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The valves of the internal jugular veins: a statistical investigation in 120 living subjects using ultrasonic tomography

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Key words: internal jugular vein valves, ultrasonic tomography.

SUMMARY

We examined both jugular veins of 120 healthy subjects (60 men, 60 women; age range: 18 to 90 years); thus, a total of 240 jugular veins were examined. The vessel diameter was measured by color Doppler ultrasonography, and when valves were present at the ostial level, their morphology and competence were assessed. A single valvular apparatus was detected in 206 cases (86%). It consisted of 2 cusps in 75% of these 206 cases, of one in 15%, and of three in 10%. No correlations with side or the subjects' sex, age, height, or body weight were observed.

In the 34 cases in which a valvular apparatus was not visualized, we found a male predominance (22 men as compared to 12 women). The mean diameter of the jugular vein at the ostial level was 13.8 mm, with that of the men being significantly larger than that of the women ($p < 0.01$), and it showed a tendency to increase with age. The valves were observed to be incompetent in 95% of the cases.

INTRODUCTION

Since as early as the sixteenth century, a number of medical authorities have been interested in the valvular apparatuses of human veins (Canano, 1541; Harvey, 1649; Kampmeier and Birch, 1917; Franklin, 1927; Gottlob and May, 1986). Others have turned their attention specifically to the valves of the jugular veins

(Riolano, 1649; Kerckring, 1670; Haller, 1757; Houze, 1854; Poirier and Charpy, 1903; Anderhuber, 1984; Midy et al., 1988). Among these investigations, there is considerable disagreement regarding both the presence and morphology of these valves in the internal jugular vein at the ostial level. Thus, it seemed to us worth conducting a study to determine the presence or absence of such valves, to identify their gross morphology, and to establish their competence with respect to sex, age, side, body weight, height, and to the diameter of the internal jugular vein at the ostial level.

SUBJECTS AND METHODS

We examined 120 subjects (60 men, 60 women; age range: 18 to 90 years) with no known cardiovascular disease, particularly valvular disease or hypertension. Each subject underwent bilateral ultrasonography of the internal jugular veins and color doppler echocardiography to exclude cardiac valvular incompetence and/or stenosis. A tutal of 240 veins was therefore examined. Since in living subjects the jugular vein is not cylindrical and its caliber can vary considerably during the various phases of the cardiac cycle, the venous diameter was determined at the ostial level by the measurement of 4 perimetral averages in the various phases of the cardiac cycle.

Subsequently, we examined the gross structure of the valves that were present at the level of the ostium, again using ultrasonography. Their competence was assessed by the presence or absence of reflux, as indicated by a retrograde color jet on color Doppler during insufflation of a cannula connected with a mercury sphygmomanometer to each subject until a pressure of 20 mm Hg was achieved for 5 seconds.

An Acuson 128 XP Doppler ultrasonography apparatus with a 5 MHz probe was used in the study.

RESULTS

Among the 240 jugular veins examined, a valvular apparatus was documented in 206, or 86% of the cases (*Tab. I*). In the 34 cases (14%) in which a valvular

TABLE 1 - *Ostial valves in the internal jugular veins.*

Total of cases	Presence		Absence	
240	206		34	
	Males 101	Females 105	Males 22	Females 12

apparatus was not observed, a male predominance (22 men as compared to 12 women) was observed. However, the differences between the two sexes and between the two sides were not significant, nor were there correlations with height, body weight, or age. In all case, only a single valvular apparatus was found. It was situated an average of 28 mm from the end of the internal jugular vein.

In 154 of the 206 cases (75%) in which a valvular apparatus was visualized, it was bicuspid; in 31 cases (15%), it constituted only a single cusp; and in 21 cases (10%), a tricuspid valve was observed (*Tab. II*). There were no significant correlations among the number of cusps and side or the subjects' sex, age, body weight, or height.

the mean diameter of the jugular vein (*Tab. III*) was 13.8 mm, that of the men being significantly larger ($p < 0.01$), and it demonstrated a tendency to increase with age (*Tab. IV*).

TABLE 2 - *Valvular morphology.*

Total of cases	Two cusps		One cusp		Three cusps	
206	154 (75%)		31 (75%)		21 (10%)	
	Males	Females	Males	Females	Males	Females
	74	80	17	14	10	11

TABLE 3 - *Internal jugular veins diameter (mm ± sd).*

Total (240 cases)	Males		Females		pt
13.8 ± 1.7	15.5 ± 1.8		12.1 ± 1.6		0.01
	DX	SN	DX	SN	
	15.2 ± 1.4	15.8 ± 1.4	11.8 ± 1.4	12.4 ± 1.8	
pt	ns		ne		

TABLE 4 - *Internal jugular vein diameters. Statistical significance (pt<) of the difference of the mean (mm ± sd) between a class of age and the following one.*

Classes of age		pt<
from	to	
18-30	30-42	ns
42-54	54-66	0.02
66-78	78-90	0.01

When valvular competence was assessed, reflux was documented in 196 cases (95%) during insufflation (*Tab. V*); the 10 cases in which reflux was not observed (*Tab. VI*) were those of 6 women and 4 men, all below the age of 20 years; in 7 of the cases (4 men and 3 women), the valves were bicuspid, in 2 cases (1 man and 1 woman), they were monocuspid, and in only one case (a woman), tricuspid.

CONCLUSION AND DISCUSSION

Regarding the presence and competence of valvular apparatuses in the internal jugular vein, our data are generally in concordance with those of the classical authorities, who describe the finding of bicuspid apparatuses (Haller, 1757; Houze, 1854; Poirier and Charpy, 1903; Chiarugi, 1912; Testut and Latarjet, 1972), although some of them (Haller, 1757; Houze, 1854) state that they were competent, while others (Testut and Latarjet, 1972) speak of «bivalvular» apparatuses. In the latter case, however, it is likely that the authors intended to describe a single valvular apparatus with two cusps, i.e. a bicuspid apparatus.

In contrast, the data reported by Kerckring (1670), who found mono- or tricuspid valves only occasionally, are totally discordant. Similarly, Riolano (1649) and Kampmeier and Birch (1917) found more valvular apparatuses.

Undoubtedly, our data correspond most closely to those of Poirier and Charpy (1903) and Chiarugi (1912), who nonetheless have reported the frequent absence of valvular apparatuses in the left internal jugular vein; to those of Testut and Latarjet (1972), and, among contemporary investigators, Midy et al. (1988). Even with regard to vessel diameter, our data are quite similar, although our measurements are slightly lower.

The fact that the vessel caliber was significantly larger in the men than in the women aggrees with most of the case series, as with the arteries of the supraaortic

TABLE 5 - *Valvular continence.*

Total: 206	Incontinence: 196 (95%)	Continence: 10 (5%)

TABLE 6 - *Valvular continence and morphology.*

Total: 10	Bicuspid		Monocuspid		Tricuspid	
	7		2		1	
	Males	Females	Males	Females	Males	Females
	4	3	1	1	0	1

trunks (Macchi et al, 1993). The extremely low percentage of valvular competence during a very weak maneuvre suggests that valvular incompetence represents the norm and that the finding of a competent valve probably reflects the limits of the methodology employed or its range of variability.

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