

Supplemental Digital Appendix 1

Checklists Used to Assess Performance in Six Simulated Bedside Procedures during an Objective Structured Clinical Examination, University of Calgary Internal Medicine Residency Program, 2011^a

Note: For all checklists, a rating of “No” indicates item was not completed; a rating of “Yes, but” indicates item was completed incorrectly; a rating of “Yes” indicates item was completed correctly.

Arterial Blood Gas Sampling CHECKLIST Items	No 0	Yes, but 1	Yes 2
PRE-PROCEDURE			
1. Wash hands			
2. Extend wrist and immobilize wrist in appropriate position <i>It is acceptable for trainee to only comment on patient positioning.</i>			
3. Locate/palpate radial artery			
4. Put on nonsterile gloves			
PROCEDURE			
5. Clean site with alcohol swab			
6. Allow alcohol to dry on skin			
7. Re-palpate artery without contaminating site of needle insertion			
Blood collection			
8. Insert needle at appropriate landmark <i>At 30-45 degree angle towards the upper arm. If unsuccessful, trainee must withdraw needle to subcutaneous level to get “Yes”; Change of needle direction with needle deep in tissues is a “Yes, but”.</i>			
9. Able to obtain blood <i>Please note number of attempts below</i>			
10. Comment on nature of blood (pulsatile, bright red)			
11. Obtain a minimum of 1cc of blood <i>Simply stating how much to collect is equally acceptable.</i>			
12. Remove needle and apply pressure to site <i>Simply stating will apply pressure is equally acceptable.</i>			
13. Remove syringe, place cap over top, and expel air from syringe			
14. Submit sample immediately, or on ice if time to analysis is anticipated to be prolonged			
POST-PROCEDURE			
15. State/mime placement of bandage on wrist			

Knee Arthrocentesis CHECKLIST Items	No 0	Yes, but 1	Yes 2
PRE-PROCEDURE			
1. Wash hands			
2. Put on "sterile" gloves <i>For the purposes of this test, mask is optional</i>			
3. Prepare the skin with cleansing agent <i>Must clean a minimum of 2 times to get "Yes"</i> <i>Cleaning 1 time is "Yes, but"</i>			
4. Dispose of sponge sticks appropriately without contaminating sterile equipment <i>"No" if sponge sticks are placed back on sterile tray</i>			
5. Place sterile drape around site			
6. Withdraw anesthetic with syringe <i>It is acceptable for trainee to ask you for assistance to pour anesthetic solution into tray well in a sterile fashion or in holding up the anesthetic container provided anesthetic is withdrawn in a sterile manner</i>			
PROCEDURE			
<i>Anesthetize the skin</i>			
7. Landmark prior to administering anesthetic agent <i>Lateral, superior third of patella or medial, superior third of patella; either is acceptable</i>			
8. State/mime injection of anesthetic solution to raise a bleb or wheal, aspirate for blood as the needle enters, and provided no blood is aspirated, inject anesthetic solution into deeper structures along the path of anticipated aspiration <i>Note: Candidates have been asked NOT to actually inject any "anesthetic" solution into the simulator</i> <i>Must comment on bleb, and aspiration to ensure not in blood stream prior to injection to get "Yes"</i>			
<i>Fluid collection</i>			
9. Insert needle at appropriate landmark <i>Lateral, superior third of patella, direct towards intracondylar notch</i> <i>Or</i> <i>Medial, superior third of patella, direct towards intracondylar notch</i>			
10. Apply negative pressure (aspirate) while advancing the needle into the synovial cavity			
11. Able to obtain fluid <i>Must obtain fluid after no more than 3 attempts to get "Yes"</i> <i>Please note number of attempts below</i>			
12. Remove needle and dispose into appropriate sharps container			
13. State will place fluid into collection tubes			
14. State/mime placement of bandage on knee			

Intubation CHECKLIST Items	No 0	Yes, but 1	Yes 2
PRE-PROCEDURE			
1. Put on face mask, eye protection, and non-sterile gloves <i>Note: Gown optional</i>			
2. Ensure required equipment available: ET tube, stylet, syringe, bag-valve mask, suction, functioning laryngoscope, device to secure ET tube			
3. Check for leaks by inflating cuff of endotracheal tube			
4. Ensure IV access available (or delegate assistant to obtain IV access)			
5. Place patient's head in "sniffing position" if no contraindications to doing so			
PROCEDURE			
6. Pre-oxygenate patient in an appropriate manner <i>May use bag valve mask for this with or without an oral airway</i>			
Optional: Have assistant apply cricoid pressure			
7. With laryngoscope in left hand, insert the blade to the right of the tongue			
8. Advance blade tip to appropriate position, depending on blade type used <i>You may ask the candidate to identify where the end of the blade is: Macintosh: between base of tongue and epiglottis Miller: posterior to epiglottis</i>			
9. Apply upward and forward force on the laryngoscope at 45-degree angle to visualize vocal cords <i>"No" if trainee levers blade on patient's teeth</i>			
10. Insert endotracheal tube into right side of patient's mouth and visualize passage of tube through vocal cords until balloon is no longer visible			
11. Remove stylet once tube has just passed vocal cords <i>Note: May ask assistant to remove stylet</i>			
12. Inflate balloon using 10cc syringe			
13. Attach ventilation bag/oxygen supply to endotracheal tube			
Confirmation of intubation			
14. Auscultate (over lung fields +/- stomach) to confirm equal and bilateral breath sounds and observe for equal chest expansion <i>"Yes, but" if only one region auscultated</i>			
15. Confirmation of intubation by at least one other method: Options: a) use of end-tidal CO ₂ detector; b) use of self-inflating esophageal detector bulb; or c) quantitative CO ₂ measurement			
16. Use tape to secure tube			
17. Reassess vitals			
POST-PROCEDURE			
18. State will arrange for chest x-ray			

Lumbar Puncture CHECKLIST Items	No 0	Yes, but 1	Yes 2
PRE-PROCEDURE			
1. Wash hands			
2. Identify or mark the L4-5 interspace at the point intersecting the iliac crest line with body midline. (L3-L4, L5-S1 also acceptable)			
3. Open the tray using sterile technique			
4. Pour "chlorhexidine" into the tray well <i>Candidate may request your assistance to do this</i>			
5. Don mask then "sterile" gloves <i>Must place mask then gloves (in that order) to get "Yes"</i> <i>"Sterile" gown is optional</i> <i>Not using either piece of equipment is a "No"</i>			
Tray set up			
6. Open and place collection tubes in their respective tray wells <i>Setting up collection tubes AFTER fluid is already obtained is a "No"</i> <i>Set up, but not in order is a "Yes, but"</i>			
7. Connect the two parts of the manometer and attach stopcock to the bottom part of the manometer <i>Using only the bottom part of manometer is a "Yes, but"</i>			
8. Withdraw anesthetic with syringe <i>It is acceptable for trainee to ask you for assistance to pour anesthetic solution into tray well in a sterile fashion or in holding up the anesthetic container provided anesthetic is withdrawn in a sterile manner.</i>			
PROCEDURE			
<i>Cleaning and draping the skin</i>			
9. Place sponge stick into "chlorhexidine" and clean the skin 2 times in a circular motion from the target area <i>Must clean a sufficient area (approximate radius 10cm) to get "Yes";</i> <i>Must clean a minimum of 2 times to get "Yes"</i>			
10. Dispose of sponge sticks appropriately without contaminating sterile equipment <i>"No" if sponge sticks are placed back on sterile tray</i>			
11. Place sterile drape between hip and bed <i>"Yes, but" if trainee contaminates equipment</i>			
12. Place fenestrated sterile drape on patient's back with the hole centered over the target area			
<i>Anesthetize the skin</i>			
13. State/mime injection of anesthetic solution to raise a bleb or wheal, aspirate for blood as the needle enters, and provided no blood is aspirated, inject anesthetic solution into deeper structures <i>Note: Trainees have been asked NOT to actually inject any</i>			

<i>"anesthetic" solution into the simulator</i> <i>Must comment on bleb, and aspiration to ensure not in blood stream prior to injection to get "Yes"</i>			
Fluid collection			
14. Ensure stylet is in place and bevel facing laterally (facing up in lateral decubitus). <i>Must ensure both stylet in place and bevel facing up to get "Yes".</i> <i>If stylet not in place "No"</i>			
15. Advance the needle in the appropriate interspace, aiming towards the umbilicus <i>If an obstruction is encountered (e.g. – hits bone), trainee must withdraw the needle to subcutaneous level prior to repositioning to get "Yes". Change of needle direction with needle deep in tissues is a "Yes, but"</i> <i>Must obtain fluid after no more than 4 attempts to get "Yes"</i> <i>Please note number of attempts below</i>			
16. Remove the stylet completely to check for fluid <i>May advance needle without re-inserting stylet once skin is punctured</i> <i>Removing stylet only partially such that fluid cannot be detected is a "No".</i>			
Measuring CSF Pressure			
17. Attach the manometer/stopcock to the needle hub Checking for CSF pressure after CSF collection is a "No"			
18. Turn the stopcock valve and allow the fluid to fill the manometer until the meniscus stops rising <i>Trainee may describe and not actually wait for fluid to stop if "CSF" flow from task trainer is slow</i>			
19. Collect 1cc of CSF in each collection tube <i>Must demonstrate collection of minimum of two tubes and cap without spillage.</i> <i>Should state will collect 4 tubes to get "Yes"</i> <i>Not screwing cap on is a "Yes, but"</i> <i>Any tube < 1cc (and did not state will collect more than 1cc) is a "No"</i>			
20. Replace stylet and withdraw needle <i>Must replace stylet prior to withdrawing needle to get "Yes"</i>			
21. Place bandage over puncture site <i>Simply stating will place bandage over site is equally acceptable.</i>			

Ultrasound-Guided Paracentesis CHECKLIST Items	No 0	Yes, but 1	Yes 2
PRE-PROCEDURE			
1. Wash hands			
2. Correctly identify landmark as right or left lower quadrant (Approximately 2 cm below the umbilicus, 2-4 cm medial and superior to the ASIS) <i>Note: Although LLQ is the recommended site, the simulator will only allow a RLQ tap</i>			
3. Using ultrasound, appropriately visualize peritoneal fluid			
4. Using ultrasound, identify bowel			
5. Using ultrasound, state that will identify spleen or liver depending on chosen quadrant			
6. Open tray with sterile technique			
7. Pour "chlorhexidine" into the tray well <i>Candidate may request your assistance to do this</i>			
8. Put on mask then "sterile" gloves and gown <i>Must place mask then sterile equipment to get "Yes"</i>			
Tray Set up			
9. Withdraw anesthetic with syringe <i>It is acceptable for trainee to ask you for assistance to pour anesthetic solution into tray well in a sterile fashion or in holding up the anesthetic container provided anesthetic is withdrawn in a sterile manner.</i>			
PROCEDURE			
<i>Cleaning and draping the skin</i>			
10. Place sponge stick into "chlorhexidine" and clean the skin 2 times in a circular motion from the target area <i>Must clean a sufficient area (approximate radius 10cm) to get "Yes"; Must clean a minimum of 2 times to get "Yes"</i>			
11. Dispose of sponge sticks appropriately without contaminating sterile equipment <i>"No" if sponge sticks are placed back on sterile tray</i>			
12. Place sterile fenestrated drape around site of needle insertion			
<i>Anesthetize the skin</i>			
13. State/mime injection of anesthetic solution to raise a bleb or wheal, aspirate for blood as the needle enters, and provided no blood is aspirated, inject anesthetic solution into deeper structures <i>Note: Candidates have been asked NOT to actually inject any "anesthetic" solution into the simulator Must comment on bleb, and aspiration to ensure not in blood stream prior to injection to get "Yes"</i>			
14. Discontinue needle advancement when peritoneal fluid is aspirated; anesthetize the parietal peritoneum using an additional 3-5 mL anesthetic solution			

Ultrasound Probe Preparation			
Optional: Set up ultrasound probe properly with sterile sheath and sonographic gel <i>If candidate chooses to do the procedure under real-time guidance, please ask the candidate how he/she would sheath the probe. It is acceptable for trainee to ask assistant to hold the probe wearing sterile gloves</i>			
Fluid collection			
15. Insert the needle at the target site, continuously aspirating while advancing			
16. State will slide the catheter over the needle once peritoneal fluid is obtained			
17. Remove the needle			
18. Connect tubing to port (either with or without stopcock)			
19. State will attach tubing end to fluid collection bag or vacuum bottles			
20. Remove catheter			
POST-PROCEDURE			
21. State/mime placement of bandage over insertion site			

Ultrasound-Guided Thoracentesis CHECKLIST Items	No 0	Yes, but 1	Yes 2
PRE-PROCEDURE			
1. Wash hands			
2. Correctly identify landmark 5-10cm lateral to the spine <i>Must be above 9th rib</i>			
3. Using ultrasound, appropriately visualize pleural fluid <i>Must correctly identify rib spaces and pocket of fluid.</i>			
4. Using ultrasound, identify underlying lung and diaphragm			
5. Using ultrasound, state that will identify intra-abdominal organs (liver, spleen)			
6. Open tray with sterile technique			
7. Pour "chlorhexidine" into the tray well <i>Candidate may request your assistance to do this</i>			
8. Put on "sterile" gloves and mask <i>"Sterile" gown is optional</i>			
Tray Set up			
9. Withdraw anesthetic with syringe <i>It is acceptable for trainee to ask you for assistance to pour anesthetic solution into tray well in a sterile fashion or in holding up the anesthetic container provided anesthetic is withdrawn in a sterile manner</i>			
PROCEDURE			
<i>Cleaning and draping the skin</i>			
13. Place sponge stick into "chlorhexidine" and clean the skin 2 times in a circular motion from the target area <i>Must clean a sufficient area (approximate radius 10cm) to get "Yes"; Must clean a minimum of 2 times to get "Yes"</i>			
14. Dispose of sponge sticks appropriately without contaminating sterile equipment <i>"No" if sponge sticks are placed back on sterile tray</i>			
15. Place fenestrated sterile drape on patient's back with the hole centered over the target area			
<i>Anesthetize the skin</i>			
16. State/mime injection of anesthetic solution to raise a bleb or wheal, aspirate for blood as the needle enters, and provided no blood is aspirated, inject anesthetic solution into deeper structures <i>Note: Trainees have been asked NOT to actually inject any "anesthetic" solution into the simulator</i> <i>Must comment on bleb, and aspiration to ensure not in blood stream prior to injection to get "Yes"; "Yes, but" if only one</i>			
<i>Ultrasound Probe Preparation</i>			
Optional: Set up ultrasound probe properly with sterile sheath and sonographic gel <i>If candidate chooses to do the procedure under real-time guidance,</i>			

<i>please ask the candidate how he/she would sheath the probe. It is acceptable for trainee to ask assistant to hold the probe wearing sterile gloves</i>			
Fluid collection			
17. Insert the needle at the target site, continuously aspirating while advancing			
18. State will avoid inferior aspect of the rib above			
19. State will slide the catheter over the needle once pleural fluid is obtained <i>Note: Catheter cannot be advanced on the simulator. You may direct the candidate to the next step by asking, "assuming the catheter is now advanced, what would you do next?"</i>			
20. Remove the needle and occlude catheter with finger			
21. Connect stopcock to catheter			
22. Connect syringe and/or tubing for additional fluid collection			
23. Appropriately maneuver stopcock to avoid introduction of air			
24. Ensure positive intrathoracic pressure while removing catheter <i>May ask patient to hum or exhale, etc.</i>			
POST-PROCEDURE			
25. Apply occlusive dressing/bandage over insertion site			

Supplemental Digital Appendix 2

Interrater Reliability of Individual Checklist and Global Rating Scale Items for the Six Simulated Bedside Procedures, Objective Structured Technical Examination, University of Calgary Internal Medicine Residency Program, 2011

(Note: Data represent a total of 218 performances from 47 Internal Medicine residents)

Arterial blood gas sampling

Arterial blood gas sampling checklist Item	Inter-rater reliability: ICC (95% CI)	Global rating scale Item	Inter-rater reliability: ICC (95% CI)
Wash hands	Perfect agreement	Appropriate preparation of instruments pre-procedure	0.27 (-0.04-0.55)
Extend wrist and immobilize wrist in appropriate position	0.92 (0.84-0.96)	Appropriate analgesia	N/A
Locate/palpate radial artery	0.83 (0.68-0.91)	Time and motion	0.64 (0.38-0.80)
Put on nonsterile gloves	0.95 (0.91-0.98)	Instrument handling	0.79 (0.62-0.89)
Clean site with alcohol swab	Perfect agreement	Flow of procedure and forward planning	0.83 (0.69-0.91)
Allow alcohol to dry on skin	0.90 (0.81-0.95)	Knowledge of instruments	0.68 (0.45-0.83)
Re-palpate artery without contaminating site of needle insertion	0.84 (0.68-0.92)	Aseptic technique	0.91 (0.83-0.96)
Insert needle at appropriate landmark	0.84-0.71	Seeks help where appropriate	N/A
Able to obtain blood	Perfect agreement		
Comment on nature of blood	Perfect agreement		
Obtain a minimum of 1 cc of blood	Perfect agreement		
Remove needle and apply pressure to site	0.98 (0.95-0.99)		
Remove syringe, place cap over top, and expel air from syringe	0.80 (0.64-0.90)		
Submit sample immediately	0.96 (0.92-0.98)		
State/mime placement of bandage on wrist	0.93 (0.86-0.97)		
Overall Score	0.98 (0.96-0.99)	Overall ability to perform procedure	0.89 (0.79-0.94)
		Overall agreement on competence	Kappa = 0.94 (0.82-1.00)

Total number of performances: 33. Abbreviations: ICC denotes intraclass correlation coefficient; CI, confidence interval.

Knee Arthrocentesis

Knee arthrocentesis checklist Item	Inter-rater reliability: ICC (95% CI)	Global rating scale item	Inter-rater reliability: ICC (95% CI)
Wash hands	Perfect agreement	Appropriate preparation of instruments pre-procedure	0.98 (0.95-0.99)
Put on sterile gloves	Perfect agreement	Appropriate analgesia	0.82 (0.68-0.90)
Prepare the skin with cleansing agent	0.95 (0.90-0.97)	Time and motion	0.59 (0.33-0.77)
Dispose of sponge sticks appropriately without contaminating equipment	Perfect agreement	Instrument handling	0.67 (0.45-0.82)
Place sterile drape around site	0.75 (0.53-0.87)	Flow of procedure and forward planning	0.78 (0.62-0.88)
Withdraw anesthetic with syringe	Perfect agreement	Knowledge of instruments	0.50 (0.22-0.70)
Landmark prior to administering anesthetic agent	0.94 (0.89-0.97)	Aseptic technique	0.95 (0.90-0.97)
State/mime injection of anesthetic solution	0.95 (0.90-0.97)	Seeks help where appropriate	0.80 (0.65-0.89)
Insert needle at appropriate landmark	0.98 (0.96-0.99)		
Aspirate while advancing the needle	0.99 (0.97-0.99)		
Able to obtain fluid	Perfect agreement		
Remove needle and dispose into appropriate sharps container	Perfect agreement		
State will place fluid into collection tubes	0.79 (0.61-0.89)		
State/mime placement of bandage on knee	0.83 (0.68-0.91)		
Overall Score	0.97 (0.95-0.99)	Overall ability to perform procedure	0.92 (0.84-0.96)
		Overall agreement on competence	Kappa = 0.84 (0.66-1.00)

Total number of performances: 37. Abbreviations: ICC denotes intraclass correlation coefficient; CI, confidence interval.

Intubation

Intubation checklist Item	Inter-rater reliability: ICC (95% CI)	Global rating scale item	Inter-rater reliability: ICC (95% CI)
Put on face mask, eye protection, and non-sterile gloves	Perfect agreement	Appropriate preparation of instruments pre-procedure	0.74 (0.33-0.89)
Ensure required equipment available	Perfect agreement	Appropriate analgesia	N/A
Check for leaks by inflating cuff of endotracheal tube	Perfect agreement	Time and motion	0.69 (0.47-0.83)
Ensure IV access available	Perfect agreement	Instrument handling	0.69 (0.41-0.84)
Place patient's head in "sniffing position"	Perfect agreement	Flow of procedure and forward planning	0.68 (0.34-0.85)
Pre-oxygenate patient	Perfect agreement	Knowledge of instruments	0.45 (0.14-0.68)
With laryngoscope in left hand, insert the blade to the right of the tongue	0.79 (0.62-0.89)	Aseptic technique	N/A
Advance blade tip to appropriate position	0.89 (0.78-0.94)	Seeks help where appropriate	0.69 (0.32-0.86)
Apply upward and forward force on the laryngoscope at 45 degree angle to visualize vocal cords	0.96 (0.92-0.98)		
Insert endotracheal tube into right side of patient's mouth and visualize passage of tube through vocal cords until balloon is no longer visible	0.92 (0.84-0.96)		
Remove stylet once tube has just passed vocal cords	0.96 (0.91-0.98)		
Inflate balloon using 10cc syringe	0.87 (0.76-0.93)		
Attach ventilation bag/oxygen supply	0.85 (0.73-0.92)		
Auscultate to confirm equal and bilateral breath sounds	Perfect agreement		
Confirm intubation with at least one other method	0.98 (0.96-0.99)		
Use tape to secure tube	Perfect agreement		
Reassess vitals	Perfect agreement		

State will arrange for chest x-ray	Perfect agreement	
Overall Score	0.99 (0.99-1.00)	Overall ability to perform procedure 0.88 (0.72-0.95)
		Overall agreement on competence Kappa = 1.00 (perfect agreement)

Total number of performances: 34. Abbreviations: ICC denotes intraclass correlation coefficient; CI, confidence interval.

Lumbar Puncture

Lumbar Puncture Checklist Item	Inter-rater reliability: ICC (95% CI)	Global rating scale item	Inter-rater reliability: ICC (95% CI)
Wash hands	Perfect agreement	Appropriate preparation of instruments pre-procedure	0.80 (0.63-0.89)
Identify or mark the L4-5 interspace	0.84 (0.70-0.92)	Appropriate analgesia	0.69 (0.46-0.83)
Open the tray using sterile technique	Perfect agreement	Time and motion	0.74 (0.54-0.86)
Pour chlorhexidine into the tray well	Perfect agreement	Instrument handling	0.77 (0.69-0.88)
Don mask then sterile gloves	0.98 (0.95-0.99)	Flow of procedure and forward planning	0.79 (0.52-0.90)
Open and place collection tubes in their respective tray wells	Perfect agreement	Knowledge of instruments	0.88 (0.77-0.94)
Connect the two parts of the manometer and attach stopcock to the bottom part of the manometer	0.96 (0.93-0.98)	Aseptic technique	0.99 (0.97-1.00)
Withdraw anesthetic with syringe	Perfect agreement	Seeks help where appropriate	0.90 (0.79-0.96)
Place sponge stick into chlorhexidine and clean the skin 2 times in a circular motion from the target area	Perfect agreement		
Dispose of sponge sticks appropriately without contaminating sterile equipment	Perfect agreement		
Place sterile drape between hip and bed	0.91 (0.81-0.96)		
Place fenestrated sterile drape on patient's back with the hole centered over the target area	Perfect agreement		
State/mime injection of anesthetic solution	Perfect agreement		
Ensure stylet is in place and bevel facing laterally	0.92 (0.85-0.96)		
Advance the needle in the appropriate interspace, aiming towards the umbilicus	Perfect agreement		
Remove the stylet completely to check for	0.89 (0.79-0.94)		

fluid			
Attach the manometer/stopcock to the needle hub	0.89 (0.78-0.94)		
Turn the stopcock valve and allow the fluid to fill the manometer	0.98 (0.97-0.99)		
Collect 1cc of CSF in each collection tube	Perfect agreement		
Replace stylet and withdraw needle	Perfect agreement		
Place bandage over puncture site	Perfect agreement		
Overall Score	0.99 (0.98-1.00)	Overall ability to perform procedure	0.87 (0.73-0.94)
		Overall agreement on competence	Kappa = 1.00 (perfect agreement)
Total number of performances: 34. Abbreviations: ICC denotes intraclass correlation coefficient; CI, confidence interval.			

Ultrasound-Guided Paracentesis

Paracentesis checklist Item	Inter-rater reliability: ICC (95% CI)	Global rating scale item	Inter-rater reliability: ICC (95% CI)
Wash hands	Perfect agreement	Appropriate preparation of instruments pre-procedure	0.46 (0.13-0.69)
Correctly identify landmark as right or left lower quadrant	0.96 (0.93-0.98)	Appropriate analgesia	0.49 (0.08-0.73)
Using ultrasound, appropriately visualize peritoneal fluid	Perfect agreement	Time and motion	0.44 (0.08-0.69)
Using ultrasound, identify bowel	0.89 (0.80-0.94)	Instrument handling	0.61 (0.33-0.78)
Using ultrasound, state will identify spleen or liver	0.93 (0.87-0.96)	Flow of procedure and forward planning	0.74 (0.54-0.85)
Open tray with sterile technique	0.81 (0.66-0.90)	Knowledge of instruments	0.77 (0.61-0.88)
Pour chlorhexidine into the tray well	0.94 (0.88-0.97)	Aseptic technique	0.94 (0.89-0.97)
Put on mask then sterile gloves and gown	0.94 (0.89-0.97)	Seeks help where appropriate	0.77 (0.60-0.87)
Withdraw anesthetic with syringe	Perfect agreement		
Place sponge stick into chlorhexidine and clean the skin 2 times in a circular motion from the target area	0.95 (0.92-0.98)		
Dispose of sponge sticks appropriately without contaminating sterile equipment	Perfect agreement		
Place sterile fenestrated drape around site of needle insertion	Perfect agreement		
State/mime injection of anesthetic solution	Perfect agreement		
Discontinue needle advancement when peritoneal fluid is aspirated	0.94 (0.89-0.97)		
Insert the needle at the target site, continuously aspirating while advancing	Perfect agreement		
State will slide the catheter over the needle once peritoneal fluid is	Perfect agreement		

obtained			
Remove the needle	Perfect agreement		
Connect tubing to port	0.97 (0.94-0.98)		
State will attach tubing end to fluid collection bag or vacuum bottles	Perfect agreement		
Remove catheter	Perfect agreement		
Place bandage over insertion site	Perfect agreement		
Overall Score	0.99 (0.98-1.00)	Overall ability to perform procedure	0.85 (0.72-0.92)
		Overall agreement on competence	Kappa = 0.95 (0.84-1.00)

Total number of performances: 39. Abbreviations: ICC denotes intraclass correlation coefficient; CI, confidence interval.

Ultrasound-Guided Thoracentesis

Thoracentesis checklist Item	Inter-rater reliability: ICC (95% CI)	Global rating scale item	Inter-rater reliability: ICC (95% CI)
Wash hands	0.98 (0.96-0.99)	Appropriate preparation of instruments pre-procedure	0.65 (0.43-0.79)
Correctly identify landmark 5-10cm lateral to the spine	0.99 (0.97-0.99)	Appropriate analgesia	0.62 (0.34-0.79)
Using ultrasound, appropriate visualize pleural fluid	Perfect agreement	Time and motion	0.75 (0.57-0.86)
Using ultrasound, identify lung and diaphragm	0.98 (0.97-0.99)	Instrument handling	0.73 (0.54-0.85)
Using ultrasound, state will identify liver or spleen	0.97 (0.95-0.99)	Flow of procedure and forward planning	0.53 (0.27-0.71)
Open tray with sterile technique	Perfect agreement	Knowledge of instruments	0.48 (0.21-0.69)
Pour chlorhexidine into the tray well	0.97 (0.95-0.98)	Aseptic technique	0.78 (0.62-0.88)
Put on sterile gloves and mask	Perfect agreement	Seeks help where appropriate	0.79 (0.62-0.89)
Withdraw anesthetic with syringe	Perfect agreement		
Place sponge stick into chlorhexidine and clean the skin 2 times in a circular motion from the target area	Perfect agreement		
Dispose of sponge sticks appropriately without contaminating sterile equipment	Perfect agreement		
Place fenestrated sterile drape on patient's back with the hold centered over the target area	0.96 (0.93-0.98)		
State/mime injection of anesthetic solution	0.93 (0.88-0.96)		
Insert the needle at the target area, continuously aspirating while advancing	0.42 (0.14-0.64)		
State will avoid inferior aspect of the rib above	Perfect agreement		
State will slide the catheter over the needle once pleural fluid is	0.89 (0.81-0.94)		

obtained			
Remove the needle and occlude catheter with finger	0.99 (0.97-0.99)		
Connect stopcock to catheter	0.96 (0.92-0.98)		
Connect syringe and/or tubing for additional fluid collection	0.95 (0.91-0.97)		
Appropriately maneuver stopcock to avoid introduction of air	Perfect agreement		
Ensure positive intrathoracic pressure while removing catheter	Perfect agreement		
Place occlusive dressing/bandage over insertion site	0.99 (0.97-0.99)		
Overall Score	0.99 (0.99-1.00)	Overall ability to perform procedure	0.89 (0.80-0.94)
		Overall agreement on competence	Kappa = 1.00 perfect agreement

Total number of performances: 41. Abbreviations: ICC denotes intraclass correlation coefficient; CI, confidence interval.