

Assesment of internal jugular vein diameters in Turkish adults

Türk popülasyonda juguler ven çaplarının değerlendirilmesi

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SUMMARY

Objective: As the internal jugular vein (IJV) is a vessel used for cannulation in central venous approaches in medical applications, knowledge of the anatomic details is significant for clinicians knowing that vascular diameter varies according to age and gender is an extremely useful data. The aim of this study was to evaluate differences in the right and left side diameters of the internal jugular vein in normal adult Turkish population and to determine any relationship between these diameters and age, gender and maneuver.

Method: The study included a total of 140 patients. The maximal transverse and anterior-posterior diameters of the internal jugular veins were measured on both sides, both with the patient at rest and during the Valsalva maneuver with USG.

Results: No statistically significant difference was determined in respect of diameter values above and below 60 years of age ($p < 0.05$). No statistically significant difference was determined between male and female genders in respect of all the diameter values ($p < 0.05$) except LIJV in transverse diameter with valsalva. The right IJV diameter in both the transverse and anteroposterior sections were determined to be statistically significantly wider both at rest and during the Valsalva maneuver ($p < 0.05$).

Conclusions: According to the results of this study, the right-side IJV diameter was found to be statistically significantly greater than that of the left side in Turkish population. Valsalva effects, age and gender are non-effective on diameters. Distinguishing the diameters, surgical and interventional risks can be decreased.

Keywords: Jugular vein, age, gender, valsalva maneuver.

ÖZET

Amaç: Internal juguler ven santral venöz girişimlerde sıklıkla kullanıldığından, anatomik ayrıntılarının, yaş ve cinsiyet ile ilişkisinin bilinmesi klinisyenler için önemlidir. Bu çalışmanın amacı sağ ve sol IJV çaplarının normal Türk erişkin popülasyonundaki değerlerinin ve bunların yaş, cinsiyet ve valsalva manevrası ile ilişkisinin saptanmasıdır.

Yöntem: Bu çalışma 140 hastayı içermektedir. Dinlenme ve valsalva manevrasında, sağ ve sol taraftaki maksimal transvers ve anteroposterior IJV çapları USG ile ölçüldü.

Bulgular: 60 yaş altı ve üstü oluşturulan iki grupta IJV çapları arasında anlamlı fark saptanmadı ($p < 0.05$). Kadın-erkek arası yapılan değerlendirmede valsalvalı sol transvers çap hariç diğer çaplarda anlamlı fark saptanmadı ($p < 0.05$). Valsalva manevrası ile tüm çaplar anlamlı olarak daha geniş bulundu ($p < 0.05$). Hem istirahat hemde valsalva manevrasıyla

transvers ve anteroposterior düzlemdeki sağ IJV çapları, istatistiksel olarak anlamlı şekilde sol tarafa göre geniş bulundu($p<0.05$).

Sonuç: Bu çalışmanın sonuçlarına göre, Türk popülasyonda sağ internal juguler ven çapı, sol internal juguler vene göre istatistiksel olarak anlamlı derecede geniş bulundu. Yaş ve cinsiyet etkilemezken valsalva manevrası ile çaplar anlamlı olarak daha genişti. Çapların önceden bilinmesi, cerrahi girişimler ve özellikle girişimsel radyolojik işlemlerdeki riskleri azaltabilir.

Anahtar sözcükler: Juguler ven, yaş, cinsiyet, valsalva manevrası

INTRODUCTION

As the internal jugular vein (IJV) is a vessel used for cannulation in central venous approaches in medical applications, knowledge of the anatomic details is significant for clinicians knowing that vascular diameter varies according to age and gender is an extremely useful data. The wider the vessel diameter, the more successful entry will be the first time¹. Catheterisation and cannulation procedures are applied more often in Intensive Care Units (ICU) and in patients with a narrow vascular diameter, the procedure can be more risky^{2,3}. Sometimes in our daily routine, we examine children who present with a mass in the neck named flebectasia, which is a widening of this vein. Although there are many studies related to jugular vein diameter in pediatric patients, there are very few studies related to the jugular vein diameter in adults^{4,5}.

Evaluation of the jugular vein before interventional procedures is important because of anatomic variations and its proximity to the carotid artery. This observation may be performed with ultrasonography (USG). USG, which is currently often used in disease diagnosis, is a non-invasive, inexpensive and reliable method that does not include radiation and can be easily applied. When evaluating jugular vein diameters, it is more correct to take measurements with USG both at rest and during the Valsalva manoeuvre^{6,7}.

The aim of this study was to evaluate differences in the right and left side diameters of the internal jugular vein in normal adult Turkish population and to determine any relationship between these diameters and age and gender.

MATERIAL AND METHODS

The study included a total of 140 patients who presented at the Ear, Nose and Throat (ENT) clinic of Health and Science University Adana City Hospital with otolaryngological reasons other than a mass in the neck, between May and June 2017. The research was designed as a prospective study. Patients with anemia and a history of neck trauma were excluded from the study.

The patients included comprised 68 females and 72 males in the age range of 17-80 years. Female group was selected with a fair average age, 34 patient was over the age of 60 years, 34 was under 60 years of age. 72 patient male group were selected in the same way as female group, 36 above, 36 under 60 years. Informed consent was obtained from all the patients. Approval for the study was granted by the Local Ethics Committee with the principles of the Helsinki Declaration(66-2017).

The USG examination of the patients was made using a 7 MHz linear transducer with the patient in a supine position facing the opposite direction at 15°. The measurements were taken at the level of the cricoid cartilage with the probe perpendicular to the skin and applying minimal pressure so as not to deform the vein. The maximal transverse (T) and coronal (anterior-posterior:AP) diameters of the internal jugular veins were measured on both sides, both with the patient at rest and during the Valsalva maneuver.

In the analysis, it was examined whether or not, the mean jugular vein diameters changed with age, gender and the Valsalva maneuver.

Data were analysed using SPSS(Statistical Package for the Social Sciences)15.0. Parametric T test were applied to data of questionably normal distribution. A value of $p<0.05$ was accepted as statistically significant.

RESULTS

140 patients met the eligibility criteria for the study. Of the 140 patients(68 females,72 males) whose charts were reviewed, the mean age was 47.83 ± 15.07 (range, 17-80 years).

No statistically significant difference was determined between male and female genders in respect of all the diameter values ($p<0.05$) except IJV in transverse diameter with valsalva ($p>0.05$).(Table-1)

Table-1: The comparison of female and male IJV diameters at rest and during the Valsalva maneuver.

Difference of gender (F/M)	
Independent Samples Test	p
RIJV-T(-) valsalva	0,181
RIJV-AP(-) valsalva	0,721
RIJV-T(+) valsalva	0,162
RIJV-AP(+) valsalva	0,296
LIJV-T(-) valsalva	0,824
LIJV-AP(-) valsalva	0,458
LIJV-T(+) valsalva	0,032
LIJV-AP(+) valsalva	0,980

RIJV: Right internal jugular vein

LIJV: Left internal jugular vein

T: Tranvers Diameter

AP: Anteroposterior Diameter

When the patients were separated into age groups of above and below 60 years in both gender, no statistically significant difference was determined

in respect of diameter values with independent samples test ($p > 0.05$). (Table-2)

Table-2: The comparison of IJV diameters at rest and during the valsalva maneuver in age groups over and under 60 years in both gender.

Difference of < 60 years >60 years	
Independent Samples Test	p
RIJV-T(-) valsalva	0,781
RIJV-AP(-) valsalva	0,250
RIJV-T(+) valsalva	0,825
RIJV-AP(+) valsalva	0,905
LIJV-T(-) valsalva	0,125
LIJV-AP(-) valsalva	0,687
LIJV-T(+) valsalva	0,196
LIJV-AP(+) valsalva	0,142

RIJV: Right internal jugular vein

LIJV: Left internal jugular vein

T: Tranvers Diameter

AP: Anteroposterior Diameter

Table-3: The comparison of right and left IJV diameters at rest and during the Valsalva maneuver (mean±standard deviation)

Diameter	rest	valsalva	p-value
RIJV(T)	13.98-4.02	17.04-4.17	0.000
LIJV(T)	12.60-3.10	14.89-3.91	0.000
RIJV(AP)	9.58-2.83	11.26-3.17	0.000
LIJV(AP)	9.08-2.49	10.84-2.94	0.000

RIJV: Right internal jugular vein
 LIJV: Left internal jugular vein
 T: Tranvers
 AP:Anteroposterior

The comparison of the mean AP(9,58) and T(13,98) diameters of the right and left AP(9,08) and T(12,6) IJVs at rest with those during the Valsalva manoeuvre(RIJV-AP:11,26; RIJV-T:17,04; LIJV-AP:10,84; LIJV-T:14,89) ; revealed statistically significant differences between the

resting and Valsalva states (P < 0.05) (Table 3). The right IJV diameter in both the transverse and anteroposterior sections were determined to be statistically significantly wider both at rest (figure 1) and during the Valsalva maneuver (figure 2) with one -sample test (Table 4).

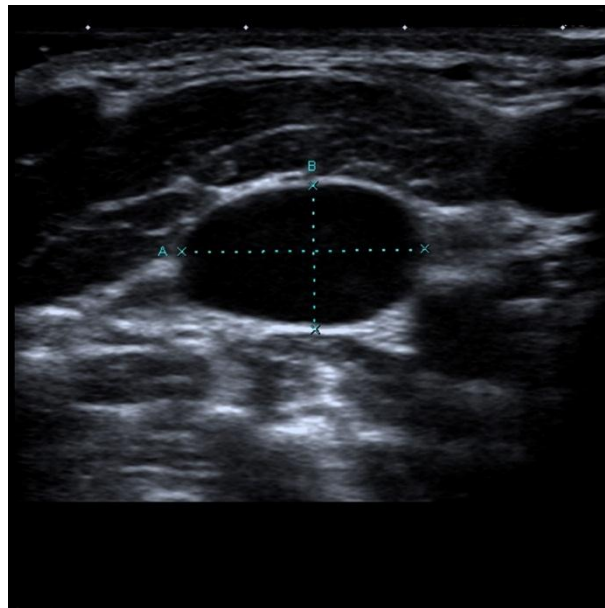


Figure 1: The transvers and anteroposterior dimensions of right jugular vein without valsalva maneuver.

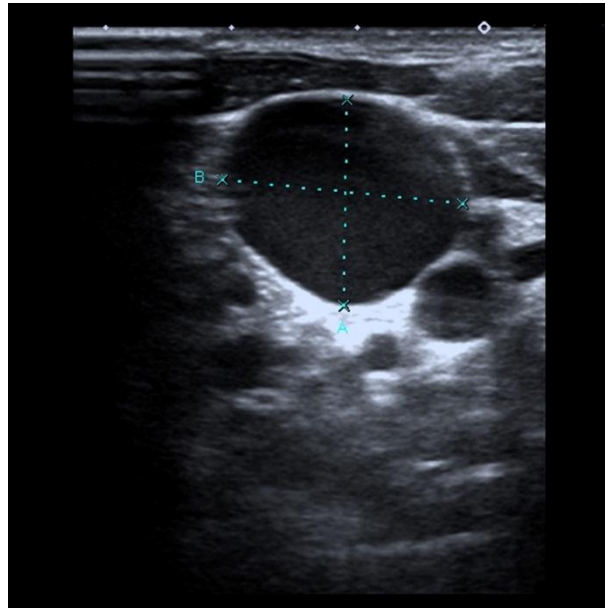


Figure 2: The transvers and anteroposterior dimensions of right jugular vein with valsalva maneuver.

The findings of the transverse and anteroposterior diameters of the right and left IJVs both at rest and

during the Valsalva maneuver are shown in Table 4.

TABLE-4:The transverse and anteroposterior diameters of right and left IJV at rest and during the Valsalva maneuver, with minimum, maximum and average values.

	Mean	Median	Std. Deviation	Minimum	Maximum	P
Right ijv transverse diameter, not valsalva	13.98	14.1	4.02	6	30.3	0,000
Left ijv transverse diameter, not valsalva	12.60	12.25	3.10	6.8	23.8	
Right ijv ap diameter, not valsalva	9.58	9.45	2.83	4	21.3	0,000
Left ijv ap diameter, not valsalva	9.08	8.7	2.49	4.1	17.1	
Right ijv transverse diameter, with valsalva	17.04	17.15	4.17	9	30	0,000
Left ijv, transverse diameter, with valsalva	14.89	14.75	3.91	7.1	25	
Right ijv ap diameter, with valsalva	11.26	10.8	3.17	5.3	22.2	0,000
Left ijv ap diameter, with valsalva	10.84	10.6	2.94	5.5	18.2	

IJV: Internal jugular vein
Std.Deviation: Standard deviation

DISCUSSION

The internal jugular vein (IJV) is an extremely important structure in respect of head and neck surgery. In many neck surgeries, such as neck dissections and benign or malignant mass excision, attention must be paid to IJV variations and diameter. In this study we attempted to demonstrate whether there was a relationship between IJV diameters with gender, age, maneuver and to know the approximate diameters in Turkish adult population. Age and gender was ineffectual whereas side and maneuver was determinative in IJV diameters.

IJV is the central venous entry for taking blood samples and the catheterisation entry route for infusion. Therefore, because of this frequent use, the anatomy is of great importance to the surgeons, anesthetists and the radiologists. IJV variations must be paid special attention because of the proximity to the carotid artery. In a study of 188 cases it was reported that the IJV was anterior to the carotid artery on the left in 6% and on the right in 4% of cases⁸. We have no patient having this anomaly. Failure in IJV cannulation in adults may occur at rates of 7%-16%⁹. In the procedure of IJV cannulation, significant complications such as arterial injury, pneumothorax, nerve damage, air embolism, venous thrombosis must be considered^{10,11}. For the diagnosis of phlebectasia, in which the IJV is expanded, there must be evaluation of the IJV diameters. Although phlebectasia is generally a congenital state that emerges in childhood, it may also occasionally be seen in adults. Inflammation, injury, and the forcing of muscles with valsalva are states which contribute to the development of phlebectasia in adults¹²⁻¹⁴. Surgical intervention is recommended for those at risk of rupture, those with the potential to develop intramural thrombus which could be a cause of pulmonary embolism or individuals with cosmetic reasons to provide psychological relief. In addition to suture venoplasty and encapsulation, ligation and resection can be surgically applied¹⁵. Appointing the expanded vessel in adults is advantageous in surgical procedures and radiological interference and also in problems caused by phlebectasia.

Previous studies in literature have determined that IJV diameter is independent of age and gender^{5,16}. No correlation has been determined between adult height, weight, body mass index, neck circumference and IJV diameter. In the current study, only left transvers diameter with valsalva was significantly lower in females; in all diameters

but this, we didn't find any relationship between IJV diameter and gender. Additionally age doesn't influence the diameters.

Botero et al reported that the right jugular vein cross-section area was greater than that of the left jugular vein¹⁶. Mortenson also reported that the right side vein was slightly larger but not to a statistically significant degree¹⁷. In the current study, the right-side IJV diameter was determined to be wider, statistically significant, in the transverse and anteroposterior sections both at rest and during the Valsalva maneuver.

In a study by Stickle, the mean transverse diameter of the IJV was found to be 17.4 mm (range 4-30mm)¹. In another study using CT evaluation, the right IJV diameter was measured as 17 mm (range, 13-20 mm) and the left as 13 mm (range, 10-16 mm)¹⁸.

RIJV-T at rest was 13,98 mm (6-30.3), LIJV-T was 12.6 mm (6.8-23.8) in our study.

After measurement of the jugular vein diameters in the resting position, USG must be repeated with the valsalva maneuver or in the Trendelenburg position or with liver compression to evaluate the maximal diameter reached. Of these, the Valsalva maneuver is the most effective measurement¹⁸. On account to the fact that we used valsalva maneuver. RIJV-T at valsalva was 17,04 mm (9-30), LIJV-T was 14.89 mm (7.1-25) in our study.

By these, an evaluation was made of the IJV diameters of an adult Turkish population. There have been previous studies of measurements made in a Turkish pediatric population^{6,7}, but there has been no previous information in literature of adult groups in Turkish population.

According to the results of this study, no correlation was determined between IJV diameters and age in adults or gender except left transverse with valsalva in a Turkish population. Between the right and left sides, the right-side IJV diameter was found to be statistically significantly greater than that of the left side. A statistically significant difference was also determined on both the right and left sides during the Valsalva maneuver compared to the measurements taken at rest.

The main limitation of our study was relatively small size of our series. Secondly this was a single-institution study. Due to these restrictions, associations should be interpreted with caution. We still consider our results as preliminary, further randomised, prospective trials on larger series are necessary for making more precise interpretations.

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