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Medical Error-Psychological Consequence of Osmotic Demyelination Syndrome

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Abstract: Osmotic Demyelination Syndrome (ODS) is a rare but potentially fatal neurological, iatrogenic disorder that occurs due to the rapid correction of chronic hyponatremia. The physical consequences of this condition are well documented and include symptoms such as confusion, cognitive impairment, motor dysfunction, etc. However, the psychological aspect remains relatively underexplored. The present case aims to understand the psychological impact of ODS post medical intervention and its effects on quality of life. The participant was a 73 year old female who was selected through purposive sampling. She was reported to be diagnosed with osmotic demyelination syndrome following rapid correction of chronic hyponatremia. Data were collected using semi-structured interviews, content analysis, and information from clinical and social records was also reviewed. The findings indicate that the impact of ODS extends beyond neurological impairment and also affects the psychological aspects such as emotional well-being, autonomy, social functioning and the overall quality of life. Consequently, this study highlights the significance of careful medical monitoring, multidisciplinary intervention, psychological support, rehabilitation, and family involvement to improve the long-term psychosocial quality of life.

Keywords: Osmotic Demyelination Syndrome, hyponatremia, multidisciplinary intervention

INTRODUCTION

Sodium is an important electrolyte in the human body and helps maintain physiological functions and ensures the homeostatic state of the body. It is responsible for the generation of a membrane potential that ensures signal transmission from nerve and muscle cells to the executive organs, which is especially important for the rhythmic contraction of the myocardium. Sodium aids in maintaining osmotic blood concentration, acid-base balance, and water balance. Additionally, it facilitates membrane transport by transferring carbon dioxide from cells to the lungs and provides hypotensive effects by expanding blood vessels. Sodium is also involved in the synthesis of gastric juice and participates in all types of metabolism, including the activation of many enzymatic systems, while acting as a cofactor in the most important biochemical transformations (Kodintsev *et al.*, 2022). Sodium is primarily found in the blood and in the fluid around cells. The main source of sodium is food and drinks, and it is excreted primarily in sweat and urine. The kidneys regulate sodium levels in the body by adjusting the amount excreted in urine. When the amount of sodium consumed and excreted is unbalanced, the total amount of sodium in the body is affected. This may cause an excessive level of sodium in the blood called hypernatremia or an insufficient level of sodium in the blood called hyponatremia (Lewis, 2025).

In order to raise sodium levels and alleviate neurological symptoms, hypertonic saline is frequently used to treat severe symptomatic hyponatremia. However, osmotic demyelination syndrome (ODS), a rare but dangerous neurological disorder, can result from treating chronic hyponatremia too quickly. Osmotic demyelination syndrome (ODS) is a rare but fatal neurological disorder that is caused by the rapid correction of chronic hyponatremia. This rapid correction results in ODS because of the damage to the myelin sheath of neurons as a result of osmotic shifts. In chronic hyponatremia, the brain cells adapt to the reduced level of extracellular sodium in the blood by reducing intracellular osmolytes in order to prevent swelling and maintain normal cell volume. However, rapid correction of sodium levels leads to a hypertonic state of the extracellular environment, and brain cells have difficulty in rapidly regaining these osmolytes to attain osmotic balance. This leads to the movement of water out of the cells and causes cellular shrinkage, osmotic stress, and ultimately demyelination (Lambeck et al., 2019).

The clinical picture of osmotic demyelination syndrome is not consistent and is based on the brain region that is being affected. This condition may produce a wide variety of neurological manifestations such as confusion, altered consciousness and cognitive impairment. It also causes motor symptoms such as motor dysfunction, Parkinsonism, or even death (Adrogué *et al.*, 2022). The onset of these symptoms following the triggering event is often delayed after a brief asymptomatic period. Depending on the brain regions involved, ODS may be presented as central pontine myelinolysis, in which the brainstem is affected and elicits symptoms such as dysarthria, dysphagia, and motor weakness; or as extrapontine myelinosis, in which the extrapyramidal regions, such as the basal ganglia, are affected and may cause movement disorders like tremors, rigidity, or dystonia (Lambeck et al., 2019). Therefore, careful monitoring and gradual correction of sodium levels is essential. The present study focuses on the case of a 73-year-old female who presented with the condition of Osmotic Demyelination Syndrome because of rapid correction of sodium levels.

METHODOLOGY

The study used a single participant case study. Purposive sampling was used to select the participant. Information was collected using semi-structured interviews. Audios were recorded and transcribed. Content analysis was carried out. Information from clinical and social records was also collected.

CASE PRESENTATION

This case is about FN, a 73-year-old female from an urban background who lived in a nuclear family. Before the onset of illness in 2018, she functioned independently and was actively involved in her roles and responsibilities as a wife, mother, mother-in-law, and grandmother. She also played a major role in caring for her ill husband. She was physically active and led a healthy lifestyle except for a history of hypertension. The household had adopted a low-sodium diet due to her husband's dietary restrictions. When FN was 65 years old, she developed symptoms like fever and vomiting and was rushed to the hospital. Upon arrival, she was diagnosed with chronic hyponatremia and a rapid correction of sodium levels was implemented. Post correction, she seemed to be stable, but shortly developed neurological symptoms. She exhibited a gradual decline in motor functioning, resulting in

severe weakness and eventually, a bedridden state. Speech reduced progressively and culminated in mutism, significantly affecting her ability to communicate. She also had difficulty swallowing food, especially solids. Over multiple hospital visits, she was diagnosed with Osmotic Demyelination Syndrome(ODS). As a consequence of her neurological deterioration, FN faced severe impairment and dependence in activities of daily living (ADLs) such as mobility, feeding, grooming, toileting, and self-care, requiring complete assistance from caregivers. This represented a marked decline from her premorbid level of independence. The onset of illness occurred around the same time as the death of her husband. FN exhibited crying spells quite frequently as a mode of communication and expression of needs. Over time, the frequency of crying has reduced significantly and is limited to emotionally salient moments. Her overt emotional expression is restricted. At present, FN remains bedridden and fully relies on her caregivers for all activities of daily living, with severely limited communication. Due to profound physical dependence and communication deficits, FN shows reduced social interaction and withdrawal. Loss of previously held roles and reliance on others for basic requirements and activities have likely affected her sense of autonomy, meaning and quality of life.

Tools Used

1. Brief COPE (Carver, 1997)

Brief COPE was used to measure the coping styles- self distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, self-blame. It consists of 28 items with a 4 point Likert scale.

The internal consistency of the Brief COPE was reported as acceptable, with Cronbach's alpha of .70, and good convergent validity, while test-retest reliability was .60 (Mohanraj et.al., 2015).

2. Geriatric Depression Scale (Yesavage et al., 1983)

The Geriatric Depression Scale was used to measure depression. The scale consists of 15 questions with yes or no options. There are 5 negatively scored items. GDS exhibited high internal consistency with Cronbach’s alpha coefficient of .94, split-half reliability of .94, and test-retest reliability of .85. Good concurrent and convergent validity were also observed (Yesavage et al., 1983).

3. Barthel Index (Mahoney & Barthel, 1965)

The Barthel index measures the independence of chronically ill patients. The scale evaluates various aspects of independence, such as feeding, bathing, grooming, dressing, bowel and bladder, toilet use, transfers from bed to chair and back, mobility, and stairs. Scoring is based on the level of assistance required for each aspect and the items are scored using values such as 0, 5, 10 or 15. The lower the score, the greater the level of dependence.

A moderate to substantial level of agreement was established with weighted kappa values ranging from .61 to .75, and a sensitivity of 89.2% was confirmed, implying good validity (Prasad et al., 2018).

4. Rosenberg Self-Esteem Scale (Rosenberg, 1965)

The Rosenberg Self-Esteem Scale was used to measure self-esteem and overall self-worth. The scale comprises 10 items evaluating positive and negative attitudes towards oneself. The responses are rated on a 4 point Likert Scale with the options ranging from strongly agree to strongly disagree. Five items on the scale are reverse scored. Higher the score, higher the self-esteem of the participant.

An acceptable internal consistency was demonstrated for the Rosenberg Self-Esteem Scale with Cronbach's alpha of .71, a moderate test-retest reliability, and satisfactory construct validity (Tulachan et al., 2022).

5. Multidimensional Scale of Perceived Social Support (Zimet et al., 1988)

The Multidimensional Scale of Perceived Social Support was used to measure the perceived social support received by the participant. The scale includes three subscales namely family support, friend support and support from significant others. It consists of 12 items with 4 items in each subscale. The items are rated on a 7 point Likert scale ranging from very strongly agree to very strongly disagree. Higher the scores, higher the perceived social support.

MSPSS displayed an excellent level of internal consistency with Cronbach's alpha values ranging from .84 to .87 for the subscales and .92 for the total scale. The values for Split-half reliability varied from .72 to .85, and satisfactory construct validity was established with the help of factor analysis (Kaur & Beri, 2022).

6. Learned Helplessness Scale (Quinless & Nelson, 1988)

The Learned Helplessness Scale was used to measure learned helplessness. The scale is composed of 20 items assessing perceived lack of control, pessimism, self-blame and persistence after failure. The responses are rated on a 4 point Likert scale with options ranging from strongly agree to strongly disagree. Higher the scores, higher the levels of learned helplessness.

Good internal consistency was established for LHS with a standardised alpha reliability coefficient of .85 and satisfactory construct validity through factor analysis (Quinless & Nelson, 1988).

RESULTS

From Table 1,

In Brief COPE, FN scored high on behavioural disengagement, self-blame and religious coping strategies.

In the Geriatric Depression Scale, FN obtained a score of 15/15, suggesting symptoms of severe depression.

In the Barthel Index, FN scored 0 out of 100, suggesting total dependence in activities of daily living and severe functional impairment.

In the Rosenberg Self-Esteem Scale, FN obtained a score of 4 out of 30, indicating very low self-esteem and negative self-perception.

In the Multidimensional Scale of Perceived Social Support, FN received a mean score of 4.25, suggesting moderate perceived social support. The results indicate stronger familial support compared to support from friends and others.

In the Learned Helplessness Scale, FN obtained a score of 61 out of 80, which indicates a high level of learned helplessness, suggesting strong feelings of lack of control, pessimism about future outcomes, and low persistence after failure.

Table 1 shows the assessment tool, its subscales, the scores obtained by FN in the assessment

Assessment Tool	**Subscales/Dimension**	**Possible range**	**Score Obtained**
Brief Cope	Self- distraction	2-8	4
	Active Coping	2-8	2
	Denial	2-8	5
	Substance use	2-8	2
	Use of emotional support	2-8	4
	Use of instrumental support	2-8	3
	Behavioral disengagement	2-8	8
	Venting	2-8	4
	Positive reframing	2-8	2
	Planning	2-8	2
	Humour	2-8	2
	Acceptance	2-8	2
	Religion	2-8	8
	Self-Blame	2-8	8
Geriatric Depression Scale	Depression	0-15	15
Barthel Index	Feeding	0-10	0
	Bathing	0-5	0
	Grooming	0-5	0
	Dressing	0-10	0
	Bowel	0-10	0
	Bladder	0-10	0
	Toilet Use	0-10	0
	Transfers (Bed to chair and back)	0-15	0
	Mobility	0-15	0
	Stairs	0-10	0
Rosenberg Self-Esteem Scale	Self-Esteem	0-30	4

Multidimensional Scale of Perceived Social Support	Family Support	4-28	23
	Friends Support	4-28	14
	Significant others support	4-28	14
Learned Helplessness Scale	Learned Helplessness	20-80	61

DISCUSSION

Medical errors are one of the biggest concerns in the healthcare system because a large number of patients encounter serious harm during treatment, which is usually avoidable. This can lead to various outcomes ranging from extended hospital stays, long-term disability or even death (World Health Organization, 2019). Medical errors can also cause psychological distress, including feelings of fear, anxiety, helplessness, betrayal, and emotional insecurity, as well as a loss of trust in the healthcare system (Iedema et al., 2011). These physical and psychological consequences combined can have adverse effects on the quality of life of the patient, which is also evident in the case of FN. The rapid correction of sodium led to neurological symptoms, a gradual decline in motor functioning and severe impairment and dependence in activities of daily living (ADLs) such as mobility, feeding, grooming, toileting, and self-care, requiring complete assistance.

The psychological perspective suggests that an important factor in how a person copes with a stressful event is how the individual appraises it (Taylor, 2018). This can be explained using the Transactional Model of Stress and Coping, which states that an individual's stress depends on how they appraise the situation. FN's primary appraisal likely recognises that the loss of movement and autonomy is a serious threat, and the secondary appraisal accepts that FN cannot cope with such a situation. When the situation feels threatening and uncontrollable, it may lead to increased distress and an inability to cope efficiently. Additionally, the theory of learned helplessness explains that repeated failure may affect a person's self-esteem and make them believe that their further attempts are futile. This explains FN's withdrawn state and lack of interest in communication. Additionally, the death of her husband may also play a role as an additional stressor, further reducing her ability to cope and contributing to distress.

From a social perspective, FN's difficulty in communication and expressing her needs may lead to reduced interaction and fewer meaningful relationships. Since FN is unable to perform her daily activities or fulfil her previous lifestyle roles, she may also face a loss of autonomy and independence and rely on caregivers. Her reduced participation in her environment may result in withdrawal and isolation. The less interaction that FN has in her daily life, the less social support she receives, which in turn worsens feelings of distress and reinforces withdrawal. The lack of meaningful social interaction in her daily life may also lead to feelings of loneliness.

CONCLUSIONS AND IMPLICATIONS

This case illustrates the physical and psychological consequences of medical errors on a patient's life. In this case, rapid correction of chronic hyponatremia leads to the development of Osmotic Demyelination Syndrome. Although it is largely preventable and can be avoided by careful and gradual correction, rapid correction resulted in neurological

damage such as motor problems, dysarthria, and dysphagia. Therefore, it is important for the doctors to monitor patients carefully while treating chronic hyponatremia.

This iatrogenic condition has a wide range of consequences. It is necessary for the patient to be provided with care across various domains to deal with these consequences, such as early psychological support and counselling, in order to reduce distress and withdrawal, prevent learned helplessness and improve coping strategies. Communication difficulties that develop due to this condition may lead to isolation and reduced interaction, so it is important to strengthen family ties and communication support in order to reduce loneliness. This condition also requires a multidisciplinary approach, which makes it essential for doctors, psychologists, and caregivers to work together to address the biological, psychological and social aspects of the condition and to improve the patient's quality of life.

Intervention

A multidisciplinary approach should be adopted for FN to prevent further deterioration and improve her current level of functioning. To improve motor control, physiotherapy should be incorporated into her schedule. This may help improve movement, muscle strength, coordination, and mobility. The use of orthopaedic tools such as splints is also recommended to maintain her current level of functioning. Speech therapy should be provided to help maintain jaw muscle flexibility and improve swallowing and communication. Psychological interventions such as supportive counselling and coping skills training are also important to help FN adjust to her condition and improve her quality of life. To facilitate FN's social functioning, it is important for her family to be involved in her care, support her, and encourage social interaction, no matter how limited, in order to reduce isolation and provide FN with a sense of belongingness and hope. It is also necessary to provide psychoeducation to FN's family and relatives about her condition to improve their understanding and support. Overall, a coordinated system of care is necessary to enhance FN's overall well-being.

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