

Summary of Nursing Experience for Severe Complications after Hematopoietic Stem Cell Transplantation

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ABSTRACT

TA-TMA is one of the serious complications after hematopoietic stem cell transplantation. It has a rapid onset rate and seriously threatens the lives of patients. In clinical practice, it is necessary to strengthen the nursing intervention for TA-TMA. Based on the relevant treatment of a patient with TA-TMA after hematopoietic stem cell transplantation, this article summarizes the symptomatic nursing plans for symptoms such as thrombocytopenia, neurological injury, severe infection and renal system injury in the patient, with the aim of providing practical references for the nursing of similar patients in clinical practice.

KEYWORDS

Hematopoietic stem cell transplantation; Thrombotic microangiopathy; Nursing

1 Introduction

Hematopoietic stem cell transplantation is an important treatment for severe hematological malignancies such as leukemia and lymphoma, as well as severe aplastic anemia. However, after transplantation, common complications such as infection and graft-versus-host disease (GVHD) are prone to occur due to factors such as low immune function in patients and toxic side effects of pre-treatment regimens. These complications can cause progressive damage to the patient's skin, liver, kidneys and hematopoietic system. Transplantation associated thrombotic microangiopathy (TA-TMA) is a serious complication after hematopoietic stem cell transplantation. Its typical clinical manifestations include microangiopathy hemolysis and decreased platelet count. In some cases, acute renal function impairment, fever and other symptoms may also occur. In severe cases, it may even lead to abnormal mental state and neurological dysfunction. The clinical symptoms of this disease lack specificity, making early diagnosis difficult and posing a great challenge to timely treatment. Therefore, how to better identify and care for such serious complications and improve the prognosis of patients has become a key issue that urgently needs to be overcome in the field of clinical nursing. This article will summarize the nursing experience of severe complications after hematopoietic stem cell transplantation based on practical cases. In April 2025, a patient with TA-TMA complications after transplantation was admitted to the Fifth Affiliated Hospital of Guangzhou Medical University and successfully discharged after relief.

2 Case introduction

The patient, female, 35 years old, chose to seek medical treatment at the Second Affiliated Hospital of Guangzhou Medical University on September 1, 2023 due to stomach discomfort. Blood routine examination shows: white blood cell count of $8.8 \times 10^9/L$, hemoglobin of 83g/L, platelet count of $85 \times 10^9/L$, and monocyte count of $5.1 \times 10^9/L$. The results of blood smear microscopy show that primitive cells are easily visible in white blood cells, and primitive cells account for 68% of white blood cells. On September 4, 2023, after completing bone marrow puncture and other examinations, the patient was diagnosed with acute myeloid leukemia M4. On April 26, 2025, the patient underwent hematopoietic stem cell transplantation at the Fifth Affiliated Hospital of Guangzhou Medical University. In the first 2 weeks after transplantation, the patient's condition stabilized and cyclosporine and methotrexate were used according to the routine protocol to prevent GVHD.

On May 12th, the patient developed a fever with a maximum body temperature of $39.2^{\circ}C$, accompanied by coughing and sputum, which appeared yellow and viscous. Blood routine examination shows: white blood cell count of $12.3 \times 10^9/L$, hemoglobin level of 65g/L, and platelet count of $28 \times 10^9/L$. Chest CT showed multiple infiltrations in both lungs, and blood and sputum cultures were simultaneously sent for testing. Given the low immune status, it is highly suspected that there is a risk of severe infection combined with TA-TMA. In response to the risk of infection, cefoperazone sodium and sulbactam sodium (3g/time, intravenous infusion every 8 hours) were used to cover common pathogenic bacteria and form an initial anti infection defense line. At the same time, considering the patient's weakened immune system, posaconazole (300mg each time, orally twice a day), voriconazole (200mg each time, intravenously infused every 12 hours), and esconazole (200mg each time, intravenously infused once a day) were added for preventive antifungal treatment. For cytopenia, the white blood cell-increasing drug PEG-rhG-CSF (3mg subcutaneously injected once every

three days) and red blood cell and platelet transfusions were used to correct anemia and thrombocytopenia. At the same time, monitor the blood routine dynamically and adjust the dosage according to the increase of white blood cells. During this period, the related indicators of renal function were monitored simultaneously. It was found that the patient's serum creatinine gradually increased ($80\mu\text{mol/L}$ on May 20th and rose to $130\mu\text{mol/L}$ on May 25th), and the urine output decreased compared with before. The 24-hour urine output gradually decreased from 1500ml to about 1000ml. It was considered that TA-TMA involved the kidneys and there was renal function impairment. Furthermore, the precise recording of input and output has been strengthened, unnecessary water intake has been restricted, and capacity overload has been guarded against.

On June 10th, the patient's body temperature dropped to 37.8°C , and the symptoms of coughing and expectoration were alleviated. On June 13th, the body temperature returned to $36.5\text{--}37.2^{\circ}\text{C}$, and the sputum turned white and thin. The re-examination of blood routine showed that the white blood cell count was $8.2\times 10^9/\text{L}$, the hemoglobin was 69g/L , and the platelet count was $35\times 10^9/\text{L}$. The chest CT showed that the infiltration shadows in both lungs were absorbed compared with before, and the infection symptoms were effectively controlled. On June 15th, the patient suddenly suffered from epilepsy during sleep at night, presenting with loss of consciousness, upward rolling of the eyes, and tonic-clonic convulsions of the limbs. Medical staff immediately administered sodium valproate for antiepileptic treatment, provided oxygen, cleared oral secretions, and initiated electrocardiogram monitoring to monitor vital signs. After two minutes, the patient's convulsions stopped and consciousness gradually returned, but symptoms such as drowsiness and dizziness still persisted. Subsequently, five plasma exchange treatments were given successively, and defibrinogen and rituximab injection were used for combined intervention. On June 20th, the patient's blood routine indicators steadily improved, meeting the clinical improvement criteria, and the patient was discharged from the hospital.

3 Nursing experience of severe complications after hematopoietic stem cell transplantation

3.1 Early screening of TA-TMA

Considering the rapid onset of TA-TMA, early screening is of vital importance. The main clinical manifestations of TA-TMA include a series of characteristic symptoms. Microangiopathy hemolysis is often manifested as accelerated destruction of red blood cells. Patients may present with anemia symptoms such as pale complexion and fatigue, accompanied by abnormal laboratory indicators such as elevated serum bilirubin and increased reticulocytes. A decrease in platelet count can easily lead to phenomena such as petechiae on the skin and mucous membranes, bleeding gums, and fever. The fever symptoms are mostly persistent moderate to high fever, and the effect of body temperature control after conventional anti-infection treatment is not good. Renal function impairment is often manifested as reduced urine output, edema, elevated levels of serum creatinine and urea nitrogen, etc. In addition, some patients may also experience abnormal changes in the nervous system such as headache, confusion, and numbness in limbs. During the progression of the disease, symptoms of functional disorders in multiple organs such as the heart and lungs may occur.

3.2 Symptomatic care for TA-TMA

Firstly, strengthen targeted care for thrombocytopenia. Thrombocytopenia is one of the core manifestations of TA-TMA. The main reason is that platelet aggregation leads to thrombosis, causing a sharp decrease in the number of platelets in peripheral blood due to "excessive consumption". In nursing, it is necessary to closely monitor platelet count. When it is less than $20\times 10^9/\text{L}$, the risk of spontaneous bleeding is higher. At this time, nursing staff need to take measures to prevent bleeding. At the operational level, invasive operations must be strictly controlled to minimize intramuscular injections, arterial puncture, etc. If venous puncture is necessary, priority should be given to using fine indwelling needles of 22G or higher specifications. The puncture process should be gentle and precise to avoid repeated punctures causing vascular damage. After the puncture is completed, a sterile cotton ball should be used to vertically press the puncture point for at least 10 minutes, and the pressure should be uniform and stable to prevent subcutaneous hematoma caused by improper pressing. At the therapeutic level, a stepwise intervention should be implemented. When the platelet count remains persistently low and early bleeding symptoms such as skin ecchymosis occur, the responsible nurse should promptly perform apheresis platelet intravenous infusion and closely monitor for any allergic reactions during the infusion process. At the same time, plate-raising drugs should be used in combination to promote platelet production. The dosage and frequency of medication should be dynamically adjusted according to the recovery of platelets to ensure the effectiveness of the treatment. At the daily management level, it is necessary to focus on reducing the risk of bleeding and build a full-scenario protection system. Medical staff should provide patients with anti-collision protective gear, add thick cotton pads to the bed rails, and guide them to wear soft-soled anti-slip shoes to reduce limb bumps and lower the risk of accidental bleeding.

Secondly, strengthen targeted care for the nervous system. TA-TMA is a group of clinical complex disorders with tissue

damage in multiple systems. Approximately 70% of patients will present with neurological dysfunction to varying degrees. Epilepsy is one of the common diseases of the nervous system. The epileptic seizure of the patient in this case is closely related to the microcirculation disorder and ischemia and hypoxia of brain tissue caused by TA-TMA. Medical staff need to keep a close eye on the patient's condition at all times. Besides the routine observation of consciousness and pupils, they should also monitor the patient's limb sensation and mental state, and pay attention to whether there are any prodromal symptoms such as numbness or tingling in the limbs. The responsible nurse needs to monitor the electroencephalogram (EEG) every shift. If any abnormal EEG activity is detected, preventive antiepileptic drug intervention should be given in advance as per the doctor's advice. At the same time, the ward environment needs to be adjusted, with the temperature controlled at around 24°C and the humidity between 50% and 60%, to reduce the stimulation of environmental factors on the patient's nervous system. Nursing staff should guide patients to perform simple finger grasping and limb stretching activities 3 to 4 times a day, each time for 15 to 20 minutes, to promote the recovery of nerve function. Considering that TA-TMA may cause multi-system damage, when patients' neurological care is affected by complications of other systems, collaborative care should be achieved. For instance, in view of the bleeding risk of patients due to coagulation dysfunction, when performing electroencephalogram electrode placement and limb rehabilitation massage, it is necessary to pay attention to gentle movements, appropriately extend the pressing time, and observe whether there is any subcutaneous ecchymosis. It should be particularly noted that during an epileptic seizure, patients may lose consciousness and their limbs are prone to uncontrolled convulsions and large-scale swaying. Medical staff should quickly remove dangerous items from the bedside, fix the bed rails and surround the patient's body with soft pillows to prevent accidental injuries such as falling out of bed and fractures.

Thirdly, strengthen targeted care for severe infections. When TA-TMA is complicated with severe infection, nursing should focus on infection control, protection of multiple system functions and collaborative care. In view of the multi-system damage characteristics of TA-TMA itself, medical staff need to monitor the vital signs of patients dynamically. Each shift should monitor infection indicators such as blood routine and procalcitonin. Once infection is confirmed, medical staff should strictly follow the doctor's advice and implement the anti-infection plan. In terms of infection control, intravenous infusion of cefoperazone sodium and sulbactam sodium should be administered in combination with antifungal therapy. During the treatment process, it is necessary to strictly control the administration time and contraindications, and observe whether the patient has adverse reactions such as rash and nausea. Before performing intravenous infusion of voriconazole, the responsible nurse should use a specialized solvent to fully dissolve the drug to prevent crystallization, and inspect the puncture site every 2 hours. If there is redness, swelling, or pain, the infusion route should be changed in a timely manner to prevent phlebitis. In terms of multi system functional protection, due to the risk of respiratory failure caused by infection, nurses should assist patients in turning over and patting their backs every 2 hours. If breathing difficulties occur, relevant personnel should promptly activate mechanical ventilation and strictly follow the aseptic principle during the operation to prevent ventilator-associated pneumonia and protect the patient's respiratory system. Meanwhile, during anti-infection treatment, nursing staff need to dynamically monitor blood pressure, heart rate, as well as the infusion access and drip rate to avoid overburnishing the patient's heart and protect the patient's circulatory function. In terms of collaborative care, nursing staff should work with doctors to adjust the care plan. Based on the results of blood routine tests, CT scans, etc., they should adjust the frequency of environmental disinfection and the density of monitoring. When there are concurrent neurological complications such as epilepsy, medical staff should promptly clear the respiratory tract and protect the limbs to prevent secondary injuries to the patient. Subsequently, plasma exchange treatment should be provided in a timely manner, and the exchange process should be precisely executed.

Finally, strengthen symptomatic care for the renal system. The care of the renal system should focus on three major goals: early monitoring, functional protection, and prevention of complications. In terms of early monitoring, the responsible nurse should monitor the levels of serum creatinine, urea nitrogen and serum uric acid at regular intervals every day, and pay attention to the patient's urine output. If the urine output is less than 0.5ml/kg·h for six consecutive hours, it is necessary to be alert to insufficient renal perfusion or renal function damage. In addition to the monitoring of basic indicators, it is also necessary to strengthen the monitoring of electrolytes and acid-base balance. Renal function impairment is prone to cause electrolyte imbalance in patients (such as hyperkalemia and hyperphosphatemia) and metabolic acidosis. In this case, the nursing team strengthened electrolyte monitoring after the patient's epileptic seizure and promptly detected mild hyperkalemia, and improved the condition by limiting the intake of high potassium foods and intravenous infusion of sodium bicarbonate to avoid the risk of arrhythmia. In terms of functional protection, for renal function impairment caused by TA-TMA, nursing needs to achieve functional protection by optimizing blood perfusion and reducing factors of renal injury. On the one hand, medical staff should precisely control fluid replacement based on the patient's renal function status. When a patient is in the compensatory stage of renal function, normal saline or balanced fluid should be given priority to avoid excessive fluid replacement and increase the burden on the kidneys. When a patient experiences oliguria or anuria, the daily fluid replacement volume should be no more than the previous

day's urine volume plus 300ml to avoid volume overload caused by a large amount of fluid replacement in a short period of time. On the other hand, medical staff need to strictly sort out the medication list, avoid nephrotoxic drugs such as aminoglycoside antibiotics and non-steroidal anti-inflammatory drugs. When antifungal drugs are necessary, the dosage should be adjusted based on the blood creatinine level and the blood drug concentration should be monitored to reduce the risk of kidney damage.

4 Conclusion

Although the probability of TA-TMA and other serious complications after hematopoietic stem cell transplantation is relatively low, such complications develop rapidly and have the characteristics of multi-system tissue damage. If not intervened in time, it may cause the death of patients in a short period of time. Therefore, in clinical practice, it is essential to enhance the awareness of early warning, accurately identify early signs through dynamic monitoring of typical indicators, and promptly initiate comprehensive intervention plans. Nursing work requires simultaneous follow-up of multi-system symptomatic care to build a solid defense line against complications. At the same time, it is necessary to deepen the research on the influencing factors of complications, improve the accuracy of early intervention, gain precious treatment time for patients, and minimize the risk of adverse prognosis to the greatest extent.

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