Left Femoral Vein is a better choice for cannulation in children: A computed tomography study.

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Purpose

A reliable central venous catheter is an important tool for the management of critically ill children in intensive care and/or those undergoing major surgical procedures.\textsuperscript{1} The internal jugular vein, external jugular vein, subclavian vein, and femoral vein (FV) are the most common sites for central venous catheter placement.\textsuperscript{2,3} In critically ill or injured patients, common FV central access is frequently the preferred option for several reasons.\textsuperscript{4} For example, it is a relatively safe and accessible central vein to cannulate as compared to the internal jugular and subclavian veins.\textsuperscript{4}

It is important to have a clear understanding of the anatomy of the central veins and their correlation to the adjacent arteries and structures. Due to the anatomical configuration, the right internal jugular vein is preferred for safer cannulation.\textsuperscript{5} Currently, there is no information concerning side selection for FV cannulation.

The aim of this retrospective CT imaging study was to compare the right and the left FVs in terms of depth, diameters, and their relationship with FAs in children.
Methods and Materials

We retrospectively reviewed the abdominal CT scans of 116 consecutive pediatric patients between September 2010 and January 2012. The scans were excluded from the study if opacification of the vessels was inadequate or if an abnormality distorted the normal anatomy. Patients were divided two groups according to their age. Group 1, patients up to 9 years and Group 2, patients between 9 to 16 years.

All images were taken with the patient in the supine positions with the leg placed straight and while the subjects held their breath. The CT scans were obtained with a 4-detector-row CT scanner (Aquillon; Toshiba Medical Systems, Tokyo, Japan). The images were reconstructed at 3.0-mm intervals. The required amount of noniodinated contrast material according to the patient's weight was administered using a power injector. All the measurements were performed separately for both the right and the left FVs 1 cm immediately distal to the inguinal ligament by an experienced radiologist. The depth of the FV from the skin was measured by drawing a line between the skin and the closest margin of the vein to the skin's surface. The diameter of the FV was measured by drawing a line between the furthest two points of the wall of the vein in the transverse plane.

The anatomical position of the FV in relation to the FA was described as medial, posterior-medial, posterior, posterior-lateral, or lateral. The degrees of overlap of the veins and the arteries were noted, and classified as an overlap of >50% (major overlap), #50% (minor overlap), or 0% (no overlap) (Fig. 1 on page 4).

Statistical analysis was performed using SPSS version 16.0 (SPSS Inc., Chicago, IL). Data were tested for normality using the Kolmogorov-Smirnov normality test. The results were expressed as means ± SD or number of patients. Categorical data were analyzed using the #² test. Student's t test was used for normally distributed data. A p value of <0.05 was considered statistically significant.
Fig. 1: The degrees of overlap of the femoral artery and vein.

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Results

We retrospectively evaluated 116 consecutive pediatric cases of contrast-enhanced CT studies at the Medical Faculty Hospital of Selcuk University. Twenty-six patients were excluded from the analysis due to inadequate vessel opacification (n = 7), inappropriate CT scan sections (n = 5), and abnormalities that distorted the normal anatomy (compressive abdominal or pelvic masses, n = 14). Thus, a total of 180 FVs of 90 study participants (53 boys and 37 girls, mean age 7.8 ± 3.6 years, range: 2-16 years) were evaluated. In group 1 (n=54) mean age 5.4±1 years. In group 2 (n=36) mean age 11.5±2 years. The reasons for obtaining CT scans were as follows: follow-up for previous cancer (n = 49), post-surgical control (n = 5), abdominal pain (n = 22), and trauma (n = 14).

The results of the CT scan analyses are presented in Table 1. The depth from the skin and the diameter did not vary significantly between the right and left FVs.

The position of FV to FA is significantly different between the left and right side in both groups (p=0.001) (Fig. 2 on page 7) (Fig. 3 on page 7). The left FV was most commonly located medial to the FA. However, the right FV was most commonly located posterior-medial to the FA. Posterior, posterior-lateral, or lateral positions were not detected in the present study.

The overlap of femoral artery to femoral vein is significantly different between the left and right side in both groups (p=0.001). Minor overlaps were less frequently detected on the left side than on the right. None of the patients presented with major overlap on the left side.

<p>| Results of the analysis of the CT scans. Results shown as: | |
|---|---|---|
|a mean ±SD, b n, (%) | Right FV | Left FV |
| <strong>n=90</strong> | <strong>n=90</strong> | |
| Depth from the skin (mm) a | 14.2 ±7.1 | 14.6 ±7.9 |
| Diameter (mm)a | 7.9 ±1.7 | 7.8 ±1.8 |
| Position of FV to FA* | | |
| Medial b | 39 (43.3%) | 60 (66.7%) |
| Posterior-medial b | 51 (56.7%) | 30 (33.3%) † |</p>
<table>
<thead>
<tr>
<th>Overlap of FA**</th>
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</thead>
<tbody>
<tr>
<td>No overlap(^b)</td>
<td>48 (53.3%)</td>
<td>66 (73.3%)</td>
</tr>
<tr>
<td>Minor overlap (#50%)(^b)</td>
<td>42 (46.7%)</td>
<td>24 (26.7%)(\dagger)</td>
</tr>
<tr>
<td>Major overlap (&gt;50%)(^b)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
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</tbody>
</table>

*\(p=0.003\) between the right and the left side, **\(p = 0.008\) between the right and the left side,

\(\dagger p= 0.002\) when compared with medial position in the left side, \(\dagger\dagger p= 0.000\) when compared

with no overlap in the left side. FV: femoral vein, FA: femoral artery.

Table 1.
Figure 2. An abdominal contrast enhanced CT image obtained from 1 cm distal to the inguinal ligament is showing right posterior-medial (with minor overlap), left medial (with no overlap) femoral veins (arrows). *Femoral artery.

Fig. 2: Figure 2. An abdominal contrast enhanced CT image obtained from 1 cm distal to the inguinal ligament is showing right posterior-medial (with minor overlap), left medial (with no overlap) femoral veins (arrows). *Femoral artery.

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**Fig. 3:** An abdominal contrast enhanced CT image obtained from 1 cm distal to the inguinal ligament is showing right posterior-medial (with minor overlap), left medial (with no overlap) femoral veins (arrows). *Femoral artery.R: right, L: left

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Conclusion

Our results revealed that the depth and diameter of FVs were not significantly different between the right and the left side in both groups. The incidence of overlap of the FA over the FV was significantly lower at the left side in the study participants both group 1 and group 2. This finding may have significant clinical implications. Guiding clinicians to select the left FV of children for cannulation may result in lower arterial puncture rates while accessing the central vein.
References


