

VIDEOS IN CLINICAL MEDICINE

SUMMARY POINTS

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Examination of the Neck Veins

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*The following text summarizes information provided in the video.***OVERVIEW**

Examination of the neck veins is routinely performed to evaluate right atrial pressure and to estimate intravascular volume in patients with dyspnea, edema, or hypovolemia.¹ In patients with dyspnea or edema, it is essential to estimate the venous pressure and to perform the abdominojugular reflux test at the bedside, as described in the accompanying video.¹⁻³ If the venous pressure is elevated or the abdominojugular reflux test result is abnormal, it is very likely that the patient has heart disease, such as left or right ventricular failure.¹ If the venous pressure and the abdominojugular reflux test results are both normal, it is probable that the dyspnea or edema is not caused by heart disease but by some other condition, such as pulmonary, liver, or kidney disease.¹⁻³

ANATOMY OF THE NECK VEINS

The neck, or jugular, veins consist of external and internal veins. These veins receive blood from the brain, face, and neck and drain into the brachiocephalic veins (Fig. 1).

External Jugular Vein

The retromandibular vein and the posterior auricular vein join at the angle of the mandible to form the external jugular vein, which receives blood from the outer part of the cranium and the deep tissues of the face and neck.^{4,5} The external jugular vein runs inferiorly in the subcutaneous tissue of the anterolateral region of the neck, beneath the platysma muscle but superficial to the sternocleidomastoid muscle. The vein then pierces the deep cervical fascia posterior to the clavicular head of the sternocleidomastoid muscle and drains into the subclavian vein (Fig. 2).^{4,5}

Internal Jugular Vein

The internal jugular vein is formed by the convergence of the inferior petrosal sinus and the sigmoid dural venous sinus, which are in or just distal to the jugular foramen (Fig. 3).⁴ The vein descends alongside the internal carotid artery in the carotid sheath and continues posteriorly to the space between the two heads of the sternocleidomastoid muscle. The vein then merges with the subclavian vein to form the brachiocephalic vein, which drains blood from the brain, face, and neck (Fig. 4).⁴

LOCATING THE NECK VEINS

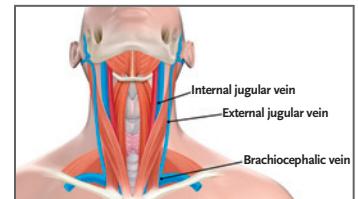
To locate the neck veins, begin by evaluating the right side of the neck. The right jugular veins have a more direct course to the heart than the left jugular veins. Raise the head of the bed to an angle of 30 to 45 degrees. This angle is generally the best for locating the neck veins. If the neck veins cannot be located with the patient in this position, raise or lower the head of the bed by 15 to 30 degrees and look for the veins again. Raising the head of the bed results in a decrease in venous pulsations, whereas lowering the head of the bed results in an increase in venous

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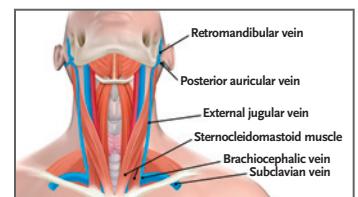
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**Figure 1. Anatomy of the Neck Veins.**

The external and internal jugular veins receive blood from the brain, face, and neck and drain into the brachiocephalic veins.

**Figure 2. Anatomy of the External Jugular Vein.**

The retromandibular and posterior auricular veins join at the angle of the mandible to form the external jugular vein, which runs inferiorly in the subcutaneous tissue of the anterolateral neck and drains into the subclavian vein.

pulsations. (Note that lowering the head of the bed may not be practical in patients with conditions such as orthopnea because it can worsen the patient's symptoms.)

To locate the right jugular venous pulse, ask the patient to turn his or her head slightly to the left and to relax the neck so that the sternocleidomastoid muscle is not excessively tense and does not obscure the venous pulsations.⁶ Dim the light in the room and, standing on the patient's right side, shine a flashlight obliquely across the patient's neck, just below the ear. This will accentuate the pulse (Fig. 5).

External Jugular Vein

The external jugular vein lies across the sternocleidomastoid muscle, directed toward the mandible. Two downward flicking movements should be visible at the superior portion of the vessel. These two descending movements correspond to the x' descent and the y descent on a tracing.¹ The tracing includes a jugular venous waveform that corresponds to different portions of the cardiac cycle. The a wave corresponds to right atrial contraction, and its peak denotes the end of atrial systole. The x' descent denotes right atrial relaxation. The c wave denotes right ventricular contraction and closure of the tricuspid valve. The x' descent, which begins during ventricular systole, reflects the downward movement of the right atrial floor and the contraction of the right ventricle. The v wave corresponds to right atrial filling. The y descent, which begins during diastole, reflects the filling of the right ventricle after the opening of the tricuspid valve (Fig. 6).¹

If it is difficult to identify the external jugular vein, there are three methods that can be used to aid identification. First, try pressing on the base of the patient's neck, above the clavicle, with your index finger. The vein should become engorged and visible in the area superior to your finger. If this method is not effective, ask the patient to perform the Valsalva maneuver. The maneuver should result in engorgement of the external jugular vein superiorly, toward the mandible. However, the Valsalva maneuver may not be practical in some patients with dyspnea, as it may lead to clinical deterioration. If this is the case, try the third method, in which moderate pressure is applied to the right upper quadrant of the abdomen or the area between the epigastrium and the umbilicus. The external jugular vein should become engorged and should empty instantly once you stop applying pressure. It is important to apply only moderate pressure when attempting this technique. If the patient has abdominal pain or a history of abdominal aortic aneurysm, extreme caution should be used when attempting to use this technique or it should be avoided altogether.

Internal Jugular Vein

The internal jugular vein lies deep within the neck, between the two heads of the sternocleidomastoid muscle, and may not be visible. However, two downward flicking movements may be seen on the patient's neck at the top of the vessel. These movements correspond to the x' descent and the y descent on a tracing.¹ If the two downward flicking movements cannot be seen, raise or lower the head of the bed by 15 to 30 degrees and look for them again. The internal jugular vein can also be detected by compressing the abdomen, as described above.

Vein Selection

Since the pressure in the external and internal jugular veins is similar, either vein in which the two descending movements are generally visible can be used.¹ In hypovolemic patients, the above-mentioned methods may not identify the jugular veins. In this case, placing the patient in the Trendelenburg position may permit identification.

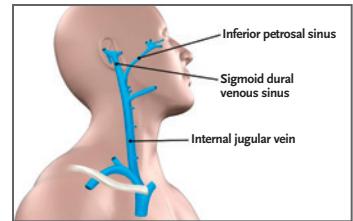


Figure 3. Anatomy of the Internal Jugular Vein, Lateral View.

The internal jugular vein is formed by the convergence of the inferior petrosal and sigmoid dural venous sinuses in or just distal to the jugular foramen.

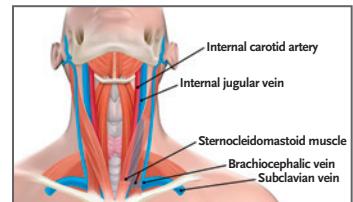


Figure 4. Anatomy of the Internal Jugular Vein, Frontal View.

The internal jugular vein descends in the carotid sheath, continues posteriorly to the space between the two heads of the sternocleidomastoid muscle, and then merges with the subclavian vein to form the brachiocephalic vein.



Figure 5. Flashlight Technique.

The flashlight technique is used to locate the right jugular venous pulse. The patient's head is turned slightly to the left and the neck relaxed so that the sternocleidomastoid muscle is not excessively tense and does not obscure the venous pulsations.⁶ The light in the room is dimmed, and a flashlight is shined obliquely across the right side of the neck, just below the ear, which accentuates the pulse.

DISTINGUISHING THE NECK VEINS FROM THE CAROTID ARTERY

The characteristic movements of the neck veins and the carotid artery are distinct. The differences in their pulsations are described in Table 1. During ventricular systole, the jugular veins have two inward movements and the carotid artery has one outward movement. The jugular venous pulsations are not palpable, whereas the carotid arterial pulsations are easily palpated. During inspiration, jugular venous pulsations diminish but become more prominent in the lower part of the neck, whereas carotid arterial pulsations do not change. Similarly, when the patient is sitting up, jugular venous pulsations decrease, whereas carotid arterial pulsations do not change. When the abdominal pressure is increased, jugular venous pulsations become more prominent and move higher in the neck, whereas carotid arterial pulsations do not change.¹

ESTIMATING THE VENOUS PRESSURE

Once you have located one of the jugular veins and made sure that the patient is not performing a Valsalva maneuver, which can produce a falsely elevated jugular venous pressure, you can measure the jugular venous pressure. Observe the patient, looking for the two characteristic descending movements of the external or internal jugular vein. Use the sternal angle, also called the angle of Louis, as a reference point for measuring the venous pressure when the head of the bed is at 30 to 45 degrees. Note that the sternal angle is not an accurate reference point when the patient is in a completely supine or a completely upright position because the neck veins are fully engorged when the patient is in the supine position and fully collapsed when the patient is sitting or standing upright.¹

Using a small metric ruler, measure the distance from the highest point of venous pulsation to the sternal angle. A distance of less than 3 cm is normal (Fig. 7). According to the method of Lewis,^{7,8} 5 cm may be added to this distance to estimate the jugular venous pressure in centimeters of water. Thus, when the jugular venous pressure is more than 3 cm above the sternal angle, which is a distance corresponding to 8 cm of water, the pressure is considered to be elevated.¹ The sensitivity and specificity of elevated jugular venous pressure for the detection of elevated right atrial pressure are 57% and 93%, respectively.⁹ A totally flat jugular venous pressure corresponds to a distance of less than 5 cm of water and generally indicates hypovolemia.⁶

ABDOMINOJUGULAR REFLUX TEST

The abdominojugular reflux test measures the jugular venous pressure through the distention of the internal or external jugular vein while the abdomen is being compressed.² Since this test can detect elevated right atrial pressure, it can be used to detect the cause of dyspnea or edema and is an important part of the bedside examination.¹

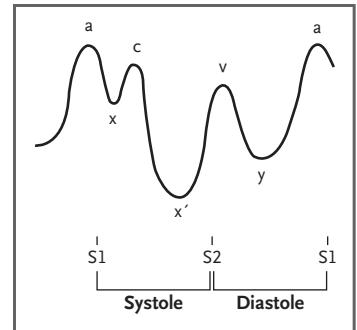


Figure 6. Jugular Venous Waveform.

The jugular venous waveform corresponds to the different stages of the cardiac cycle.



Figure 7. Estimation of the Venous Pressure.

The venous pressure is estimated by measuring the distance from the highest point of venous pulsation to the sternal angle when the head of the bed is inclined at 30 to 45 degrees.

Table 1. Distinguishing the Jugular Veins from from the Carotid Arteries.		
Characteristic	Jugular Veins	Carotid Arteries
Movement	Two inward movements per ventricular systole	One outward movement per ventricular systole
Pulsations	Not palpable	Easily palpated
Change with inspiration	Pulsations diminish but become more prominent in lower part of neck during inspiration	No change
Change with position	Pulsations decrease when sitting up	No change
Change with abdominal pressure	Pulsations become more prominent and move higher in neck	No change

After measuring the jugular venous pressure, press on the patient's abdomen — either the right upper quadrant or the area between the epigastrium and the umbilicus. It is prudent to apply the pressure gradually and gently to avoid eliciting hepatic pain in patients with heart failure. Exert moderate and sustained pressure for approximately 10 seconds. (This technique should be used with extreme caution or avoided in patients with abdominal pain or a history of abdominal aortic aneurysm.) Note the increase in the filling of the jugular vein. Measure the pressure in centimeters of water, and then compare this measurement with the previously obtained measurement of the jugular venous pressure. Note the number of seconds for which the increase in the jugular venous pressure is sustained.

The abdominojugular reflux test result is abnormal when the increase in the jugular venous pressure is more than 4 cm of water and is sustained for the entire 10 seconds of abdominal compression.^{1,3,10} An abnormal result indicates that the right atrial pressure is elevated. Such a finding in a patient with dyspnea indicates heart failure on the right side. A normal result decreases the probability that the patient has elevated filling pressure on the right side of the heart.¹⁰ When the abdominojugular reflux test and the jugular venous pressure are combined, their sensitivity and specificity for the detection of elevated right atrial pressure are 80% and 81%, respectively.⁹

KUSSMAUL'S SIGN

Paradoxical elevation of the jugular venous pressure during inspiration is called Kussmaul's sign. In a healthy person, the venous pressure decreases during inspiration because pressure on the right side of the heart falls as intrathoracic pressure decreases. The differential diagnosis for Kussmaul's sign includes constrictive pericarditis, severe heart failure, pulmonary embolism, and right ventricular infarction.¹

SUMMARY

Examination of the neck veins can be easily performed in less than a minute and poses little risk to the patient. Direct examination of the neck veins, estimation of venous pressure, and performance of the abdominojugular reflux test are essential for evaluating right atrial pressure and estimating intravascular volume in patients with dyspnea, edema, or hypovolemia.

No other potential conflict of interest relevant to this article was reported.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

REFERENCES

1. Inspection of the neck veins. In: McGee S. Evidence-based physical diagnosis. 4th ed. Philadelphia: Elsevier, 2018:301-4.
2. Wiese J. The abdominojugular reflux sign. *Am J Med* 2000;109:59-61.
3. Ewy GA. The abdominojugular test: technique and hemodynamic correlates. *Ann Intern Med* 1988;109:456-60.
4. Veins. In: Whitaker RH, Borley NR. Instant anatomy. 5th ed. Hoboken, NJ: Wiley-Blackwell, 2016:47-58.
5. Rubin JA, Wesolowski JR. Neck MR imaging anatomy. *Magn Reson Imaging Clin N Am* 2011;19:457-73.
6. Applefeld MM. The jugular venous pressure and pulse contour. In: Walker HK, Hall WD, Hurst JW, eds. Clinical methods: the history, physical, and laboratory examinations. Boston: Butterworths, 1990:107-11.
7. Lewis T. Remarks on early signs of cardiac failure of the congestive type. *Br Med J* 1930;1:849-52.
8. Borst JG, Molhuysen JA. Exact determination of the central venous pressure by a simple clinical method. *Lancet* 1952;2:304-9.
9. Butman SM, Ewy GA, Standen JR, Kern KB, Hahn E. Bedside cardiovascular examination in patients with severe chronic heart failure: importance of rest or inducible jugular venous distension. *J Am Coll Cardiol* 1993;22:968-74.
10. Congestive heart failure. In: McGee S. Evidence-based physical diagnosis. 4th ed. Philadelphia: Elsevier, 2018:411-8.

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