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Skin Disinfection with 2% Chlorine Gluconate-Adine in Autologous Peripheral Hematopoietic Stem Cell Transplantation Patients

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Abstract

Background: Autologous peripheral blood hematopoietic stem cell transplantation is widely used in the treatment of malignant lymphoma. Patients are prone to infection during the transplantation immune deficiency period. There has been a lot of clinical research into how to better manage this period of vulnerability. **Objective:** This study aims to investigate the efficacy of 2% chlorhexidine gluconate (CHG) for skin disinfection in patients undergoing autologous hematopoietic stem cell transplantation (HSCT) and observe any adverse reactions. **Methods:** A total of 106 patients receiving autologous hematopoietic stem cell transplantation from November 2019 to December 2020 in our district were selected as the control group. From January 2021 to January 2022, 106 patients with autologous hematopoietic stem cells were included in the experimental group. The control group used the immersion bath method. The experimental group was treated with an improved scrub bath method (including 3M 2% chlorhexidine gluconate medical sanitary wipes to wipe the whole skin once). **Results:** The bacteria-carrying rate of the improved method (37.74%) was significantly better than that of the traditional soaking method (72.64%), and the difference was statistically significant ($P < 0.05$). The disinfection effect of the improved scrub bath method is obviously better than that of the traditional soaking method. The incidence of adverse reactions, such as skin and mucous irritation, irritation and choking, in the experimental group was significantly lower than that in the control group. **Conclusion:** The improved bath/wipe method has a significant positive effect on skin disinfection for patients undergoing HSCT.

Keywords

2% Chlorhexidine Gluconate, Drug Bath, Skin Disinfection, Autologous Peripheral Blood Stem Cell Transplantation

1. Introduction

Autologous peripheral hematopoietic stem cell transplantation (APBSCT) has recently become widely used in the treatment of blood diseases and is the most effective treatment, especially for malignant lymphoma and myeloma [1]. However, patients undergoing APBSCT are extremely prone to infection during the transplant immunodeficiency period [2], which may lead to transplantation failure in severe cases [3]. Therefore, to avoid infection caused by decreased body resistance in sterile laminar flow wards [4], it is critical that patients effectively remove their pathogenic bacteria before transplantation, especially the permanent and temporary flora of the largest area of skin tissue in the human body [5]. Chlorhexidine gluconate (CHG) acts as a lysozyme, and a physical seal can be formed when CHG is adsorbed around microorganisms, leading to deformation and destruction of the cytoplasmic membrane and thereby inhibiting and killing microbial cells. This broad-spectrum antibacterial method is safe and easy to perform [6]. The skin and hand cleaning disinfectant and sanitary disinfection wipes used in this study contained 2% (1.8% - 2.2%) gluconate chloride as the main effective ingredient. Studies have shown that 2% CHG has the advantages of low irritation, less allergic reaction and almost no skin absorption toxicity [7]. This agent is suitable for disinfection of patients by hand washing and as a preoperative bath, but it is rarely used for skin disinfection of patients undergoing APBSCT. This study was conducted to investigate the efficacy and any adverse effects of 2% CHG for skin disinfection in patients undergoing APBSCT and provide a basis for clinical skin disinfection.

2. Methods

2.1. Study Participants

Among the patients with APBSCT at the institute of the current study, two groups of 106 patients each were selected for comparison of different skin disinfection methods—the improved bath/wipe method (experimental group) and the soaking bath method (control group). The control group was enrolled first from November 2019 to December 2020, and the experimental group was enrolled from January 2021 to January 2022. Inclusion criteria were age (18 - 70 years old), self-care ability, and barrier-free language communication. Exclusion criteria were age (<18 years old or >70 years old), impaired self-care ability, and communication barriers because of dialect or language. The control group had 51 women and 55 men (average age, 43.83 ± 13.79 years old), and 95 and 111

patients had lymphoma and multiple myeloma, respectively. The experimental group had 50 women and 56 men (average age, 41.77 ± 12.44 years old), and 99 and seven patients had lymphoma and myeloma, respectively. The two groups were similar in terms of sex, age, type of disease, and degree of disease. No between-group statistical differences were noted ($P > 0.05$).

2.2. Initial Preparation

Preparation for both groups 1 day before entering the laminar flow chamber was as follows: teeth were cleaned, external auditory canal and navel (with alcohol if necessary) were cleaned, fingernails were trimmed, and consultation was conducted in the stomatology and gynecology department (female patients). The patients then waited for treatment in the laminar flow ward the next day.

2.3. Disinfection Methods

The control group used the traditional soaking method. Patient preparation began by the patient self-cleaning the skin with ordinary bath lotion the night before, with instructions to pay attention to cleaning the skin folds, and the patient then changed into clean clothes. Environmental preparation was performed by the nurses the next morning, who cleaned the disposal room, cleaned and disinfected the bathtub, and conducted indoor disinfection under ultraviolet radiation for 1 h. Patient skin disinfection was performed by the nurse preparing a 1:2,000 chlorine solution at two-thirds of the bathtub capacity, adjusting the water temperature to 38˚C - 40˚C. After checking the patient, the nurse asked the patient to enter the disposal room and soak in the chlorine solution for 30 min [8]. The patient was instructed to repeatedly wipe the head, armpits, inguinal, perineum, and other skin folds with a sterile towel and cleans the nostrils and external auditory canal by washing chlorhexidine glycerin. Next, the patient administered Tarivid eye drops and used oral Yixin (containing cipyridine) to gargle twice for 3 - 5 min each time. The procedures for nurses also included following these instructions: observing whether the patient's body is fully immersed in chlorinated solution, not leaving the door of the disposal room, focusing attention on the water temperature and asking about the patient's perception of the temperature, and observing whether the patient has dizziness, panic, pale complexion, deficiency, skin irritation, and other symptoms. Finally, the nurses should inform patients to focus attention on safety precautions (e.g., anti-skid and anti-fall measures).

The experimental group used the improved bath/wipe method. Patient preparation began the night before entering the laminar flow chamber and 30 - 60 min in advance on the day of entering the laminar chamber by bathing with 2% CHG antibacterial shower gel (AihujiaTM skin and hand cleaning disinfectant). The patients were instructed to follow these bathing steps: 1) wet the whole body with warm water in the bathroom; 2) use an appropriate amount (3 mL) of 2% CHG antibacterial bath liquid to clean the head and face, especially the nostril

area, while avoiding contact with the eyes, and then rinse the cleaned areas with water; 3) use an appropriate amount (about 3 mL) of 2% CHG antibacterial bath liquid to scrub the neck, arms, and upper body, especially underarms and navel; 4) use an appropriate amount (about 3 - 4 mL) of 2% CHG antibacterial bath liquid to focus on cleaning the body parts typically covered (e.g., the groin, perineum, anus, with special attention to the male penis and subscrotum skin and the female vulva folds); and 5) use an appropriate amount (about 5 mL) of 2% CHG antibacterial bath liquid to clean the thighs, calves, and feet, and toes. The patients were also given these instructions: do not touch the eyes or enter mucous membranes (e.g., the ears); do not dilute the bath lotion with water; do not use moisturizer after the antibacterial bath is completed; replace sterile clothes after bathing; and if the disinfectant accidentally enters the eyes, immediately rinse them with water for 15 min, and notify the physician if the eyes do not improve after rinsing. Patients who are allergic to CHG were forbidden to use it. After all of these steps, the patient wears sterile clothes and puts on a sterile hat and mask before entering the disposal room, and the patient then wipes the skin of the whole body with 3M 2% chlorine gluconate medical sanitary wipes once. The wiping order is as follows: 1) head, chest, and abdomen; 2) upper limbs, shoulders, and underarms; 3) perineum; 4) left lower limb; 5) right lower limb; 6) back and buttocks. Next, the face is wiped using a pure water wipe wrapped separately. Patient instructions are to use six wet wipes (one pack) at one time to fully wipe all parts of the body and to wait to dry naturally. The wet wipes contain moisturizing ingredients; thus, after wiping, the skin may have a short-term stickiness, which is a normal phenomenon and will disappear after drying. By the way, all operations in the control group were performed at room temperature (22˚C - 25˚C). Finally, the eye drop administration, oral gargling treatment, and environmental preparation processes are similar to the control group. During the disinfection process, nurses should focus on the patient's discomfort and the main complaint.

2.4. Evaluation Method

After the drug bath, the patients in both groups wore sterile slippers and sat on a chair covered with sterile sheets. Bacterial culture samples were taken in seven body parts (e.g., eyes, ears, pharynx, nose, armpit, navel, and perianal area). The incidence of dizziness, postural hypotension, fall, cold and fever, skin irritation, and other adverse reactions were simultaneously observed and compared between the two methods.

3. Statistical Approach

Data analysis was performed using the statistical analysis software SPSS version 20.0 (IBM, Armonk, NY, USA). The positive rate and incidence of adverse reactions of the two medicinal bath methods are tested by χ^2. A difference of $P < 0.05$ was considered statistically significant.

4. Results

Between the two drug bath methods, the disinfection effect of the improved bath/wipe method was better than that of the traditional immersion method, and the difference was statistically significant ($P < 0.05$; Table 1).

The adverse effects of the two drug bath methods were postural hypotension, skin mucosal irritation symptoms, irritant cough, and other effects. The incidence of adverse effects in the experimental group was lower than that of the control group, which was statistically significant ($P < 0.05$; Table 2).

5. Discussion

A comparison of the two skin disinfection methods in patients with APBSCT showed a higher rate of skin sterilization after using the improved bath/wipe method, which was significantly better than the traditional soaking method, suggesting that the skin disinfection effect containing 2% chlorine gluconate is better.

In addition, the traditional soaking method requires that patients must soak in the bath for 30 min, during which time the water temperature may easily decrease. With this method, the control group had the following adverse effects: eight patients developed a cold, three had skin itching and other skin stimulation symptoms, two had dizziness, and one collapsed and fell. Thus, the patient satisfaction with and comfort in using this method is low. Reported adverse effects of CHG include not only strong irritation to the skin and mucosa [9] but also cough, causing patient injury. In addition, with the traditional soaking method, nurses cannot leave the disposal room and must accompany the patient to the bath and spend long working hours, even explaining the procedure two or three times to older people.

In contrast, the improved bath/wipe method is simple and easy to perform, the skin exposure time is brief, and the patient is less likely to develop a cold (only one patient had a cold and low fever in the experimental group), and the

Table 1. Comparison of skin disinfection rates after the drug bath (n, %).

project	experimental group	control group	χ^2	P
infection	66	29	26.11	0.000
Free from infection	40	77		
positive rate (%)	37.74	72.64		

Table 2. Comparison of the incidence of drug bath-related adverse reactions (%)

project	experimental group	control group	χ^2	P
Have adverse reaction	1	14	12.13	0.000
No adverse reaction	105	92		
occurrence rate (%)	0.94	13.21		

chance of dizziness and fall is very small. In particular, 3M 2% chlorine gluconate disinfection wipes contain moisturizing skincare ingredients, which improve the patient's comfort and satisfaction. In addition, the improved bath/wipe method greatly shortens the labor cost of nurses, optimizes the nursing process, and is conducive to providing quality nursing services for patients.

6. Limitations

Without the joint research practice of multiple hospital centers, the acceptance of programs by patients in different hospitals will be different, and the possible effects will be different.

7. Conclusion

In conclusion, the improved bath/wipe method has an accurate disinfection effect and less incidence of adverse reactions, which is easier to understand, easier to operate, and higher security, especially for the elderly, and labor-saving, and is better than the traditional soaking method. In addition, the improved method is also suitable for [2] female patients who are menstruating to reduce patient concerns and improve clinical satisfaction, which deserves further research for clinical promotion.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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