
Experience on the Protection and Management of PICC Patients in the Department of Hematology During COVID-19 Epidemic

Chen Jiayu

Department of Rheumatism, The First Affiliated Hospital of Jinan University, Guangzhou, China

Email address:

574262621@qq.com

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Abstract: *Objective* Discuss the prevention and control measures of the Department of Hematology and standardize the PICC catheter maintenance procedures during the outbreak of corona virus disease. *Method* Understand the severity of COVID-19, interpret relevant documents of the Ministry of Health and hospital prevention and control requirements, formulate prevention and control measures and improve the PICC catheter maintenance process during the epidemic, and provide special prevention care for 527 patients admitted to our department during the epidemic, provide PICC catheter maintenance for 205 hospitalized patients with catheters, and nursing 21 patients with related complications due to delayed maintenance of Catheter care. *Result* There was no infection in both doctors and patients during the epidemic; a total of 707 patients' catheters maintenance were completed and 17 cases were extubation, of which 3 cases were unplanned remove, and the symptoms of 21 cases of catheter-related complications were improved. *Conclusion* During the epidemic, strict prevention and control measures can effectively implement epidemic prevention and control, standardize PICC catheter maintenance procedures, and strengthen catheter assessment may reduce incidence of PICC catheter complications. Staying in Laminar flow room can protect Hematology patients.

Keywords: COVID-19, PICC Maintenance, Epidemic Prevention and Control, Hematology Patients, Safety

1. Introduction

The outbreak of Corona virus disease-2019 (corona virus disease-2019, COVID-19) occurred in 2020. It has not been found in humans before, and it has the characteristics of human-to-human transmission, multiple routes of transmission and easy spread, and can attack the human immune system [1]. According to the World Health Organization's daily epidemic report, as of 10:27 on September 3rd, 2020 (Beijing time), 26,067,292 confirmed cases of coronavirus have been reported globally, and 861,696 deaths. The number of confirmed cases of novel coronavirus in China exceeds 90,442. The annual incidence of leukemia in my country is 2.76 per 100,000 [2]. PICC catheters are widely used in clinics, especially for patients undergoing chemotherapy in the department of hematology, because of their long indwelling time, safety and painlessness, and the ability to take the catheter home during intermittent

chemotherapy. However, patients with hematological malignancies may have varying degrees of defects in cellular immunity or humoral immunity, they belong to the high-risk group of COVID-19, and once infected, the risk of death is extremely high [3]. During the epidemic, the number of unplanned maintenance of patients under management in our department has increased, and it is more common for delayed maintenance. In response to these situations, our department has formulated a series of measures to strengthen the prevention and control of the epidemic and standardize the process of catheter maintenance. Such measures have achieved good results. Details are as follows.

2. Materials and Methods

2.1. Materials

From December 30, 2019 to July 10, 2020, a total of 527 patients were admitted the Department of Hematology in our

hospital, of which 205 were admitted to the hospital with catheters, a total of 707 patients were provided catheter maintenance, of which 95 PICC catheters were indwelled by our department, and they are maintained 683 times, 4 PICC catheters were indwelled in other hospitals, and they were maintained 24 times. In these patients with catheters, 38 cases of acute myeloid leukemia, 1 case of chronic myeloid

leukemia, 19 cases of Lymphoma, 19 cases of acute lymphocytic leukemia, 1 case of chronic lymphocytic leukemia, 7 cases of myelodysplastic syndrome, 6 cases of multiple myeloma, 1 case of autoimmune hemolytic anemia, 2 cases of aplastic anemia, 1 case of paroxysmal hemoglobinuria. Among them, 3 were transplanted from our department. Details are as follows.

Table 1. Details of extubation.

project	group	frequency	Constituent ratio%
gender	Femal	49	51.58
	Male	46	48.42
age	≤18	5	52.63
	18-44	35	36.84
	45-59	28	29.47
	60-74	24	25.26
	75-81	1	1.05
	≥82	2	2.11
	illiteracy	3	3.16
Degree of education	Primary school	24	25.26
	Junior-senior High school	27	28.4
	Junior college	18	18.95
Catheter type	College graduate	23	24.21
	Bard 4Fr	80	80.81
	Power PICC SOLO 4F	3	3.03
	Power PICC SOLO 5F	11	11.11
	SHUBEIKANG 4fr PICC	1	1.01
Catheter port	Basilic vein	80	80.81
	Brachial vein	9	9.09
	Median cubital vein	8	8.08
	Other vein	2	2.02

2.2. Nursing

2.2.1. Protection Methods

By interpreting the prevention and control plan of the COVID-19 [4] and the technical guidelines for infection prevention and control in medical institutions, and Learn from the Guangdong Provincial Health Commission broadcasted by our hospital to carry out the epidemic infection control expert classroom activities, and timely follow the epidemic prevention requirements issued by the hospital to prevent and control during the epidemic, and formulate specific measures as follows:

(1) Admission screening of patients and accompanying staffs Check: (1) Strict temperature monitoring: The hospital's gate is equipped with a rapid temperature monitoring, which can quickly separate fever patients. The temperature $\geq 37.3^{\circ}\text{C}$ will be guided by a special person to the fever clinic for further screening and treatment. Patients with normal temperature were allow to enter the PICC catheter dressing room through dedicated channel. Before entering the dressing room, the medical staffs will re-measure the temperature of the patients and the accompanying staffs, only people with normal temperatures could get in. (2) Epidemiological history screening: The medical staffs will ask the patients and the accompanying staffs in detail about the epidemiological history and inform the promise. After the legal responsibilities, sign the letter of commitment with the patients, and hand it over to the nurse for safekeeping; (3) Both the patients and the

accompanying staffs must have a valid nucleic acid test (NAT) report before entering the ward.

(2) Protective measures for the dressing room:

(1) Setting special access channels for patients who entering in dressing room. (2) The novel coronavirus can survive up to 9 days on the surface of plastic, metal, glass and other objects [5], so the dressing room should be simple, non-essential items were not allowed place in the dressing room; (3) Keep air circulation in the dressing room, and arrange the dressing room in the negative pressure laminar flow room if possible [6]; (4) Family members are prohibited staying at dressing room during the dressing, and patients should leave the dressing room immediately after the dressing are changed. The nurse should wait for the patient to leave before calling the next patient; (5) The hematology patients in the granular deficiency stage are given priority to change the dressing in the laminar flow room, and the dressing should be changed on the upwind side [7], if there is no laminar flow room, it should be arranged in front of the dressing room window in a fresh and ventilated place [8]; (6) Each room in the ward, including the bathroom, should be disinfected with ultraviolet light at least once a day for at least 30 minutes each time to prevent cross-infection.

(3) Use protective equipment in the proper way: Wear masks correctly: Both nurses and patients must wear masks correctly when changing dressings. Before wearing masks, check the integrity of the masks and the quality of the elastic bands [9]. The nurse should wear an N95 mask or a KN95

mask for protection when conditions permit.

2.2.2. Catheter Assessment

Patient's education levels, physical conditions, traffic, family economic and family factors are the main reasons leading to poor compliance of catheter maintenance for patients with catheters discharged from hospital [10]. Under the influence of the COVID-19, we found that the number of patients who with PICC catheters but do not maintain it in time has increased. Therefore, we not only strengthened health education, but also strictly regulate the content of evaluation related to catheter maintenance [11].

(1) Overall Assessment: (1) Cognitive situations of patients: state of consciousness, awareness of the importance of catheter maintenance, the ability to self-manage the catheters, etc.; (2) The history of allergies to drugs, disinfectants and dressings; (3) Abnormal conditions: whether there was catheterization side limbs, shoulders, neck and chest swelling, pain, numbness and other discomforts, and whether the patient has coagulation dysfunction, etc.

(2) Local Assessment: (1) Assessment of local skin: Whether there is redness, swelling, heat, pain and other complications, or any rash and itching; (2) Assessment of puncture point: whether there is oozing of the blood and fluid, redness, swelling, tenderness, etc.; (3) Assessment of puncture side arm circumference; (4) Assessment of catheters joints: whether the joints are loose, whether they are in good condition, whether there are abnormal conditions such as blood or foreign bodies in the joints.

(3) Assessment of catheter function: (1) Whether the catheter is displaced or broken; (2) Whether there is blood residue in the lumen of the catheter; (3) Whether the catheter bolus or intravenous drip is unobstructed; (4) Whether the catheter is damaged or broken.

Details of Catheter assessment: 2 cases of delirious extubation, 1 case of partial catheter prolapses, 1 case of phlebitis, 8 cases of poor catheter infusion or catheter infusion completely blocked, 12 cases of oozing of blood at puncture point, 2 cases of partial broke of catheters, 1 case of catheterization limbs swollen, which diagnosis of venous malformation by catheterization by color Doppler ultrasound.

2.2.3. Cautions for Catheter Maintenance

(1) The operator should fully prepare the materials according to the assessment of the catheter to reduce the number of people going back and forth; (2) Emphasis on hand hygiene, set up a fixed hand disinfectant in each ward, emphasize hand hygiene, and avoid cross-infection: Before performing catheter maintenance, patients must wash their hands under running water according to the "seven-step hand washing method", contact with different parts of the same patient, use quick hand disinfectant for hand disinfection or wash hands under running water according to the actual situation; (3) Choose the right skin disinfectant: Choose the right disinfectant which is generally 75% alcohol, chlorhexidine gluconate with a concentration > 5%, iodophor with an effective iodine concentration of not less than 0.5%, or 2% iodine tincture solution [11], skin of patients after

hematopoietic stem cell transplantation are fragile, 2% chlorhexidine gluconate and 0.5% iodophor disinfectant are the best choice [12]; (4) The dressing change should be gentle: people who have skin rejection after hematopoietic stem cell transplantation will have very fragile skin and dermatitis. It is easy to tear the skin. Use 180° or 0° avulsion to remove the applicator. For those who have difficulty in avulsion, use a sterile cotton swab with normal saline to assist; (5) Use a gauze block at the puncture point to stop bleeding when we indwelling the new catheter, those with active bleeding at the puncture point, should be protected by a 3M elastic bandage [13], and do the first catheter maintenance after 24 hours. The puncture point can be covered with sterile alginate excipients to prevent bleeding, the blood oozing condition of one day puts pressure on the outside of the yarn block. There are some literatures [14] pointed out that the blood routine report showed that the platelet count was $0-20 \times 10^9/L$, and the catheter was placed for less than 24 hours, the dressing should be changed according to the situation, because the dressing may cause the puncture opening to split and cause new bleeding; (6) For the first dressing change, we can use applicators which can prevent phlebitis, and we can use plaster to prevent phlebitis; (7) Patient's catheter maintenance manual should be checked before each maintenance. If the catheter is found to be prolapsed, the current catheter should be recorded, and use sterile scissors to trim the exposed excess catheter. After the catheter maintenance, a chest radiograph should be taken to determine the position of the catheter tip, and finally determine whether the catheter can continue to be indwelled; (8) Catheter blockage treatment: hematology patients often have thrombocytopenia but increased D-dimer, and urokinase should be used carefully for thrombolytic treatment [15] to avoid aggravating the bleeding of patients; (9) Reduce the incidence of complications: Desensitization 3M transparent dressing can be selected as dressing to avoid unplanned extubation [16]. (10) Prevent the catheter from slipping out: It is recommended to use Sile buckle fixed catheters for all catheterized patients [17]. Patients with extubation tendency or accidental extubation are recommended to wear anti-extubation cuffs while sleeping, and irritable patients should be properly restrained.

2.2.4. Psychological Nursing

(1) Psychological nursing of patients: (1) Relieve the psychological concerns of patients: During this epidemic, some patients expressed that they were worried that going to the hospital for catheter maintenance would increase their risk of contracting coronavirus. They did not perform catheter maintenance on schedule or had the idea of removing the catheter themselves in advance. For this situation, let the patients know that the hospital have taken some measures to prevent and control coronavirus; secondly, inform the patient of the correct way to prevent and control coronavirus, such as wearing masks when going out and keeping social distancing, good hand hygiene and avoiding crowded places, etc.; (2) Inform patients of the necessity of indwelling catheters and the importance of correct maintenance of catheters [18].

(2) Psychological nursing of medical staffs: In a major public health incident, front-line medical staffs bear more pressure and risks, and are prone to pandemic-related negative emotions such as anxiety and depression [19, 20]. First of all, managers of hospital should pay attention to the mental health of front-line medical staffs, strengthen psychological counseling, induction training and hospital infection management, so that medical staffs can be more confident in the face of the epidemic and maintain a positive mental state. Secondly, it is essential to improve the hospital management model and build a reasonable and sound social support system. Psychological intervention for stressful physical and mental problems is an important way. Mindfulness decompression management can improve the physical and mental health of medical staff. Improve the work quality of medical staff and realize the improvement of the quality of medical services. Third, medical staffs should learn to self-regulate. Amateurs

can adjust the tense work rhythm by listening to soothing music, painting, etc., and proactively confide to relatives or colleagues or psychologists. If the pressure is too high, they should promptly report to the supervisor after treatment by the psychologist. Submit an application for suspension or transfer from front-line work; supervisors should be concerned about the mental state of subordinates, and promptly intervene when problems are discovered.

3. Result

3.1. The Occurrence of COVID-19

No coronavirus infection occurred in the hospitalized patients and their accompanying staffs in our department; The nucleic acid test results of throat swabs performed by medical staffs in the whole hospital on May 14 were all negative.

3.2. A Total of 707 Patients Were Performed Catheter Maintenance

3.2.1. Nursing of Extubation: 17 Cases of Extubation, Seeing Table 2

Table 2. Nursing of extubation.

Reason of extubation	Unplanned extubation		Other extubation			
	delirious	Catheter prolapse	Abandon treatment	Patients died	Catheter expiration	Complete treatment
Number of extubation	2	1	2	3	3	6
proportion (%)	11.70	5.88	11.76	17.65	17.65	35.29

3.2.2. Nursing of Complications: 27 Cases of Nursing of Complications, Seeing Table 3

Table 3. Nursing of complications.

complications	phlebitis	Blocked/catheter poor infusion	Oozing blood at puncture point	Limbs swelling at the side of catheter	Catheter broken	Catheter prolapse
Number Of patients	1	8	12	1	2	1
Proportion (%)	3.70	29.63	44.44	3.70	7.41	3.70
Result of nursing	Symptoms subsided	reopen	Symptoms subsided	Limbs no longer swell	Trim the catheter	extubation

4. Discussion

(1) The number of new cases of coronavirus in China is gradually decreasing, indicating that the epidemic situation in China has been controlled by the joint efforts of the people across the country. However, due to the gradual spread of foreign epidemics, China is still facing the pressure of importing overseas epidemics. It develops into deformed respiratory distress syndrome and leads to death [21], and the prevention and control of the epidemic cannot be relaxed. As hospitals are crowded public places, epidemic prevention and control are the top priority. Patients in the department of hematology have low immunity and are prone to various infections. It is particularly important to strictly screen patients and their accompanying staffs who enter the department. It is the first line of defense to prevent coronavirus infections in the hospital.

(2) Standardize the procedures of PICC catheter maintenance. (1) Do a good job in catheter assessment. A complete catheter assessment should include three parts: overall assessment, local assessment, and assessment of catheter

function. However, in clinical work, only local assessment and assessment of catheter function are often emphasized. Lack of the overall assessment of patients, especially the assessment of the patient's cognition. There are 3 cases of unplanned extubation that occurred in our department, of which 2 cases were unconscious patients. The main two reasons for extubation are as following: first, the patients had hallucinations and was very irritable, and the catheter maintenance nurse did not pay attention to the patient's consciousness and did not use the fixing devices of the catheters such as Sile buckle were reinforced; secondly, the replacement nurse did not evaluate the patient's consciousness and take corresponding measures to prevent extubation, such as wearing anti-extubation gloves. Therefore, to standardize the process of PICC catheter maintenance, we should first emphasize the full assessment of the catheter. (2) Prevention of complications. PICC brings great convenience to clinical patients, but also has some complications, such as phlebitis, deep vein thrombosis, ectopic catheters, local skin allergic dermatitis, etc., According to the different conditions of different patients, the corresponding nursing intervention methods can be carried out, which can effectively prevent the occurrence of catheter-related

complications [22]. Standardizing the catheterization process, strengthening nurse training, exchange of experience, and implementing the consultation system can effectively prevent the occurrence of PICC catheterization complications and extend the catheter indwelling time [23].

5. Conclusion

Strictly controlling admissions screening, strengthening patients' health education, and cleaning and disinfecting the ward environment can effectively prevent nosocomial infections of disease; and standardizing the catheter maintenance process can reduce the incidence of PICC catheter complications. Staying in Laminar flow room can protect Hematology patients. It is more feasible to prevent and control CoVID-19 by reducing the number of patients with tubes and reducing the rate of person-to-person contact, so that patients in the hematology department are relatively safe.

Conflict of Interest

All the authors do not have any possible conflicts of interest.

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