

Supplementary Material 1. Peripheral Inserted Central Catheter Maintenance Knowledge Questionnaire

1. Which of the following is the content of PICC maintenance?
 - A. Replace the transparent dressing and infusion connector.
 - B. PICC flushing and sealing.
 - C. Observe the patient's general condition and local condition of puncture point.
 - D. All above. (Correct answer)
2. Which of the following are the preferred disinfectant and correct disinfection range for skin disinfection when replacing the dressing?
 - A. 0.4% iodophor; 10cm above and below the puncture point, both sides to the arm's edge.
 - B. 70% alcohol; 15 cm above and below the puncture point, both sides to the arm's edge.
 - C. >0.5% chlorhexidine alcohol solution; 10cm above and below the puncture point, both sides to the arm' edge. (Correct answer)
 - D. 2% tincture of iodine; 15 cm above and below the puncture point, both sides to the arm's edge.
3. Which of the following is the incorrect method of tearing the film when replacing it?
 - A. From outer edge to center.
 - B. The catheter at the puncture point should be fixed when tearing the film.
 - C. From top to bottom. (Correct answer)
 - D. From bottom to top.
4. Which of the following is the wrong time to replace the transparent dressing and infusion connector?
 - A. Replace infusion connector daily. (Correct answer)
 - B. Replace gauze dressing every 2 days.
 - C. Replace the transparent dressing and infusion connector every 5-7 days.
 - D. Replace the connector after removing it for any reason.
5. Which of the following is the incorrect method of sterilizing the spiral part when replacing the infusion connector?
 - A. Mechanical rubbing in the same direction for 15 seconds.
 - B. Disinfection in the same direction for 10-15 turns.
 - C. Mechanical rubbing in forward and reverse directions for 5-15 seconds. (Correct answer)
 - D. Positive and negative rubbing sterilize 10-15 turns.
6. What type of flushing fluid should be used after the infusion of blood products and

- fat emulsions? And what is the minimum volume?
- Normal saline; 10ml. (Correct answer)
 - Hypertonic brine; 5ml.
 - Normal saline; 20ml.
 - Heparin saline (10u/ml); 5ml.
7. Which of the following is the correct type and volume of sealing fluid when maintaining PICCs?
- Normal saline; at least 2 times the sum of the catheter volume plus the additional device volume.
 - Heparin saline 125u/ml; at least 2 times the sum of the catheter volume plus the additional device volume.
 - Heparin saline 100u/ml; at least 1.2 times the sum of the catheter volume plus the additional device volume.
 - Heparin saline 0-10u/ml; at least 1.2 times the sum of the catheter volume plus the additional device volume. (Correct answer)
8. What kind of techniques should be used for tube flushing and locking when maintaining PICCs?
- Pulsed flushing the tube, sealing the tube with positive pressure. (Correct answer)
 - Flushing the tube with positive pressure, pulsed sealing the tube.
 - Flushing and sealing the tube with positive pressure.
 - Pulsed flushing and sealing the tube.
9. Which of the following is the incorrect intervention if PICC is accidentally completely dislodged?
- Observe the scale and integrity of the catheter.
 - Observe the punctured point for hematoma and bleeding.
 - Immediate re-tubing. (Correct answer)
 - Disinfect the puncture site and cover with a sterile dressing.
10. Which of the following is the correct intervention for PICC occlusion?
- Remove the PICC directly.
 - Pressurized infusion of heparin saline.
 - Push normal saline with 5ml syringe.
 - Thrombolysis of blood coagulation blockage with 5000u/ml of urokinase. (Correct answer)
11. Which of the following is the preferred auxiliary examination for PICC-related thrombosis?
- Vascular ultrasound. (Correct answer)
 - X-rays.
 - Cardiac ultrasound.

- D. CT Scan.
12. Which of the following is the correct preventive measure for PICC-related infections?
- A. Strictly implement the five indications of hand hygiene.
 - B. Preventing intracatheter thrombosis.
 - C. Perform professional and standardized PICC maintenance regularly.
 - D. All above. (Correct answer)
13. Which of the following is the incorrect intervention for PICC breakage in vitro?
- A. Remove the catheter directly.
 - B. Repair catheter with spare connector. (Correct answer)
 - C. Report to the doctor and head nurse.
 - D. Re-x-ray to determine catheter tip position.
14. Which of the following is the first intervention for PICC breakage in vivo?
- A. Ligation of the vessel with a pressure band at the highest part of the upper arm on the side of the indwelling catheter. (Correct answer)
 - B. Immediate chest x-ray to confirm the location of the disconnected end of the catheter.
 - C. Intravenous dissection for removal.
 - D. Removal by grasper in the catheterization chamber.
15. Which of the following is the incorrect intervention for phlebitis?
- A. Use hesperidin sodium gel 20g+dexamethasone 20mg for topical application.
 - B. Elevate the affected limb to promote venous return.
 - C. Apply magnesium sulfate 200ml+dexamethasone 20mg mixture as a wet compress.
 - D. Remove PICC catheter, notify physician and record. (Correct answer)
16. Which of the following is the correct intervention for contact dermatitis?
- A. Remove the catheter immediately.
 - B. Use a hydrocolloid dressing and change every week. (Correct answer)
 - C. Change to gauze dressing and change every week.
 - D. Do not use anti-allergy drugs.
17. Which of the following is not true related to health education for discharged patients with PICC?
- A. The PICC can be left in place for 1 year. During the interval of treatment, catheter maintenance should be carried out once a month. During daily life, attention should be paid to whether the puncture point is redness, swelling, pain, and dampness. (Correct answer)
 - B. Elevate the arm with the PICC and avoid weight and pressure on the arm.
 - C. Keep the area clean and dry, do waterproof treatment before showering, ask the nurse to help replace the film if it is curled, loose or wet, do not tear off the film

without permission.

- D. The arm on the side of the PICC can make a fist, rotate the wrist, etc., and cannot do sports such as jumping rope, weight lifting, swimming, push-ups, etc., as well as household chores such as carrying water and children.
18. Which of the following is the wrong operation when removing the PICC?
- A. When approaching the puncture point, ask the patient to hold his breath, cover the top of the puncture point with sterile gauze with one hand, pinch the catheter with the other hand and pull out quickly in parallel.
- B. When approaching the puncture point, ask the patient to breathe deeply, cover the puncture point with sterile gauze with one hand, pinch the catheter with the other hand and pull out quickly in parallel. (Correct answer)
- C. Keep a tourniquet handy.
- D. Close the puncture hole with sterile gauze or a patch for at least 24 hours after extubation to prevent infection and air embolism.
19. If the patient suddenly develops signs and symptoms such as dyspnea, chest pain, hypotension, dysphoria, and sweating in the process of PICC removal, which of the following is the incorrect intervention?
- A. Absolute bed rest with elevated bed head.
- B. Inform the doctor and follow medical advice on anticoagulation.
- C. EKG / blood gas analysis / lung CTA.
- D. Intermittent low-flow oxygen intake. (Correct answer)

Supplementary Material 2. Peripheral Inserted Central Catheter Maintenance Attitude Questionnaire

NO.	Item	Strongly disagree	Disagree	Agree	Strongly agree
1	Patients with PICC need regular catheter maintenance during both the treatment period and the treatment intermission.				
2	There is a correlation between indwelling time and the timely and correct PICC maintenance.				
3	Timely and correct PICC maintenance can reduce the occurrence of PICC related complications.				
4	PICC maintenance needs to be performed according to a standardized process.				
5	Strict aseptic procedures in the process of PICC maintenance is essential to prevent PICC-related infections.				
6	Choosing the right disinfectant and disinfection range is important to prevent PICC-related infections.				
7	Using the correct flushing and locking techniques is essential to prevent PICC occlusion.				
8	A comprehensive and systematic catheter function assessment contributes to the early identification of PICC-related complications.				
9	Effective health education for patients with PICC contributes to PICC self-management.				
10	Nurses are responsible to provide education on PICC daily management for patients with PICC and their caregivers.				
11	Nurses can play an important role in catheter maintenance for discharged patients with PICC.				
12	It's necessary for nurses to master the knowledge of PICC maintenance and complication management.				

13	Nurses need to master the PICC maintenance technique to better meet the needs of discharged patients with PICC.				
14	Participation in PICC maintenance training is important for nurses to improve relevant knowledge and skills.				
15	PICC maintenance training should be conducted regularly.				
16	I am interested in learning knowledge of PICC maintenance.				
17	I am willing to take an active part in PICC maintenance training.				

Supplementary Material 3. Peripheral Inserted Central Catheter Maintenance Practice Questionnaire

NO.	Item	Never	Seldom	Sometime	Often	Always
1	I take the initiative to learn the background knowledge and development status of PICC maintenance technology.					
2	I proactively follow the promotion of PICC maintenance technology.					
3	I am familiar with the types and specifications of PICC catheters.					
4	I learn about PICC maintenance and management of complications through electronic resources such as online databases and professional journals.					
5	I take the initiative to participate in the training related to PICC maintenance organized by the department and the hospital.					
6	I identify risk factors for PICC-related complications for patients with PICC.					
7	I provide targeted education to patients with PICC on maintenance related knowledge.					
8	I follow a standardized process for PICC maintenance no matter with or without supervision.					
9	I strictly follow the principle of asepsis when performing PICC maintenance.					
10	I master PICC flushing and sealing techniques.					
11	I can select the correct type and amount of PICC flushing and sealing fluids for patients.					
12	I can select the correct disinfectant solution and disinfection area when disinfecting the skin.					
13	I can correctly time the change of transparent dressings and connectors.					

14	When performing PICC maintenance, I assess the limb inserted with catheter to determine if there are any PICC-related complications.					
15	I properly manage various PICC-related complications.					
16	I indicate the date of maintenance and record relevant information in long-term care booklet after performing PICC maintenance.					