The diameter of the internal jugular vein studied by autopsy

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Abstract: Central venous cannulation is frequently used in patients with serious disease. However, it can be unsuccessful and many patients have complications. Central venous access for surgical procedures and nonsurgical reasons is a valuable adjunct to patient care. The recommended use of ultrasound to guide and optimize vascular catheterization has increasingly reduced the incidence of complications. The internal jugular vein can be visualized during the ultrasound-guided procedure. However, many factors influence accurately measuring the internal jugular vein when using ultrasound. The purpose of this study is to measure accurately the diameter of the internal jugular veins. We obtained internal jugular vein autopsy measurements from 30 subjects. The subjects died of natural or traumatic causes and were candidates for autopsy because of medico-legal reasons. In 73.3 percent of subjects, the right internal jugular vein was larger than the left internal jugular vein. However, there was considerable variation of the right and left jugular vein diameter within an individual.

Key words: autopsy, diameter, internal jugular vein

Internal jugular vein (IJV) catheterization is commonly performed to obtain central venous access for hemodynamic monitoring (such as monitoring central venous pressure) and for the long-term administration of fluids, antibiotics, total parenteral nutrition, chemotherapeutics, and hemodialysis [1,2]. Classic techniques for central venous access are based on superficial anatomic references and knowledge of an area’s vascular anatomy. The rate of technical complications can be as high as 15 percent [3]. Ullman et al. in 1978 first described using ultrasound to facilitate the placement of catheters in the IJV [3].

Ultrasound provides a direct visualization of vascular and perivascular structures and the needle, and it allows subsequent measurements of the IJV to be obtained. The variables of the surface ultrasound technique include the amount of head rotation to the contralateral side, the degree of Trendelenburg position, and the collapse of the vein by the compressing probe [4,5]. It is important to investigate the differences between the right and left IJV. The purpose of this study is to measure the diameter of the IJV by autopsy.

Materials and Methods
The autopsy data of 30 individuals was collected as a part of normal forensic medicine autopsies. The subjects were 18 males and 12 females, their mean age was 54.4 years, and their age range was 21 to 85 years.

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The subjects died of natural or traumatic causes and were candidates for autopsy because of medico-legal reasons. The study was approved by the ethical committee of our university.

However, the ethics committee waived the need for consent from the patients’ next of kin because the autopsy was dictated by law. The left and the right jugular vein were measured at the midlevel of the thyroid gland (Fig. 1).

![Fig. 1 Diameter of the left and right internal jugular veins before removal](image)

**Results**

Table 1 summarizes the results of the IJV diameter comparisons. In 73.3 percent of subjects, the right IJV was larger than left IJV; in 10 percent, the left IJV was larger than right IJV; and in 16.7 percent, the left and right IJV were equal.

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<th></th>
<th>Right (cm)</th>
<th>Left (cm)</th>
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<tbody>
<tr>
<td>maximum</td>
<td>2.0</td>
<td>1.8</td>
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<tr>
<td>minimum</td>
<td>1.0</td>
<td>0.4</td>
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<tr>
<td>average</td>
<td>1.34</td>
<td>0.94</td>
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**Table 1** The diameter of the internal jugular veins

The right internal jugular vein (IVJ) is larger than the left IVJ in 22 subjects. The right IVJ is smaller than the left IVJ in 3 subjects. The right IVJ equal to the left IVJ in 5 subjects. The number (N) of subjects is 30 (18 males, 12 females with a mean age of 54.4 years).

**Discussion**

Approximately 5 million central venous punctures are performed every year in the United States. There is a 15 percent incidence of complications, which include arterial puncture, hematoma, pneumo-thorax, and death [6, 7].

Physicians should have prior knowledge of the anatomical references
and the vascular anatomy of the cervical region, and have experience in introducing a catheter into the IJV. However, anatomical variations are frequent, which hinder puncture and can lead to the development of the Doppler to locate and facilitate catheterization of the right jugular vein.

Since 1984, the recommendation of using ultrasound to guide and to optimize vascular catheterization has increasingly reduced the incidence of complications [6,8].

The safe and efficient placement of central venous catheters is an essential skill in many fields of clinical medicine. Previous work by Lobato et al. measured the cross-sectional area of the right and left internal jugular veins [9]. The IJV can be visualized during the ultrasound-guided procedure.

The IJV was examined from a short- or long-axis view by using the two-dimensional view to direct the M-mode beam across the maximal diameter.

However, many factors influence the measurement of the IJV when using ultrasound. Differences in the diameter of the IJV are influenced by the supine and Trendelenburg positions, by head rotation conditions, and by the respiratory circle. It has long been known that collapsible vessels interposed throughout the circulation have a key role in flow limitation [10].

Diastolic and systolic changes are an important consideration in an individual with an inadequate circulatory adaptation to the respiratory cycle and in fluid administration.

We selected our cases from autopsies done on subjects for whom the apparent cause of death was classified as “natural” or “traumatic.” We can never be sure that our postmortem measurements are similar to those of live people. We measured the diameters of the IJV before their removal, which may have minimized the potential sources of error.

The IJV collects blood from the skull, brain, superficial parts of face and much of the neck. It begins at the cranial base in the posterior compartment of the jugular foramen, where it is continuous with the sigmoid sinus. The origin of the IJV is dilated at the superior bulb, which lies below the posterior part of the tympanic floor.

The IJV descends into the carotid sheath and unites with the subclavian vein (which lies posterior to the sternal end of the clavicle) to form the brachiocephalic vein. Near its termination, the IJV dilates into the inferior bulb, above which is a pair of valves. On the left, the internal jugular crosses anterior to the thoracic duct.

The right IJV was larger than the left IJV in 73.3 percent of subjects. The vascular anatomy may have contributed to this. However, we can not neglect the fact that the left IJV was larger than the right in 10 percent of subjects.

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References