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Efficacy of the Hepatojugular Reflux Test

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Abstract:

Congestive heart failure, CHF, can be evaluated through the hepatojugular reflux test (HJR) and other clinical assessments without the need for invasive testing in many cases. The objective of this paper is to evaluate the correlation of a positive HJR test with elevated right heart pressures measured by cardiac catheterization, predictors of CHF. PubMed was utilized to identify studies focused on assessing the efficacy of the HJR by comparing estimated pressures to catheterization obtained pressures. This yielded three studies by Sochowski et al, Ducas et. al, and Butman et al. In conclusion, The HJR test has a clinically significant sensitivity and specificity for predicting elevated hemodynamic pressures. The HJR test is a clinically useful bedside test that should be used in conjunction with physical exam, history, and laboratory and imaging data.

Introduction:

Congestive heart failure (CHF) is a common condition affecting over 6 million people in the US and over 64 million people worldwide.[1] This represents a large burden on the healthcare system. CHF is caused by impaired ventricular filling and cardiac output leading to decreased ability to pump blood adequately to vital organs. There are a wide variety of causes including ischemic heart disease, hypertrophic cardiomyopathy, valvular heart disease, and myocarditis.[2] The incidence of CHF in the US increases with age, and is more common in those with coronary artery disease, diabetes mellitus, sedentary lifestyle, obesity, and metabolic syndrome.[1]

CHF is primarily a clinical diagnosis, so it is imperative to obtain a complete history, physical exam, and supporting tests.[2] The most common symptom reported is shortness of breath, that is usually exertional and positional (orthopnea and paroxysmal nocturnal dyspnea).[1] Other symptoms include chest pain, palpitations, anorexia, fatigue, and frothy sputum.[1] Physical exam findings may include wheezing, rales, S3 gallop, pulsus alternans, murmurs, cardiomegaly, peripheral edema, and jugular venous distension (JVD).[1] Supporting tests include echocardiogram, B-type natriuretic peptide (BNP), troponin, chest x ray, and electrocardiogram (EKG).[2] Additionally CHF can be assessed to determine a patient's degree of disability. Tools for this assessment include the NYHA Functional Classification and the Modified Framingham Criteria for the diagnosis of CHF (Tables 1 and 2).

The hepatojugular reflux test (HJR) is a physical exam maneuver that demonstrates peripheral congestion common in CHF. This maneuver is done by applying pressure to the liver for about 10 seconds while the patient lies supine at a 45° angle and observing the flutter of the jugular veins. An increase in jugular venous pressure by more than 3 cm is considered a positive result. This test indicates that the right ventricle cannot accommodate an increased venous return, and has been shown to significantly relate with pulmonary capillary wedge pressure (PCWP), central venous pressure (CVP), and right atrial pressures.[3,4] These pressures are measured directly through cardiac catheterization, an invasive test requiring close monitoring.[4] Increases in these pressures are consistent with decreased right ventricular function and peripheral congestion.

The gold standard in diagnosing CHF is a hemodynamic exercise test which measures PCWP through cardiac catheterization both at rest and with exercise.[5] Given the primary importance of clinical assessment in the diagnosis of CHF, this paper will focus on the efficacy of the hepatojugular reflux test in assessing right heart pressures and severity of CHF. This bedside test can provide important information about a patient's status and prognosis immediately. We will compare the efficacy of the HJR test versus cardiac catheterization in diagnosing CHF in adults over 45 years of age.

Stage/Degree	Symptoms and Functional Limitations
I- None	No symptoms with everyday activities or limitations in physical activity.
II- Mild	Comfortable at rest. Ordinary activity causes shortness of breath. Slight limitation in physical activity.
III- Moderate	Comfortable at rest. Less than ordinary activity causes shortness of breath. Marked limitation in physical activity.
IV- Severe	Discomfort at rest. Any activity causes shortness of breath. Serious limitation to all physical activity.

Table 1: New York Heart Association Heart Failure Functional Classification[6]

Major Criteria	Minor Criteria
Neck vein distension Orthopnea or paroxysmal nocturnal dyspnea Crackles Cardiomegaly on chest x ray S3 gallop Central venous pressure >12mmHg LV dysfunction on echocardiogram Weight loss > 4.5kg in response to CHF treatment Acute pulmonary edema	Bilateral ankle edema Night cough Dyspnea on exertion Hepatomegaly Pleural effusion Tachycardia (>120 bpm)
Diagnosis of CHF requires two major criteria or one major criteria with two minor criteria.	

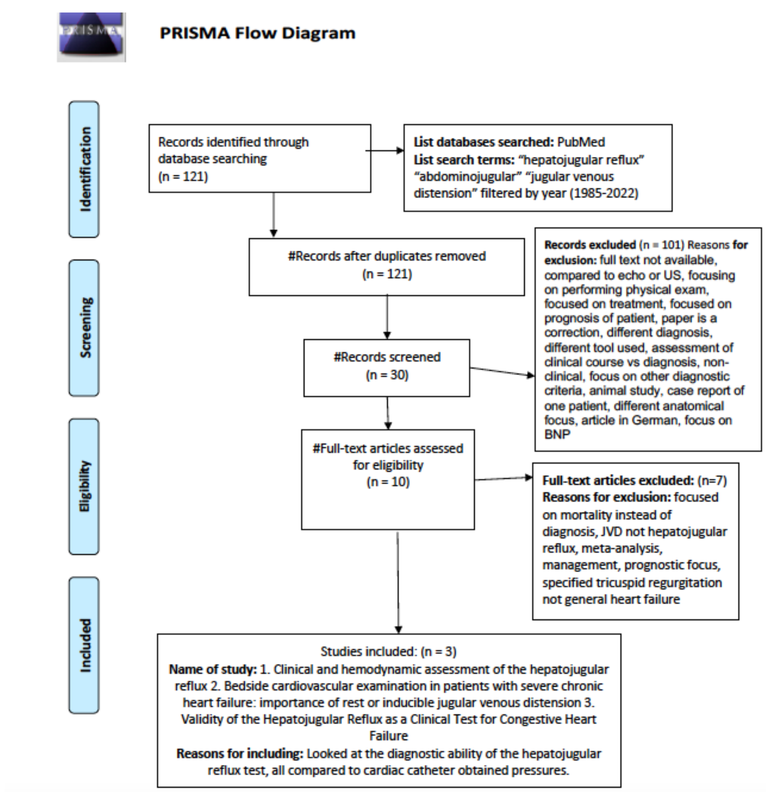
Table 2: Modified Framingham Criteria for the Diagnosis of CHF[2]

Methods:

To begin our search, PubMed was utilized with the search terms "hepatojugular reflux", "abdominojugular reflux", and "jugular venous distention". Filters at this point included studies published 1980 and later. This resulted in 121 studies fitting this description. Inclusion criteria at this point included, using cardiac catheterization as a gold standard, hepatojugular reflux used as the comparison test, and comparing these two tests in their ability to diagnose CHF. Records were then excluded for reasons including full text not being available or not in english, gold standard being echocardiogram instead of cardiac catheterization, the focus was on the physical exam, treatment, or prognosis, the paper was a correction to a previous publication, focus was not on CHF, HJR was not the test focused on, study was on animals, the study was a case report on a single patient, or the focus was on BNP as a diagnostic criteria (Figure 1). This revealed 20 studies that fit the criteria and purpose of this research paper. The 10 most promising papers were read in their entirety, with 7 excluded due to exclusion criteria as mentioned above. Quality assessment criteria required that the 3 studies we chose to focus on were primary research studies, had a study population greater than 10 patients, and provided raw data of their results.

In *Validity of the Hepatojugular Reflux as a Clinical Test for Congestive Heart Failure*[7] (Study 3), only raw data was provided and no statistical analysis of this data was performed. For completeness of this paper, statistics were generated by the authors of this paper using the data given. This was done through compiling the data into an Excel sheet and a regression analysis was performed to compare the CVP and JVP during the HJR test.

Figure 1. PRISMA Flow Diagram



Results:

Study 1

Clinical and Hemodynamic Assessment of the Hepatojugular Reflux (Sochowski, Randall A, et al.)[8]

Objective:

The purpose of this study was to assess the ability of the bedside HJR test to predict response during right sided cardiac catheterization and assess a patient's baseline hemodynamic parameters. Therefore, this information was used to further evaluate the significance of the HJR test in patients without CHF.

Study Design

Sixty-five patients without overt CHF, assessed by an absence of S3, clear lung fields, and a normal jugular venous pressure, underwent routine cardiac catheterization between November 1987 and March 1988. These patients had different past medical histories including coronary artery disease alone (n=40), valvular heart disease alone (n=6), neither (n=15), or both (n=4). Researchers were unaware of the patients' medical history or reason for catheterization. At the bedside, the HJR test was performed in a standardized manner by applying continuous pressure to a blood pressure cuff over the epigastric area until a pressure of 35 mmHg was achieved. Then a right sided cardiac catheterization was performed via the femoral vein in order to measure pulmonary capillary wedge pressure, mean pulmonary artery pressure, right ventricular end diastolic pressure, and right atrial pressure. These values were converted to millimeters of mercury so that they may be compared. The HJR test was repeated for a minimum of 45 seconds with the catheter in the mid right atrial position in order to measure the right atrial pressure. Then left sided cardiac catheterization was completed in order to measure left ventricular end diastolic pressure. This was followed by a ventricular angiography to determine the ejection fraction. The results were based on one observer or the agreement of two observers.

In the study, the authors calculated sensitivity and specificity of the bedside HJR test, as compared cardiac catheterization to measure exact pressures in various areas in the heart during the HJR test. They also used a *k* statistic with this information to make sure that these values are agreeable among the raters. The Pearson correlation coefficient (r) was used to correlate the baseline hemodynamic parameters to the absolute right atrial pressure. The results of the HJR test were used as the independent variable while the baseline hemodynamic parameters were used as the dependent variable generating F and R^2 values with the Bivariate regression analysis. Baseline hemodynamic parameters were used to perform a stepwise multiple regression analysis to then predict a positive HJR test.

Study Results

For the purpose of this paper, the results of the pulmonary capillary wedge pressure will be focused on. Other parameters were measured and can be found in Table 3. Using baseline parameters as the dependent variables and the HJR test as the independent variable, $r=0.38$, $F=10.5$, $R^2 = 0.15$, $p= 0.002$. This shows a less significant, but still positive correlation between the HJR test and pulmonary capillary wedge pressure. Furthermore the HJR test was used to predict a wedge pressure >15 mm Hg which demonstrates a sensitivity 0.55, specificity 0.83, positive predictive value 0.40, negative predictive value=0.90.

The researchers heavily focused on the results of the right atrial pressure in relation to the HJR test because they found the strongest positive correlation between these two findings ($r=0.59$). For a right atrial pressure increase of greater than 8 mmHg, sensitivity=0.73, specificity=0.87, negative predicted value=0.94, positive predictive value=0.53. A right atrial pressure increase of more than 9 had a sensitivity=1.0, specificity=0.85, negative predictive value=1.0, and positive predictive value=0.40. Simply put, a more abnormal resting pressure correlated with a positive HJR test. When evaluating the prediction of the HJR test at catheterization in relation to the bedside HJR test result, it was found to have a sensitivity of 0.80 and specificity of 0.94 (k=0.74, p<0.001).

	HJR Test Result			
Parameter	r	F	R^2	p
Right atrial pressure (mm Hg)	0.59	32.8	0.34	<0.0001
Right ventricular end-diastolic pressure (mm Hg)	0.51	22.0	0.26	<0.0001
Pulmonary capillary wedge pressure (mm Hg)	0.38	10.5	0.15	0.002
Pulmonary artery pressure (mm Hg)	0.18	2.2	0.03	0.14
Left ventricular end-diastolic pressure (mm Hg)	0.15	1.3	0.02	0.26
Ejection fraction (%)	0.03	0.05	0.001	0.83

Table 3: Correlation of Hepatojugular Reflux (HJR) Result (Absolute Change in Right Atrial Pressure to Abdominal Compression in mmHg) with Baseline Hemodynamic parameters [8]

Study Critique

This study considers a positive HJR test to be a sustained increase of JVP for > 1cm. In current practice, a positive HJR is considered a sustained JVP >3 cm. Additionally, the study assumed that only 10 seconds was necessary for a stabilization response; however, other research has stated that 15 seconds is needed to properly classify a positive or negative response on the HJR test. This lower threshold for a positive test may have resulted in an increased number of false positives and therefore a type 1 error. Since this study looks at patients without CHF, the internal jugular vein may be very difficult to locate and have an inaccurate estimate of the internal jugular venous pressure at bedside. Therefore, this can also lead to unintentional false positives or false negatives.

The study also had multiple positive aspects such as reporting the use of interobserver agreements, which leads to more confident test results. Although it was noted that some patients were evaluated by only one observer researcher; however, the numbers were not stated. Another positive aspect of the study is that they used a standardized method to complete the HJR test, which makes the results more unified. Also, the subjects were evaluated without the provider having knowledge of why cardiac catheterization was done. This helps to decrease bias in reporting the results.

Study 2

Bedside Cardiovascular Examination in Patients with Severe Chronic Heart Failure: Importance of Rest or Inducible Jugular Venous Distension. Butman, Samuel M, et al.[9]

Objective:

The objective of this study was “to determine the sensitivity, specificity, and utility of the cardiovascular examination in predicting cardiac hemodynamics in patients with advanced congestive heart failure”.[9] While the correlation of bedside exams with hemodynamics had previously shown to be high, the usefulness of these tests, such as HJR, had not been established specifically.

Study Design:

The study assessed 52 patients with chronic left ventricular dysfunction who had been referred for evaluation of heart transplant candidacy. 94% were males and the mean age was 53.1 years. All patients were NYHA functional class III. 42 were taking digitalis and 40 were taking an ACE inhibitor. Each patient went through a complete cardiovascular history and bedside exam, an upright posteroanterior chest radiograph, right heart catheterization, and multigated radionuclide ventriculography study of the heart. All tests were done within 24 hours of the bedside exam. 27 of the patients had the bedside exam repeated by a second cardiologist who was blind to the results of the first examination. The bedside exams included auscultation for pulmonary crackles or rales, measurement of jugular venous distension, abdominojugular test (also called hepatojugular reflux or HJR), auscultation for third and fourth heart sounds, evaluation of heart rate, blood pressure, and peripheral edema. For defined positive and negative findings see Table 4. Percutaneous right heart catheterization was also done in all 52 patients. This utilized femoral vein access using a balloon-tipped thermodilution triple-lumen catheter. Pressures were measured with Statham fluid-filled transducers. Pulmonary capillary wedge pressure was also confirmed by fluoroscopy.

Statistical comparisons between proportions were done using a two-tailed Fisher exact test and comparisons between groups were done using the Student t test. All results were reported as a mean value +/- 1 SD and p values were adjusted for multiple comparisons. Additionally, a kappa statistic was used to assess interobserver agreement. The study used a PCWP of ≥18mmHg as a clinically relevant positive, and further used those results to calculate sensitivity, specificity, and predictive values. A backward elimination technique was used to form multivariate models from univariate physical findings. Variables were eliminated singly until only those significant at $p<0.05$ remained. The statistical software used in the analyses were SAS software and STATA software.

Bedside exam	Method	Positive	Negative
Pulmonary crackles or rales	Auscultation of lung fields	Presence	Absence
Jugular venous distension	Patient elevated to 45°	Venous pulsations visible or venous pressure estimated to be >7 cm H_2O	Absence of positive signs

Abdominojugular test/HJR	Firm abdominal pressure applied over abdomen for 10 seconds with palm and fingers of examiner's right hand	Elevation of the mean jugular venous pressure with an abrupt fall of ≥4 cm with the release of abdominal pressure	Absence of positive signs
Peripheral edema	Palpation of lower extremities	Presence	Absence
Third and fourth heart sounds	Auscultation of valvular areas	Presence	Absence

Table 4: Bedside exam findings in Study 2[9]

Study Results:

Interobserver agreement for the HJR was high at 97% (kappa = 0.92, p <0.001). Cardiac catheterization was only performed once, so no comparison between observers was possible. A PCWP of ≥18mmHg as measured by cardiac catheterization was used as a clinically significant comparison point for bedside findings. Although all bedside exams were compared to this measurement, for the purposes of this review only HJR and JVD, will be discussed. A JVD was seen in 22 of the 52 patients overall. 21 of the 37 patients with a PCWP ≥18mmHg also had JVD while only 1 of the 15 patients with a PCWP <18mmHg had JVD. Patients with JVD had significantly higher PCWP than those without (p <0.0001). The sensitivity of the JVD for PCWP of ≥18mmHg was 57% and the specificity was 93%. The positive predictive value was 95% and the negative predictive value was 47%.

A positive HJR test was present in 33 of the 52 patients in total, including all 22 patients with JVD and 11 without JVD. The presence of either HJR or JVD had high sensitivity and specificity for predicting elevated PCWP (81% and 80% respectively). This corresponds to a positive predictive value of 91% and a negative predictive value of 63%. In terms of specific hemodynamic values, a positive HJR with JVD correlated to a PCWP of 27.4 +/- 5.8 mmHg, a positive HJR alone correlated to 21.7 +/- 5.2 mmHg, and a negative JVD with negative HJR correlated to 14.9 +/- 8.5 mmHg. As a univariate predictor of PCWP ≥18mmHg the combination of positive JVD and positive HJR was significant (coefficient 2.842 (+0.770SE), p = 0.0002). Broadly, a positive HJR test was correlated with worse hemodynamic status in these patients. Furthermore, positive HJR test with positive JVD outperformed all other bedside exam maneuvers in detecting elevated PCWP.

Study Critique:

This study had a number of strengths. Although they were not discussed in depth, the study compared HJR to a number of other bedside exams in order to identify the significance of each exam and to see how they related to each other. This is helpful for clinicians in considering their physical exam findings overall. Finally, the study examined the efficacy of HJR both with and without the presence of JVD. This is helpful because it is another common finding in CHF and it is therefore important to know how its presence may change the diagnostic value of the HJR test.

There were a few significant limitations in this study. The first is that bedside exams (namely JVD and HJR) were not performed simultaneously with cardiac catheterization, raising the question of whether the values found during catheterization were the same at that time as during the bedside examination. However, all tests were performed within a 24-hour timeframe and were done in patients with established chronic heart failure, so the measurements were unlikely to have changed.

Additionally, while this study showed good correlation between the HJR and elevated PCWP, all the subjects had previously diagnosed chronic heart failure. Furthermore, they were from a population of patients referred for assessment for heart transplant, indicating a high level of dysfunction. No control group of healthy, acutely ill, or mildly ill individuals was used as a comparison for these results. This makes it difficult to generalize the results of this study to a broader patient population.

Although there was no blinding used in this study, all PCWPs were measured after the bedside exam findings had been recorded so providers could not have known the measurements in advance. However, it would have been more transparent for the authors of the study to report which providers were performing the bedside exams versus the cardiac catheterization, and the blinding status of each.

Study 3

Validity of the Hepatojugular Reflux as a Clinical Test for Congestive Heart Failure (Ducas, John et. al.)[7]

Objective:

This study aimed to evaluate possible confounding variables of the HJR test to determine the efficacy of the test. These variables included accuracy of jugular venous pressure (JVP) as a correlate for central venous pressure (CVP), duration and force of compression necessary for an accurate result, and change of pleural pressure along with compression of the left ventricle resulting from diaphragmatic displacement (thus affecting JVP and CVP in the absence of CHF).

Study Design

The sample consisted of 25 patients, split into two groups. Group 1 contained 6 individuals without history of congestive heart failure or abnormal ventricular function. Group 2 contained 19 patients who were or had recently been in heart failure. The study was conducted in the intensive care ward after a medical emergency requiring Swan-Ganz catheterization or in the cardiac catheterization lab before angiography. Catheters were placed 5 cm below the sternal angle in all patients. During the HJR test, patients were placed with their trunk at a 45 degree angle. The highest point of the internal jugular vein flutter was identified by two different investigators, and measured from 5 cm below the sternal angle. The measurement was obtained during quiet breathing and within 2 minutes after 10 seconds of abdominal compression (with the hand applied over a semi inflated blood pressure cuff with enough pressure to reach 35 mmHg), instructing the patient to breathe normally. Two measurements of

CVP and pulmonary artery wedge pressure were then averaged before and during compression.

This paper's focus is on the efficacy of the HJR test in correlating with CVP, and thus the other variables in this study will not be addressed at length. For example, cardiac output was also obtained on these patients before and after compression. Pleural pressures, esophageal and gastric pressures, and diaphragm levels were also observed but on separate healthy patients.

Study Results

Each patient had two analyses, one comparing the JVP and CVP while at rest and the other comparing CVP and JVP during the HJR test. The study removed two comparisons from their analysis, due to not obtaining CVP measurements during the HJR test. This made for 48 total comparisons. In 19 instances, JVP could not be seen, and was judged to be <5 or >19 mm Hg. This was confirmed by the corresponding CVP measurement. For the rest of the observable JVP measurements, the mean and standard deviation of the differences between JVP measurements and CVP was -0.4 ± 3.1. The authors considered a difference of 4 mmHg or less between JVP and CVP measurements to be a clinically significant relationship. From this they concluded that in 44 of 48 (92%) comparisons, the internal jugular vein measurement accurately reflects CVP. The increase in CVP with compression during the HJR test was reflected accurately within 2 mmHg in 45 of the 48 comparisons (94%).

Only raw data was provided and no statistical analysis of this data was performed. For completeness, statistics were generated by the authors of this paper using the data given. This was done through compiling the data into an Excel sheet and a regression analysis was performed to compare the CVP and JVP during the HJR test. A regression analysis was performed comparing CVP and JVP during the HJR test. Due to the fact that some JVP measurements were undetectable (< 7 mmHg or >25 mmHg), two separate regression analyses were performed. For the first analysis, values of 6 mmHg and 26 mmHg were used in place of JVP's that were unmeasurable. The second removed these comparisons entirely from the analysis. The R^2 values were 0.7751 and 0.6141, respectively. Thus, it can be said that with abdominal compression, the elevation in JVP can be strongly correlated with an elevation in CVP.

The study also concluded that the effect of compression can be estimated anytime after 12 seconds, that cardiac output is not significantly affected by abdominal compression, and that the diaphragm has no significant change in position or change in pleural pressures with abdominal compression to confound JVP measurements. Thus, indicating that a positive HJR test correlates with an abnormal resting pressure that would be seen in CHF patients, and is not positive due to hypothesized confounding variables.

		JVP (mm Hg)		CVP (mm Hg)		PAW (mm Hg)		CO (l/min)	
Case	Diagnosis	C	HJR	C	HJR	C	HJR	C	HJR
	Group 1								
1	Stable angina	. . .	. . .	0		4	5	4.5	3.2
2	Stable angina	. . .	. . .	0		1	1	4.7	4.8
3	Stable angina	. . .	. . .	−3	−3	2	2	4.2	3.9
4	Amniotic fluid embolus	7	8	10	11	13	16		
5	Recovered sepsis	5	6	3	4	10	10	9.6	9.9
6	Stable angina	. . .	. . .	2	4	4	5	5.5	5.2
	Group 2a								
7	Acute MI	. . .	. . .	3	5			5.6	5.5
8	Acute MI	11	13	13	14	15	18	3.3	3.4
9	Acute MI	6	7	0	2	9	18	3.7	4.0*
10	Acute MI	†	†	22	29			5.0	5.2*
11	Acute MI	. . .	6	2	7			4.0	3.8*
12	Acute MI	. . .	10	5	10				
13	Anemia, Sepsis	6	10	6	10			15	16.5
14	Acute MI	6	8	4	12	12	25	3.2	2.9*
15	Cardiomyopathy (dilated)	7	10	11	15				
16	Acute MI	. . .	. . .	0	4			5.3	5.0*
17	LV Aneurysm, healed MI	10	†	12	18	24	30	6.5	6.6
18	Aortic regurgitation	†	†	16	36				
19	Acute MI, inf & RV	8	11	7	11	9	15	4.4	5.7
20	Cardiomyopathy (dilated)	10	15	11	16			4.4	4.8
21	Aortic stenosis (mild)	6	8	4	8	14	18	5.8	6.7
22	CAD	6	6	5	6			5.6	5.5
	Group 2b								
23	Scleroderma, PH	. . .	. . .	0	6	8	10	2.8	2.7*
24	Fibrotic lung disease PH	6	10	5	10	7	11	5.7	7.1
25	Primary PH	6	11	10	18	8	9	4.7	5.9

* Cardiac output measurement done approximately 90 seconds after abdominal pressure applied.
† Patients with JVP above angle of jaw.
. . . = patients with no visible distention of neck veins; C = control; CAD = coronary artery disease; HJR = hepatojugular reflux; inf = inferior; LV = left ventricular; MI = myocardial infarction; PH = pulmonary hypertension; RV = right ventricle.

Table 5: The Diagnosis, Clinical Estimate of JVP, and Measured CVP and PAW, Each in mmHg Above a Reference Level 5 cm Below the Sternal Angle, and CO[7]

Study Critique

This study utilized a small population of patients with current emergent exacerbations requiring catheterization to monitor PCWP's. Both the smaller sample size and the unknown confounding variables associated with the patients' current medical emergency most likely affected the data obtained. There was a large discrepancy between the sizes of the control and test groups. Additionally the authors of this study do not explain why some patients did not receive CVP during HJR testing, when they excluded them from analysis, or how many patients received emergent cardiac catheterization. This vague presentation of information is a possible source of critique.

This study was published in 1983, however this physical exam maneuver has been long used in the clinical world, so it lacks many recent studies analyzing its efficacy. This study also lacks any personal critique of itself and does not report any information regarding conflicts of interest.

Discussion:

Congestive heart failure is a chronic progressive disease that benefits from early detection. The hepatojugular reflux is a simple bedside test to detect increases in pressure behind the right side of the heart, consistent with CHF. In patients with risk factors for or signs and symptoms of CHF, this screening tool can indicate a need for a further work up and ability to start earlier treatment.

Sochowski, et al. revealed that changes in right atrial pressures in those without overt clinical evidence of heart failure, was predicted by the bedside HJR test. Furthermore, the patients with a positive HJR test were associated with increased right sided cardiac pressures, such as right atrial pressure, as seen with catheterization, while a negative bedside HJR test confirmed the clinical belief that the resting cardiac pressures are within normal range. Additionally, a more elevated baseline right atrial pressure positively correlated with a larger absolute change in right atrial pressure with the HJR test. It was determined through a stepwise multiple regression that a positive HJR test best correlates with right heart function. Overall, the correlation coefficients are modestly statistically significant which suggests that there multiple factors contribute to the relationship between the bedside HJR test and change in right heart pressure.

The study by Ducas et al highlighted that jugular venous pressure and the hepatojugular reflux test reflects central venous pressure with over 90% accuracy. Thus they concluded that the HJR test can estimate true central venous pressures with clinical accuracy. This gives clinicians the ability to detect CHF at the bedside. They also proved that the HJR test is without confounding variables that would alter the clinical usefulness of the study, such as increases in pleural or esophageal pressure causing an inaccurate increase in JVP. By ruling out confounding variables, they concluded that those with normal right atrial pressure or without CHF, will not have a false positive HJR test. Additionally they determined that in those with heart failure, CVP will increase >3 mm Hg or JVP will increase at least 4 cm during a HJR test.

Butman et al found a strong correlation between a positive HJR test and a PCWP of >15mmHg on cardiac catheterization. Although the study did not find that any specific JVD measurement in the context of an HJR test corresponded to a specific PCWP, this general finding is still useful in the evaluation of patient heart function. With a predictive accuracy of 81% a clinician can be relatively sure that a patient with a positive HJR test has significant heart dysfunction that should be addressed. Unfortunately the population sampled in the study consisted solely of previously diagnosed CHF patients undergoing evaluation for heart transplant, limiting the external validity of these results. The test is nonspecific for determining the cause of heart dysfunction, for example CHF versus a valvular problem, and must therefore be used with clear clinical or laboratory correlation. That said, Butman et al found that a positive HJR test was predictive of increased PCWP even without the presence of other signs or symptoms of CHF.

In general, each of these three studies found that a positive HJR test is strongly correlated with elevated heart and lung pressures consistent with CHF. Butman et al did not perform the HJR test while the cardiac catheter was in place and was only able to comment on an overall increase in baseline pressures. On the other hand, the Ducas et al and Sochowski et al both performed the HJR test during cardiac catheterization and at bedside allowing them to make quantitative assessments about the absolute pressure changes associated with the HJR test and CHF. Sochowski et al and Ducas et al also both used, either solely or in part, study participants that had not already been diagnosed with CHF. This was important in establishing the clinical value of a negative HJR test in ruling out elevated pressures. Ducas et al was the only study that analyzed possible confounding variables during a HJR test, in an effort to get a clearer picture of the true effects.

Conclusion:

Overall these three studies demonstrated clearly that this simple, noninvasive bedside exam is extremely useful in assessing patients with suspected heart dysfunction. A negative HJR test can reassure a clinician that their patients' hemodynamic pressures are within normal range, barring other concerns. A positive HJR test should be followed by a full workup of heart function given its high correlation with abnormal pressures, heart dysfunction, and CHF in particular. While there is no absolute gold standard test in diagnosing CHF, a clinical assessment of PCWP is essential in diagnosis making the HJR test a valuable tool for clinicians[5] and may save a patient from unnecessary invasive or expensive tests. However, the progression of CHF may require further testing and monitoring and the HJR test should not be used in isolation.

It is important to note however, that a positive hepatojugular reflux test correlates with left and right sided heart dysfunction or isolated right heart dysfunction. Isolated left heart dysfunction may not result in a positive HJR test, but may present with respiratory signs and symptoms. Thus, if patients present with dyspnea, orthopnea, displaced PMI, or other signs or symptoms consistent with LVHF, other exam maneuvers should be completed. Additionally, the HJR test should not be used in isolation as a patient's history, physical, and labs should be utilized in a patient workup for heart failure.

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