

# Why is the measurement of jugular venous pressure discredited?

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*'Failure to identify the height of the jugular venous pulsations most commonly results from failure to look at it.'*<sup>n</sup>

## ABSTRACT

Every doctor should be able to make a probable diagnosis of congestive heart failure by clinical examination. The most revealing clinical sign is an elevated jugular venous pressure. The measurement of this pressure was introduced by Lewis in 1930 and refined and standardised by Borst and Molhuysen in 1952. Still, this method has fallen into disuse and is thought to be not very sensitive for diagnosing congestive heart failure. A study of the methods described in the literature reveals that variations in technique are responsible for great differences in normal values. It is argued that smaller elevations of jugular venous pressure can only be measured reliably by adhering strictly to the conditions put forward by Borst and Molhuysen. In this way the sensitivity will improve considerably. A plea is made for an intensive training in this method for doctors and medical students.

Congestive heart failure (CHF) is a serious and widespread disorder. Prevalence in Western countries is estimated at 1 to 2%<sup>2</sup> and is increasing as a result of the ageing of the population and the improvement in short-term outcome of myocardial infarction. Early diagnosis is important, in particular in view of the newer therapeutic modalities such as the addition of ACE inhibitors,  $\beta$ -blockers and spironolactone.<sup>3,5</sup> In recent years a number of studies have been devoted to the efficiency of diagnosing CHF in a specialistic setting as well as in primary care. In general,

cardiologists deem echocardiography desirable for establishing the diagnosis,<sup>2,6,7</sup> the left ventricular ejection fraction (LVEF) being considered as the most important parameter for the performance of the left heart. However, many patients with CHF have a normal LVEF, whereas diastolic dysfunction is prominent.<sup>8-10</sup> No differences in clinical signs and symptoms were found between CHF with and without a low LVEF.<sup>10,11</sup>

However, irrespective of the availability of specialist cardiological techniques, most patients with symptoms of CHF present to the general practitioner or the general internist. Their symptoms, e.g. dyspnoea or oedema, are not specific for heart disease. So, the doctor must be able to make a probable diagnosis of CHF by looking for clinical signs using bedside methods. This holds even stronger for doctors in developing countries, where specialist facilities may be hard to reach or even absent. It is noteworthy that in Africa cardiovascular disease is becoming a major cause of morbidity and mortality.<sup>12</sup>

It is common knowledge that the estimation of jugular venous pressure (JVP) is the method of choice to establish CHF at the bedside. At the end of the 19<sup>th</sup> century distinguished clinical investigators like Mackenzie and Wenckebach had already unravelled many aspects of the pathophysiology of heart disease by meticulous studies of the jugular venous pulse. Lewis was the first to use the external jugular vein as a manometer to record the pressure in the right atrium.<sup>13</sup> He used the sternal angle as a reference point, assuming that this point lies about 5 cm above the centre of the right atrium in all positions of the patient between lying and sitting. Borst and Molhuysen modified

and improved this method and carried out an extensive study in a more modern quantitative way, establishing normal values and interobserver variance.<sup>14</sup> Their most important additions to the Lewis method were:

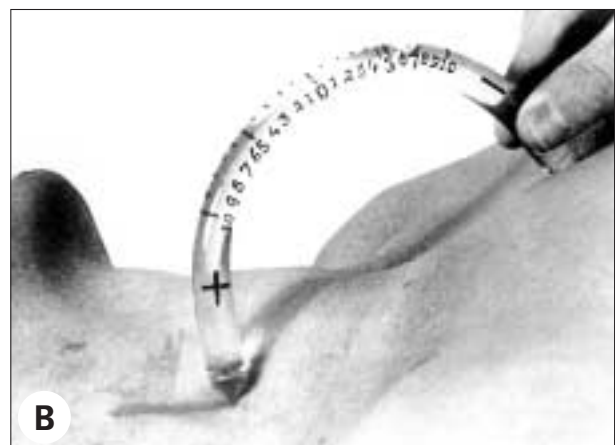
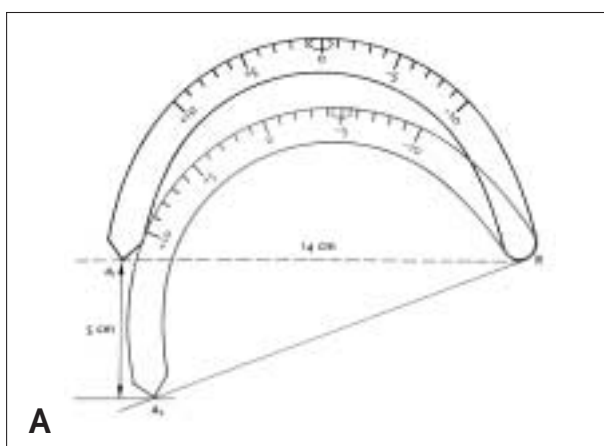
1. The height of the blood column in the vein is measured at the lowest point of collapse during inspiration, because during atrial systole and expiration the pressure rises and does not reflect atrial filling pressure. Therefore, venous pulsations should be visible.
2. During the measurement the flow of blood in the vein is stopped by light pressure of a finger below the angle of the jaw.
3. The position of the patient is adapted so that the pulsations are visible preferably midway between the clavicle and the jaw. Patients with normal or low central venous pressure have to be positioned horizontally and it may even be necessary to raise the foot of the bed by 20 to 40 cm. The spine must be slightly over-extended and the neck must not be flexed.
4. A simple instrument containing a spirit level was introduced to measure the vertical distance between the point of venous collapse and the sternal angle. Later this instrument (depicted in *figure 1*) was replaced by an elegant device, an arched, calibrated, plastic tube containing fluid and an air bubble, that fits in a coat pocket and has been used now for many decades by doctors and medical students in the Netherlands.

The importance of measuring JVP has been stressed by authoritative clinicians and most textbooks on cardiology, internal medicine and physical examination.<sup>15-20</sup> It has been stated more than once that the examination of the jugular veins should be an integral part of every physical

examination.<sup>1,15</sup> The independent prognostic significance of elevated JVP in CHF has been shown in a large retrospective study.<sup>21</sup> In a study relating clinical signs with right heart catheterisation<sup>22</sup> it was found that an elevated JVP had the highest predictive accuracy for elevation of the pulmonary capillary wedge pressure. This comes close to the statement by Lewis that 'there is a perfectly clear relation, constant within narrow limits, between the degree of breathlessness and the pressure in the (jugular) veins'.<sup>13</sup>

So, there seems to be little doubt concerning the value of JVP measurement. However, there is a general impression among experienced clinicians that the exact measurement is practised less and less. The same idea has been expressed in the United States: 'Once a cardinal aspect of the clinical cardiovascular examination, jugular venous pulsations are unlikely to be sought by contemporary physicians'.<sup>1</sup> This is not just an idea, it also appears from the literature in case reports and scientific papers. When it is stated that 'JVP was normal', 'not elevated', 'neck veins not distended', one knows that no exact measurement took place. In recent studies into the efficiency of diagnosing CHF the JVP was not even mentioned among the clinical signs.<sup>23-27</sup>

Why is JVP discredited? One can think of some obvious reasons. The availability of the modern noninvasive tools, such as echocardiography, brings about a boundless trust in technology rather than in using one's own eyes and hands at the bedside. Besides, there is nothing stylish and flashy about standing for five minutes next to a patient, carefully moving his head to and fro, looking for venous pulsations. The task forces on heart failure of the European



**Figure 1**

- A. The 'venous arch', a plastic, calibrated, arched tube, filled with fluid and an air bubble, to measure the vertical distance between two levels, in this example 5 cm.
- B. Application of this instrument for measuring jugular venous pressure, in this case 6 cm, a normal value.

and Dutch societies of cardiology<sup>2,6</sup> do not attach much value to the measurement of JVP. Their arguments are in the first place that the method is difficult because training and experience are necessary. This is a peculiar argument, suggesting that other procedures, e.g. the determination of LVEF, are easy without the need for training and experience. Performing a physical examination properly is not easy and therefore doctors have to be well-trained professionals. The second argument is that only a minority of patients with CHF have an elevated JVP. The study most cited in this respect, by Stevenson and Perloff,<sup>28</sup> concerned 50 patients with chronic CHF: an elevated JVP was only found in 25 of them. However, most patients were already being treated with digoxin and diuretics and the ten patients who still had oedema also had an elevated JVP, just as the patients with a right atrium pressure above 10 mmHg. Moreover, their method of measurement can be criticised (*vide infra*).

The crucial question remains: what is the value, in terms of specificity and sensitivity, of an elevated JVP for diagnosing CHF?

Little doubt exists concerning the specificity.<sup>2,22</sup> As to sensitivity a close look at the technique of measurement is necessary. A striking difference appears to exist regarding normal values. With the carefully standardised method of Borst and Molhuysen<sup>14</sup> in a large normal population, 90% of the results were between -4.5 and -8.5 cm relative to the reference point, equivalent to a right atrium pressure of +0.5 and -3.5 cm H<sub>2</sub>O. (As the measurement is in fact taken relative to the reference point (R) it seems appropriate to present the results in that way: R -4.5 and R -8.5, as is customary in the Netherlands.) In 12 patients there was a close match between JVP and right atrial pressure measured by catheterisation.<sup>14</sup> In the literature usually only the upper limit of the normal range is given: R + 3,<sup>15,18,19,29</sup> R + 4,<sup>16,20,30</sup> R + 5<sup>17</sup> or R + 6.<sup>8,23</sup> These upper limits are at least 7 to 10 cm higher than with the method of Borst and Molhuysen. Most authors advise positioning the patient with head and thorax elevated between 30 and 45° above the horizontal plane. In patients with markedly elevated JVP the blood column will then be visible above the clavicle, but smaller elevations will be missed. Although some mention that it may be necessary to lay the patient flatter to see pulsations, they keep their upper limit at the high level. McGee<sup>29</sup> even remarked: 'It is difficult to conceive how the clinician could ever distinguish low and normal CVP during examination, ..... , levels that actually make the jugular veins invisible to the examiner'. The sternal angle is almost universally used as the point of reference. In the above-mentioned study by Stevenson and Perloff, JVP was determined relative to the clavicle with the patient in an elevation of 30 to 45°.<sup>28</sup> The pressure was defined as normal when the blood column was not visible. So, slight elevations of JVP were probably missed.

It can be concluded that the alleged low sensitivity of elevated JVP for diagnosing CHF<sup>2,6,28</sup> is probably caused by the use of methods that can only establish strongly elevated pressures. Moreover, by not trying to measure lower and normal pressures the medical student will never learn to measure JVP properly. In this respect it is regrettable that an outstanding textbook of physical examination<sup>20</sup> states that in patients with JVP below the reference point the pressure is not elevated and thus there is no need to measure it.

Of course there are patients with a borderline JVP, which makes a definite conclusion not possible. In these cases use may be made of the abdominojugular reflux sign, which is rather well founded.<sup>31-33</sup>

It seems justified to state that the best way to measure JVP is by adhering strictly to the stringent conditions put forward by Borst and Molhuysen.<sup>14</sup> In the international literature this method is seldom mentioned. In the Netherlands it has been described twice in great detail in recent years.<sup>34-35</sup>

Some minor points of disagreement remain to be discussed.

The assumption that the reference point is always 5 cm above the centre of the right atrium has been open to criticism.<sup>14,29</sup> In a recent study using computed tomography in 160 patients the median vertical distance between the sternal angle and the mid-right atrium was found to be 5.4 cm.<sup>36</sup> There was a considerable variation between individuals and between positions of the patient. The distance tended to increase with more upright positions. So, in patients with markedly elevated JVP, the pressure tends to be underestimated a little, which is not a serious drawback.

Some authors prefer the internal jugular vein to measure JVP, others prefer the external vein. In one textbook<sup>19</sup> it is stated that use of the external vein is unreliable because of interfering valves that should not exist in the internal jugular vein. However, recent investigations with modern visualising methods demonstrated, without a doubt, valves in the internal jugular vein, although they were often incompetent.<sup>37,38</sup> Moreover, if the pressure is measured at the lowest point of collapse of the vein, interference by valves is not possible. There is enough evidence to claim that pressures in the external and the internal vein are not different.<sup>39,40</sup> The external vein is visible, which makes measurement easier. So, in line with the publications of Lewis<sup>13</sup> and Borst<sup>14</sup> the external vein is to be preferred, provided pulsations can be seen. If not, the internal jugular vein should be tried.

So far, we have discussed JVP measurement regarding the diagnosis of CHF. However, there is also a role for this method in monitoring therapy of CHF and in assessing

the volume status of patients with other diseases.<sup>1,14</sup> Especially in patients presenting with oedema or dyspnoea it is an essential method to rule out CHF as the cause. Apart from measuring JVP, the study of the jugular venous pulsations may disclose abnormalities, such as tricuspid valve insufficiency and atrioventricular dissociation. Making discoveries like these at the bedside is a gratifying experience.

It is clear that every doctor should be able to measure JVP properly. This applies in particular to those who wish to care for patients in less affluent surroundings, but also to all physicians in primary care and internists. How to achieve this? In the first place, the responsibility lies with clinical teachers in medical schools. They must have mastered the method themselves. Secondly, all doctors must be convinced by logical and scientifically sound arguments that the measurement of JVP in the proper way, as outlined above, is a valuable method that should be practised frequently.

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## Dutch resident abroad

What kind of equipment  
have you got there?

