Central Vascular Catheter Placement Evaluation Using Saline Flush and Bedside Echocardiography

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Abstract

Objectives: Central venous catheter (CVC) placement is a common procedure in critical care management. The authors set out to determine echocardiographic features during a saline flush of any type of CVC. The hypothesis was that the presence of a rapid saline swirl in the right atrium on bedside echocardiography would confirm correct placement of the CVC tip, similar to the accuracy of the postplacement chest radiograph (CXR).

Methods: This was a prospective convenience sample of emergency department (ED) and intensive care unit (ICU) patients who had CVCs placed. Investigators used subcostal or apical four-chamber echocardiography windows to evaluate the onset and appearance of turbulent flow in the right atrium when the distal port of the CVC was flushed with 10 mL of saline. Onset was rated as “immediate” (within 2 seconds), “delayed” (2 to 6 seconds), or “absent” (did not appear within 6 seconds). Appearance was rated as “prominent,” “speckling,” or “absent.” Digital video review was used later to objectively determine precise timing of turbulence onset. The rapid atrial swirl sign (RASS) was defined as the echo appearance of turbulence entering the right atrium immediately (within 2 seconds) after the saline flush of the CVC distal port. The observance of RASS (“positive”) was considered “negative” for CVC malposition. Echocardiographic results were compared to CVC tip locations within predetermined zones on the CXR. Superior vena cava (SVC) region was considered the optimal CVC tip position for subclavian and internal jugular CVC. Left CVC tips within the mid left innominate vein were also considered appropriately placed.

Results: A total of 142 patients enrolled, yielding 152 CVCs. Two CVCs were excluded from analysis due to incomplete data. Both CXR and echocardiographic images for 107 internal jugular CVCs and 28 subclavian CVCs were available for analysis. Saline flush echo evaluations were also performed on 15 femoral CVCs. Either 16-cm triple-lumen or 20-cm PreSep CVCs were used. CVC malposition was discovered on CXR in four of 135 (3.0%) of the subclavian and internal jugular CVCs. RASS for subclavian and internal jugular CVC evaluations versus CXR results for CVC tip malposition yielded 75% sensitivity, 100% specificity, positive predictive value (PPV) 100% (95% confidence interval [CI] = 29.24% to 100%), and negative predictive value (NPV) 99.24% (95% CI = 95.85% to 99.98%). Mean (±SD) time for onset of saline flush turbulence was 1.1 (±0.3) seconds for subclavian and internal jugular CVC tips within the target CXR zone.

Conclusions: The rapid appearance of prominent turbulence in the right atrium on echocardiography after CVC saline flush serves as a precise bedside screening test of optimal CVC tip position.

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before successful venous catheterization.\textsuperscript{1–4} Additionally, iatrogenic pneumothorax is reduced with US guidance.\textsuperscript{5}

Successful CVC placement includes positioning of the catheter tip near the right atrium. The optimal CVC tip placement using the subclavian and internal jugular venous approaches is in the distal superior vena cava (SVC), above the pericardial reflection. For the femoral approach, the preferred CVC tip position is the proximal inferior vena cava. Complications of subclavian and internal jugular CVC placement can include inadvertent arterial cannulation or misguided venous catheter entry into the internal jugular or subclavian vein, the inferior vena cava, or the right ventricle. Reports of CVC tip misplacements range from 3.3\% to as high as 14\%.\textsuperscript{6–10}

Chest radiography (CXR) is the current criterion standard for detecting post-CVC placement complications of CVC malposition. Performance and interpretation of the post-CVC CXR is associated with time delay, additional radiation exposure, and additional costs.\textsuperscript{8,11} Femoral CVC placement is often performed without US guidance in high-acuity medical and trauma resuscitation conditions and may result in arterial cannulation and thus emboli and ischemia. The uncertainty about safe CVC tip positioning can therefore delay the administration of time-sensitive medications or interventions.

To the best of our knowledge, US-guided CVC placement as of yet has not been shown to assure proper placement of the distal CVC tip. Other methods for guiding and verifying CVC tip location, such as right atrial electrocardiography fluoroscopy, venography, and computed axial tomography, either are of limited benefit or are not practical for cost-effective and emergent patient management. Optimal venous placement of the CVC tip has been verified by use of contrast-enhanced bedside cardiac US in mechanically ventilated intensive care unit (ICU) patients. The immediate or rapid visualization of fluid agitation within the right atrium after the routine injection of saline flush of the CVC port can be interpreted as adequate venous placement of the CVC tip.\textsuperscript{11,12} We set out to determine echocardiography features during the saline flush of any type of CVC.

We hypothesized that the rapid atrial swirl sign (RASS) US evaluation is equal to portable CXR in evaluation for optimal subclavian and internal jugular venous CVC tip placement. Our primary objective was to investigate whether a prominent fluid swirl in the right atrium within 2 seconds of a 10-mL normal saline flush would correlate with optimal subclavian and internal jugular CVC placement as confirmed on CXR. We also prospectively evaluated the saline flush characteristics of femoral CVC placements.

**METHODS**

**Study Design**

This was a prospective convenience sample of emergency department (ED) and ICU patients who had CVCs placed. Our institutional review board approved the study. Waiver of informed consent and waiver of authorization were granted.

**Study Setting and Population**

The research study was conducted between January and April 2013 at our single suburban academic hospital with an annual ED census of 114,000 patients. US guidance with CVC placement was highly recommended and routine within our emergency medicine and critical care practice. The saline flush of CVC ports was a required and established standardized step in the CVC placement procedure.

Research study enrollment inclusion criteria were patients older than 17 years receiving CVC insertion via the internal jugular, subclavian, or femoral approaches. Exclusion criteria were preexisting internal jugular catheter or indwelling subclavian device; detection of internal jugular thrombosis or right atrial mass, known SVC syndrome; inability to obtain adequate subcostal or apical four-chamber images; and significant high-acuity traumatic conditions.

**Study Protocol**

We enrolled critically ill patients in our ED or critical care units soon after CVC placement (Figure 1). A four-chamber cardiac view was obtained in the supine patient. The study investigators were blinded to post-CVC CXR reports and were not involved in CVC placement unless one of the investigators was working clinically at the time of enrollment.

Five emergency physicians (EPs) enrolled patients and performed the goal-directed echocardiographic studies. Three of the five physicians were emergency medicine residents during their second year of training (SMK, BE, CC). All three of these physicians completed an intensive month-long US rotation during their intern year. The other two EPs were the emergency US fellow (DAJ) and the emergency US fellowship director (AJW).

**Figure 1.** Study flow diagram. *One patient taken directly to operating room then died, and one patient had central line inadvertently dislodged prior to obtaining postinsertion chest x-ray.*
Each resident had training on the research study protocol by the fellow or fellowship director.

Our emergency and critical care departments typically use the triple-lumen 16-cm CVC (Arrowgard Blue Teleflex Inc., Research Triangle Park, NC) or 20-cm sep sis catheter (PreSep, Edward Lifesciences Corp., Irvine, CA). For the majority of our enrollments, we used a 3- to 5-MHz phased array transducer on a Philips Sparq US machine (Philips Healthcare, Andover, MA).

A 10-mL sterile saline flush of the distal CVC port was performed simultaneously to the start of prospective recording of a 6-second digital video clip of either a standard subcostal or an apical four-chamber transthoracic cardiac window. The appearance of the saline swirl entering the right atrium within 2 seconds of the start of the saline flush was interpreted as being indicative that the CVC tip was close to, or within, the target zone. The time interval chosen was based on a previous investigation by Vezzani et al.¹¹ that used a cutoff of 2 seconds for visualizing the entrance of agitated saline into the right atrium with echocardiography. They used contrast-enhanced echo with the saline flush to yield a 96% sensitivity and 93% specificity in detecting catheter misplacement.¹¹ In our study, we used the 2-second cut off as well, and if uncertain, a second saline flush was performed while the right atrium was observed in real time. Both onset and appearance of the turbulence were subjectively rated at the bedside by one of the EP study investigators (Figure 2). Turbulence onset was subjectively rated as immediate (within 2 seconds), delayed, or absent. On our US machine, a distinct beep signals the end of the 6 seconds of digital video acquisition (see Video S1, available as supporting information in the online version of this paper). Turbulence appearance was rated as “prominent,” “speckling,” or “absent” at the bedside. RASS was considered “positive” (appropriate CVC position) if either prominent or speckled flow was noted to immediately enter the right atrium (RA). RASS was considered negative (suggestive of an aberrant or suboptimal CVC position) if either no turbulent flow was noted in the RA within 2 seconds of the saline flush, or the turbulent flow was initiated within the RA or right ventricle (RV). The digital video files were later reviewed using QuickTime software (Apple Inc., Cupertino, CA) to objectively determine the 1-second interval in which RASS was first detected by either the fellow or fellowship director.

Postprocedural CXRs for subclavian and internal jugular CVCs were evaluated by the individual investigator who enrolled the patient and performed the RASS assessment. Review of each data collection form and postprocedure CXR was also performed by either the fellow or the fellowship director. Specific zone assignments were done by EPs according to criteria used by Fletcher and Bodenham.⁶ We assigned catheter tip locations according to anatomic zones on the anterior posterior CXR. There were six zone assignments (Figure 3). The carina serves as an easily identified and reliable anatomic radiographic landmark that correlates well with the midpoint of the SVC⁶;⁷;⁹;¹³–¹⁶; therefore, one line was drawn at the level of the tracheal carina.¹⁶ A second horizontal line was drawn at the level of the lung apices to set an upper border for the thoracic cavity. Zone 3 was considered 3 cm cephalad to the tracheal carina level and to the right of midline of the chest.¹⁴–¹⁶ This represented the proximal SVC region. Zone 5 was considered 3 cm caudal to tracheal carina level and to the right of the chest. This represented the

Figure 2. Ultrasound views of heart in the subcostal window during saline flush of catheter placement aimed at the internal jugular blood vessel. The empty right atrium (RA) and right ventricle (RV) are shown in the 0.5-second frame in A. The second frame, taken at the 0.75-second mark (B), shows turbulence (large arrow) within the right atrium and mild specking (small arrow) emerges into the right ventricle. This prompt and transient appearance of turbulence after the saline central venous catheter (CVC) port flush was considered a positive rapid atrial swirl sign and was associated with a CVC tip location within the superior vena cava on chest x-ray.
distal SVC region. Left-sided CVCs located within the SVC region or the mid to distal innominate veins were also considered acceptably placed. Right subclavian or internal jugular CVC tips were considered “aberrant” or suboptimal if the CVC tip was identified outside of Zone 3 and 5 on the CXR.

Data Analysis
A sample size estimate using the method described by Buderer was calculated. Assuming a sensitivity of the US survey of 98% to detect complications in our patient cohort, a confidence interval (CI) of 10%, and a 5% prevalence of complications in our patient cohort, a sample size of 151 patients was estimated to calculate the need for adequate sensitivity.

Descriptive statistics, including means and standard deviations (SDs), or counts and percentages, were calculated. To assess the diagnostic accuracy of the US survey compared to the standard post-CVC placement CXR for the detection of proper subclavian and internal jugular CVC tip positioning, the sensitivity, specificity, positive predictive values (PPVs), and negative predictive values (NPPVs), and corresponding 95% CI were calculated. A correlation analysis compared time to fluid swirl detection with CVC tip location. A p-value of less than 0.05 was considered statistically significant. SAS, Version 9.3 (SAS Institute, Cary, NC), was used for all analyses. Interobserver agreement on echo interpretations was calculated for a subset of CVC evaluations.

RESULTS
The study flow diagram is shown in Figure 1. We assessed 148 eligible patients (one declined) and evaluated 152 CVC sites in 147 patients. Echocardiography was feasible in 142 of 147 patients evaluated (96.6%). We enrolled 152 different CVC placements, but two were excluded from analysis due to incomplete data collection, resulting in 150 CVC placements for evaluation. Table 1 provides further details of patient and study characteristics.

There were four malpositioned CVC tips identified on CXR. RASS was absent in three of these misplaced CVC tips. The three true positives involved a right internal jugular CVC entering the right axillary vein, a right subclavian CVC entering the right internal jugular, and a right internal jugular CVC curling back into the right internal jugular. The one false negative involved a right subclavian CVC with its distal tip in the mid to proximal left innominate vein that was associated with a rapid onset of turbulence on saline flush echocardiographic testing. This single unexpected result lowered our sensitivity to 75%. In the three patients with initial aberrant CVCs, subsequent corrected CVC placements were associated with a change from negative RASS to positive RASS results (Figure 4).

Table 2 shows detailed results of the comparison of the RASS screening test of subclavian and internal jugular CVCs with CXR determination of optimal CVC tip positioning. We determined that detection of a RASS was associated with a sensitivity of 75%, specificity 100%, PPV 100%, and NPV 99.24% (95% CI = 95.85% to 99.98%). Table 3 compares bedside subjective evaluations of turbulence onset with objective measurements of turbulence onset.

Mean (±SD) time for onset of saline flush turbulence was 3.0 (±1.8) seconds in femoral CVCs and 1.1 (±0.3)

**Table 1** Characteristics of Subjects and CVC Placements

<table>
<thead>
<tr>
<th>Clinical Characteristics</th>
<th>Value (±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td>58.4 (±15.7)</td>
</tr>
<tr>
<td>Male patients</td>
<td>68/148 (46%)</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>109 (±27)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>63 (±16)</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td>95 (±21)</td>
</tr>
<tr>
<td>Mechanically ventilated (%) during testing</td>
<td>80/152 (53%)</td>
</tr>
<tr>
<td>Type of central vascular catheter*</td>
<td></td>
</tr>
<tr>
<td>Triple lumen</td>
<td>117 (76%)</td>
</tr>
<tr>
<td>PreSep</td>
<td>35 (23%)</td>
</tr>
<tr>
<td>Depth of CVC insertion (cm²)</td>
<td></td>
</tr>
<tr>
<td>Triple lumen</td>
<td>15.2 (±0.7)</td>
</tr>
<tr>
<td>PreSep</td>
<td>17.1 (±2.1)</td>
</tr>
<tr>
<td>US guidance for CVC placement</td>
<td></td>
</tr>
<tr>
<td>Pneumothorax evaluated by CXR†</td>
<td>114/152 (75%)</td>
</tr>
</tbody>
</table>

Data are reported as number (%) or mean (±SD).

*Triple lumen if “hubbed” = 16-cm mark; PreSep if “hubbed” = 21-cm mark
†Data relevant for internal jugular and subclavian only.
§CXR not obtained on patient taken immediately to operating room.

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**Figure 3.** This chest x-ray shows the zoning assignments for catheter tip location. Note the line at the level of the carina (dotted line). This CVC was inserted in the right subclavian vein. Its tip (arrow) was located below the tracheal carina and in the right hemithorax. It was therefore categorized as being in Zone 5. Zone 3 represents proximal superior vena cava region. Zone 5 represents distal superior vena cava region. The third oval area represents the left innominate vein region.
seconds for subclavian and internal jugular CVC tips within the target CXR zone. For the three aberrant CVC tips within the right axillary and internal jugular, the mean (±SD) time to turbulence was 5.00 (±1.73) seconds.

Two investigators independently reviewed 22 deidentified echo video clips selected by the primary investigator. The saline flush echo clips included the above-mentioned true positives, the false negative, and true negatives. The reviewers were blinded to the CVC tip positions. The scoring results are detailed in Table 4.

There were 131 subclavian and internal jugular CVCs with their tips in the SVC region by CXR (see Table 5). The mean (±SD) times of onset of turbulence for CVC tips in proximal and distal SVC zones were 1.12 (±0.33) and 1.10 (±0.30) seconds, respectively.

**DISCUSSION**

Other studies have addressed CVC tip misplacement and identifying adequate placement using US. We compared our results with three similarly themed studies. First, in the study by Vezzani et al., a single intensivist performed short axis subcostal cardiac views of IVC, SVC, and right atrium. He then employed agitated saline flush to detect features of intracardiac CVC location or finally performed an US survey of bilateral subclavian and internal jugular veins to

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Table 3
Saline Flush Echocardiographic Findings

<table>
<thead>
<tr>
<th>Turbulence Characteristics Within Right Heart After Saline Flush of Catheter</th>
<th>Number Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedside estimate of onset of turbulence</td>
<td></td>
</tr>
<tr>
<td>Immediate (≤2 seconds)</td>
<td>142</td>
</tr>
<tr>
<td>Delayed</td>
<td>8</td>
</tr>
<tr>
<td>Absent</td>
<td>2</td>
</tr>
<tr>
<td>Bedside estimate of level of contrast of turbulence</td>
<td></td>
</tr>
<tr>
<td>Prominent</td>
<td>135</td>
</tr>
<tr>
<td>Speckling</td>
<td>15</td>
</tr>
<tr>
<td>Absent</td>
<td>2</td>
</tr>
<tr>
<td>Objective onset of turbulence within 6-second digital video clip</td>
<td></td>
</tr>
<tr>
<td>1st second</td>
<td>122</td>
</tr>
<tr>
<td>2nd second</td>
<td>20</td>
</tr>
<tr>
<td>3rd second</td>
<td>1</td>
</tr>
<tr>
<td>4th second</td>
<td>5</td>
</tr>
<tr>
<td>5th second</td>
<td>2</td>
</tr>
<tr>
<td>6th second</td>
<td>0</td>
</tr>
<tr>
<td>Absent</td>
<td>2</td>
</tr>
</tbody>
</table>

Measurement, value: weighted kappa, 0.76; sample size, 22. "Positive" defined as prominent turbulence was noted in the right atrium within 2 seconds. "Indeterminate" defined as onset > 2 seconds, if noted to be very weak turbulence, or technically limited study. "Negative" defined as significantly delayed (>4 seconds), absent turbulence, or initiation within right ventricle.
directly identify misplaced catheters. Twenty-five intracardiac CVC tips and four aberrant CVCs were correctly identified. The second study, by Maury et al., evaluated CVC tip placement with US views of the subclavian and internal jugular vein and an echocardiogram, but did not employ a saline flush. In another study, by Zanobetti et al., adequate CVC tip positioning within the SVC was assumed to occur based on absence of an echogenic CVC tip within the heart or the internal jugular or subclavian vein during the US protocol. The direct visualization of a normal SVC or left innominate vein is not always feasible with transthoracic echocardiography. The distal SVC as it enters the right atrium is a challenging echocardiographic view to obtain. Obtaining a direct view of the CVC tip within the SVC is therefore not a practical or generalizable expectation for bedside transthoracic echocardiography.

In our study, we experienced the CVC saline flush method to be simple and relatively time-efficient. The saline flush of a CVC is a routine and simple step. The brief intravascular turbulence created was easily viewed with goal-directed US. The four-chamber cardiac views we used are basic emergency medicine US skills. The RASS evaluation protocol would add only minimal time to the CVC placement procedure and would enable the clinician either to immediately feel confident about correct CVC placement or to raise a concern for malposition. Based on our hypothesis and our results, we would strongly advocate a heightened suspicion for CVC misplacement if RASS is absent or uncertain.

Our study results did not clarify the debate on optimal CVC placement. CVC placement within the SVC region was associated with rapid onset of turbulence into the right atrium. We were not able to distinguish between proximal and distal SVC positioning of CVC tips based on echo flush characteristics. RASS was seen with CVC tips positioned in the left innominate vein segments. It has been argued that left subclavian and internal jugular CVC tip positioning within the left innominate is adequate. CXR remains the more available method of detecting the alignment of the CVC tip within the SVC.

Previous studies have suggested that post-line placement CXR may be unnecessary in uncomplicated procedural placement. One research study’s authors even concluded that CXR could be safely omitted with an uncomplicated right internal jugular CVC placement. Our data revealed 100% sensitivity and 100% specificity for detection of abnormal catheter position in right internal jugular line placements. This suggests that a postprocedural CXR to confirm location could be omitted in cases of US-guided right internal jugular CVC placement with positive RASS results. Our study did not specifically include US screening for a post-CVC pneumothorax, although this would be less likely to occur under the aforementioned conditions. There were no pneumothoraces in our US-guided internal jugular placements. However, this could be incorporated as part of the US evaluation for mechanical complications after CVC placement.

It is safe to assume that arterial placement of CVC will not result in prompt venous turbulence entering the heart. We did not confirm any arterial CVC placements. In our evaluations of 15 femoral CVCs, we did note that one femoral CVC placement (performed during a cardiopulmonary resuscitation and without US guidance) did not show any turbulence. CVC misplacement, venous or arterial, was strongly suspected by our investigators. We were not able to confirm its location without an autopsy. Aside from this single outlier, the onset of turbulence into the right atrium was marginally more delayed than the saline flush of the subclavian and internal jugular CVCs. This is consistent with the longer venous path from common femoral CVC insertion site to the inferior vena cava entrance into the right atrium.

**LIMITATIONS**

The research was conducted in an ED and ICU with a well-established emergency US program, where US-guided vascular access is routinely performed for internal jugular vascular access. The femoral and subclavian approaches to CVC placement, however, were performed mostly without US guidance. Our results may not be generalizable to practices without US-guided CVC placements. The study was limited to adult patients and cannot be generalized to pediatric patients.

We did not evaluate the relation of CVC selection and depth of insertion with the patient’s physical characteristics such as height that could affect the proximity to the right atrium. The sepsis protocol at our institution uses a 20-cm PreSep CVC for oxygen saturation monitoring and central venous pressure monitoring. There were no predetermined criteria for selecting the CVC insertion site, depth of insertion, or CVC type other than the sepsis protocol.

We also note that CVC tip position on CXR could move due to adjustments in patient positioning and the parallax effect of slightly varied x-ray projections. Some initial CXRs showed CVC tips that seemed advanced

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**Table 5**

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Right Internal Jugular</th>
<th>Right Subclavian</th>
<th>Left Internal Jugular</th>
<th>Left Subclavian</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 3 cm above carina</td>
<td>27</td>
<td>1</td>
<td>10</td>
<td>10</td>
<td>48</td>
</tr>
<tr>
<td>Within 3 cm below carina</td>
<td>65</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>82</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>7</td>
<td>13</td>
<td>19</td>
<td>131*</td>
</tr>
</tbody>
</table>

CVCs = central venous catheters; CXR = chest x-ray.

*There were four aberrant CVCs and two tested CVCs without confirmatory CXRs.
into Zone 5, but then appeared closer to the level of the carina on subsequent CXRs.

Our study design did not directly detect the CVC tip using US. An option for CVC malposition detection is to directly look for an echogenic CVC tip within US-accessible vascular regions. Another potential way of detecting CVC misplacement is to also look for turbulence within the subclavian and internal jugular veins after the saline flush.

There are limitations to the plausible interpretations of the saline flush test. The absence of a prompt saline swirl does not differentiate an arterial placement from an aberrant venous location of the CVC tip. Prompt detection of echo turbulence did not differentiate left innominate vein location from mid SVC location that might affect CVP monitoring or potential for mechanical complications. The delayed or speckled appearance of turbulence may be affected by factors other than nonvenous location or increased distance from the right atrium. These other factors may include high right heart pressure conditions and conditions with poor cardiac venous return such as low volume states or severely reduced cardiac function.

The best method of evaluating interobserver agreement would have two investigators present at each CVC testing to provide bedside assessments. Such a study design would have been logistically daunting and significantly demanding, so the second best option that we chose was to have two blinded investigators independently evaluate and interpret a portion of the deidentified echo clips for a subset of the total tests performed.

CONCLUSIONS

The prompt appearance of fluid turbulence in the right atrium then into the right ventricle with a saline flush of central venous catheters was associated with central venous catheter tip placement near or within the superior vena cava in subclavian and internal jugular central venous catheters. The saline flush echocardiographic evaluation is moderately sensitive and highly specific when compared to chest x-ray for detecting adequate central venous catheter tip placement. Confirmation of venous placement of central venous catheters with the femoral approach is another potential use. This postcentral venous catheter placement test is simple and feasible in the critical care setting. Our sensitivity results, however, suggest that further studies will be required to determine if the saline flush echo test can serve as an alternative to the chest x-ray for verifying central line placement.

References


Supporting Information

The following supporting information is available in the online version of this paper:

Video S1. Dynamic ultrasound of the heart in the subcostal window during saline flush of catheter placement aimed at the internal jugular blood vessel.

The video in WMV format.