

Submission ID #: 70321

Scriptwriter Name: Poornima G

Project Page Link: <https://review.jove.com/account/file-uploader?src=21447953>

Title: Nurse-Performed Point-of-Care Ultrasound-Guided Peripherally Inserted Central Catheter Insertion: A Standardized Nursing Protocol

Authors and Affiliations:

Paula Ayumi Shimizu Oda^{1*}, Silmara Elaine Malaguti Toffano^{2*}, Jennifer Machado de Oliveira¹, Priscilla Roberta Silva Rocha³, Vinicius Batista Santos⁴, Roberta de Paula Silva⁵, Emanuel Nunes⁶, Fernanda Raphael Escobar Gimenes¹

¹ Ribeirão Preto College of Nursing, University of São Paulo

² Federal University of Triângulo Mineiro

³ University of Brasília

⁴ Paulista Nursing School, Federal University of São Paulo

⁵ Hospital das Clínicas, Ribeirão Preto Medical School, University of São Paulo

⁶ Pequeno Príncipe College

*These authors contributed equally

Corresponding Authors:

Fernanda Raphael Escobar Gimenes

fregimenes@eerp.up.br

Email Addresses for All Authors:

Jennifer Machado de Oliveira

jennimo@usp.br

Priscilla Roberta Silva Rocha

priscillarocha@unb.br

Vinicius Batista Santos

v.santos@unifesp.br

Roberta de Paula Silva

roberta.paula.silva@usp.br

Emanuel Nunes

emanuel.n@usp.br

Paula Ayumi Shimizu Oda

paulaoda@usp.br

Silmara Elaine Malaguti Toffano

silmara.toffano@uftm.edu.br

Fernanda Raphael Escobar Gimenes

fregimenes@eerp.up.br

Author Questionnaire

1. Microscopy: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**

2. Software: Does the part of your protocol being filmed include step-by-step descriptions of software usage? **Yes**

Videographer: Please record the computer screen for the shots labeled as SCREEN. The screen should be in focus and the fonts/images should be clearly visible

3. Filming location: Will the filming need to take place in multiple locations? **No**

4. Testimonials (optional): Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **No**

Current Protocol Length

Number of Steps: 25

Number of Shots: 56 (11 SC)

Interviews

Videographer: Obtain headshots for all authors available at the filming location.

Authors: Please note that **the questions will not appear on screen**. Please answer in **stand-alone full sentence with sufficient context**

INTRODUCTION:

~~**REQUIRED:** Summarize your research focus and the main questions it aims to answer.~~

- 1.1. **Fernanda Gimenes:** Our research focuses on standardizing nurse-performed ultrasound-guided PICC placement to enhance bedside clinical safety and procedural consistency.
 - 1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

~~**Describe the research gap or limitation in existing methods and how this protocol addresses them.**~~

- 1.2. **Fernanda Gimenes:** Existing methods lack a reproducible clinical workflow; this protocol operationalizes international guidelines into explicit, step-by-step actions.
 - 1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

CONCLUSION:

~~**What does this protocol allow researchers to study or measure?**~~

- 1.3. **Fernanda Gimenes:** This protocol allows researchers to measure clinical performance metrics like first-attempt success rates and procedural complication incidence.
 - 1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

~~**How can future studies build on this work? Describe the questions or research directions that can be investigated next.**~~

- 1.4. **Fernanda Gimenes:** Future studies can conduct comparative efficacy trials or integrate this framework with emerging technologies.

- 1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

Videographer: Obtain headshots for all authors available at the filming location.

Ethics Title Card

This research has been approved by the Institutional Review Board of the Ribeirão Preto College of Nursing, University of São Paulo

Protocol

***Videographer:** Please always record an audio slate while filming each shot mentioned in the shotlist.*

2. Ultrasound Setup

Demonstrators: Roberta Silva and Paula Oda

Authors: During filming, please point out the parts or veins if possible

2.1. To begin, turn on the ultrasound device [1]. Confirm an adequate battery charge or power supply [2] and select the vascular preset [3].

2.1.1. WIDE: Talent turning on the ultrasound device.

2.1.2. Talent showing an adequate battery charge status or power supply on the ultrasound device.

2.1.3. SCREEN: Show the vascular preset being selected on the ultrasound device.

***Videographer:** Please record the computer screen for the shots labeled as SCREEN. The screen should be in focus and the fonts/images should be clearly visible*

2.2. Use a high-frequency linear transducer from 5 to 15 megahertz [1]. Position the ultrasound monitor within the operator's line of sight to maintain clear visualization and an ergonomic posture [2].

2.2.1. Talent selecting a high-frequency linear transducer from 5 to 15 megahertz.

2.2.2. Talent positioning the ultrasound system on the ipsilateral side of the intended procedure site.

3. Patient Positioning and Vein Assessment

3.1. Position the patient supine on the bed [1].

3.1.1. WIDE: Talent positioning the patient in the supine position on the bed.

3.2. Elevate the patient's head between 0 and 15 degrees [1] and abduct the arm to approximately 90 degrees with external rotation [2]. ~~and support the arm using a rolled towel [3]~~

3.2.1. Talent elevating the patient's head.

- 3.2.2. Talent abducting the arm to approximately 90 degrees with external rotation.
- 3.2.3. ~~Talent placing a rolled towel under the arm for support.~~ **Author's NOTE: Delete**
- 3.3. Apply a tourniquet for venous assessment [1]. Assess peripheral veins by palpation to identify at least two potential sites [2] and release the tourniquet [3].
 - 3.3.1. Talent applying a tourniquet to the patient's arm.
 - 3.3.2. Talent palpating to assess the veins.
 - 3.3.3. Talent releasing the tourniquet from the patient's arm.
- 3.4. Place the linear transducer transversely over the mid-upper arm and identify the median basilic vein, basilic vein, and cephalic vein [].
 - 3.4.1. Talent placing the linear transducer transversely over the mid-upper arm.
 - 3.4.2. ~~Talent identifying/or if possible, pointing to the mentioned veins.~~ **Author's NOTE: Not filmed**
- 3.5. Identify the brachial artery and the median nerve [1].
 - 3.5.1. SCREEN: Show/point to the brachial artery and median nerve on the ultrasound image.
- 3.6. Assess the venous network and select the basilic vein as the primary access site when suitable [].
 - 3.6.1. ~~SCREEN: Show and point to the venous network being assessed on the ultrasound image.~~ **Author's NOTE: Not filmed**
 - 3.6.2. SCREEN: Show and point to the basilic vein.
- 3.7. Assess the vein diameter, depth, patency, and presence of valves [1]. Select a vein that maintains a catheter-to-vein ratio below 45 percent based on the chart [2].
 - 3.7.1. SCREEN: Show the assessment of vein diameter, depth, patency and presence of valves.
 - 3.7.2. LAB MEDIA: JOVE_SCREEN_STEP3.7.2._Image
- 3.8. Apply the PICC Zone Insertion Method to divide the upper arm into 3 zones and identify the optimal insertion site [1-TXT]. Select the proximal half of the Green Zone if there

are no anatomical limitations [2].

3.8.1. Talent divides the upper arm into 3 zones. **TXT: PICC: Peripherally Inserted Central Catheter**

3.8.2. Talent selecting the proximal half of the Green Zone.

3.9. Measure the arm circumference 2 centimeters above the potential insertion site [1]. Ask the patient about their comfort during the measurement [2].

3.9.1. Talent measuring the arm circumference 2 centimeters above the potential insertion site.

3.9.2. Talent asking the patient about their comfort level during the measurement by gesturing.

4. Catheter Length Measurement and Preparation

4.1. Maintain the patient supine with the arm abducted to 90 degrees [1].

4.1.1. Talent adjusting the patient's position and pointing to the abducted arm.

4.2. Use a tape to measure the estimated catheter length [1]. For right-arm insertion, measure from the insertion site to the right sternoclavicular joint [2], then to the third intercostal space [3]. ~~For left arm insertion, measure from the insertion site to the left sternoclavicular joint across the right sternoclavicular joint and to the third intercostal space.~~

Author's NOTE: Shots 4.2.4–4.2.6 were not filmed because a torso simulator with only a right arm was used to demonstrate the anatomical landmarks

4.2.1. Talent picking up and showing a metric tape.

4.2.2. Talent measuring from the right-arm insertion site to the right sternoclavicular joint.

4.2.3. Talent measuring from the right sternoclavicular joint to the third intercostal space.

4.2.4. ~~Talent measuring from the left arm insertion site to the left sternoclavicular joint.~~

4.2.5. ~~Talent measuring from the left sternoclavicular joint to the right sternoclavicular joint.~~

4.2.6. ~~Talent measuring from the right sternoclavicular joint to the third intercostal space.~~

- 4.3. Select the catheter material, size, and number of lumens based on therapy requirements, flow needs, and vein diameter [1-TXT]. Perform surgical hand antisepsis [2] and wear sterile protective equipment [3].

4.3.1. Talent selecting the catheter from a pool of catheters. **TXT: Catheter-to-vein ratio: <45%**

Added shots:

- 4.3.2. 4.3.3, 4.3.4, 4.3.5. Talent performing a surgical hand scrub (only one step of the procedure) **NOTE: Use an appropriate footage among these shots**
- 4.3.6 and 4.3.7 Talent donning gown and gloves. **NOTE: Show both, wearing a gown and gloves.**

- 4.4. Prime all components with sterile 0.9 percent saline and check for leakage [1].

4.4.1. Talent priming all components with sterile 0.9 percent saline and checking the components for leakage.

- 4.5. If trimming is required, retract the guidewire [1] and cut the catheter using sterile scissors. Avoid trimming catheters with distal valves [2].

4.5.1. Talent retracting the guidewire.

4.5.2. Talent cutting the catheter with sterile scissors.

5. Skin Preparation and Ultrasound-Guided Venipuncture

- 5.1. Wipe the patient's skin with chlorhexidine, let it dry [1], and apply sterile drapes [2]. Then, place the sterile probe cover and sterile gel [3].

5.1.2,. Talent wiping skin using chlorhexidine solutions. **Author's NOTE: Re-order the shots as follows: 5.1.2, then 5.1.3 and then 5.1.1**

5.1.3,. Talent applying sterile drapes.

5.1.1. Talent applying the sterile probe cover and sterile gel.

- 5.2. Administer 1 to 2 milliliters of 1% or 2% lidocaine without a vasoconstrictor for local anesthesia [1]. Apply a sterile tourniquet [2].
 - 5.2.1. Talent administering local anesthesia with 1 to 2 milliliters of 1% or 2% lidocaine without a vasoconstrictor.
 - 5.2.2. Talent applying a sterile tourniquet.
- 5.3. Visualize the target vein in short-axis view [1] and insert a puncture needle under real-time ultrasound guidance [2]. Confirm intraluminal placement by blood return and ultrasound visualization [3].
 - 5.3.1. SCREEN: Show the target vein in short-axis view.
 - 5.3.2. SCREEN: inserting the needle under real-time ultrasound guidance.
 - 5.3.3. SCREEN: Show and point to intraluminal placement on the ultrasound image.
- 5.4. Release the tourniquet [1] and advance the guidewire under ultrasound visualization [2]. Then, remove the needle while maintaining guidewire position [3].
 - 5.4.1. Talent releasing the tourniquet.
 - 5.4.2. Talent advancing the guidewire under ultrasound visualization.
 - 5.4.3. Talent removing the needle while maintaining guidewire position.

6. Catheter Insertion and Tip Confirmation

- 6.1. Advance the dilator and introducer over the guidewire [1] and remove the guidewire as appropriate [2].
 - 6.1.1. Talent advancing the dilator and introducer over the guidewire.
 - 6.1.2. Talent removing the guidewire.
- 6.2. Then, advance the peripherally inserted central catheter to the predetermined length [1] and remove the peel-away sheath [2]. Confirm patency by aspiration and saline flush [3].
 - 6.2.1. Talent advancing the peripherally inserted central catheter to the predetermined length.
 - 6.2.2. Talent removing the peel-away sheath.
 - 6.2.3. Talent aspirating and flushing saline for patency check.

6.3. Secure the catheter using a stabilization device [1] and apply a sterile dressing [2]. ~~Track catheter progression using ultrasound [3].~~

6.3.1. Talent securing the catheter using a stabilization device.

6.3.2. Talent applying a sterile dressing.

6.3.3. ~~SCREEN: Show catheter progression being tracked using ultrasound.~~

6.4. Confirm final catheter tip position using radiography [1]. Confirm that the catheter tip is positioned in the lower third of the superior vena cava for upper-extremity insertion [2].

6.4.1. SCREEN: Confirming the final catheter tip position using the available method.

6.4.2. SCREEN: Show and point to the catheter tip position on the screen.

Author's NOTE: We could do only radiography and please merge steps 6.4.1 and 6.4.2, as we were able to film them as a single scene

6.5. ~~Finally, obtain chest radiography if required, per the institutional protocol or if tip position remains uncertain [1].~~

6.5.1. ~~Talent obtaining chest radiography.~~ Authors: This could be a representative demo only.

Results

7. Results

7.1. The anteroposterior chest radiograph confirmed catheter tip location after upper extremity insertion [1].

7.1.1. LAB MEDIA: Figure 7A.

7.2. The abdominal radiograph confirmed the catheter tip positioned in the upper third of the inferior vena cava after lower extremity insertion [1].

7.2.1. LAB MEDIA: Figure 7B.

Authors: Can you draw red boxes over the specific areas we need to look for in these figures and provide us? You can provide this after the shoot.

1. Ultrasound
Pronunciation link: <https://www.merriam-webster.com/dictionary/ultrasound>
IPA: /'ʌltrəˌsaʊnd/
Phonetic Spelling: ul·truh·sound
2. Vascular
Pronunciation link: <https://www.merriam-webster.com/dictionary/vascular>
IPA: /'væskjələr/
Phonetic Spelling: vask·yuh·ler
3. Transducer
Pronunciation link: <https://www.merriam-webster.com/dictionary/transducer>
IPA: /trænzˈduːsər/, /trænsˈduːsər/
Phonetic Spelling: tranz·doo·ser, trans·doo·ser
4. Megahertz
Pronunciation link: <https://www.merriam-webster.com/dictionary/megahertz>
IPA: /'megəˌhɜːts/
Phonetic Spelling: meg·uh·hurts
5. Ipsilateral
Pronunciation link: <https://www.merriam-webster.com/dictionary/ipsilateral>
IPA: /,ɪpsəˈlætərəl/
Phonetic Spelling: ip·suh·lat·uh·ruhl
6. Supine
Pronunciation link: <https://www.merriam-webster.com/dictionary/supine>
IPA: /suːˈpaɪn/
Phonetic Spelling: soo·pyne

7. Abduct
Pronunciation link: <https://www.merriam-webster.com/dictionary/abduct>
IPA: /æb'dʌkt/
Phonetic Spelling: ab·duhkt
8. Venous
Pronunciation link: <https://www.merriam-webster.com/dictionary/venous>
IPA: /'vi:nəs/
Phonetic Spelling: vee·nuhs
9. Palpation
Pronunciation link: <https://www.merriam-webster.com/dictionary/palpation>
IPA: /pæl'peɪʃən/
Phonetic Spelling: pal·pay·shuhn
10. Transversely
Pronunciation link: <https://www.merriam-webster.com/dictionary/transversely>
IPA: /trænz'vɜ:sli/, /træns'vɜ:sli/
Phonetic Spelling: tranz·vurss·lee, trans·vurss·lee
11. Median
Pronunciation link: <https://www.merriam-webster.com/dictionary/median>
IPA: /'mi:diən/
Phonetic Spelling: mee·dee·uhn
12. Basilic
Pronunciation link: <https://www.merriam-webster.com/dictionary/basilic>
IPA: /bə'zɪlɪk/
Phonetic Spelling: buh·zil·ik
13. Cephalic
Pronunciation link: <https://www.merriam-webster.com/dictionary/cephalic>
IPA: /sə'fæɪlɪk/
Phonetic Spelling: suh·fal·ik
14. Brachial
Pronunciation link: <https://www.merriam-webster.com/dictionary/brachial>
IPA: /'breɪkiəl/
Phonetic Spelling: bray·kee·uhl
15. Patency
Pronunciation link: <https://www.merriam-webster.com/dictionary/patency>
IPA: /'peɪtənsi/
Phonetic Spelling: pay·tuhn·see
16. Catheter
Pronunciation link: <https://www.merriam-webster.com/dictionary/catheter>
IPA: /'kæθətər/
Phonetic Spelling: kath·uh·ter
17. PICC
Pronunciation link: <https://www.merriam-webster.com/medical/PICC>
IPA: /pɪk/
Phonetic Spelling: pik

18. Sternoclavicular
 Pronunciation link: <https://www.merriam-webster.com/medical/sternoclavicular>
 IPA: /,stɜːnoʊkləˈvɪkjələr/
 Phonetic Spelling: stur·noh·kluh·vik·yuh·ler
19. Intercostal
 Pronunciation link: <https://www.merriam-webster.com/dictionary/intercostal>
 IPA: /,ɪntərˈkɑːstəl/
 Phonetic Spelling: in·ter·kaas·tuhl
20. Lumen
 Pronunciation link: <https://www.merriam-webster.com/dictionary/lumen>
 IPA: /ˈluːmən/
 Phonetic Spelling: loo·muhn
21. Antisepsis
 Pronunciation link: <https://www.merriam-webster.com/medical/antisepsis>
 IPA: /,æntiˈsɛpsɪs/, /,æntaɪˈsɛpsɪs/
 Phonetic Spelling: an·tee·sep·suhs, an·tye·sep·suhs
22. Saline
 Pronunciation link: <https://www.merriam-webster.com/dictionary/saline>
 IPA: /ˈseɪˌliːn/
 Phonetic Spelling: say·leen
23. Guidewire
 Pronunciation link: <https://www.merriam-webster.com/medical/guidewire>
 IPA: /ˈɡaɪdˌwaɪər/
 Phonetic Spelling: gyde·wire
24. Chlorhexidine
 Pronunciation link: <https://www.merriam-webster.com/medical/chlorhexidine>
 IPA: /,klɔːrˈheksəˌdiːn/
 Phonetic Spelling: klor·hek·suh·deen
25. Lidocaine
 Pronunciation link: <https://www.merriam-webster.com/dictionary/lidocaine>
 IPA: /ˈlaɪdəˌkem/
 Phonetic Spelling: lye·duh·kayn
26. Vasoconstrictor
 Pronunciation link: <https://www.merriam-webster.com/medical/vasoconstrictor>
 IPA: /,veɪzookənˈstriktər/
 Phonetic Spelling: vay·zoh·kuhn·strik·ter
27. Anesthesia
 Pronunciation link: <https://www.merriam-webster.com/dictionary/anesthesia>
 IPA: /,ænəsˈθiːzə/
 Phonetic Spelling: an·uhs·thee·zhuh
28. Introducer
 Pronunciation link: <https://www.merriam-webster.com/medical/introducer>
 IPA: /,ɪntrəˈduːsər/
 Phonetic Spelling: in·truh·doo·ser

29. Intraluminal
 Pronunciation link: <https://www.howtopronounce.com/intraluminal>
 IPA: /ˌɪntrəˈluːmɪnəl/
 Phonetic Spelling: in·truh·loo·muh·nuhl
30. Dilator
 Pronunciation link: <https://www.merriam-webster.com/dictionary/dilator>
 IPA: /dɪlˈeɪtər/
 Phonetic Spelling: dye·lay·ter
31. Peel-away
 Pronunciation link: <https://www.merriam-webster.com/dictionary/peel-away>
 IPA: /ˈpiːl əˈweɪ/
 Phonetic Spelling: peel·uh·way
32. Aspiration
 Pronunciation link: <https://www.merriam-webster.com/dictionary/aspiration>
 IPA: /ˌæspəˈreɪʃən/
 Phonetic Spelling: ass·puh·ray·shuhn
33. Stabilization
 Pronunciation link: <https://www.merriam-webster.com/dictionary/stabilization>
 IPA: /ˌsteɪbələˈzeɪʃən/
 Phonetic Spelling: stay·buh·luh·zay·shuhn
34. Radiography
 Pronunciation link: <https://www.merriam-webster.com/dictionary/radiography>
 IPA: /ˌreɪdɪˈɑːɡrəfi/
 Phonetic Spelling: ray·dee·og·ruh·fee
35. Institutional
 Pronunciation link: <https://www.merriam-webster.com/dictionary/institutional>
 IPA: /ˌɪnstəˈtuːʃənəl/, /ˌɪnstəˈtjuːʃənəl/
 Phonetic Spelling: in·stuh·too·shuh·nuhl, in·stuh·tyoo·shuh·nuhl
36. Anteroposterior
 Pronunciation link: <https://www.merriam-webster.com/medical/anteroposterior>
 IPA: /ˌæntərəʊpəˈstriər/
 Phonetic Spelling: an·ter·oh·pos·teer·ee·er
37. Inferior
 Pronunciation link: <https://www.merriam-webster.com/dictionary/inferior>
 IPA: /ɪnˈfɪriər/
 Phonetic Spelling: in·feer·ee·er
38. Superior
 Pronunciation link: <https://www.merriam-webster.com/dictionary/superior>
 IPA: /suːˈpiəriər/
 Phonetic Spelling: soo·peer·ee·er
39. Vena cava
 Pronunciation link: <https://www.merriam-webster.com/dictionary/vena%20cava>
 IPA: /ˌviːnə ˈkeɪvə/
 Phonetic Spelling: vee·nuh·kay·vuh

