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Case Report

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Serotonin Syndrome in an Adolescent: Early Nursing Interventions and Care Strategies in the Emergency Department Using the Components of Life Model

Sevgim Küçük Ulak,[1] Aslı Alaca[2]

[1]Department of Pediatrics, University of Health Sciences, Tepecik Training and Research Hospital, İzmir, Türkiye

[2]Department of Pediatric Emergency, İzmir City Hospital, İzmir, Türkiye

Abstract

This case report discusses a 16-year-old female patient who presented to the emergency department following a suicide attempt involving an overdose of lamotrigine and sertraline tablets, resulting in symptoms consistent with serotonin syndrome. The patient's presentation highlights the complexities of managing neuropsychiatric conditions associated with suicide attempts in adolescents, particularly given the rarity of serotonin syndrome in this age group. Upon admission, the patient exhibited acute serotonin syndrome symptoms including tachycardia, sweating, delirium, and neuromuscular disturbances, which led to the diagnosis of serotonin syndrome. Early intervention involved close monitoring of vital signs, administration of oxygen and fluid therapy, and treatment with the serotonin antagonist cyproheptadine alongside benzodiazepines. This comprehensive approach, supported by multidisciplinary collaboration, enabled the patient to be safely stabilized. In conclusion, this case emphasizes the importance of early recognition and prompt treatment of serotonin syndrome in adolescents, as well as the vital role of a multidisciplinary team in managing such cases. It also offers valuable insight into the emergency management of suicide attempts. Furthermore, the application of Jones' Life Components Model in nursing care within the emergency department proved instrumental in enhancing patient outcomes through improved collaboration and a patient-centered approach.

Keywords: Adolescent, case study, Jones Dependency Tool, Life Components Model, nursing care, serotonin syndrome, suicidal behavior

Introduction

Adolescence is a distinct phase of human development occurring between the ages of 10 and 19, bridging the gap between childhood and adulthood. During this period, individuals undergo rapid physical, cognitive, and psychosocial growth, which influences how they feel, think, make decisions, and interact with the world. Although often considered a generally healthy stage of life, adolescence is also marked by increased risks of death, illness, injury, and suicide.[1] Globally, it is estimated that 1 in 7 individuals aged 10 to 19 (14%) experience mental health issues, yet many of these conditions remain unrecognized and untreated.[2] According to the World Health Organization (WHO), approximately 720,000 people die by suicide each year, making it the third leading cause of death among individuals aged 15 to 29.[3]

Mental health issues during adolescence can significantly impact an individual's quality of life. Without appropriate interventions, these issues may escalate to suicide attempts. The rapid cognitive and emotional changes that occur during adolescence increase vulnerability to mental health disorders, thereby heightening the risk of suicide at this developmental stage.[4] In particular, medications used in suicide attempts can lead to both physiological and psychological complications.[5] In this context, intentional overdose can result in life-threatening conditions such as serotonin syndrome.

Serotonin syndrome, also known as serotonin toxicity, is a potentially life-threatening condition caused by increased serotonergic activity in the central nervous system. It typically arises from therapeutic drug use, drug interactions, or overdoses, especially in the context of suicide attempts.[6] Clinically, serotonin syndrome is characterized by a triad of symptoms: altered mental status, autonomic hyperactivity, and neuromuscular abnormalities. However, it can present with a broad spectrum of severity, ranging from mild symptoms to fatal outcomes.[7]

In serotonin syndrome, changes in mental status may include anxiety, restlessness, disorientation, agitation, and delirium. Patients often exhibit signs of hyperexcitability. Autonomic symptoms can include sweating, tachycardia, fever, hypertension, vomiting, and diarrhea.[8] Neuromuscular hyperactivity is characterized by tremors, myoclonus, hyperreflexia, and a positive Babinski sign. Hyperreflexia and clonus, particularly in the lower extremities, are commonly observed. Diagnosis is based on clinical findings; therefore, a detailed history and thorough physical and neurological examination are essential.[9]

Symptoms of serotonin syndrome in the pediatric population generally mirror those seen in adults. Most cases of serotonin syndrome develop within 24 hours of a medication dosage change or the introduction

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Corresponding author: Sevgim Küçük Ulak
E-mail: sevgimkucuk@hotmail.com

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of a new drug, often within the first six hours. Toxicity tends to be more severe in cases of intentional ingestion, making it crucial to assess the patient's intent.[10] However, information provided by patients who have overdosed is often unreliable, requiring further verification. The patient's history should also be obtained from family members, friends, emergency medical services personnel, and law enforcement.

In mild cases, supportive care and the use of benzodiazepines for sedation are typically sufficient, while moderate to severe cases require more aggressive treatment. Cardiac monitoring is essential in all cases.8 The appropriate dose of cyproheptadine in children varies by age, with a recommended maximum daily dose ranging from 0.25 mg/kg to 16 mg.[11,12]

Emergency nursing care plays a critical role in ensuring patient safety, preventing complications, and achieving rapid stabilization. In life-threatening conditions such as serotonin syndrome, nurses promptly implement interventions including monitoring vital signs, ensuring adequate oxygenation, administering intravenous therapy, and managing medications. Safety measures are prioritized for high-risk patients, and holistic care is delivered through collaboration with multidisciplinary teams. A model-based approach supports systematic, consistent, and patient-centered care, ultimately streamlining emergency responses and improving patient outcomes.[13]

Emergency nursing interventions require a contextualized framework tailored to the specific role of the emergency nurse. To address this need, Jones developed the practice-based "Life Components Framework" for emergency nursing.[13–15]

The Components of Life Model

Jones in 1990 developed the Components of Life Model to provide a practical framework aimed at maintaining individuals' health and quality of life. While many models are developed from a theoretical perspective, Jones based this model on observations conducted in the emergency departments of two hospitals, establishing a philosophy grounded in human needs.[16]

The model proposes that individuals possess seven components of life encompassing physical, behavioral, and social dimensions. Maintaining a balance among these components is essential for preserving both health and quality of life. Disruptive events such as illness or injury can disturb this balance. In this context, emergency care personnel are viewed as key resources in helping to restore equilibrium and support the individual's independence, as well as their physical, emotional, and social well-being. The model, and the dependency tool derived from it, has since been revised and updated to include six components of life (Figure 1).[16,17]

The model has four primary objectives:

1. Establishing collaboration with patients and their families.
2. Promoting an appropriate level of independence based on the nature of the illness or injury.
3. Supporting individuals in preventing illness or injury through self-care, health education, and environmental safety.
4. Facilitating the most effective implementation of nursing and medical treatments.

The Dependency Tool was developed using the same core principles as the Components of Life Model. It serves as the foundation for the development of a dependency tool, which assigns a dependency score to each patient upon arrival and is updated regularly throughout their stay.[14,15,17,18]

The Jones Dependency Tool (JDT) supports nurses in accurately planning patient care by considering not only the urgency of the patient's condition but also their specific nursing needs. The tool incorporates six components of the model: Communication; Airway/Breathing/Circulation; Mobility; Eating/Drinking/Elimination and Personal Care; Environmental Safety; and Health and Social Needs, along with Triage.[14]

Each component is rated on a three-level scale, with the total dependency score ranging from 3 to 18:

6–7 points: Low dependency (Score: 0)

8–12 points: Moderate dependency (Score: 1)

13–15 points: High dependency (Score: 2)

16–18 points: Full dependency (Score: 3).

The Turkish validity and reliability study of the Jones Dependency Tool was conducted by Arslan and Dağ[19] in 2023 for use in adult populations. The model also includes a dependency tool designed for younger children; however, the author (Jones) stated that the tool can be applied to individuals as young as 16 years old.

Case Presentation

A 16-year-old female patient presented to the emergency department following the ingestion of a high dose of medication with suicidal intent. She had taken 1200 mg of lamotrigine and 600 mg of sertraline. Upon admission, she exhibited symptoms of acute altered mental status, tachycardia, and diaphoresis. Her medical history revealed that she had been on Lamotrigine and Sertraline for 12 years and was under psychiatric care for Attention Deficit Hyperactivity Disorder (ADHD). The patient had no prior hospital admissions. Physical examination showed ocular clonus, mydriasis, hyperreflexia, and altered consciousness–neurological and physical signs consistent with serotonin syndrome. Laboratory tests revealed the following blood gas results: pH 7.25, pCO_2 46.5 mmHg, HCO_3 2.3 mEq/L, and lactate 2.3 mmol/L. Hemogram results indicated acetaminophen levels of <5 and creatine kinase (CK) levels of 6900. Informed written consent was obtained from the patient's parent (father). This case report was prepared in accordance with the CARE (Case Report) Checklist guidelines to ensure transparency and comprehensive reporting.

Care Strategies

In the management of serotonin syndrome, Jones's Components of Life Model provides a robust framework for organizing nursing care in emergency settings. The model's six core components including communication, airway/breathing/circulation, mobility, eating/drinking/elimination, and personal care, environmental safety and social needs, and triage serve as a guide for systematically delivering patient care. These strategies are detailed in Table 1. As outlined in Table 1, the *triage component* involved a comprehensive patient assessment and the preparation of resuscitation equipment and medications to prevent potential deterioration. The patient was positioned strategically for continuous monitoring, with oxygen saturation recorded at 100%, and hourly electrocardiograms (ECGs) confirming normal sinus rhythm. The *ABC component* emphasized maintaining airway, respiratory, and circulatory stability. Vital signs were monitored every 30 minutes, and arterial blood gases were analyzed regularly to prevent hypoxia. Due to the risk of autonomic dysfunction, hemodynamic parameters were closely observed. Intravenous midazolam and oral cyproheptadine hydrochloride were administered as part of the treatment protocol (Tables 1, 2). *The Communication component* (Table 1) prioritized continuous observation and psychological support, with strict suicide risk precautions, including the removal of

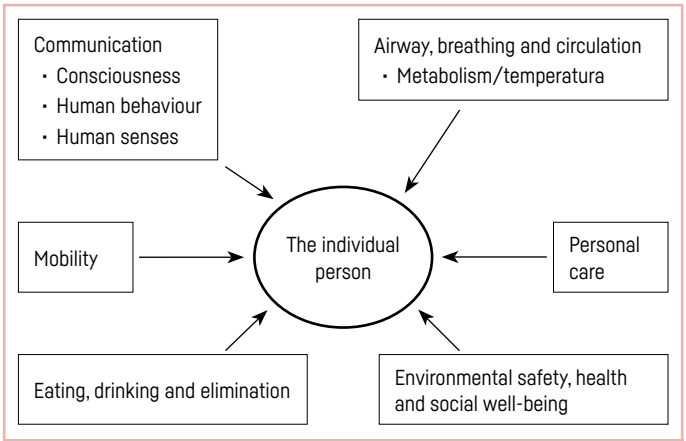

Figure 1. The components of life framework.[16]

Table 1. Emergency department interventions based on the components of life model

Component	Indicators	Dependency score	Nursing interventions
Triage	Red/Orange	3 points	• General Condition Assessment: The patient's overall condition was evaluated. • Preparation for Potential Deterioration: Age-appropriate resuscitation materials, medications, and equipment were prepared in the resuscitation room. • Bag-Valve Mask Readiness: A bag-valve mask was kept at the bedside in case of deterioration. • Initial Assessment: Upon presentation to the emergency department, oxygen saturation was 100%. • Hourly Electrocardiogram (ECG) Monitoring: Continuous ECG recordings were conducted (ECG findings: normal sinus rhythm). • Placement in the Emergency Department: The patient was placed in a location within the emergency department that allowed for continuous observation.
Airway, Breathing, Circulation (ABC)	- Risk of deterioration in airway, breathing, or circulation leading to shock	2 points	• Vital Signs Monitoring: Conducted every 30 minutes (Table 2). • Airway and Breathing Monitoring: Airway and respiratory indicators were closely monitored to prevent hypoxia. • Arterial Blood Gas Monitoring: Arterial blood gases were regularly assessed. • Cardiac Observation: The patient was closely monitored for any cardiac anomalies. • Location Adjustment: The patient was relocated to an area with enhanced visibility for continuous observation by medical staff. • ECG Observation: ECG findings were regularly recorded and evaluated. • Hemodynamic Monitoring: Due to the effects of delirium, the risk of autonomic dysfunction was considered, and the patient's hemodynamic status was closely monitored. • Required Intravenous (IV) Treatment: IV midazolam and oral cyproheptadine were administered.
Communication	- Presence of behavioral disturbances due to psychological issues or medications - The patient is unresponsive	3 points	• Accessibility of Healthcare Professionals: Medical staff remained readily available in a clearly designated area for immediate access. • Continuous Observation: The patient was continuously monitored due to behavioral disturbances and the need for psychological support. • Parental Supervision: The accompanying parent was instructed to closely supervise the patient and avoid leaving them unattended for extended periods. • Suicide Risk Precautions: Staff were informed of the patient's suicide risk. All potentially harmful items (e.g., glass objects, scissors, syringes, needle tips, cannulas) were removed from the bedside to ensure safety.
Mobility	- The patient requires a stretcher or wheelchair for movement	2 points	• Fall Risk Assessment Score: The patient had a fall risk score of 11 (high fall risk). Contributing factors included: age (12–18 years - 1 point), medication (2 points), presence of medical equipment (2 points), mental status (3 points), and vital signs (3 points). • Fall Risk Precautions: Bed rails were raised, and the patient was safely positioned in bed to reduce the risk of fall. • Delirium Monitoring: The patient's extremities were restrained to ensure safety while monitoring for signs of delirium. • Family Presence and Support: A family member remained with the patient to provide emotional support and received guidance on safe monitoring practices. • Positioning Adjustments: The patient's positioning and mobility were regularly adjusted based on clinical condition and comfort.
Eating, drinking, elimination, and personal care	- Partial loss of bowel/bladder function and/or vomiting - Requires assistance with personal care	3 points	• Inability to Eat Orally Due to Altered Consciousness: Non-oral feeding was initiated as the patient was unable to eat orally. • Nasogastric (NG) Tube Insertion: An NG tube was inserted. • Fluid Therapy: To maintain fluid and electrolyte balance, fluid therapy was initiated using 5% Dextrose + 0.9% NaCl (1900 cc/24 hours). • Hourly Blood Glucose Monitoring: Blood glucose levels were checked every hour.
Environmental safety, health, and social needs	- Risk of harm to self or others - Requires extensive social support	2 points	• Frequent Monitoring: The patient was closely monitored due to behavioral disturbances and the presence of delirium. • Enhanced Observation Location: The patient was moved to an area where medical staff could observe them more easily. • Written Physician Order: A written order was obtained from the physician prior to applying physical restraints. • Use of Physical Restraints: Physical restraints were applied to prevent agitation, delirium-related behavior, and self-harm. • Documentation: All observations regarding the patient's condition and the use of restraints were recorded in the nursing observation form. • Restraint Evaluation: The need for physical restraints was reassessed hourly by the physician. • Necessary arrangements for the patient's transfer to the intensive care unit were made in coordination with the attending physician. • The patient's family was informed and updated regularly.

Jones Dependency Score. 15 points (High Dependency Level): According to the Component of Life Model, a score of 15 indicates that a high level of nursing intervention is required. However, it does not meet the threshold for complete dependence, which applies to fully dependent patients.[19]

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Table 2. Vital signs monitoring

Time	Blood pressure (mmHg)	Heart rate (bpm)	Body temperature (°C)	Oxygen saturation (%)	Blood glucose (mg/dL)	Arterial blood gas	Acute interventions
11:25	120/89	122	36.5	100	87		
12:30	98/53	111	36.7	100	91		0.1 mg/kg of midazolam administered
13:30	96/54	117	36.8	99	85	pH: 7.25 pCO_2: 46.5 mmHg HCO_3: 2.3 mEq/L Lactate: 2.3 mmol/L	0.01 mg/kg midazolam administered again
14:00	105/55	117	36.8	97			
14:30	122/69	111	36.9	100	87		10 mg of cyproheptadine administered; plan: 2 mg every two hours
15:00	110/69	110	36.7	98			
15:30	120/58	101	36.5	100	96		
16:00	105/65	101	36.7	97			The patient was transferred to the pediatric intensive care unit for close monitoring

pH: Power of hydrogen, pCO_2: Partial carbon dioxide pressure, HCO_3: Bicarbonate

hazardous objects. The accompanying parent was instructed to remain with the patient to ensure safety and provide emotional stability. The *Mobility component* (Table 1) included a fall risk assessment, with a score of 11 indicating high risk due to the patient's age, medication effects, and altered mental status. Fall prevention strategies included raised side rails and the use of extremity restraints to reduce agitation related to delirium. Family members were educated on safe monitoring practices. The *Nutrition, Hydration, Elimination, and Personal Care component* (Table 1) addressed the patient's altered consciousness through the use of nasogastric feeding, with fluid and electrolyte balance was maintained via intravenous 5% Dextrose + 0.9% NaCl (1900 cc/24 hours). Hourly blood glucose monitoring was conducted to ensure metabolic stability. The *Environmental Safety and Social Needs component* (Table 1) focused on self-harm prevention and delirium management. Physician-authorized physical restraints were used and reassessed hourly. Preparations were made for a potential intensive care unit (ICU) transfer, and the patient's family received regular updates. All interventions were thoroughly documented to ensure a coordinated, interdisciplinary approach. The Jones Dependency Score was calculated as 15 points, indicating a high level of dependency that required extensive nursing interventions. While this score reflects significant reliance on nursing care, the patient did not meet the criteria for full dependency. Continuous, comprehensive nursing interventions were essential to maintain the patient's physical stability, psychological well-being, and overall safety.

Discussion

The complexity of serotonin syndrome necessitates a thorough understanding of its symptoms, potential complications, and appropriate interventions, particularly in the pediatric population. The presence of symptoms such as altered mental status, tachycardia, and neuromuscular disturbances underscores the importance of timely diagnosis and intervention to prevent life-threatening outcomes.[20,21]

Current research indicates that although the suicide rate is higher among males, the incidence of suicide attempts is greater among females. Suicide is the third leading cause of death among individuals aged 15 to 29.[3,22] According to 2023 data from the Turkish Statistical Institute (TÜİK), the crude suicide rate in Türkiye is 0.476%.[23] Upon admission to the emergency department, our patient presented with altered consciousness, sweating, and tachycardia. A 2021 study reported only 10 documented cases of serotonin syndrome in individuals under the age of 18 between 1965 and 2020.[21] Our patient also had a history of ADHD, and similar cases have been reported by Gill et al.[11] in 1999 and Godinho et al.[24] in 2002, involving one female and one male patient with ADHD.[11,24] Individuals with ADHD are more prone to major depression, suicidal tendencies, and other psychiatric comorbidities. Furthermore, long-term use of serotonergic medications can disrupt serotonin balance in the brain, thereby increasing the risk of serotonin syndrome. The neuropsychiatric effects of ADHD, along with its pharmacological treatment, may have played a significant role in the development of this condition.[25,26]

Symptoms in our case shared several characteristic features, including sweating, tremors, and fluctuations in consciousness.[21,27] In pediatric cases, serotonin syndrome symptoms typically appear within 24 hours following an increase in medication dosage or an overdose.[28,29] In our patient, symptoms were observed approximately 24 hours after ingesting an excessive dose of medication with suicidal intent. The management strategies employed in this case, such as continuous monitoring of vital signs, administration of oxygen and fluids, and pharmacological intervention with serotonin antagonists, are consistent with current best practices for the treatment of serotonin syndrome.

In this case, the integration of the Life Components Model provided a structured and evidence-based framework for the comprehensive nursing management of serotonin syndrome. The model effectively guided assessment and intervention across six primary components, prioritizing both physiological stability and psychological well-being. Upon admission, the patient exhibited altered consciousness, tachycardia, and sweating—symptoms characteristic of serotonin syndrome. Nursing interventions, guided by the model, included continuous monitoring of vital signs, administration of oxygen and intravenous fluids, and pharmacological treatment with serotonin antagonists such as cyproheptadine. These measures were effective in alleviating symptoms and maintaining physiological stability. Additionally, communication strategies were implemented to address behavioral disturbances, including continuous observation and the removal of potentially hazardous objects to ensure patient safety. Mobility-related interventions focused on reducing fall risk by securing the patient in bed with raised side rails and providing education to family members on safe observation techniques. Environmental safety measures, including the use of physical restraints under strict medical supervision, were implemented to prevent self-harm while adhering to ethical and clinical guidelines.[30]

The application of the Life Components Model also facilitated systematic monitoring of the patient's condition, enabling early detection of clinical deterioration and timely adjustments to the care plan. For instance, the onset of symptoms approximately 24 hours after the overdose aligns with findings in the existing literature, emphasizing the importance of regular assessment and prompt phar-

macological intervention. By integrating theoretical approaches, nursing care in this case was not only scientifically grounded but also tailored to the complex and unique needs of a pediatric patient.[31,32]

This rare condition provides valuable insights into nursing practice by highlighting the challenges of managing uncommon clinical presentations. The implementation of the Life Components nursing model, a distinctive and relatively underutilized approach, enhances the precision and efficiency of real-time assessments and targeted interventions in complex cases.[33]

The integration of evidence-based practices, such as the use of serotonin antagonists and continuous monitoring, ensures that clinical interventions are grounded in scientific principles, while also emphasizing the importance of interdisciplinary collaboration.[34] However, the report also highlights several limitations. The urgency of interventions in the emergency department often prevents nurses from fully addressing the psychological aspects of care. Although multidisciplinary teams are in place, maintaining continuity of care in the emergency setting presents a significant challenge. Additionally, the patient's transfer to intensive care limited the availability of long-term outcome data, making it difficult to assess recovery rates or any residual effects of serotonin syndrome. Consequently, this limitation hinders a comprehensive understanding of the long-term efficacy of the interventions.

Conclusion

This case report highlights the management of an adolescent patient diagnosed with serotonin syndrome in the emergency department. Early intervention and effective nursing strategies were critical to ensuring patient safety and promoting recovery. The patient received continuous monitoring, fall risk prevention measures, and regular assessments of vital signs, along with careful management of fluid and electrolyte balance. Psychosocial support was provided by creating a calming environment and offering appropriate information to the patient's family. This holistic approach, supported by targeted nursing interventions and multidisciplinary collaboration, facilitated the patient's safe stabilization and recovery. Jones's Components of Life Model served as a vital framework for structuring care processes by holistically addressing patient needs in the management of complex conditions. Its application enables nurses to assess the patient's condition accurately and plan care strategies efficiently, thereby enhancing patient safety and supporting recovery.

To further enhance outcomes in similar cases, several key recommendations can be made:

1. Comprehensive information should be provided to the families of pediatric and adolescent patients to promote treatment adherence and support effective monitoring for potential complications.
2. Family education programs should be widely implemented to help caregivers better understand the psychosocial changes that occur during adolescence and to recognize suicide risk factors.
3. Mental health screenings for adolescents should be prioritized to enable early detection and appropriate treatment of psychiatric conditions such as depression and anxiety, thereby reducing the risk of suicide.

In conclusion, the utilization of the Life Components Model and contextual care strategies empowers nurses and healthcare professionals to deliver rapid and effective interventions in acute situations such as serotonin syndrome. By addressing physiological, psychological, and social needs in an integrated manner, this approach not only supports patient recovery but also enhances the quality of nursing practice in complex clinical scenarios.

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