

1-24-2025

Central Line Associated Bloodstream Infection Prevention in Medical Intensive Care Unit

Linet Angir
Walden University

Follow this and additional works at: <https://scholarworks.waldenu.edu/dissertations>

This Dissertation is brought to you for free and open access by the Walden Dissertations and Doctoral Studies Collection at ScholarWorks. It has been accepted for inclusion in Walden Dissertations and Doctoral Studies by an authorized administrator of ScholarWorks. For more information, please contact ScholarWorks@waldenu.edu.

Walden University

College of Nursing

This is to certify that the doctoral study by

Linnet Achieng Angir

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee

Dr. Cara Krulewitch, Committee Chairperson, Nursing Faculty
Dr. Andrea Tatkon-Coker, Committee Member, Nursing Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2024

Executive Summary: Staff Education Project
Central Line Associated Bloodstream Infection Prevention in Medical Intensive Care

Unit

by

Linnet Achieng Angir

BS, Cedar Crest University, 2022

Executive Summary Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Nursing Practice

Walden University

November 2025

Summary

The doctoral project was a collaborative endeavor focused on central line dressing sites at a state university hospital in the northeastern United States. The aim was to reduce the current central line-associated infections (CLABSIs) rate. Through audits, it was discovered that most central line dressings needed to be completely sealed, some required insertion site clipping to ensure a complete seal, and some dressings were saturated. To uphold a commitment to quality care, clinical excellence, patient care, and superior outcomes, the Doctor of Nursing Practice (DNP) project recognized the importance of implementing the recommendations to reduce CLABSIs by maintaining central venous catheter (CVC) line dressing adherence and proper dressing management.

The results of the DNP project highlighted the importance of maintaining CVC dressing adherence as part of the CVC maintenance bundle (i.e., appropriate hand hygiene, sterility during line insertion, skin cleaning with chlorhexidine gluconate wipes, use of alcohol caps on infusible and access port, and early CVC removal) and the significant impact of evidence-based practice in reducing CLABSIs. Staff education, which involved power point presentations, a competency checklist, posters, and pre- and posttests, was instrumental in this success. The data collected from the pre- and posttests showed a mean pretest score of 78.40 and a posttest score of 88.80, and the calculated p value was less than 0.001, indicating an improvement in staff understanding of the importance of maintaining the CVC maintenance bundle. The daily audit results also demonstrated a significant improvement in central line dressing adherence and maintenance, with only three dressings out of 523 audits not meeting the requirements. No CLABSIs were reported after the project take-up, and the CLABSIs rate was reduced.

Background

CLABSIs are one of the reportable hospital-acquired infections. An estimated 250,000 bloodstream infections occur annually, and most are related to the presence of intravascular devices. In the United States, the CLABSIs rate in intensive care units (ICUs) is estimated to be 0.8 per 1,000 central line days (Haddadin et al., 2022). CLABSIs lead to prolonged hospital stays and increase healthcare costs and mortality; therefore, reducing CLABSIs is paramount to ensure patient safety and positive outcomes.

CVC are vital medical devices for patients in acute care units that help facilitate interventional medical therapy and fluid and medication administration (Mitchell et al., 2020). CVCs are inserted in an emergency or as a planned procedure. Maintaining sterility during insertion and ongoing maintenance is crucial to prevent bloodstream infections associated with these catheters.

According to the Centers for Disease Control (CDC) guidelines, several strategies have been established to avoid CLABSIs. However, education and awareness are equally important in preventing central line-associated bloodstream infections. CVC bundles that include proper line insertion, appropriate handling, maintenance, and removal of central lines when not required are essential in preventing CLABSIs. Organizational practices such as auditing, staff education, and using antiseptic caps, ports, and impregnated catheters are also necessary. Adhering to the central line insertion bundle is crucial when inserting a CVC line. This comprehensive set of guidelines includes optimal site selection, hand hygiene skin preparation with alcohol-based chlorhexidine skin preparation, removal of hair on the insertion site, and maximum barrier precautions.

Equally important is maintaining an effective dressing, which is necessary to prevent exposure to the insertion site. Multiple evidence-based studies report that the risk of infection significantly increases when the CVC insertion site is exposed due to non-adherent dressing. For example, Steen et al. (2019) showed that adherent dressings were not associated with CLABSIs.

During audit rounds, the CLABSIs team observed that the status of CVC dressings did not meet the required standards of practice for preventing central line-associated bloodstream infection. The team noted that most dressings needed to adhere better, especially on patients with facial hair. The DNP project aimed to empower and educate nurses in the medical ICU about the importance of the CVC maintenance bundle and to implement CVC insertion site clipping to ensure dressing adherence. The project sought to answer the question of whether implementing CVC insertion site clipping as a part of the CVC maintenance bundle reduces CLABSI in patients requiring central lines in the medical intensive care unit. The ultimate goal was for the educated staff to be informed about reducing CLABSI in patients needing central lines in the medical intensive care unit, thereby significantly improving patient outcomes, and enhancing the quality of care provided by medical intensive care unit nurses.

CLABSI is a serious and potentially fatal condition acquired in hospitals. It is a significant issue due to its high mortality rate and the increased medical expenses associated with treating it. CVCs, commonly used in most ICU patients for administering medicine and fluids, are a major contributor to this problem. Although these catheters are essential for treating critically ill patients, they can also be a source of severe bloodstream infections that can lead to prolonged hospital stays, increased morbidity, and higher

mortality rates (Yaseen et al., 2016). Exposure to the CVC insertion site due to a non-adherent central line dressing increases the risk of infection. Healthcare-associated infections increase the length of hospital stay, medical cost, patient discomfort, and morbidity and mortality rates. Therefore, healthcare professionals must engage in evidence-based practices promoting patient safety and comfort, as they are the key implementers of these practices. The central line maintenance bundle, which includes appropriate hand hygiene, sterility during line insertion, skin cleaning with chlorhexidine gluconate wipes, use of alcohol caps on infusible, and access port and early CVC removal is a known intervention to decrease CLABSI when implemented and adhered to completely (Burke et al., 2021).

Ten peer-reviewed articles were used to gain insight into the evidence for the project. These articles included a cross-sectional study, a quasi-experimental study, an integrative literature review, five qualitative studies, a retrospective study, and one quantitative study. Most of the reviewed articles concluded that care bundles and peer observations effectively decrease CLABSIs and eventually improve patient psychological state and hospitalization satisfaction. Research analysis of the peer-reviewed articles has highlighted the ongoing nature of the problem of CLABSIs in critical care units among patients with CVCs. Training is a major factor in determining central line bundle knowledge and maintenance (Almahmoud et al., 2020). It is crucial to emphasize the need for continuous staff training regarding the proper implementation of bundles. The ongoing effort to reduce bloodstream infection is not just a requirement but a testament to the value and importance of healthcare professionals in ensuring patient safety and comfort. The intensive care staff continuous training is a key factor in reducing

CLABSIs, and they should feel the impact of their efforts on patient outcomes.

Staff Education Project Development

The education project is a critical component in meeting Walden DNP project requirements and ensuring alignment with the institution's standards for completion of the DNP project. The project involved 25 nurses from a university teaching hospital's 16-bed medical intensive care unit. To prepare for the project, I created teaching materials (Appendix A), a competency checklist (Appendix B), and a poster for proper dressing application (Appendix C). I also developed pre- and posttest questionnaires to assess the staff's knowledge (Appendix D). After presenting the project aim, I obtained approval from Walden University's ethics committee. The staff then took a pretest followed by a 2-week teaching period to reach most staff members across both shifts. Utilizing PowerPoint, the staff were educated in proper clipping techniques and the importance of the central line maintenance bundle, and their competency in clipping was assessed. Finally, the posttest was administered.

Upon receiving the test results, I recorded the pre- and posttest data in an Excel spreadsheet for analysis. I employed the use of descriptive statistics, a scientifically rigorous method, to evaluate the changes observed after implementing evidence-based teaching. Additionally, I collected information on the staff's competency level from the pre- and posttest questionnaires. The dressing audit results were also obtained on a Microsoft Excel spreadsheet and analyzed, giving descriptive information.

Results

The staff who participated had varying levels of experience, from those who were just starting out in their careers (competent, with less than 1 year of experience) to those

who were highly experienced (expert, with more than 3 years of nursing experience; see Figure 1). Despite having a large majority of the staff, 62% being experienced, the test scores were low among the experienced nurses, just like among the less skilled and novice nurses. The scores varied among the staff. The pretest results ranged from 60-100% in scores, and the posttest scores ranged from 80-100%. The mean of the pretest was 78.40, the posttest mean was 88.80, and the p value for evaluating the t test evaluating the difference between the means was 0.000184, indicating the significance of the implementation of the project. After the implementation of the project, the central dressing audits completed showed an improvement in dressing maintenance. Of the 523 dressings audited, only four did not meet the standard of appropriate central line dressing guidelines. Most of the central lines were placed in the inter jugular vein (see Figure 2).

Figure 1

Staff Years by Experience

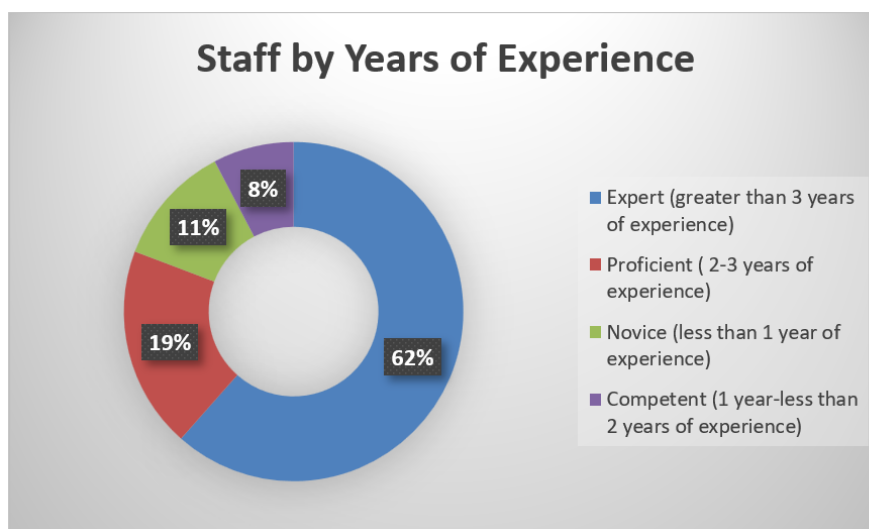
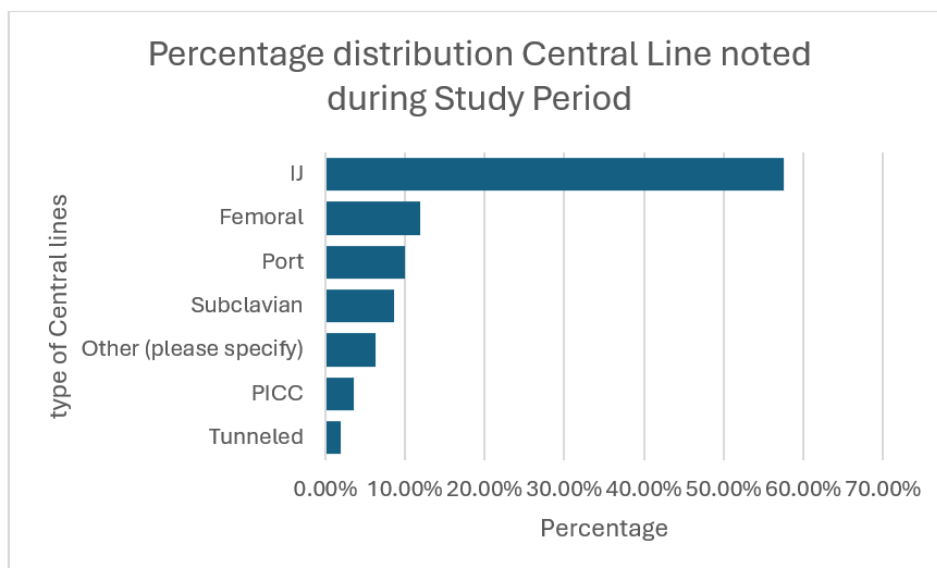


Figure 2

Percent Distribution Central Line During Study Period



The project's findings indicate that applying knowledge, such as adherence to CDC guidelines, leads to improved patient care. For instance, the proper management and care of central line venous catheters, as per the CDC guidelines, have been shown to reduce the incidence of CLABSI. However, the small sample size limits the results' generalization. Additionally, the study was prolonged, and the dynamics of staff experience were altered due to a strike that affected the institution, resulting in the hiring of new staff. Knowledge of the requirements per the CDC guidelines on managing and caring for central line venous catheters is necessary to avoid CLABSI. Nurses who are informed perform better patient care and improve outcomes. Central line-associated infection remains a significant preventable healthcare-associated infection that is nationally compared and monitored.

Conclusions

The education project was aimed at reinforcing the staff's role in preventing a rise in central line-associated bloodstream infection by maintaining CVC line dressing adherence and proper dressing management. The post-implementation test scores highlighted the staff's commitment and responsibility, showing significant improvements in their knowledge and skills, thereby reducing the risk of infections. Implementing periodic sessions and revisiting required guidelines is necessary to maintain standards and prevent patient mortality. I recommend using the teaching aide on new hire orientation and during the annual skills lab for the nursing.

References

- Almahmoud, R. S., Alfarhan, M. A., Alanazi, W. M., Alhamidy, F. K., Balkhy, H. H., Alshamrani, M., El-Saed, A., Sairafi, B. A., & Bahron, S. A. (2020). Assessment knowledge and practices of central line insertion and maintenance in adult intensive care units at a tertiary care hospital in Saudi Arabia. *Journal of Infection and Public Health*, *13*(11), 1694–1698. <https://doi.org/10.1016/j.jiph.2020.07.009>
- Burke, C., Jakub, K., & Kellar, I. (2021). Adherence to the central line bundle in intensive care: An integrative review. *American Journal of Infection Control*, *49*(7), 937–956. <https://doi.org/10.1016/j.ajic.2020.11.014>
- Haddadin, Y., Annamaraju, P., & Regunath, H. (2022). Central line associated blood stream infections. <http://europepmc.org/books/NBK430891>
- Mitchell, M., Ullman, A., Takashima, M., Davis, C., Mihala, G., Powell, M., Gibson, V., Zhang, L., Bauer, M., Playford, G., & Rickard, C. (2020). Central venous access device securement and dressing effectiveness: The cascade pilot randomised controlled trial in adult intensive care. *Australian Critical Care*, *33*, S2. <https://doi.org/10.1016/j.aucc.2020.04.004>
- Steen, C., Cole, M., Hendrickson, A., Remker, C., & Wilcox, M. (2019). Making it stick: Central line dressing adherence. *Biology of Blood and Marrow Transplantation*, *25*(3), S434–S435. <https://doi.org/10.1016/j.bbmt.2018.12.503>
- Yaseen, M., Al-Hameed, F., Osman, K., Al-Janadi, M., Al-Shamrani, M., Al-Saedi, A., & Al-Thaqafi, A. (2016). A project to reduce the rate of central line associated bloodstream infection in ICU patients to a target of zero. *BMJ Quality Improvement Reports*, *5*(1). <https://doi.org/10.1136/bmjquality.u212545.w4986>

Appendix A: Poster for Visual Aide for Proper Dressing

How is My Central Line Dressing?



If the central line site dressing looks like this, document assessment. Ensure the date on the dressing is not over 7 days.


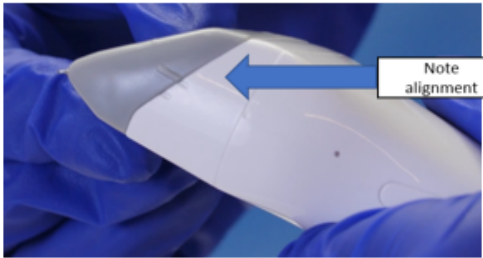



If the dressing looks like this, change immediately. Use clippers to remove hair this will assist with dressing adherence. Document dressing change, initial and date.

Appendix B: Competency Checklist

Surgical Clippers by Source Mark Clinical Competency Checklist

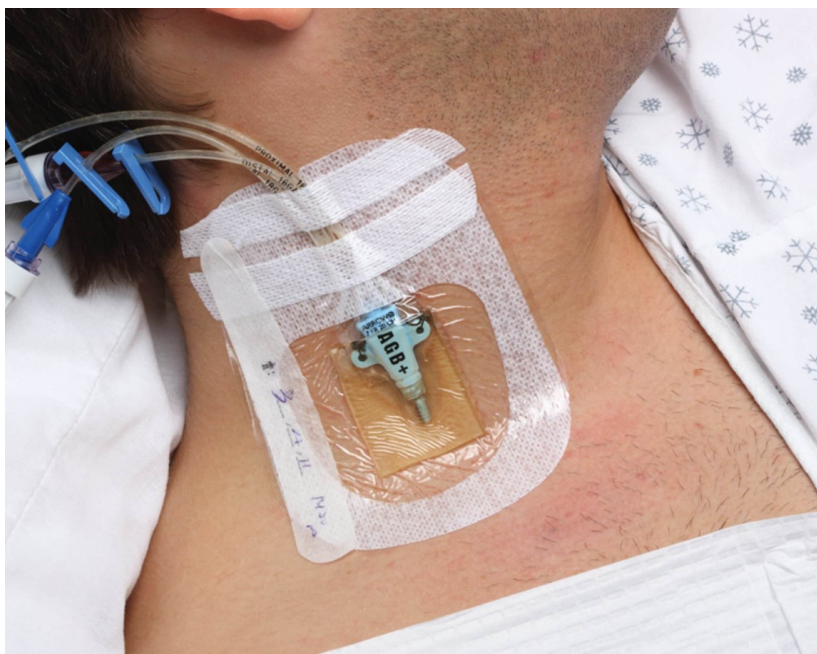
Evaluation Methods key: O=Observed, D=Demonstrated V=Verbal Response

Competency Steps	Met	Comments
1. Gather and prepare equipment and supplies.		
2. Explain the procedure to the patient.		
3. Verify that there are no religious and cultural contraindications to hair clipping.		
4. Confirm patient identity.		
5. Perform hand hygiene.		
6. Don gloves.		
7. Obtain clipper from charging station and select appropriate blade. <i>Blade selection is based upon the location of the patient's central line.</i>		
 <p>The diagram shows three colored boxes with arrows pointing to corresponding blades. The red box is labeled 'For Sensitive Loose Skin Under Arms and Groins'. The blue box is labeled 'For Scalp & Coarse Dense Hair'. The grey box is labeled 'For General use'.</p>		
8. Attach blade to clipper hand piece by aligning from the lower line to the upper line on the side of hand piece. A 'click' will be heard which indicates proper alignment.		
 <p>The photo shows a close-up of a white clipper hand piece. A blue arrow points to a specific line on the side of the hand piece. A white box with the text 'Note alignment' is positioned next to the arrow.</p>		
9. Place the clipper flat against the patient's skin with the logo facing upwards.		
Competency Steps	Met	Comments
10. Holding the clipper like a pen, use short gentle strokes to clip. You will be clipping against the direction of hair growth.		

		
<p>11. If loose skin is present, stretch taut with one hand while clipping with the other hand.</p>		
<p>12. Upon completion, remove the blade and dispose in a sharps container.</p>		
<p>13. Rinse clipper under water to remove excess hair, then disinfect with Sani Prime Wipes (plum wipes).</p>		
<p>14. Remove and discard your gloves.</p>		
<p>15. Perform hand hygiene.</p>		
<p>14. Return clipper back onto the charger base.</p>		
<p>15. Document procedure.</p>		


Date	
Examinee Name	
Evaluator Name	
Evaluator Signature	

Appendix C: Power Point Presentation



Maintaining The CLABSI Bundle by Clipping.

Linef Angir
Walden University



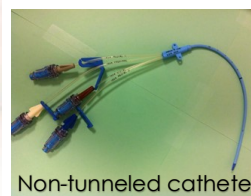
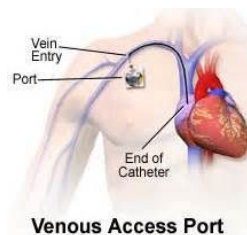
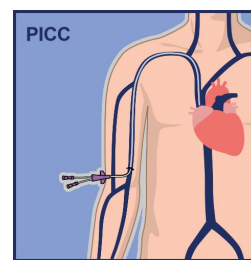
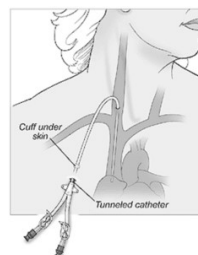
CLINICAL ISSUE OF INTEREST :

Central Line Associated Blood Stream Infections (CLABSIs)

- According to Agency for Health care Research and Quality fact sheets, (CLABSIs) result annually in 84,551 to 203,916 preventable infections. 10,426 to 25,145 preventable deaths. \$1.7 to \$21.4 billion avoidable costs.
- Central line-associated bloodstream infections are costly, extend the length of stay and contribute to 30,000 deaths per year (Mitchell et al., 2020).
- An estimated 250,000 bloodstream infections occur annually, and most are related to the presence of intravascular devices. In the United States, the CLABSI rate in intensive care units (ICU) is estimated to be 0.8 per 1000 central line days (Haddadin et al., 2022).
- Central lines are vital medical devices for patients in acute care units. In addition, the central line helps facilitate interventional medical therapy and fluid and medication administration (Mitchell et al., 2020).
- Implementing formalized nursing-led rounding process leads to increased bundle compliance and decreased CLABSIs (Hugo et al., 2022).

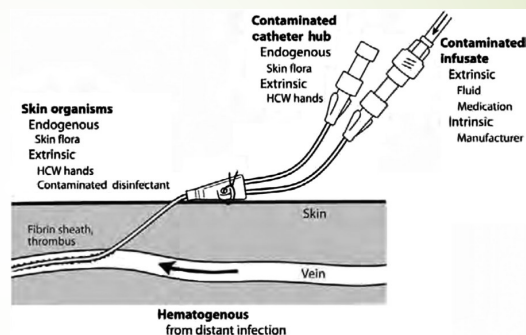
What is a Central Line?

- A central line, or a central venous catheter, is typically inserted into a large vein for treatment or diagnostic purposes.
- There are 4 types of catheters venous catheters
 1. Tunneled catheters
 2. Non tunneled catheters
 3. Peripherally inserted central catheter (PICC)
 4. Implanted venous access ports



Sources of Central Line Infection.

- Catheter contaminated at insertion site.
- Catheter hub manipulation.
- Catheter contaminated by secondary infection – intraluminal spread
- Contaminated infusate.





Best Practice

- Discussing the need for a catheter daily and removing it when it is no longer medically necessary is essential.
- The catheter site should be carefully assessed, and the central line should be removed if the site is erythematous or tender.
- Dressings should be changed every seven days for CHG transparent dressings, every 48 hours for gauze dressings, or when they become saturated or start peeling.
- It is essential to keep the dressing clean, dry, and intact.
- Alcohol caps should be used on all infusible and access ports, and male luer connectors should have red end caps.
- Access ports should be scrubbed with alcohol for 15 seconds immediately prior to each subsequent access.
- Utilizing a pulsatile flushing procedure is recommended.
- Blood for culture should be collected from peripheral sites, and routine drawing of blood cultures from central lines should be avoided unless ordered by the physician.
- HD catheters can only be accessed by specifically trained staff for HD and CVVH.
- Central Lines placed under emergent situation with compromised technique need to be changed within 24 hrs.
- Insertion clipping to allow for dressing adherence.

Evidence-Based Practice.



Routine evaluation checking on the central line dressing sites.



Discontinue of lines when not indicated.



Utilization of the central line care bundle during placement.



Measure rates of CLABSIs.



Annual skills check on central line management competencies.



Daily review of central line necessity

Preventing Infection is key

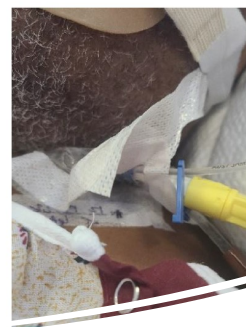
- Maintain dressing sites clean and dry.
- Dressing should be intact and adherent on all edges.
- Utilize the gel dressing and should be placed correctly over insertion site.
- Use the impregnated caps on all unused ports.
- All dressings should be dated, initialed for easy tracking of next due change date.



Dressing should be adherent and with no drainage or blood.



Be "in the moment" at the bedside



Your actions make real-time difference

https://www.bhg.com/images/search?view=detailv2&insightsToken=bcid_smywmwGbwTUGXg^ccid_d%2BbcY2I&form=ANChAS1&sp=SBUPLQADGEI&selectedIndex=0&id=248083079&ccid=d%2BbcY2I&expri=339&expw=600&v1=5&sm=1&cal=0.05&cab=0.95&cat=0.05&cam=0.95



<https://sourcemarkusa.com/wp-content/uploads/2022/10/ClipperPic.jpg>

Clipping

- Improves dressing adherence.
- Prevents interruption and exposure of site before the change date.
- Dressing looks neater and prevents CLABSI
- It is recommended that an electric clipper be use.
- Manufacturer's instructions should be followed for the cleaning and disinfection of reusable electric clippers and shaving head.
- Single-use shaving heads should be disposed of in a sharp container.

How to safely use the clippers.

Hold clipper like a pen.

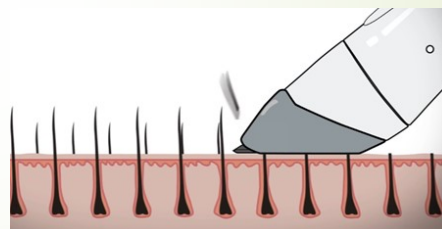
Grasp sides of clipper

Always keep SourceMark logo facing upwards.

The bottom blade is stationary, and the upper blade is the one clipping

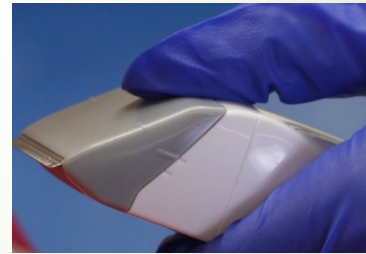
If loose skin is present, stretch the skin with one hand while resting the base of the clipper blade flat on the skin.

Do NOT toe in the blade to try and get a closer clip.



Removing the Clipper Blade.

- ▶ Press thumb on textured indentation and push forward to remove the blade.
- ▶ Dispose of used blade in the sharp container.

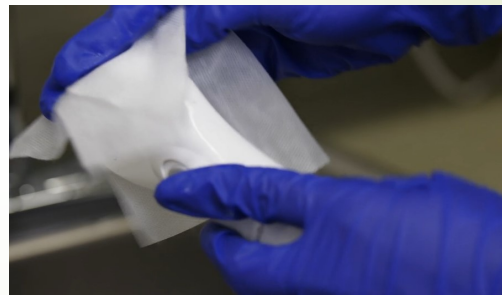


How to Clean the Clipper Head



Rinse hair clippings under water

Then use disinfecting wipes (Sani Prime WIPES) to disinfect before use on another patient.



Surgical Clippers by SourceMark Clinical Competency Checklist

Evaluation Methods key: O-Observed, D-Demonstrated V-Verbal Response

Competency Steps	Met	Comments
1. Gather and prepare equipment and supplies.		
2. Explain the procedure to the patient.		
3. Verify that there are no religious and cultural contraindications to hair clipping.		
4. Confirm patient identity.		
5. Perform hand hygiene.		
6. Don gloves.		
7. Obtain clipper from charging station and select appropriate blade. Blade selection is based upon location of the patient's central line.		
8. Attach blade to clipper hand piece by aligning from the lower line to the upper line on the side of hand piece. A 'click' will be heard which indicates proper alignment.		
9. Place the clipper flat against the patient's skin with the logo facing upwards.		
10. Holding the clipper like a pen, use short gentle strokes to clip. You will be clipping against the direction of hair growth.		
11. If loose skin is present, stretch taut with one hand while clipping with the other hand.		
12. Upon completion, remove the blade and dispose in a sharps container.		
13. Rinse clipper under water to remove excess hair, then disinfect with Sani Prime Wipes (plum wipes).		
14. Remove and discard your gloves.		
15. Perform hand hygiene.		
16. Return clipper back onto the charger base.		
17. Document procedure.		

Date _____
 Examinee Name _____
 Evaluator Name _____
 Evaluator Signature _____

Clinical Competency Checklist

- (n.d.). <https://sourcemarkusa.com/wp-content/uploads/2022/10/Clipper-Pic.jpg>
- (n.d.). https://www.bing.com/images/search?view=detailV2&insightsToken=bcid_smvwmwGbwTUGXg*ccid_a%2BbCYZtZ&form=ANCMST1&iss=SBUIPLOADGET&selectedindex=0&id=248083079&ccid=a%2BbCYZtZ&exp=339&expw=600&vt=3&sim=1&cal=0.05&cab=0.95&cat=0.05&car=0.95
- Haddadin, Y., Annamaraju, P., & Regunath, H. (2022). Central line associated blood stream infections. <http://europepmc.org/books/NBK430891>
- Hugo, M. C., Rzucidlo, R. R., Weisert, L. M., Parakati, I., & Schroeder, S. K. (2022). A quality improvement initiative to increase central line maintenance bundle compliance through nursing-led rounds. *Pediatric Quality & Safety*, 7(1), e515. <https://doi.org/10.1097/pq9.0000000000000515>
- Mitchell, M., Ullman, A., Takashima, M., Davis, C., Mihala, G., Powell, M., Gibson, V., Zhang, L., Bauer, M., Playford, G., & Rickard, C. (2020). Central venous access device securement and dressing effectiveness: The cascade pilot randomised controlled trial in adult intensive care. *Australian Critical Care*, 33, S2. <https://doi.org/10.1016/j.aucc.2020.04.004>

REFERENCES



Appendix D: Pre- and Posttest Questions

Pre/ Post -Test Questions Central Line Dressing Maintenance

1. Level of expertise in critical care nursing:

- Novice (less than 1 year of experience)
- Competent (1 year -less than 2 years of experience)
- Proficient (2-3 years of experience)
- Expert (Greater than 3 years of experience)

2. What causes central line associated blood stream infection?

- Viruses
- white blood cells
- Organisms
- Bacteria

3. To determine that there is CLABSI, what blood test is ordered.

- Complete blood count.
- Blood Glucose
- Blood Cultures
- Lactic Acid

4. What is the most common infection that occurs as a result of infection in the blood?

- Bladder infection
- Osteomyelitis
- Skin lesions
- Endocarditis

5. What is endocarditis?

- Inflammation of the veins
- Infection of the bone
- An infection of the heart
- Inflammation of the arteries

6. All of the following are correct about central line dressing change except

- Central line dressing is changed if dressing is lifting and is not adherent.
- Central line dressings should be changed only when soiled.
- Central line dressings are changed weekly or as per the institution's set policy.
- A central line dressing initially inserted that has a gauze should be changed within 24 hours.

7. Which is most preferable site for central line insertion

- Cephalic vein
- Femoral site
- Jugular site
- Subclavian site

8. Why is the insertion site clipped using disposable-head surgical clippers?

- Patient preference.
 - To facilitate dressing application.
 - Because the physician requested.
 - To ensure a sterile environment.
-

9. When should a central line be discontinued?

- When no longer required.
- All the above.
- If the insertion site is leaking or looks infected.
- When blood stream infection is present.

10. Which of the following is considered a component of maximal barrier precaution in a central line bundle?

- Using a sterile drape that covers the patient's head and body.
- Wearing Sterile gloves
- Wearing an isolation gown and gloves.
- Wearing a non-sterile cap and mask

11. The highest rate of CLABSI is found in which patient care area.

- Medical surgical unit
 - Hemodialysis unit
 - Intensive care units
 - Outpatient dialysis unit
-