

The association of diameter and depth of internal jugular and subclavian veins with hand dominanceMehrdad Salari¹, Mohammad Reza Sasani², Mansoor Masjedi³, Anahita Pourali⁴, Sedigheh Aghazadeh⁴

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Type of article: Short report**Abstract**

Background: The central veins' catheterization, required in critically ill patients, is more successful in larger veins. Some researchers hypothesized that hand preference might be associated with larger ipsi/contra central veins.

Objective: To determine the diameter and depth of internal jugular and subclavian veins on both sides and its association with left- or right-handedness.

Methods: This cross-sectional study, was conducted on patients referring for elective breast or thyroid check-up to Shahid Faghihi Hospital ultrasound unit, Shiraz, Iran, from September 2014 to May 2015. Inclusion criteria consisted of adult normotensive patients with American Society of Anesthesiology (ASA) class I without underlying diseases. The patients' demographics were recorded and the diameter and depth of the internal jugular and subclavian veins were measured by ultrasound. The results of measurements were compared between patients' hand preference by SPSS version 19, using paired-samples t-test and independent-samples t-test.

Results: Of 65 patients, 86% were women and 19 were left-handed (29%) with the only significant difference between the right and left subclavian diameter in right-handed individuals ($p=0.007$) and no significant difference between the left and right internal jugular vein diameter and depth and subclavian vein depth between the left- and right-handed patients. The subclavian diameter of the right and left side was also not different in left-handed patients.

Conclusion: The right or left central veins are not superior to each other with respect to diameter and depth in right- or left-handed patients.

Keywords: Jugular veins, Subclavian vein, Central venous catheters

1. Introduction

Access to the central venous catheter (CVC) is important in critically ill patients for administration of drugs and other clinical measures (1). The most common insertion sites with less complications include internal jugular and subclavian veins (2) and insertion success is associated with mortality and morbidity rates (3), nevertheless the external anatomical landmarks are not always reliable (4, 5). Alongside the general asymmetry between the right and left side of the body, diameter of some arteries and veins also vary between the body sides (6). Studies have recently reported that the size of the subclavian and internal jugular vein differs between the two body sides in adults

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(7-10). As the size difference affects CVC success and complications (11), specifying the difference between the size of right and left central veins is of great importance (11). On the other hand, each individual has a specific hand preference, determined by genetic, hormonal, and developmental factors and brain speech lateralization (12). Some studies have suggested that left-handedness is associated with greater brain asymmetry (13, 14). Accordingly, some suggested that hand preference could predict larger ipsi/contralateral internal jugular veins (15), while others found no association (7). Confirmation of this hypothesis can reduce the time to diagnose the larger vein by ultrasound and enable the physician to insert the CVC in the larger central vein. Thus, we aimed to determine the diameter and depth of the internal jugular and subclavian veins on both sides, and study its association with left- or right-handedness.

2. Material and Methods

2.1. Study design and data collection

In the present cross-sectional study, samples were selected by convenient sampling method from the patients who referred to Shahid Faghihi ultrasound unit, affiliated to Shiraz University of Medical sciences, Shiraz, Iran, from September 2014 to May 2015. The sample size was calculated based on a pilot study on 25 patients referring to the same center, which indicated that 65 participants, considering both hands, were adequate. The inclusion criteria consisted of adult normotensive patients (aged 18-50 years) with the American Society of Anesthesiologists (ASA) class I, who were not fasting when referring for elective breast or thyroid check-up and had no known underlying diseases, such as hypertension, diabetes mellitus, cardiovascular and hepatorenal disease. In the beginning, the blood pressure of patients were measured by a physician according to Joint National Committee Guideline (JNC8) and if the patient had a systolic blood pressure greater than 140 mmHg or a diastolic blood pressure greater than 90 mmHg, the patient was excluded from the study. One radiologist, who was trained before the study and his performance was tested on more than 50 cases by the specialist, measured the diameter and depth of the internal jugular and subclavian veins using ultrasound (Medison-Accuvix-V 10 device, made in South Korea) with a linear high frequency 8-10 MHz probe. The diameter and depth of the internal jugular vein was determined in transverse view at the level of cricoid cartilage beneath the Adam's apple and the subclavian vein in the lateral part of the clavicle in transverse view. The person who performed the ultrasound was unaware of the hand preference of participants. Another researcher collected the demographic information of participants, including age, sex, hand preference, and measured the patients' weight, height, and body mass index (BMI).

2.2. Ethical considerations

The Ethics and Human Rights Committee of Shiraz University of Medical Sciences approved the present study (IR.SUMS.MED.REC.1394.s78), and written informed consent in accordance with the Declaration of Helsinki was obtained from all subjects for which the purpose of study was explained. The researcher explained the design and objectives of the study to all participants and obtained written informed consent from those who were willing to participate in the study. Their volunteer participation was ensured and they were assured that their choice would not affect their diagnostic procedure and their information would be kept confidential in all phases of the study and analyzed anonymously.

2.3. Statistical analysis

Quantitative variables were presented as mean \pm standard deviation (SD) and categorical variables as frequency (percentage). The normality of data was tested by Kolmogorov-Smirnov test and variables were compared using paired-samples t-test and independent-samples t-test. For the statistical analysis, SPSS software, version 19.0 (SPSS Inc., Chicago, IL, USA) was used. P-values of 0.05 or less were considered statistically significant.

3. Results

Among 65 patients, 56 (86%) were women and 9 (14%) were men; 46 were right-handed (71%), and 19 were left-handed (29%). The mean \pm SD age was 34.57 \pm 8.65 years in the left-handed group and 37.43 \pm 9.8 years in the right-handed group. There was no significant difference between age, sex, weight, height, and BMI of patients between the left- and right-handed patients ($p=0.312$, 0.771 , 0.413 , 0.341 , and 0.610 , respectively) (Table 1). There was neither difference between the left and right internal jugular vein diameter ($p=0.993$ and 0.156 , respectively) or depth in right- or left-handed individuals ($p=0.925$ and 0.698 , respectively), nor between the left- and right-handed patients' internal jugular vein diameter and depth ($p=0.260$ and 0.832 , respectively). The subclavian diameter ($p=0.861$) and depth of subclavian vein was also not different between the left and right side in right-handed or left-handed patients ($p=0.276$ and 0.375 , respectively). The only significant difference was in right-handed individuals between the right and left subclavian diameter ($p=0.007$) (Table 2).

Table 1. Comparing basic, clinical, and demographic characteristics of patients between the left- and right-handed patients

The demographic characteristic of patients		Left-handed group; Mean \pm SE / n (%)	Right-handed group	p-value
Age (years)		34.5 \pm 8.6	37.4 \pm 9.8	0.312
Gender	Male	3 (15.8%)	16 (84.2%)	0.771
	Female	6 (13.0%)	40 (87.0%)	
Weight (kg)		65.4 \pm 10.2	69.9 \pm 1.9	0.413
Height (cm)		163.3 \pm 7.6	162.3 \pm 9.17	0.341
BMI (kg/m ²)*		24.5 \pm 3.7	26.5 \pm 4.17	0.610

*BMI: Body mass index; SE: Standard error

Table 2. Comparing the diameter of subclavian and internal jugular veins of patients between the left- and right-handed patients

The name and side of the vein		Left-handed group, mean \pm SD	Right-handed group, mean \pm SD	p-value*
Depth of internal jugular vein, mm	Right side	10.52 \pm 2.56	11.20 \pm 2.46	0.832
	Left side	10.57 \pm 3.00	11.32 \pm 2.46	0.260
p-value**		0.925	0.698	
Diameter of internal jugular vein, mm	Right side	8.81 \pm 2.57	9.24 \pm 4.06	0.94
	Left side	8.81 \pm 2.57	8.50 \pm 3.18	0.176
p-value**		0.993	0.156	
Depth of subclavian vein, mm	Right side	20.88 \pm 4.43	24.34 \pm 6.23	0.98
	Left side	21.79 \pm 4.54	23.67 \pm 5.98	0.110
p-value**		0.375	0.276	
Diameter of subclavian vein, mm	Right side	7.47 \pm 2.13	7.45 \pm 2.02	0.678
	Left side	7.37 \pm 1.93	6.62 \pm 1.95	0.749
p-value**		0.861	0.007	

* Comparison between right-handed patients and left-handed patients,

** Comparison between the right and left side veins in each group of patients

4. Discussion

The results of the present study indicated no significant association between hand preference and demographic characteristics of the patients or diameter of the left or right internal jugular or subclavian veins. Also, depth of internal jugular vein was not associated with hand preference and the only significant difference was the right subclavian diameter, which was larger in right-handed patients. As far as the authors are concerned, few studies have investigated this hypothesis; Tan and colleagues reported the ultrasound results of 50 elective and emergency patients in the operating theater and found that the right and left subclavian vein size was significantly different in an individual, but is not associated with hand preference of patients (7), which is in line with the present study. Yoon and coworkers investigated the computed tomography (CT) scan results of 80 patients undergoing thyroid surgery and reported larger internal jugular vein in right-handed patients, suggesting the right internal jugular vein for CVC after ultrasound examination to determine the actual size of veins (15). Nevertheless, the differences in the results of the studies might be due to the different patients' selection, as in the present study, patients undergoing elective ultrasonography with ASA class I (normal healthy patients) were included, while the above-mentioned studies (7, 15) have considered patients with higher ASA class and emergency CV cannulation in the operating theater, who may be using several medications or have diseases affecting the diameter of central veins, such as trauma, hypotension, or sepsis, which was why we selected patients with ASA class I to minimize these confounders. The geographical variation of left-handedness ranges from about 3% to 27% globally (16, 17), which is lower than the present study. This discrepancy reflects different cultural, familial, and hereditary factors associated with hand preference (12). Other studies on Iranian populations have also reported different rates of left-handedness in different populations. Reports on 1,101 students reported 9.5% and on 683 students revealed 6-9% left-handedness, associated with sex and educational degree (18, 19), both much lower than the prevalence of left-handed patients in the current study, which indicates the differences in characteristics of the study population. However, as far as the authors are concerned, a nationwide study has not investigated the accurate prevalence of left-handedness in an Iranian population. In addition, some studies have found a significant association between hand preference and sex of participants; some studies have suggested a higher frequency in male patients (16, 18), which is hypothesized to be due to sex-linked genetic influence and sex hormones (12); while, in the present study, the sex distribution of patients was not associated with hand preference, which could be due to the limited sample size of the present study.

One of the limitations of the present study was evaluation of hand dominance by asking the patients, and consideration of valid questionnaires such as the Edinburgh questionnaire or Chapman Handedness Inventory could increase the reliability of the results (20). In addition, the limited sample size selected from referrals to one center, and selection of patients with elective ultrasound for thyroid or breast, limit the generalizability of the results. The cross-sectional nature of the study also limits confirmation of any causal relationships between variables.

5. Conclusions

The results of the present study indicated that only the right subclavian diameter was higher in right-handed patients and there was no association between hand preference and the size of ipsi/contralateral central veins. Accordingly, physicians should examine the central veins with great precision by ultrasound to find the best vein for cannulation. Considering the limitations of this study, future studies can obtain more accurate results by studying a large sample size of patients, selected randomly. In addition, considering these results and the significance of finding factors that can affect the size of central veins for cannulation, it is recommended to study other factors, rather than the hand preferences of patients, which may help physicians find the most appropriate vein for CVC.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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