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CASE REPORT

Management of Severe Dyselectrolytemia in an Elderly Patient with Normal Pressure Hydrocephalus

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Abstract: Dyselectrolytemia represents a significant clinical challenge, particularly in elderly patients with comorbid conditions. We present a case of a 72-year-old male with known normal pressure hydrocephalus (NPH) who presented with acute symptoms of vomiting, persistent hiccups, generalized weakness, urinary incontinence, and myalgia. Laboratory investigations revealed severe hyponatremia (118 mEq/L) and hypokalemia (2.6 mEq/L), along with elevated blood glucose levels (258 mg/dL). The patient had a 10-year history of hypertension and diabetes mellitus, managed with telmisartan, amlodipine, metformin, and glimepiride. Cardiac evaluation through 2D echocardiography showed mild tricuspid regurgitation, left ventricular hypertrophy, and slightly elevated pulmonary artery pressure. Treatment included hypertonic saline, tolvaptan, potassium supplementation, antibiotics, and supportive care. Serial monitoring of electrolyte levels showed gradual improvement, with sodium levels normalizing to 138 mEq/L by day three. The patient's symptoms resolved significantly, leading to discharge on day four with appropriate follow-up recommendations. This case shows the importance of prompt recognition and appropriate intervention in managing dyselectrolytemia in elderly patients with multiple comorbidities. The successful outcome was achieved through a multidisciplinary approach involving physicians, clinical pharmacists, and nursing staff.

Keywords: Dyselectrolytemia; Normal pressure hydrocephalus; Hyponatremia; Hypokalemia; Geriatric medicine.

1. Introduction

Electrolyte homeostasis is fundamental to maintaining physiological functions, including nerve conduction, muscle contraction, acid-base balance, and fluid regulation. Dyselectrolytemia, characterized by imbalances in electrolyte concentrations, represents a significant clinical challenge, particularly in elderly patients [1]. Among hospitalized patients, electrolyte disorders are commonly encountered, with hyponatremia being the most prevalent, followed by disturbances in potassium, calcium, and magnesium levels [2]. Normal Pressure Hydrocephalus (NPH), first described in 1965, presents a unique clinical entity characterized by the classic triad of gait disturbance, cognitive decline, and urinary incontinence. This condition is particularly significant as it represents one of the few potentially reversible causes of dementia in the elderly population [3]. The coexistence of NPH with electrolyte imbalances can complicate both diagnosis and management, requiring careful clinical consideration and monitoring.

The aging population is particularly susceptible to electrolyte disorders due to multiple factors, including decreased renal function, polypharmacy, and various comorbidities. Studies indicate that approximately 20-30% of elderly patients admitted to hospitals present with some form of electrolyte imbalance [4]. Hyponatremia, the most common electrolyte disorder, affects up to 20% of hospitalized elderly patients and is associated with increased morbidity and mortality [5]. The pathophysiology of dyselectrolytemia in elderly patients is often multifactorial. Age-related changes in renal function, including reduced glomerular filtration rate and decreased ability to concentrate urine, predispose this population to electrolyte abnormalities. Additionally, common medications in the elderly, such as diuretics, ACE inhibitors, and certain antidepressants, can significantly impact electrolyte homeostasis [6].

In patients with NPH, the management of concurrent dyselectrolytemia becomes particularly challenging. The presence of hydrocephalus can affect hypothalamic-pituitary function, potentially influencing water and electrolyte regulation. Furthermore, the symptoms of severe electrolyte imbalances may overlap with or exacerbate the classical NPH triad, making clinical assessment more complex [7]. Recent research has highlighted the importance of prompt recognition and appropriate management of dyselectrolytemia in elderly patients. Studies have shown that even mild electrolyte abnormalities can lead to significant complications, including cognitive impairment, falls, and cardiac arrhythmias [8]. The management approach must be individualized, considering the patient's comorbidities, medications, and overall clinical status.

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The role of interdisciplinary care in managing such complex cases cannot be overstated. Collaboration between physicians, clinical pharmacists, nurses, and other healthcare professionals is crucial for optimal patient outcomes. Regular monitoring, careful medication management, and appropriate nutritional support form the cornerstone of successful treatment [9]. This case report presents a unique opportunity to understand about dyselectrolytemia and NPH in an elderly patient, highlighting the challenges in diagnosis and management.

2. Case Presentation

A 72-year-old male presented to the general medicine department on September 17, 2024, with three episodes of vomiting within 24 hours. The patient reported persistent hiccups, myalgia, and urinary incontinence for the previous 16 days, with increased urinary frequency on the day of admission. He also complained of progressive generalized weakness and somnolence over the preceding three days.

2.1. Past medical history

The patient had a documented history of NPH diagnosed on April 9, 2024. His chronic conditions included:

- Hypertension (10-year duration), managed with telmisartan 40 mg daily and amlodipine 5 mg daily
- Type 2 diabetes mellitus (10-year duration), treated with metformin/glimepiride (500/2 mg) thrice weekly
- History of cataract surgery four years prior

2.2. Physical examination

- Temperature: 98.6°F (Afebrile)
- Pulse rate: 92 beats/minute
- Respiratory rate: 18 breaths/minute
- Blood pressure: 170/100 mmHg
- Systemic examination was unremarkable.

2.3. Laboratory findings

2.3.1. Hematological Parameters

- Hemoglobin: 14.6 g/dL
- WBC count: 15,580 cells/cumm
- RBC count: 5.83 million cells/cumm
- Neutrophils: 88%
- Lymphocytes: 0.6%
- MCH: 25.0 pg
- Platelets: 533,000/cumm
- ESR: 61 mm/hr

2.3.2. Liver Function Tests

- Total bilirubin: 1.9 mg/dL
- Direct bilirubin: 0.7 mg/dL
- SGOT: 31 IU/L
- Total proteins: 5.7 g/dL

Table 1. Serum Electrolyte

Parameter	Normal Range	Day 1 (17/09/2024)	Day 2 (18/09/2024)	Day 3 (19/09/2024)
Sodium	135-155 mEq/L	118	136	138
Potassium	3.5-5.5 mEq/L	2.6	3.2	2.9
Calcium	8.4-11.5 mg/dL	8.1	-	-
Random Blood Glucose	70-140 mg/dL	258	-	-

2.4. Diagnostic Imaging

2D Echocardiography shows mild tricuspid regurgitation, left ventricular hypertrophy, and mildly elevated pulmonary artery pressure. Normal chamber sizes without evidence of clots or pericardial effusion (Figure 1). Chest X-ray showing right hilar lesion and upper lobe fibrosis. ECG demonstrating irregular sinus rhythm on admission. Based on the clinical presentation, laboratory findings, and imaging studies, the patient was diagnosed with severe dyselectrolytemia (hyponatremia and hypokalemia) with known NPH

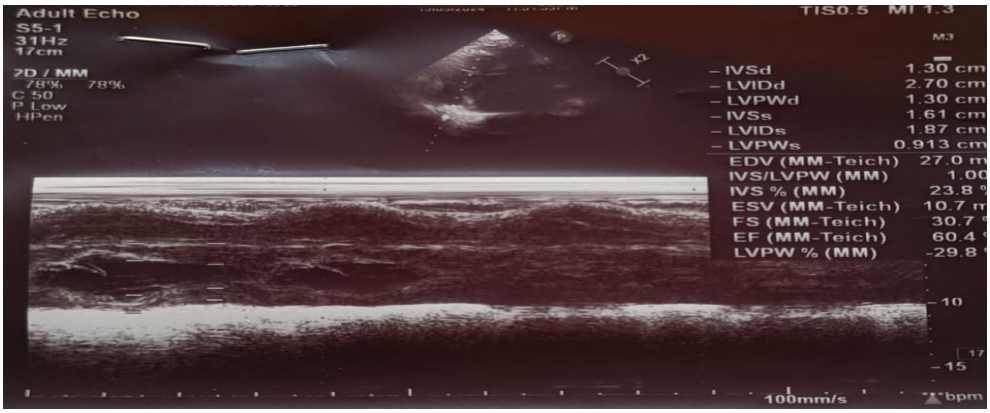

Figure 1. 2D Echocardiography showing dilated lateral and third ventricles

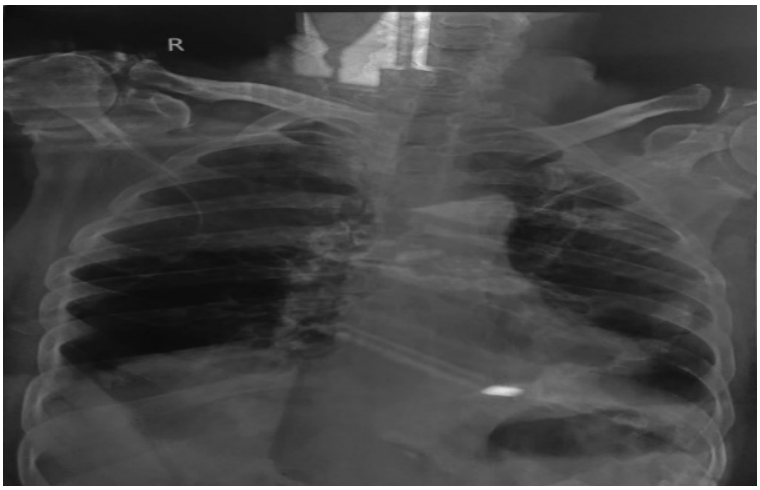

Figure 2. Chest X-ray showing right hilar lesion and upper lobe fibrosis

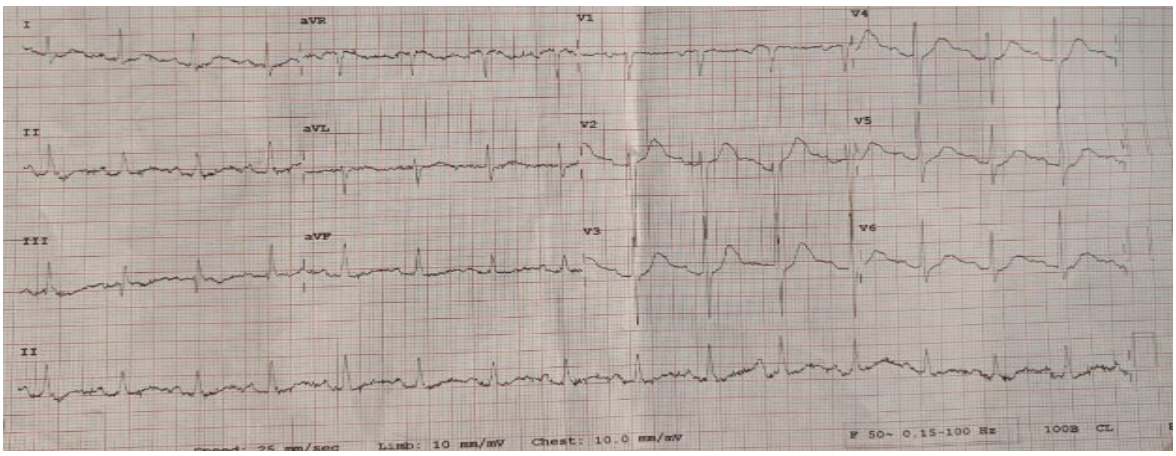

Figure 3. ECG demonstrating irregular sinus rhythm on admission

2.5. Treatment and Management

The patient was managed with a comprehensive treatment regimen:

2.5.1. Medications

1. Antibiotics: Inj. Ceftriaxone 1g IV twice daily
2. Antiemetics: Inj. Ondansetron 4mg IV thrice daily
3. Electrolyte management:
    - Tab. Tolvaptan 15mg PO twice daily
    - Syp. Potassium chloride 15ml PO thrice daily
4. Diabetes management:
    - Tab. Metformin/Glimepiride (500/1mg) PO half tablet twice daily
5. Antihypertensives:
    - Tab. Telmisartan/Amlodipine (40/5mg) PO once daily
6. Other medications:
    - Cap. Anoxy-LP PO once daily
    - Tab. Pantoprazole-Domperidone SR (40/10mg) PO once daily
    - Tab. Acetazolamide 250mg PO twice daily

2.5.2. Fluid Management

- Normal Saline 1000ml IV at 60ml/hr

2.5.3. Clinical Course:

The patient showed significant improvement in symptoms with normalized sodium levels by day three. No adverse effects were observed during the treatment period. The patient was discharged on day four with appropriate medications and follow-up instructions

3. Discussion

Dyselectrolytemia in elderly patients with NPH presents unique management challenges due to the complex interplay between age-related physiological changes, multiple comorbidities, and medication interactions. This case highlights several important clinical considerations in the management of such patients. The presentation of severe hyponatremia (118 mEq/L) and hypokalemia (2.6 mEq/L) required careful correction to avoid central pontine myelinolysis and cardiac complications [10]. The successful management of this case was achieved through a balanced approach of fluid replacement, electrolyte correction, and appropriate medication adjustment. The use of tolvaptan, a selective vasopressin V2-receptor antagonist, proved effective in managing hyponatremia while maintaining hemodynamic stability [11]. The concurrent management of diabetes and hypertension required careful consideration to avoid exacerbating the electrolyte imbalances. This case shows the importance of regular monitoring and individualized treatment approaches in elderly patients with multiple comorbidities. The positive outcome was achieved through careful titration of medications and close monitoring of electrolyte levels [12].

4. Conclusion

This case report shows the successful management of severe dyselectrolytemia in an elderly patient with NPH through careful monitoring and a comprehensive treatment approach. The favorable outcome was achieved through prompt recognition of the condition, appropriate intervention, and regular monitoring of electrolyte levels. This case emphasizes the importance of individualized treatment strategies and shows the effectiveness of a multidisciplinary approach in managing complex medical conditions in elderly patients. Regular follow-up and monitoring of electrolyte levels remain crucial for preventing future episodes and maintaining optimal health outcomes.

5. Abbreviations

NPH: Normal Pressure Hydrocephalus, CSF: Cerebro-spinal Fluid, INPH: Idiopathic Normal Pressure Hydrocephalus, Hb: Hemoglobin, RBC: Red Blood Cell, WBC: White Blood Cell, MCH: Mean Corpuscular Hemoglobin, ESR: Erythrocyte Sedimentation Rate, SGOT: Serum Glutamic Oxaloacetic Transaminase, Na+/K+ Atpase: Sodium,Potassium-Adenosine Triphosphatase, CXRs: Chest Radiograph, ECG: Electrocardiogram, IV Fluids: Intravenous Fluid, ARBs: Angiotensin-2 Receptor Blockers, MRI: Magnetic Resonance Imaging

Compliance with ethical standards

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Conflict of interest statement

The authors declare that they have no competing interests or financial relationships that could have appeared to influence the work reported in this case report.

Statement of ethical approval

This case report was conducted in accordance with the ethical standards of our institutional research committee and with the 1964 Helsinki Declaration and its later amendments. No experimental interventions were performed as part of this case report.

Statement of informed consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. All patient identifiable information has been removed to ensure anonymity.

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Author's short biography

Avinash Kumar Shah

Dedicated to using pharmaceutical expertise to enhance healthcare, this PharmD candidate of JNTUK (Jawaharlal Nehru Technological University Kakinada) is focused on combining clinical knowledge with a patient-centered approach to provide the best possible outcomes from pharmacological therapy. committed to innovation, lifelong learning, and leaving a lasting impression on the rapidly changing field of pharmacy practice.

Parash Niroula

A committed PharmD student of JNTUK (Jawaharlal Nehru Technological University Kakinada) with experience as a medical laboratory technician from CTEVT, Nepal, who is passionate about healthcare and patient well-being, actively participates in clinical rotations and research with an emphasis on clinical pharmacy and pharmaceutical science. I really enjoy using my medical expertise and outstanding communication skills to support research and care plans that are maximized while upholding patient safety and ethical standards. My goals are to improve my abilities and give back to the community. Driven by a desire to positively touch patients' lives, I am looking forward to a rewarding career in clinical pharmacy and pharmaceutical science.

Prince Kumar Yadav

A Pharm-D candidate who is passionate about the intersection between pharmacy, healthcare, and the pharmaceutical sector. With a solid academic background, my goal was to use my understanding of pharmaceuticals to improve patient care, and I was dedicated to encouraging a kind and evidence-based approach to pharmacy practice. In the ever-changing world of contemporary healthcare, I can't wait to take on challenges, learn, and contribute.

Rutendo Moleen Mautsa

Rutendo Moleen Mautsa is a dedicated Doctor of Pharmacy student from Zimbabwe, currently interning and practicing clinical pharmacy in India. With a strong interest in oncology, Rutendo plans to pursue a fellowship in oncopharmacy, focusing on advancing expertise in cancer treatment and medication management. In addition to pharmacy, Rutendo holds a certification as a dental assistant, demonstrating a broad foundation in healthcare. Driven by compassion and a commitment to patient care, Rutendo is passionate about making a meaningful impact in oncology pharmacy in the years to come.