Morphological Variations Of The Internal Jugular Venous Valve

S Furukawa, A Takaya, T Nakagawa, I Sakaguchi, K Nishi

Citation

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Abstract

The internal jugular vein is a popular route for central venous catheter placement. The internal jugular veins are also important

venous vessels for returning blood from the brain. The internal jugular vein valves are the only venous valves between the heart and the brain and incompetence may result in retrograde cerebral venous flow during coughing and other precipitating activities. We investigated 60 cadavers from legal autopsies to observe the morphological variations of the internal jugular venous valve. The position of the internal jugular venous valve in situ varied among the subjects, ranging from being directly posterior to the clavicle to a position 3cm further inferior and 2.5cm further superior. Valves were present bilaterally in 58 (96.7%) subjects and unilaterally in 2 (3.3%) subjects. Bicuspid valves were present in 72.0% of the valves we examined. As the internal jugular vein is increasingly being used for vascular access, knowledge about and evaluation of these valves may be useful in clinical practice to avoid damage during percutaneous procedures.

INTRODUCTION

Internal jugular vein (IJV) catheterization is commonly used to obtain central venous
access for hemodynamic monitoring, long-term administration of fluids, antibiotics,
total parenteral nutrition, chemotherapeutic drugs, and hemodialysis. (1,2) The anterior
jugular venous system, with its interconnections to the subclavian and deep jugular
veins, provides a collateral venous network across the midline of the neck area. This
area is especially important in the unilateral occlusion of the innominate vein. Harvey's
drawings of peripheral venous valves are well known; however, he and his teacher were
aware of the presence of venous valves in the IJV. (3) In fact, in 1628 Harvey wrote that
"the edges of the valves in the jugular veins hang downwards, and are so contrived that
they prevent blood from rising upwards."(4) The IJV valve is the only protective vessel
valve between the heart and the brain.(5) Jugular venous valves are clinically important
as an incompetent valve may be associated with increased intracranial pressure.(6)

The medical literature contains many reports and discussions concerning the presence
and clinical significance of competent jugular venous valves. Nevertheless, many
physicians remain unaware of the presence of the IJV. We investigated the autopsy data
of IJV valves from 60 individuals.

MATERIALS AND METHODS

Autopsy data of 60 individuals were collected from 35 males and 25 females ranging in
age from 17 to 85 years and with a mean age of 59.5 years. The subjects involved in the
study had been otherwise healthy and none had had a history of cerebrovascular
disorders, pulmonary disease, right-sided heart failure, neurological diseases, or notable
trauma to the cervical and supraclavicular region. The ethics committee of the
university approved the study but waived the need for consent from the patients' next of
kin because the autopsy was dictated by law.

RESULTS

A total of 118 valves were examined which were bilaterally present in 58 (96.7%)

subjects (Fig. 1.2.3). Of the female subjects 2 (3.3%) had unilateral valves. The position
of valves was noted relative to the clavicle and 63 (53.4%) valves were directly
posterior to the clavicle. In 32 subjects the right and left valves were positioned at the
same level, in 18 subjects the right valve was more superior than the left and in 10
subjects the right valve was more inferior than the left. (Table 1) Of the valves 31
(26.3%) were unicuspid (13 valves on the left side and 18 valves on the right side), 2
(1.7%) were tricuspid and the remaining 85 (72.0%) valves were bicuspid. (Table 2)

Figure 1

Table 1. Position of internal jugular venous valves relative to the clavicle.

	Left 0	Left 1	Left 2	Left 3
Right 0 (absent valve)				
Right 1 (unicuspid valve)	1	7	10	
Right 2 (bicuspid valve)	1	6	34	
Right 3 (tricuspid valve)				1

Figure 2

Table 2. Number and type of morphological variation of the internal jugular venous valves present in the 60 subjects studied.

	Left	Right
Inferior (max)	3.0	2.0
Superior (max)	1.5	2.5
average	1.05 inferior	0.01 inferior

(cm)

Left valve more inferior (n)	Both valves at same level (n)	Right valve more inferior (n)
18	32	10

Total : 60 subjects

Figure 3

Figure. 1 Internal jugular venous valve. (autopsy)

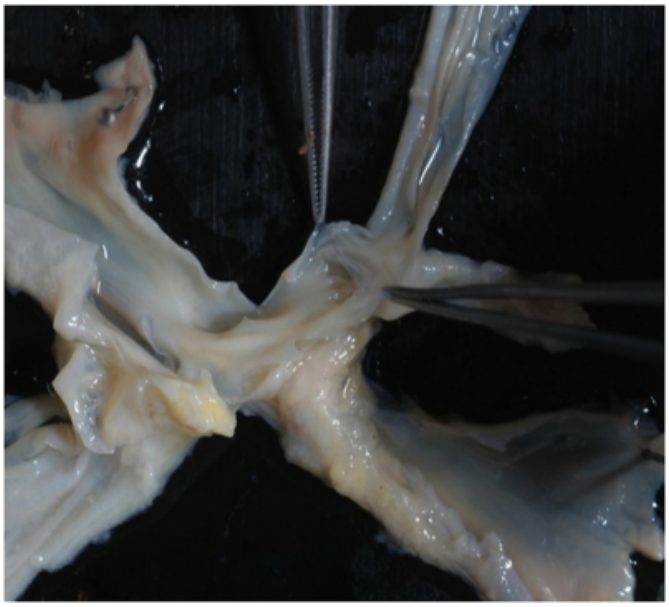


Figure 4

Figure. 2 Bicuspid valve of internal jugular vein.

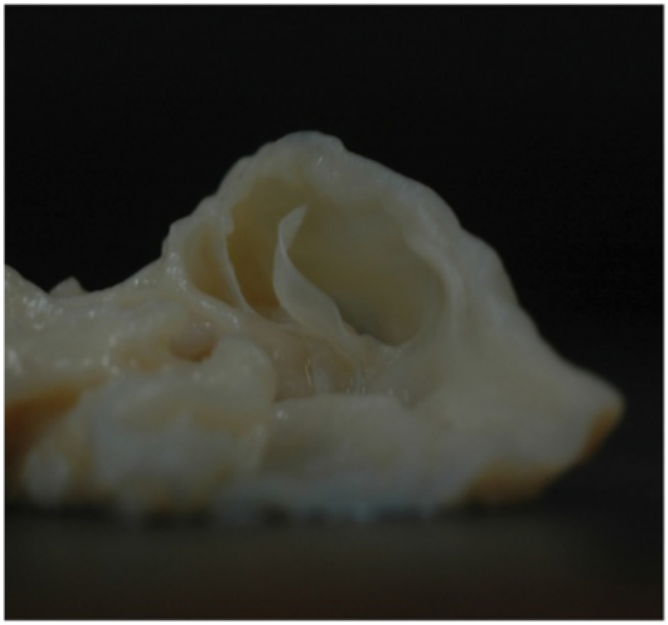
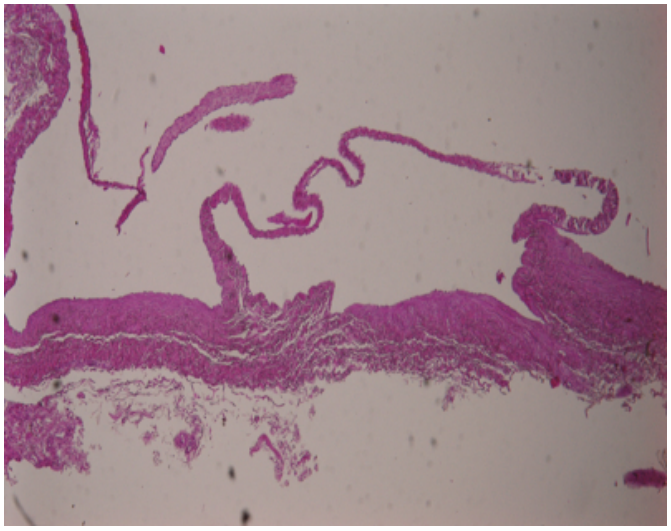


Figure 5

Figure. 3 Internal jugular venous valve. (stained with hematoxylin and eosin)



DISCUSSION

The competence of the IJV valve is crucial in maintaining the transcranial blood pressure gradient during cardiopulmonary resuscitation with closed-chest compression.(7) This valve also prevents a sudden increase in the IJV pressure during coughing or during positive pressure ventilation and may thus protect the brain from acute increases in intrathoracic pressure.(8,9) This feature is unimportant in neurologically normal patients, but may be important in patients with compromised cerebral perfusion (e.g.,after head trauma or neurosurgery).(10) At the same time the functional or morphological incompetence or absence of the IJV valves may cause cough headache, cerebral morbidity after positive end-expiratory pressure ventilation and some types of cerebrovascular diseases.(6) Transient mesiotemporal ischemia induced by venous congestion may be a potential cause of transient global amnesia (TGA).(11) In 1998, Lewis originally proposed the venous congestion hypothesis for TGA.(11) which is primarily based on the observation that the onset of symptoms is often correlated with prior Valsalva-like activities, which in turn may lead to venous reflux through the IJV.

In anatomical studies, aplasia is reportedly present in as many as 16% of non-selected patients but in these studies valve competence was not assessed.(12)

In humans approximately 90% of internal jugular veins have a valve. (13,14)

In a preclinical study, Imai et al. reported that competent IJV valves became incompetent after being punctured with a 14-gauge needle.(9) As the IJV valve may be situated slightly above the clavicle at the base of the neck, Imai et al. raised the concern that the valve may be injured in clinical situations when the IJV is cannulated at the lower neck for the insertion of a central venous catheter.(8,9) In our study valves were bilaterally present in 96.7% of the subjects but the clinical importance of such an abnormality is not yet clear. Venous back pressure due to incompetence or absence of the IJV valves may give rise to transient blood flow disturbances in the brain. Incompetence of these valves may be associated with respiratory brain syndrome.(6,11,15,16) Positive end-expiratory pressures for long periods of time may induce incompetence of the IJV valves with subsequent cerebral venous back flow which would contribute to the venous engorgement noted in patients undergoing this form of treatment. The presence and competence of the IJV valves may prevent respiratory brain syndrome. However, a thrombus may easily develop from venous congestion and blood coagulation resulting from IJV catheterization.

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CONCLUSION

Internal jugular venous valves were present bilaterally in 96.7% subjects. The position of valves was noted relative to the clavicle and 53.4% valves were directly posterior to the clavicle. Bicuspid valves were present in 72.0% of the valves we

examined.

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Author Information

Satoshi Furukawa
Department of Legal Medicine, Shiga University of Medical Science

Akari Takaya
Department of Legal Medicine, Shiga University of Medical Science

Tokiko Nakagawa
Department of Legal Medicine, Shiga University of Medical Science

Ikuo Sakaguchi
Department of Legal Medicine, Shiga University of Medical Science

Katsuji Nishi
Department of Legal Medicine, Shiga University of Medical Science