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Nursing Care for the Patient with Cavernous Sinus Thrombosis and Mucormycosis: A Case Report Based on Gordon's Functional Health Patterns Model

Kavernöz Sinüs Trombozu ve Mukormikozlu Hastada Hemşirelik Bakımı: Gordon'un Fonksiyonel Sağlık Örüntüleri Modeline Dayalı Bir Olgu Sunumu

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Abstract

This study aimed to provide an evidence-based nursing care plan using Gordon's Functional Health Patterns Model for a patient with cavernous sinus thrombosis and mucormycosis in the ICU. A 41-year-old female with visual impairment was diagnosed with rhinocerebral mucormycosis after further investigation. She received 37 days of intensive care and was assessed across 11 functional health areas. Several nursing diagnoses guided the interventions and outcomes. The study emphasized systematic assessment and individualized interventions, demonstrating Gordon's model's effectiveness in managing the patient's physical, emotional, and social needs. The findings suggest the model is useful for planning care for ICU patients with mucormycosis, while also highlighting the need for increased awareness and research on its prevalence and management.

Keywords: Cavernous sinus thrombosis, mucormycosis, case report, nursing care

Özet

Bu çalışma, yoğun bakım ünitesinde cavernous sinus trombozu ve mukormikoz tanısı konmuş bir hasta için Gordon'un Fonksiyonel Sağlık Modelleri'ne dayalı kanıta dayalı bir hemşirelik bakım planı sunmayı amaçlamıştır. Görme bozukluğu ile başvuran 41 yaşındaki kadın hasta, ileri incelemeler sonucunda rinosefalik mukormikoz tanısı almıştır. Hasta, 37 gün süreyle yoğun bakımda tedavi edilmiş ve 11 fonksiyonel sağlık alanı açısından değerlendirilmiştir. Birkaç hemşirelik tanısı, müdahaleleri ve sonuçları yönlendirmiştir. Çalışma, sistematik değerlendirme ve bireyselleştirilmiş müdahalelerin önemini vurgulamış ve Gordon'un modelinin, hastanın fiziksel, duygusal ve sosyal ihtiyaçlarını yönetmedeki etkinliğini göstermiştir. Bulgular, bu modelin yoğun bakımda mukormikozlu hastalar için bakım planlamada faydalı bir araç olduğunu, ayrıca mukormikozun yaygınlığı ve yönetimi konusunda artan farkındalık ve araştırma ihtiyacını vurgulamaktadır.

Anahtar Kelimeler: Kavernöz sinüs trombozu, mukormikoz, vaka raporu, hemşirelik bakımı

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SUMMARY STATEMENT

1-What is known about this topic?

- Mucormycosis is a rare, rapidly progressing fungal infection with high mortality, primarily observed in immunosuppressed individuals.
- Cavernous sinus thrombosis (CST) is a life-threatening complication, typically arising from the intracranial spread of infections originating from the sinuses, nose, and orbit.
- The co-occurrence of mucormycosis and CST is extremely rare, and the interaction between these two conditions presents significant challenges in diagnosis and treatment.

2-What are the results of this article?

- This case involves a rare patient who developed mucormycosis while being monitored for a diagnosis of cavernous sinus thrombosis.
- It remains unclear whether mucormycosis developed as a result of CST or as a secondary effect of immunosuppression induced by CST treatment; this is a controversial issue in the literature.
- The case highlights the systematic implementation of nursing care using Gordon's Functional Health Patterns Model and demonstrates how this model guides critical care nursing practice.

3-What are the contributions of this article?

- Although the co-occurrence of mucormycosis and CST is rare, the use of a systematic model (Gordon's model) in complex cases supports effective decision-making in nursing care.
- This case emphasizes the importance of integrating nursing models into clinical decision support systems and serves as an example in both educational and clinical guidance.
- The case contributes to the literature by promoting structured nursing care, increasing awareness, and emphasizing an interdisciplinary approach in similar cases.

Introduction

Mucormycosis is a rare but aggressive angio-invasive fungal infection caused by molds from the order Mucorales, particularly species of the genus *Rhizopus*.[1,2] It leads to vascular thrombosis and extensive tissue necrosis, often resulting in high morbidity and mortality. The global incidence of mucormycosis ranges from 0.005 to 1.7 cases per million people.[3] ~~but~~ However, its burden has increased in recent years due to the growing population of immunocompromised individuals and the widespread use of immunosuppressive therapies.

Epidemiological studies estimate that mucormycosis accounts for approximately 8–13% of all invasive fungal infections among high-risk groups, particularly patients with hematological malignancies, organ transplantation, or uncontrolled diabetes.[3] Notably, India reports the highest burden globally, contributing to nearly 70% of all documented cases. ~~while~~ In the United States, the Centers for Disease Control and Prevention (CDC) estimates approximately 500 cases per year..[3] Transmission primarily occurs through the inhalation of fungal spores or via direct inoculation through skin injuries such as burns or trauma. [2] These modes of transmission underscore the importance of early detection, especially in intensive care settings where vulnerable patients are frequently exposed.

Predisposing risk factors include diabetes mellitus, hematologic malignancies, solid organ transplantation, iron overload, malnutrition, burns, prolonged broad-spectrum antibiotic use, and intensive care unit (ICU) hospitalization. [4] The disease manifests in various forms: rhino-orbital-cerebral (44–49%), cutaneous (10–16%), pulmonary (10–11%), disseminated (6–11%), and gastrointestinal (2–11%). The infection typically begins in the paranasal sinuses and can progress to the orbit and brain, leading to severe complications [2].

Management involves addressing underlying risk factors, radical surgical debridement, and systemic antifungal therapy. [1] One of the most severe and life-threatening complications of mucormycosis is cavernous sinus thrombosis (CST), which results from the hematogenous spread of infection from adjacent anatomical regions such as the sinuses, nose, or orbital structures. Historically, the mortality rate of CST was as high as 80–100% before antibiotic use, though modern therapies have reduced this to 20–30%. [5] Although CST is considered rare, it has an annual incidence of approximately 0.2 to 1.6 cases per 100,000 people. It most commonly affects adults aged 20 to 40, with a slight female predominance. Septic CST is frequently associated with infections such as sinusitis, facial cellulitis, or dental abscesses. Despite early antibiotic use and radiological advancements, it continues to pose high morbidity risks due to potential complications such as cranial nerve palsies, meningitis, and intracranial abscess. [6,7] However, CST remains a significant clinical challenge, especially when it arises as a complication of mucormycosis, necessitating early recognition and prompt multidisciplinary intervention.

Given the complexity of the clinical picture and the multifaceted care needs, this study presents a CST case secondary to mucormycosis, evaluated using Gordon's Functional Health Patterns (FHP) and NANDA nursing diagnoses as a structured nursing care approach. Gordon's Functional Health Patterns (FHP) model, developed by Marjory Gordon, provides a systematic and holistic framework for assessing patients' health status through 11 interrelated functional

areas. These include areas such as health perception, nutrition, elimination, sleep, cognition, coping, and interpersonal relationships.[8,9] The model aims to guide nurses in identifying actual or potential health problems, planning individualized care, and promoting holistic nursing interventions. FHP is widely used in both acute and chronic care settings, including intensive care units, as it allows for a comprehensive assessment of complex patient needs.[10] In this study, Gordon's model was chosen to structure and guide the nursing care plan due to the multifaceted clinical presentation of the patient and the need for integrated and person-centered care. The case presented in this study was evaluated and interpreted using Gordon's Functional Health Patterns (FHP) Nursing Care Model and NANDA nursing diagnoses.

The combination of mucormycosis and cavernous sinus thrombosis is a rare and clinically challenging condition, with limited reports available in the current literature. To the best of our knowledge, this is one of the first case reports to apply Gordon's Functional Health Patterns Model to a patient diagnosed with both conditions simultaneously. This unique application underscores the model's flexibility and relevance in managing complex, multisystemic, and life-threatening conditions in intensive care nursing, thereby offering valuable contributions to both clinical practice and nursing education.

Case Report

A 41-year-old single woman was admitted to a public training and research hospital on March 15, 2022, due to CST and was subsequently transferred to the stroke ICU for further management. The patient's relatives provided informed consent before data collection.

Patient data were gathered using Gordon's Functional Health Patterns Nursing Care Model, incorporating structured interviews, physical examinations, laboratory assessments, and existing medical records. NANDA nursing diagnoses were applied based on the collected information. The study adhered to the CARE checklist guidelines. [11]

Socio-Demographic Characteristics

The patient, a primary school graduate and housewife, lived alone, relying on her brother for assistance when needed. She had a medical history of hypertension, diabetes mellitus (DM), and chronic kidney disease (CKD), requiring dialysis thrice weekly. There was no known drug or food allergy history, though she had undergone right arm surgery for fistula placement. Her mother had a history of DM, but no other chronic conditions were noted in her family.

Upon admission, the patient presented with a one-week history of left eye swelling and vision loss, along with a four-day history of a dental abscess. She had started antibiotic treatment on March 14, 2022. Examination revealed left-sided facial paralysis, and laboratory tests showed elevated inflammatory markers: C-reactive protein (CRP) 121 mg/L, white blood cell count

(WBC) 19.67 K/uL, and procalcitonin (PCT) 6.16 ng/mL. Ophthalmologic consultation confirmed complete right eye blindness due to DM and recent vision loss in the left eye. Neurology consultation suspected CST secondary to a dental abscess. Brain CT and MRI confirmed the diagnosis (Figure 1).

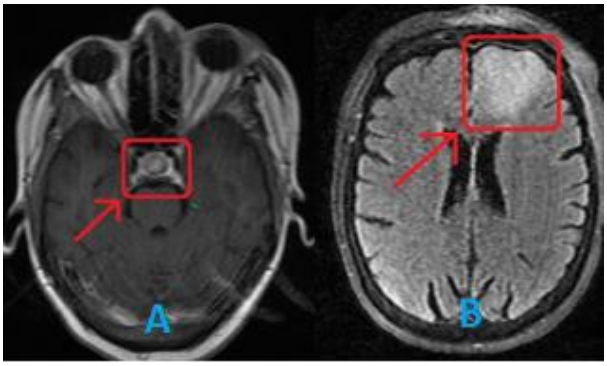

Figure 1A. Contrast-Enhanced Axial MRI Demonstrating Cavernous Sinus Thrombosis

1B. T2-Weighted MRI Showing Abscess Formation in the Left Frontal Lobe Due to Fungal Invasion

Medical History

On ICU admission, the patient was alert, cooperative, and breathing ambient air while receiving a Regimen 3 diet. Examination revealed hemorrhagic oral mucosa, upper palate necrosis, and widespread ecchymoses, particularly on the left breast and inner canthus of the left eye. There were no pressure ulcers.

Methylprednisolone (1×1 g/day) was initiated for CST, resulting in hyperglycemia managed with antidiabetic therapy. By the seventh day, clinical deterioration raised suspicion of mucormycosis due to worsening left eye ecchymosis and necrosis spreading to the left facial region (Figure 2). A biopsy of the necrotic tissue on April 22, 2022, confirmed Mucor-Aspergillus infection. Triple antibiotic and antifungal therapy were initiated, and debridement was planned in coordination with Ophthalmology, ENT, and Neurosurgery.

Figure 2. Clinical Appearance of the Patient on the 5th Day of ICU Admission Showing Periorbital Tissue Involvement

The patient developed increased secretions and drowsiness, necessitating cessation of oral intake due to aspiration risk. On day 15, a fever >38°C prompted culture-guided antibiotic adjustments (Table 1). An MRI on day 18 revealed a brain abscess. The patient was transferred to Neurosurgery for abscess drainage, requiring a hemovac drain placement. Following surgery, extubation attempts failed, leading to a percutaneous tracheostomy.

Table 1. Treatment Administered to the Patient After the Diagnosis of Mucormycosis

Drug name	Dosage	Application
Enoxaparin 0.3 ml	2x1	SC
Severamel carbonate 800 mg tb	3x1	NG
Esmolol Hydrochloride inf	20 ml/h	IV
Paracetamol 100 mg vial	1x1	IV
Pantoprazole 40 mg vial	1x1	IV
Moxifloxacin 0.5% Eye Drops	3x1	Both eyes
Amphotericin B 50 mg vial	1x 350 mg	500 cc in 5 hours in 5% dex inf
Meropenem 1 g	1 x 500mg	IV inf in 150 cc isotonic
Isoconazole Nitrate cream	2x1	To the armpits
Diabetic nutrition solution containing Protein, Carbohydrate, Fat, Vitamins, and Minerals	40 cc/h	NG
Balanced Electrolyte 1000 cc inf	40 cc/h inf	IV

Due to hemodynamic instability, planned facial debridement could not proceed. On day 30, hypotension necessitated inotropic support, and the patient required mechanical ventilation in SIMV mode. Despite interventions, the patient suffered a cardiac arrest on day 37 and passed away.

Evaluation of the Case According to Functional Health Patterns

This section includes the patient's data discussed under FHP.

Perception of Health - Management of Health

The patient perceived her health condition as poor, expressing exhaustion from managing CKD, DM, and HT.

Nutrition and Metabolic Status

Initially, on a Regimen 2 diet, enteral nutrition with diabetic formula was introduced following hemodynamic deterioration. Enteral nutrition led to intermittent diarrhea and increased metabolic demand.

Elimination

Bowel function changed from once every two days to once every four days. Diapers were required for encopresis.

Table 2. The data regarding the patient's vital signs throughout her treatment process

Hospitalization day	Fever	Blood Pressure	SpO2	Respiratory Rate	Heart Rate	Respiration Mode	Blood Glucose Level	Clinical Course (Summary)
1st day	36.4	186/104 mmHg	98	17	98	Ambient air	386 mg/dL	The patient was taken to the ICU. Treatment with of 1x1 g corticosteroid was initiated.
	36.2	144/92 mmHg	94	10	76		186 mg/dL	
3rd day	36.9	195/110 mmHg	100	24	102	Ambient air	401 mg/dL	Her blood glucose level had a labile course.
	36.4	118/82 mmHg	92	11	84		68 mg/dL	
7th day	37.4	198/101 mmHg	100	32	135	Nasal O_2 5 l/min	298 mg/dL	Hemodynamics was deteriorating. Steroid therapy was completed. A biopsy was taken from the patient with the suspicion of mucormycosis.
	36.8	134/79 mmHg	83	24	101		156 mg/dL	
10th day	37.3	150/92 mmHg	100	34	141	Mask O_2 8 l/min	236 mg/dL	The patient was diagnosed with *mucor-aspergillus.* Amphotericin-B of 1x350 mg was initiated.
	36.9	104/88 mmHg	92	28	104		186 mg/dL	
18th day	38.8	166/89 mmHg	100	14	136	SIMV-VC 100% O2	226 mg/dL	The patient underwent an MRI. She had an abscess evacuation surgery and was intubated.
	37.6	114/78 mmHg	92	14	104		134 mg/dL	
23rd day	37.4	158/82 mmHg	100	18	132	SIMV-VC 50% O_2	198 mg/dL	The patient was being followed up as intubated. An extubation attempt was made.
	36.7	98/48 mmHg	96	14	98		154 mg/dL	
28th day	37.1	144/86 mmHg	100	24	136	Easy Breath 5 l/min	216 mg/dL	Tracheostomy was performed on the patient.
	36.2	128/74 mmHg	96	18	92		148 mg/dL	
30th day	36.9	121/71 mmHg	100	25	110	SIMV-VC 80% O_2	228 mg/dL	The patient's hemodynamics were was disturbed. Inotropic support was initiated.
	36.1	62/42 mmHg	94	12	88		151 mg/dL	
37th day	36.4	92/44 mmHg	95	36	141	SIMV-VC 100% O_2	112 mg/dL	The patient died.
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Activity and Exercise

ICU nurses assisted with all self-care activities. The patient had dyspnea and fluctuating respiratory rates (12–36/min). Deep tracheal aspiration was required for secretion clearance Table 2).

Sleep and Rest

The patient struggled with sleep initiation and maintenance during ICU admission.

Cognitive Perception

Initially alert and oriented, her cognition deteriorated over time. Chronic pain (VAS: 8) was reported in joints and the back.

Self-Perception

Expressed despair and fear, feeling overwhelmed by her chronic conditions.

Role and Relationship

Limited family interactions; only maintained a close relationship with her brother.

Sexuality and Reproduction

As Patient K.K. was in the ICU, no information on this topic could be obtained and evaluated.

Coping and Stress Tolerance

High stress levels manifested as agitation and shouting. The patient requested to see her brother, but COVID-19 restrictions prevented visits.

Nursing Diagnoses According to NANDA-I Taxonomy II

This section includes the nursing diagnoses and interventions applied, which were included in NANDA-I Taxonomy II and determined by the patient's data. Table 3A and Table 3B shows the nursing care plan applied to the patient in accordance with the nursing diagnoses of acute pain, hyperthermia, impaired oral mucous membrane integrity, ineffective breathing pattern, the risk for infection, the risk for impaired skin integrity, imbalanced nutrition, ineffective health self-management, risk for unstable blood glucose level.

Table 3A. Physiological Nursing Diagnoses Based on NANDA-I Taxonomy II

Nursing Diagnosis		*Nursing Outcomes Classification (NOC)*	*Nursing Interventions Classification (NIC)*	**Assessment**
Acute Pain-00132 **Domain:** 12 Comfort **Level:** 1 Physical Comfort	**Defining Characteristics:** The patient's grimace, pain severity score of eight according to the Visual Analog Scale and uneasy and painful facial expression. **Associated Factors:** CST, long-term hospitalization in the ICU	***Pain Control -1605*** **Domain:** Health Knowledge and Behavior **Level:** Health Behavior **Indicators:** 160502- Identifying the onset of pain 160501- Identifying the causative factors 160510- Recording the symptoms that change over time 160503- Measures to prevent pain 160504- Non-pharmacological methods for pain relief (massage, relaxing position) 160505- The use of recommended analgesics	***Pain Management: Acute -1410*** **Domain:** 1 Physiological: Basic **Level:** Physical Comfort Promotion ▪ Evaluate and define the location, characteristic, onset time, frequency, nature, severity, and factors reducing and increasing pain ▪ Observe non-verbal signs of discomfort, especially in patients who cannot communicate effectively ▪ Monitor pain using a valid and reliable rating tool suitable for the age and communication skills ▪ Use therapeutic communication strategies to acknowledge the patient's pain experience and to communicate your acknowledgment of their response to pain ▪ Question the knowledge and beliefs of patients and their relatives about pain and consider the cultural influences on the response to pain ▪ Determine the required frequency to assess whether the patient has relaxed and follow up the patient according to the follow-up plan ▪ Determine the severity of pain during movements such as coughing and deep breathing, ambulation, and transfers to the armchair	At ICU admission, the patient reported severe pain with a Visual Analog Scale (VAS) score of 8/10. After the initiation of pharmacological and non-pharmacological pain management interventions, the VAS scores progressively decreased over five days, with values of 6/10 on Day 2, 5/10 on Day 3, 4/10 on Day 4, and 3/10 by Day 5. These improvements reflected a partial but clinically meaningful reduction in pain intensity.
Hyperthermia- 00007 **Domain:** 11 Safety/protection **Level:** 6 Thermoregulation	**Defining Characteristics:** The patient's body temperature of 38.8°C (Fever in intensive care patients is interpreted as hyperthermia in case of body temperature> 38.3 ^{0}C). The mean pain score by VAS ranged between 3 and 5.	***Thermoregulation-0800*** **Domain:** Physiological Health **Level:** Metabolic Regulation **Indicators:** 080009 Sweating when it is hot 080010 Shivering when it is cold 080012 Radial pulse rate 080013 Respiratory rate	***Hyperthermia Treatment-3786*** **Domain:** 2 Physiological: Complex **Level:** Thermoregulation ▪ Monitor the vital signs and give oxygen as needed ▪ Loosen or remove their clothes ▪ Apply external cooling methods as appropriate (for example, cold packs and cooling blankets on the neck, chest, abdomen, scalp, armpits, and groin). ▪ Wet the body surface and air the room ▪ Install a urinary catheter and monitor urine output ▪ Monitor the abnormalities in the mental state (e.g., confusion, strange behavior, anxiety, agitation, seizures, and coma) ▪ Monitor arterial blood gases and electrocardiography results ▪ Monitor complications (e.g., renal failure, acid-base imbalance, coagulopathy, pulmonary edema, cerebral edema, and multiple organ dysfunction syndrome)	The patient's hyperthermia symptoms were controlled, and her body temperature remained within normal limits (Table 3).

Impaired Oral Mucous Membrane Integrity-00045 **Domain:** 11 Safety/protection **Level:** 2 Physical Injury	**Defining Characteristics:** Dryness of the oral mucous membrane and tongue discoloration **Associated Factors:** The presence of necrosed tissue in the upper palate due to mucormycosis, inadequate oral hygiene and malnutrition	***Oral Health-1100*** **Domain:** Physiological Health **Level:** Tissue Integrity **Result Indicators:** 110001 Oral hygiene 110002 Hygiene of teeth 110003 Hygiene of gums 110004 Hygiene of tongue 110005 Hygiene of dentures 110009 Moistness of lips 1100010 Moistness of oral mucosa and tongue 1100011 Color of mucous membranes (pink) 1100012 Oral mucosa integrity	***Oral Health Maintenance -1710*** **Domain: 1** Physiological: Basic **Level:** Self-care Facilitation ▪ Create an oral care routine ▪ Apply lubricant to moisturize the lips and oral mucosa as needed ▪ Monitor the teeth for color, brightness, and the presence of residue ▪ Determine the risk of developing stomatitis secondary to drug therapy ▪ Encourage and help the patient to rinse their mouth ▪ Monitor the therapeutic effects of topical anesthetics, oral protective pastes, and topical or systemic analgesics as appropriate ▪ Instruct and help the patient to perform oral hygiene after eating and as often as needed ▪ Monitor the signs and symptoms of glossitis and stomatitis ▪ Help with prosthesis care as needed ▪ Encourage the patients who wear dentures to brush their gums and tongue and to wash their oral cavities daily.	The necrosed tissue remains in the oral mucous membrane of the patient. Intra-oral dryness connected to the intubation tube.
Ineffective Breathing Pattern- 00032 **Domain:** 4 Activity/rest **Level:** 4 Cardiovascular/pulmonary responses	**Defining Characteristics:** Tachypnea (36/min), hypoxemia (SpO_2:88), secretion, dyspnea, the use of auxiliary respiratory muscles **Associated Factors:** Pain, fear, anxiety	***Respiratory Status-0415*** **Domain:** Physiological Health **Level:** Cardiopulmonary **Indicators:** 041501 The speed of breathing is 12-20/min 041502 The rhythm of breathing is regular 041503 The depth of inspiration not to increase 041504 Absence of pathological lung sounds in the auscultation of respiratory sounds ***Respiratory Status: Gas Exchange-0402***	***Respiratory Monitoring-3350*** **Domain: 1** Physiological: Basic **Level:** Respiratory Management ▪ Monitor the respiratory rate, rhythm, depth, and effort ▪ Note down the chest movement, symmetry, the use of auxiliary muscles, supraclavicular and intercostal muscle retractions ▪ Monitor the breathing patterns (e.g., bradypnea, tachypnea, hyperventilation, Kussmaul breathing, Cheyne-Stokes breathing, apneustic respiration, Biot breathing) ▪ In patients undergoing sedation (e.g., SaO2, SvO2, SpO2) constantly monitor the oxygen saturation levels as specified ▪ Palpate the equal lung expansion through physical examination ▪ Listen to the breathing sounds, and determine the need for aspiration by listening to wheezes and roncuses in the main airways ▪ Carry out arterial blood gas monitoring ▪ Intubate the patient if they meet the criteria for intubation.	The patient was intubated, and a tracheostomy was performed as she could not be extubated.

		Domain: Physiological Health **Level:** Cardiopulmonary **Indicators:** 040208 PaO2 is within the range of 80-100 mmHg 040209 PaCO2 is within the range of 80-100 mmHg 040211 SaO2 is within the range of 95-100%		
Risk for Infection – 00004 **Domain:**11 Safety/protection **Level:** 1 Infection	**Risk Factors:** Chronic diseases (DM), invasive procedures, mechanical ventilation, nutrition less than the body needs **Associated Factors:** The use of high-dose immunosuppressants, existing diagnosis of dental abscess and mucormycosis, long-term hospitalization in the ICU	***Risk Control: Infection Process-1924*** **Domain:** Health Knowledge & Behavior **Level:** Risk Control **Indicators:** 192426 Identifying the infection risk factors 192405 Defining the signs and symptoms of infection 192411 Ensuring a clean environment 192415 Hand hygiene practices 192420 Monitoring the changes in general health	***Infection Protection-6550*** **Domain: 4** Safety **Level:** Risk Management ▪ Monitor the signs and symptoms of systemic and localized infections ▪ Monitor the absolute granulocyte count, albumin, serum protein, WBC, and the differential results ▪ Ensure asepsis for the patient at risk ▪ Maintain the isolation techniques as appropriate ▪ Limit the number of visitors as appropriate ▪ Administer the appropriate antibiotic therapy ▪ Check the skin and mucous membranes for redness, extreme temperatures, or discharge ▪ Take cultures when necessary ▪ Encourage adequate nutrient intake, and encourage fluid intake as appropriate ▪ Monitor the change in energy level or weakness ▪ Encourage deep breathing and coughing as appropriate	There is an increase in the patient's body temperature, as well as in the infection parameters from their laboratory findings (Table 3). The risk of infection continues.
Risk For Impaired Skin Integrity-00047 **Domain:** 11 Safety/protection **Level:** 2 Physical injury	**Risk Factors:** Having a Braden risk assessment scale score of nine, immobilization	***Tissue Integrity: Skin & Mucous Membranes-1101*** **Domain:** Physiological health **Level:** Tissue Integrity **Indicators:**	***Skin Surveillance-3590*** **Domain: 2** Physiological: Complex **Level:** Skin/wound Management ▪ Evaluate the skin and mucous membranes for redness, temperature increase, discharge, and edema ▪ Take care that the patient's clothes are not too tight and do not squeeze the patient ▪ Evaluate the patient's skin in terms of dryness ▪ Identify the situations that may cause friction	No pressure injury was observed in the patient.

		110101 The temperature of the skin is within the normal febrile range 110102 Sensory loss 110103 Loss of elasticity 110104 Hydration	▪ Evaluate the edematous Domains for infection ▪ Evaluate the extremities in terms of temperature, edema, status of pulses, and ulcerations ▪ Provide training for the patients and patient relatives about maintaining skin integrity	
Imbalanced Nutrition: Less Than Body Requirements- 00002 **Domain:** 2 Nutrition **Level:** 1 Ingestion	**Defining Characteristics:** Loss of appetite, nausea, inability to finish the meal fully **Associated Factors:** Difficulty in swallowing, insufficient food intake, dyspnea on exertion	***Nutritional Status-1004*** **Domain:** Physiological health **Level:** Digestion and Nutrition **Indicators:** 100401 Nutritional intake 100402 Solid food intake 100408 Fluid intake 100403 Energy ***Nutritional Status: Biochemical Measures - 1005*** **Domain:** Physiological health **Level:** Digestion and Nutrition **Result Indicators:** 100501 Serum albumin 100504 Hemoglobin 100510 Serum transferrin 100505 Total iron binding capacity	***Nutrition Management-1100*** **Domain: 1** Physiological: Basic **Level:** Nutrition Support ▪ Determine the patient's ability to meet nutritional needs ▪ Teach the patient and their family the patient's nutritional needs (e.g., discuss dietary guides and nutrition pyramids) ▪ Determine the calorie amount and types of nutrients needed to meet the patient's nutritional needs (in collaboration with a dietitian as appropriate) ▪ For patients with insufficient protein intake or losing protein, consult a dietitian to determine their necessary protein amounts ▪ Consult a physician to determine whether appetizers, nutritional supplements, nutrition through a feeding tube, or Total Parenteral Nutrition (TPN) are needed to maintain sufficient calorie intake ▪ For a patient unable to receive oral nutrition, initiate TPN at the appropriate speed per hour with a physician's order	The patient's nutrition during her hospital stay could not be properly provided due to her poor hemodynamics. After the seventh day, the patient was provided enteral nutrition by inserting a nasogastric probe.
Risk For Unstable Blood Glucose Level -00179 **Domain:** 2 Nutrition **Level:** 4 Metabolism	**Risk factors:** The diagnosis of DM and the use of high-dose steroids	***Blood Glucose Level-2300*** **Domain:** Physiological Health **Level:** Therapeutic Response **Indicators:**	***Hyperglycemia Management -2120*** **Domain: 2** Physiological: Complex **Level:** Electrolyte and Acid-Base management ▪ Monitor the blood sugar levels as specified ▪ Monitor the signs and symptoms of hyperglycemia: polyuria, polydipsia, polyphagia, weakness, lethargy, blurred vision, or headache ▪ Monitor urine ketones as specified ▪ Administer insulin as prescribed	After discontinuation of steroid therapy, blood glucose levels remained at normal levels (Table 3).

	230001 No deviation from normal blood glucose level 230004 No deviation from normal levels of glycated hemoglobin 230008 Lack of glucose in urine 230008 Absence of ketones in urine	▪ Consult a doctor if the signs and symptoms of hyperglycemia persist or worsen. ▪ Anticipate situations in which insulin requirements will increase (e.g., concomitant illness) ▪ Encourage self-monitoring of blood sugar levels ▪ Give instructions to the patient and their family members on diabetes management during illness, including the use of insulin and/or oral agents, monitoring the fluid intake, carbohydrate replacement, and when to seek help from a healthcare professional	

Table 3B. Psychosocial and Health Management Nursing Diagnoses Based on NANDA-I Taxonomy II

Ineffective Health Self-Management- 00276 **Domain:** 1 Health Promotion **Level:** 2 Health management	**Defining Characteristics:** Inability to perform activities of daily living, inability to place the treatment program in her everyday life, incompetence in prevention to reduce risk factors, and comorbidity **Associated Factors:** Lack of information about the therapeutic program**,** inadequate perception regarding the severity of the condition	***Self-management: Chronic disease-3102*** **Domain:** Health Knowledge and Behavior **Level:** Health Management **Indicators:** 310206- Monitoring the signs and symptoms of the disease 310211- Following the treatment recommendations 310213- Using the treatment devices correctly 310219- Following up the therapeutic effects of medical treatment 310241- Participating in the educational programs 310242- Monitoring the changes associated with the disease 310244- Participating in the health care decisions 310247- Developing a plan for medical emergencies	***Self-efficacy Enhancement -5395*** **Domain: 3** Behavioral **Level:** Coping Assistance ▪ Discover the individual's perception of their ability to perform the required behavior ▪ Discover the individual's perception of the benefits of performing the required behavior ▪ Determine the individual's perception of the risks of not performing the required behavior ▪ Identify the obstacles to changing behavior ▪ Provide information about the required behavior ▪ Reinforce the confidence of the patient to make behavioral changes and take action ▪ Provide an environment that supports the learning of the knowledge and skills needed to perform the behavior ▪ Use cultural and age-appropriate teaching strategies (e.g., games, computer-aided teaching, or conversation maps) ▪ Model or show the required behavior	The patient did not show the necessary compliance with the diet and use of medications for the hospitalization period.

Discussion and Conclusion

The nursing process is a scientific method, which nurses widely use, forms the basis of nursing practices, guides the procedures, and qualifies the care. Nurses utilize models/theories to systematize the care they provide for patients and ground it on evidence.

In this study, Gordon's Functional Health Patterns Nursing Care Model was implemented to solve the issues of a patient diagnosed with mucormycosis during CST treatment, and a care plan was prepared using NANDA nursing diagnoses. In the evaluation of the patient, she was determined to have problems in areas such as nutrition, excretion, sleep, activity/rest, self-perception, and security/protection. Considering the case's issues, nursing diagnoses and interventions were determined according to the NANDA taxonomy.

Although many nursing interventions applied to the patient solved the patient's acute problems, the patient died. In the case report presented by Jacob and Chaney (2016), similar health problems were detected, and the patient was discharged after three months. [12] In addition, in the case report presented by Ito et al. (2022), which shows a similar study example with a case diagnosed with mucormycosis and COVID-19, the patient died as in our case. [13] Moreover, in the case report of Bellazreg et al. (2016), in which they examined five patients with mucormycosis, three patients had sequelae and were discharged, while two patients died. [14]

It is vital to control the anxiety of patients treated in the ICU who have chronic diseases and cannot meet their self-care needs alone. The increase in the patient's anxiety, the lack of information, and the fear of death adversely affect the treatment. [15,16] Therefore, it is necessary to relieve the patient psychologically and to take the necessary measures environmentally and sociologically.

The patient in the present case had a diagnosis of CKD and DM. When patients with mucormycosis were examined in the literature, the predisposing factor with the highest frequency (60-80%) was reported to be diabetes. [17] The blood glucose level, which had a labile course in the first days of the patient's treatment, was controlled in the following days. The changes in blood glucose levels are believed to have been caused by methylprednisone. The literature reports that patients with diabetic mucormycosis mostly show rhino-orbital involvement. [18] When the relationship between chronic kidney disease and mucormycosis is examined, CKD has been determined to be an important predisposing factor.[19] These results support our case.

The literature has indicated retinal artery thrombosis, involvement of cranial nerves V and VII, brain abscess, CST, and internal carotid artery thrombosis as the complications of mucormycosis. [20] The fact that a brain abscess was developed during the treatment of our case

supports this finding. However, while our case was being treated in the ICU for the diagnosis of CST is in line with the literature, the question of whether CST developed after mucormycosis or mucormycosis developed due to immunosuppression after CST treatment cannot be answered definitely.

The success of mucormycosis treatment is directly proportional to early diagnosis. In the analysis of the 70 cases examined by Chamilos G. et al., a six-day delay in treatment arrangement was reported to double the mortality after one month. [21] The treatment of rhino-orbital mucormycosis consists of the systemic administration of high doses of amphotericin B in combination with total surgical debridement of infected tissues. Amphotericin B should be systematically administered IV at a 1-1.5 mg/kg dose for at least 6-10 weeks. [22] Although surgical treatment is recommended in mucormycosis, patients recovered with antifungal treatment have also been reported.[12,23] In our case, while antifungal treatment was administered for four weeks in accordance with the literature, total surgical debridement could not be administered, and the patient died.

Beyond the clinical complexity of the case, the nursing care process involved significant emotional and ethical challenges. Due to infection control protocols during the COVID-19 pandemic, the patient remained isolated from her family throughout her ICU stay, which increased her psychological distress. Her verbal expressions of fear, despair, and longing for her brother underscored the emotional burden she carried. Despite efforts to ensure comfort, end-of-life care was complicated by restricted communication and visitation. This case emphasizes the critical role of ICU nurses not only in managing physiological deterioration but also in addressing the human needs for connection, dignity, and psychological support at the end of life.

Reflections on Practice

This case report provided valuable insights into the application of standardized nursing models in managing complex and rare infections in intensive care settings. The use of Gordon's Functional Health Patterns model enabled the nursing team to deliver holistic and patient-centered care, ensuring that physiological, psychosocial, and self-management needs were comprehensively addressed. Reflecting on this experience, it is evident that early recognition of atypical co-infections, timely interdisciplinary collaboration, and structured nursing assessment tools significantly enhance care outcomes in critically ill patients. These lessons may inform future nursing practices, particularly in the context of emerging infectious diseases and multifaceted clinical presentations.

Conclusion

In conclusion, we nurses constitute an inevitable part of the care of patients with mucormycosis, an opportunistic infection with high morbidity and mortality. We should remember that using models that offer a holistic and systematized approach to our care increases our quality of care and patient satisfaction. In our case, the FHP Care Model was used in nursing care. Accordingly, the FHP Care Model is considered a valuable and practical model that can be used in professional nursing care as it enables the evaluation of the care process of a patient diagnosed with mucormycosis.

Limitations of the Case

This case report presents several limitations. First, it is based on a single patient, which inherently limits the generalizability of the findings. Second, the rare co-occurrence of mucormycosis and cavernous sinus thrombosis poses challenges in drawing comparisons with existing literature and in establishing broader clinical implications. Despite these limitations, the case contributes valuable insights into the application of structured nursing models and individualized care planning in rare, complex intensive care scenarios.

Ethical Approval and Patient Consent

Written informed consent was obtained from the patient's legal representative for the publication of clinical information and images in this case report. All ethical principles regarding patient privacy, dignity, and confidentiality were strictly followed during the preparation and publication of this study.

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