Shaver JA. Effect of respiration on pansystolic regurgitation murmurs as studied by biatrial intracardiac phonocardiography. *Am J Med.* 1965;**39**:429-41.
9. Lingamneni R, Cha SD, Maranhao V, Gooch AS, Goldberg H. Tricuspid regurgitation: clinical and angiographic assessment. *Cathet Cardiovasc Diagn.* 1979;**5**:7-17.
10. Levin HS, Runco V, Wooley CF, Goodwin RS, Ryan JM. The effect of respiration on cardiac murmurs. *Am J Med.* 1962;**33**:236-42.
11. Perloff JK. Auscultatory and phonocardiographic manifestations of pulmonary hypertension. *Prog Cardiovasc Dis.* 1967;**9**:303-40.