



Holistic Nursing Care In Bone Marrow Transplantation: A Case Study Of Multiple Myeloma

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Abstract:

This case study examines the management and clinical outcomes of a 59-year-old male diagnosed with multiple myeloma, a rapidly progressing hematologic malignancy. After completing several cycles of chemotherapy, the patient achieved remission and was recommended for an autologous bone marrow transplant (BMT). The pre-transplant conditioning regimen included stem cell collection, high-dose chemotherapy, and subsequent stem cell infusion. The patient was closely monitored for common post-transplant complications, including infection, graft-versus-host disease (GVHD), and mucositis. Following a successful engraftment phase and appropriate supportive care, the patient demonstrated positive outcomes, with improved blood counts and a stable recovery.

Nursing care played a central role throughout the transplant process. Key responsibilities included infection prevention, pain management, nutritional support, and monitoring for complications such as GVHD and mucositis. Nurses implemented strict infection control protocols, provided education on self-care and symptom recognition, and offered emotional support. During the post-transplant phase, blood counts were monitored, infection precautions were enforced, and chemotherapy-related side effects were managed.

The successful outcome of this case highlights the importance of comprehensive nursing interventions in enhancing patient recovery, reducing complications, and supporting a smoother post-BMT recovery.

Keywords: Bone marrow transplantation, multiple myeloma, nursing care.

1. Introduction

Multiple myeloma is a cancer that originates from plasma cells, a type of white blood cell in the bone marrow responsible for producing antibodies that help fight infections. In this disease, plasma cells become malignant and multiply uncontrollably, producing large quantities of abnormal antibodies. This process disrupts normal immune function and causes damage to bones, kidneys, and other organs.

Advances in diagnostic tools and treatment strategies have significantly improved survival rates for patients with multiple myeloma. Rapid molecular and cytogenetic testing plays a critical role in tailoring individualized treatment plans. While chemotherapy remains the cornerstone of therapy, autologous stem cell transplantation is particularly beneficial for patients with high-risk genetic features.

Bone marrow transplantation (BMT) is a crucial treatment for various hematologic and immunologic disorders, including leukaemia, lymphoma, and inherited blood diseases. The procedure involves replacing diseased or damaged bone marrow with healthy hematopoietic stem cells, either from the patient (autologous) or from a donor (allogeneic). This helps restore normal blood cell production and strengthens the immune system.

2. OVERVIEW OF THE CONDITION

Multiple myeloma is a disease of the bone marrow, characterized by the malignant proliferation of plasma cells. Plasma cells are a type of white blood cell that produces antibodies to help fight infections. In multiple myeloma, these plasma cells become cancerous and multiply uncontrollably, leading to an excess of abnormal proteins (known as M proteins). This accumulation can cause significant damage to the bones, kidneys, and other organs.

As the cancerous plasma cells accumulate in the bone marrow, they crowd out healthy blood-forming cells. Rather than producing functional antibodies, the malignant cells secrete ineffective proteins that contribute to complications associated with the disease.

Patients typically present with anemia, recurrent bacterial infections (especially pneumonia), thrombocytopenia, bone pain or fractures, amyloidosis, hyperviscosity syndrome, and cryoglobulinemia. The clinical presentation may vary depending on the severity of organ involvement. Recent consensus guidelines from the European LeukemiaNet (ELN) emphasize the importance of molecular characterization and risk stratification in managing multiple myeloma. These approaches help tailor treatment based on genetic risk profiles.

3. NURSING CONSIDERATIONS DURING HISTORY TAKING AND PHYSICAL EXAMINATION

When collecting patient history and performing physical examinations, nurses should be attentive to a range of signs and symptoms resulting from ineffective erythropoiesis and bone marrow suppression. These may include:

- Recurrent infections
- Fatigue and generalized weakness
- Anemia-related symptoms (shortness of breath, chest tightness, pallor)
- Easy bruising or prolonged bleeding
- Headaches and bone pain

The progression of symptoms in multiple myeloma is usually rapid, often evolving over days to weeks.

Common physical examination findings include:

- Pallor and fatigue
- Weakness in the extremities
- Nausea and vomiting
- Fever
- Unexplained weight loss
- Petechiae or bruising

4. CASE DESCRIPTION

A 59-year-old male presented with symptoms of persistent fatigue, recurrent infections, and abnormal blood counts. Following diagnostic evaluation and confirmation of multiple myeloma through a bone marrow biopsy, the patient underwent several cycles of chemotherapy. After achieving remission, he was referred for an autologous bone marrow transplant (BMT).

4.1 DIAGNOSIS AND INDICATION FOR BMT

The diagnosis of multiple myeloma was confirmed via bone marrow biopsy, which revealed a hypercellular marrow with 62% plasma cells. Additional diagnostic work-up included:

- Complete blood count showing pancytopenia
- Serum protein electrophoresis for M-protein detection
- Free kappa and lambda light chain assays
- Urinalysis to evaluate renal involvement
- Fluorescence in situ hybridization (FISH) for chromosomal abnormalities

Given the patient's response to initial chemotherapy (VRD regimen: bortezomib, lenalidomide, dexamethasone), an autologous stem cell transplant was indicated to prolong remission.

4.2 PRE-TRANSPLANT WORKUP

4.2.1 Clinical Assessment

Upon admission, the patient underwent a comprehensive evaluation by the Bone Marrow Transplant (BMT) team, which included an oncologist, transplant physician, nursing staff, and a dietician. Clinical symptoms at the time included:

- Persistent fever
- Severe fatigue
- Splenomegaly (enlarged spleen)

4.2.2 Laboratory Workup

The following tests were conducted as part of the pre-transplant assessment:

- **Complete Blood Count (CBC):** Revealed severe pancytopenia (low red blood cells, white blood cells, and platelets)
- **Serum Protein Electrophoresis:** Identified monoclonal proteins (M-protein)
- **Bone Marrow Biopsy:** Confirmed diagnosis of multiple myeloma with hypercellular marrow and 62% plasma cells
- **Free Light Chain Assays:**
 - Free Kappa
 - Free Lambda
 - Free Kappa/Lambda ratio
- **Urinalysis:** Checked for renal function and signs of infection
- **Fluorescence In Situ Hybridization (FISH):** Assessed for chromosomal abnormalities and genetic mutations

These investigations helped stratify the patient's risk level and confirmed eligibility for autologous stem cell transplantation.

4.2.3 Treatment Plan Prior to Transplant

- The patient received **four cycles** of the **VRD regimen** (bortezomib, lenalidomide, dexamethasone).
- After confirming remission, the patient proceeded to **stem cell collection (apheresis)** on Day -1.

- **CD34+ hematopoietic stem cells** were harvested from peripheral blood and **cryopreserved** for transplantation.

4.3 THE TRANSPLANT PROCESS

4.3.1 Conditioning Phase (Chemotherapy and/or Radiation)

On **Day -1**, the patient received **high-dose chemotherapy** with **melphalan**, a potent alkylating agent used to eliminate residual myeloma cells and prepare the bone marrow for new stem cells.

Goals of conditioning:

- Eradicate remaining malignant cells
- Suppress the immune system to prevent rejection
- Create space in the bone marrow for engraftment

4.3.2 Stem Cell Infusion (Day 0)

Following chemotherapy, the **autologous stem cell infusion** was performed on **Day 0** via a **central venous line**. The infusion lasted approximately one hour.

Potential complications during infusion included:

- Allergic or anaphylactic reactions
- Fluid overload
- Early onset symptoms resembling **Graft-Versus-Host Disease (GVHD)**, although rare in autologous transplants

4.3.3 Neutropenic Phase (Post-Infusion, Days +1 to +14)

The patient entered a **neutropenic phase**, lasting approximately 2–4 weeks. During this time, immune function was critically suppressed, increasing vulnerability to infection.

Key nursing interventions:

- Strict **infection control protocols** (isolation precautions, hand hygiene)
- **Prophylactic antimicrobials** (antibiotics, antifungals, antivirals)
- Administration of **colony-stimulating factors** (e.g., G-CSF)
- Monitoring for **febrile neutropenia**

4.3.4 Engraftment Phase (Typically Day +10 to +21)

Engraftment was confirmed when **neutrophil counts** recovered ($ANC > 500/mm^3$), accompanied by improvements in hemoglobin and platelets.

Indicators of successful engraftment:

- Recovery of WBCs, RBCs, and platelet counts
- Resolution of fever and mucositis
- Absence of infections or new complications

4.3.5 Post-Engraftment Phase

Following engraftment, the patient remained under close observation for **GVHD-like symptoms**, viral reactivation, or late-onset complications. Immune reconstitution occurred gradually over weeks to months.

5. NURSING MANAGEMENT AND INTERVENTIONS

5.1 Infection Prevention and Control

- Implemented **strict aseptic techniques**, especially during central line care
- Maintained **neutropenic precautions** (e.g., HEPA-filtered room, protective isolation)
- Administered **prophylactic antimicrobials**
- Provided regular **oral care** to prevent **mucositis**
- Educated the patient and caregivers on hygiene, mask use, and avoiding crowded spaces

5.2 Pain Management

- Managed **mucositis-related oral pain** using:
 - **Magic mouthwash**
 - **Topical anesthetics**
 - **Systemic analgesics** (e.g., acetaminophen, opioids if needed)

5.3 Nutritional Support

- Initiated a **neutropenic diet**, avoiding raw fruits, vegetables, and unpasteurized products
- Monitored **fluid and electrolyte status**
- Provided **high-protein, calorie-rich meals** to support recovery
- Administered **enteral or parenteral nutrition** if oral intake was insufficient

5.4 Monitoring for Complications

- **GVHD monitoring** (despite being an autologous transplant, rare auto-inflammatory effects may mimic GVHD):
 - Skin rashes
 - Diarrhea or abdominal pain
 - Elevated liver enzymes
- **Cytokine Release Syndrome (CRS)** was observed post-infusion and managed with **Tocilizumab**
- **Veno-Occlusive Disease (VOD)** was ruled out via:
 - Daily weight checks
 - Abdominal girth measurements
 - Liver function tests

5.5 Post-Transplant Follow-Up

- The patient was **discharged on Day +15** in stable condition
- Scheduled for regular follow-ups, including:

- **CBCs and blood chemistries**
- **Chimerism testing** (to confirm autologous cell persistence)
- Monitoring for **delayed infections or relapse**

5.6 Family and Patient Education

- **Infection prevention** (hand hygiene, food safety, avoiding pets/crowds)
- Early signs of **infection, GVHD, or CRS**
- **Medication adherence** and management of side effects
- Importance of **follow-up visits**, vaccinations, and dietary precautions

6. DISCUSSION

This case study presents the clinical journey of a 59-year-old male diagnosed with **multiple myeloma**, treated successfully with **autologous bone marrow transplantation** following chemotherapy-induced remission. Bone marrow transplantation remains a cornerstone in the management of hematologic malignancies such as multiple myeloma, particularly in eligible patients with high-risk disease features.

Key complications such as **infection, cytokine release syndrome**, and **mucositis** were anticipated and effectively managed through **comprehensive nursing care** and **supportive interventions**. The role of nurses was pivotal in minimizing post-transplant complications, ensuring symptom relief, maintaining nutritional status, and providing emotional support.

Through consistent monitoring, patient education, and collaboration with the multidisciplinary team, a favourable outcome was achieved. The success of this case emphasizes the importance of **early intervention, coordinated care, and nurse-led patient management** in improving quality of life and long-term recovery following transplantation.

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