Ultrasound-Guided Peripheral Venous Access in Severely Ill Patients With Suspected Difficult Vascular Puncture

To the Editor,

In EDs, the use of ultrasonography increases successful cannulation rates in difficult-to-achieve peripheral venous access. Its value in ICU patients has never been explored in a randomized trial. Sixty adults considered as having difficult-to-achieve peripheral venous access by an attending nurse were included in this study. Difficult-to-achieve peripheral venous access was defined as the absence of a vein easily visible or palpable in both arms after tourniquet placement. Patients were randomized to one of two groups according to the method used for catheter insertion. In the real-time ultrasound-guidance group, vessels were searched for in their suspected anatomic position using a Vivid e Ultrasound machine (General Electric) and a 10-MHz linear transducer. Veins were identified by their ease of collapse after mild probe pressure. Venous anatomy was considered to be adequate when the vessel diameter measured at least 2.5 mm in the transverse plane. In the traditional approach group, another nurse (different from the one who included the patient) performed the catheter placement using palpation and landmark guidance. In each group, the operator had two attempts to succeed. After two cannulation failures, the patient was switched to the other group.

Patients’ characteristics were comparable in the two groups (Table 1). Successful cannulation rates were higher (P = .02) in the ultrasound-guidance group than in the traditional-approach group (Table 1). Of the nine catheters that could not be inserted using ultrasonography, only two were successfully inserted using the traditional approach. By contrast, 15 of the 19 catheters that could not be inserted using the traditional approach were successfully inserted using ultrasonography. Overall, 36 catheters were successfully inserted with the ultrasound-guidance technique and 13 with the traditional approach. Time for cannulation was similar between the two study groups.

To our knowledge, this study is the first randomized controlled trial performed in the ICU setting comparing ultrasound-guidance technique to the traditional approach for peripheral venous catheter placement in patients with suspected difficult peripheral vascular access. The ultrasound-guidance technique was more successful without increasing cannulation time despite the use of additional equipment. This technique allowed for a high success rate even for patients having two failures with the traditional approach. In addition to the increased success rate for vein cannulation, the use of ultrasonography may have other potential advantages, including shorter time for successful cannulation of the vein, fewer skin punctures, fewer complications, and finally increased patient satisfaction. Ultrasoundography is now available in many hospitals worldwide, and most ICUs have their own equipment. Because caregivers with no experience with ultrasonography can be easily and quickly (less than 2 h) trained to perform the technique, becoming almost as efficient as experts, ultrasonography should be recommended to help peripheral venous insertion in patients with anticipated difficult vascular access.

Table 1—Patients’ Characteristics and Main Results by Insertion Technique

<table>
<thead>
<tr>
<th></th>
<th>Traditional Approach (n = 30)</th>
<th>Ultrasound Guided (n = 30)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>15 (50)</td>
<td>19 (63)</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>Age, y</td>
<td>56 ± 15</td>
<td>61 ± 17</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>Simplified Acute Physiology Score II</td>
<td>41 ± 15</td>
<td>38 ± 16</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>Presence of edema</td>
<td>23 (77)</td>
<td>24 (80)</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>History of diabetes</td>
<td>10 (30)</td>
<td>8 (27)</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>Corticosteroids therapy</td>
<td>4 (13)</td>
<td>1 (3)</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>IV drug use</td>
<td>1 (3)</td>
<td>0 (0)</td>
<td>&gt; .20</td>
</tr>
<tr>
<td>Successful cannulation, n (%)</td>
<td>Before group switched</td>
<td>11 (30 [37])</td>
<td>21 (30 [70])</td>
</tr>
<tr>
<td></td>
<td>After group switched</td>
<td>2 (9 [22])</td>
<td>15 (19 [79])</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>13 (39 [33])</td>
<td>36 (49 [73])</td>
</tr>
<tr>
<td>Time for cannulation, s</td>
<td>400 ± 195</td>
<td>435 ± 304</td>
<td>&gt; .20</td>
</tr>
</tbody>
</table>

Data are provided as No. (%) or Mean ± SD unless otherwise indicated. NA = not applicable.

© 2012 American College of Chest Physicians. Reproduction of this article is prohibited without written permission from the American College of Chest Physicians (http://www.chestpubs.org/site/misc/reprints.xhtml). DOI: 10.1378/chest.11-1986

References

To the Editor:

Pulmonary nodules (PNs) are common incidental findings on CT scans. Despite the published guidelines,1 follow-up recommendations for CT scan reports remain variable.2,3 To determine factors that may influence these recommendations, we analyzed chest CT scan reports from patients with PNs (International Classification of Diseases, Ninth Edition code 518.89) between January 1, 2006, and June 30, 2009. After approval by the Institutional Review Board of Duke University Medical Center (Pro00019510). We excluded CT scans done within 5 years of a cancer diagnosis. We categorized follow-up recommendations into level 1 (≤3 months with interventions, eg, PET scan or invasive procedures), level 2 (≤3 months without interventions, or “worrisome or suspicious for malignancy”), level 3 (3-6 months), level 4 (>6 months), and level 5 (no follow-up recommendations).

We enrolled 283 patients (Table 1). The size distribution of the nodules was 24.0%, ≤4 mm; 21.6%, 4-6 mm; 14.8%, 6-8 mm; and 39.2%, >8 mm. The follow-up recommendations were 13.4%, level 1; 21.9%, level 2; 19.1%, level 3; 23.0%, level 4; and 22.6%, level 5. Logistic regression analysis using age (<40, 40-65, >65 years), sex (male or female), largest size of the nodule (<4 mm, 4-6 mm, 6-8 mm, >8 mm), solitary or multiple nodules, availability of previous CT images, study site (university vs community hospital), and time of the CT scan study (January 1, 2006, to December 31, 2007, or January 1, 2008, to June 30, 2009) as independent variables and levels of recommendations as dependent variables showed larger size was associated with more aggressive follow-up recommendations (P < .0001). Smoking status was not included in the analysis since it was not readily available to the radiologists. We then asked two physicians to independently provide follow-up recommendations based on the same clinical information plus smoking status and the Fleischner Society guidelines. The physicians made fewer aggressive follow-up recommendations for nodules ≤8 mm (Fig 1).

The probability of malignancy for small incidental PNs is quite low (only one patient with nodules ≤8 mm had malignancy in our study), but follow-up imaging studies or procedures are frequently recommended, increasing the cost, exposure to radiation, and morbidity.4 Causes for making aggressive recommendations may include varying degrees of conformance with the existing guidelines,5 the lack of clear follow-up recommendations in the guidelines,6 the interpreting radiologist’s lack of knowledge about risk factors (eg, smoking) (Fig 1), and different weight placed on some nonspecific characteristics of the nodules, including shape, spiculation, calcification, and location.7 Our results underscore the need to standardize radiologic recommendations for small incidental PNs and the importance for physicians to formulate independent follow-up plans based on the patients’ risk factors and current guidelines.

Douglas B. Johnson, MD
Mark A. Powers, MD
Durham, NC
Shiqing Wu, PhD
Research Triangle Park, NC
Yuh-Chin T. Huang, MD, MHS, FCCP
Durham, NC

Follow-up Recommendations for Chest CT Scan Reports of Incidental Pulmonary Nodules

To the Editor:

Pulmonary nodules (PNs) are common incidental findings on CT scans. Despite the published guidelines,1 follow-up recommendations for CT scan reports remain variable. To determine factors that may influence these recommendations, we analyzed chest CT scan reports from patients with PNs (International Classification of Diseases, Ninth Edition code 518.89) between January 1, 2006, and June 30, 2009. After approval by the Institutional Review Board of Duke University Medical Center (Pro00019510). We excluded CT scans done within 5 years of a cancer diagnosis. We categorized follow-up recommendations into level 1 (≤3 months with interventions, eg, PET scan or invasive procedures), level 2 (≤3 months without interventions, or “worrisome or suspicious for malignancy”), level 3 (3-6 months), level 4 (>6 months), and level 5 (no follow-up recommendations).

We enrolled 283 patients (Table 1). The size distribution of the nodules was 24.0%, ≤4 mm; 21.6%, 4-6 mm; 14.8%, 6-8 mm; and 39.2%, >8 mm. The follow-up recommendations were 13.4%, level 1; 21.9%, level 2; 19.1%, level 3; 23.0%, level 4; and 22.6%, level 5. Logistic regression analysis using age (<40, 40-65, >65 years), sex (male or female), largest size of the nodule (<4 mm, 4-6 mm, 6-8 mm, >8 mm), solitary or multiple nodules, availability of previous CT images, study site (university vs community hospital), and time of the CT scan study (January 1, 2006, to December 31, 2007, or January 1, 2008, to June 30, 2009) as independent variables and levels of recommendations as dependent variables showed larger size was associated with more aggressive follow-up recommendations (P < .0001). Smoking status was not included in the analysis since it was not readily available to the radiologists. We then asked two physicians to independently provide follow-up recommendations based on the same clinical information plus smoking status and the Fleischner Society guidelines. The physicians made fewer aggressive follow-up recommendations for nodules ≤8 mm (Fig 1).

The probability of malignancy for small incidental PNs is quite low (only one patient with nodules ≤8 mm had malignancy in our study), but follow-up imaging studies or procedures are frequently recommended, increasing the cost, exposure to radiation, and morbidity. Causes for making aggressive recommendations may include varying degrees of conformance with the existing guidelines, the lack of clear follow-up recommendations in the guidelines, the interpreting radiologist’s lack of knowledge about risk factors (eg, smoking) (Fig 1), and different weight placed on some nonspecific characteristics of the nodules, including shape, spiculation, calcification, and location. Our results underscore the need to standardize radiologic recommendations for small incidental PNs and the importance for physicians to formulate independent follow-up plans based on the patients’ risk factors and current guidelines.

Douglas B. Johnson, MD
Mark A. Powers, MD
Durham, NC
Shiqing Wu, PhD
Research Triangle Park, NC
Yuh-Chin T. Huang, MD, MHS, FCCP
Durham, NC

© 2012 American College of Chest Physicians. Reproduction of this article is prohibited without written permission from the American College of Chest Physicians (http://www.chestpubs.org/site/misc/reprints.xhtml).

DOI: 10.1378/chest.11-2054

Acknowledgments

Role of sponsors: The sponsor had no role in the design of the study, the collection and analysis of the data, or in the preparation of the manuscript.

Other contributions: We thank all of the nurses in the surgical ICU of the University Hospital of Poitiers, France, who have participated in this work. This study is registered with the Community Clinical Trial System (EudraCT) (eudract.ema.europa.eu) as EUDRACT 2010-A01012-37.

References


