

Supplemental Digital Appendix 1

Number and Percent of Residents Who Did Not Meet the 2010 Traditional Angoff and Hofstee and the 2015 Mastery Angoff and Patient-Safety Standards Who Missed Each Item on the Internal Jugular (IJ) and Subclavian Central Line Placement Checklists, From a Comparative Study of Minimum Passing Standards for Mastery Learning, Northwestern University Feinberg School of Medicine, Chicago, Illinois, 2015

Central Line Placement (Internal Jugular)		
CHECKLIST ITEM	% of residents who missed each item who did not meet MPS based on Traditional Angoff and Hofstee 2010 (n=20)	% of residents who missed each item who did not meet MPS based on Mastery Angoff and Patient-safety MPS 2015 (n=55)
Informed consent obtained Benefits Risks Consent given	2 (10%)	5 (9%)
Call “time out” and site mark if appropriate	3 (15%)	8 (15%)
Wash hands	1 (5%)	1 (2%)
Place the patient in slight Trendelenburg position	8 (40%)	10 (18%)
Test each port and flush the lines with sterile saline	0	1 (2%)
Clamp each port	0	1 (2%)
Remove brown port from end of line to accommodate wire	0	1 (2%)
Area is cleaned with chlorhexadine	2 (10%)	0
Resident gets in sterile gown, gloves, hat and mask	1 (5%)	2 (4%)
Area is draped in usual sterile fashion (must be full body drape)	5 (25%)	2 (4%)
The US probe is properly set up, draped and sonographic gel is used (sterile sheath)	4 (20%)	1 (2%)
The vein is localized using anatomical landmarks with the ultrasound machine	2 (10%)	2 (4%)
The skin is anesthetized with 1% lidocaine in a small wheal	2 (10%)	5 (9%)
The deeper structures are anesthetized	3 (15%)	10 (18%)
Using the large needle (or catheter) syringe complex cannulate the vein while aspirating (must be done with US)	2 (10%)	9 (16%)
Remove the syringe from the needle or advance the catheter into the vein removing both the syringe and needle	2 (10%)	3 (6%)
Using the guidewire advance the guidewire into the vein no more than about 12cm-15cm	4 (20%)	4 (7%)
Make sure to nick the skin to advance the dilator (scalpel)	5 (25%)	5 (9%)
Advance the dilator over the guidewire and dilate the tissue	4 (20%)	3 (6%)

Advance the triple lumen over the wire, holding the guidewire steady as moving the catheter forward	1 (5%)	9 (16%)
Never let go of the guidewire	7 (35%)	7 (13%)
Once the line is in placed remove the guidewire in its entirety	1 (5%)	2 (4%)
Advance the line to 14-16 cm for right side 16-18 cm for the left side	2 (10%)	2 (4%)
Aspirate/flush each port	3 (15%)	7 (13%)
Secure the line in place (suture or staple)	6 (30%)	5 (9%)
Place dressing over line	4 (20%)	10(18%)
Get a chest x-ray to confirm location	1 (5%)	3 (6%)
Notify that line is ok to use	4 (20%)	4 (7%)
Maintains sterile technique	12 (60%)	12 (22%)

Central Line Placement (Subclavian)		
CHECKLIST ITEM	% of residents who missed each item who did not meet MPS based on Traditional Angoff and Hofstee 2010 (n=13)	% of residents who missed each item who did not meet MPS based on Mastery Angoff and Patient-safety MPS 2015 (n=36)
Informed consent obtained Benefits Risks Consent given	0	1 (3%)
Call “time out” and site mark if appropriate	1 (8%)	2
Wash hands	0	2
Place the patient in slight Trendelenburg position	0	5 (14%)
Test each port and flush the lines with sterile saline	2 (15%)	0
Clamp each port	2 (15%)	0
Remove brown port from end of line to accommodate wire	2 (15%)	0
Area is cleaned with chlorhexadine	0	0
Resident gets in sterile gown, gloves, hat and mask	1 (8%)	0
Area is draped in usual sterile fashion (must be full body drape)	1 (8%)	0
The vein is localized using ultrasound machine or anatomical landmarks verbalized (must do one or the other for credit)	1 (8%)	1 (3%)
The skin is anesthetized with 1% lidocaine in a small wheal	3 (23%)	3 (8%)
The deeper structures are anesthetized using a larger needle (must verbalize they numb the clavicle)	2 (15%)	3 (8%)
Using the large needle (or catheter) syringe complex cannulate the vein while aspirating (optional confirmed by US)	1 (8%)	0
<i>If US was not used then expected to state or demonstrate they must direct the needle to the sternal notch (must verbalize) (if US used may omit)</i>	2 (15%)	4 (11%)
Remove the syringe from the needle or advance the catheter into the vein removing both the syringe and needle	0	0
Using the guidewire advance the guidewire into the vein no more than 12-15cm	4 (31%)	3 (8%)
Make sure to nick the skin to advance the dilator (scalpel)	4 (31%)	4 (11%)
Advance the dilator over the guidewire and dilate the tissue	3 (23%)	1 (3%)
Advance the triple lumen over the wire, holding the guidewire steady as moving the catheter forward	3 (23%)	0
Never let go of the guidewire	3 (23%)	5 (14%)
Once the line is in place remove the guidewire in its entirety	0	0
Advance the line to 14-16 cm for right side 16-18 cm for the left side	2 (15%)	0

Aspirate/flush each port	0	5 (14%)
Secure the line in place (suture or staple)	1 (8%)	1 (3%)
Place dressing over line	0	2 (6%)
Get a chest x-ray to confirm location	1(8%)	0
Notify that line is ok to use	3 (23%)	3 (8%)
Maintains sterile technique	6 (46%)	6 (17%)