

## Electrolyte Imbalance Pattern in Hospitalized Unconscious Patients

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### ABSTRACT

**Objective:** To determine the pattern of electrolyte imbalance and associated etiological factors among the unconscious patients hospitalized at Pak Emirates Military Hospital.

**Study Design:** Cross-sectional study

**Place and Duration of Study:** Pak Emirates Military Hospital, Rawalpindi Pakistan from Sep 2019 to Feb 2020

**Methodology:** A total of 240 cases were included in this study in liaison with other departments where the admitted patients became unconscious. Patients with a Glasgow coma scale score <10 were included in the study. Serum electrolytes, including Sodium, Potassium, Magnesium and Chloride, were measured in the study participants.

**Results:** Mean age of study participants was 49.10±7.55 years. One hundred and 62(67.5%) patients were from Medicine-Allied Wards while 78(32.5%) patients were from Surgical-Allied Wards. Thirty-eight patients were from the Critical Care Unit. Mean serum sodium was 139.10±11.52 meq/L, while potassium was 4.60±1.06 meq/L. Mean chloride was 809.4±53.55 meq/L, and Magnesium was 1.40±1.05 meq/L. Our analysis revealed that advanced age, underlying medical illness and duration of hospitalization were strongly linked with electrolyte imbalance among the unconscious patients.

**Conclusion:** Electrolyte imbalance emerged as a common finding in the unconscious patients hospitalized in our tertiary care unit. Patients with advancing age, medical illnesses and long hospitalization should be screened for electrolyte wasting a priority to prevent them from going unconscious.

**Keywords:** Electrolyte imbalance, Hospitalized, Unconscious.

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### INTRODUCTION

Sodium, potassium, Magnesium, Calcium, Chloride and Phosphate are a few important electrolytes in the human body. Sodium and Potassium are usually studied widely, but less emphasis has been put on Magnesium and Chloride, which are equally important.<sup>1,2</sup> Altered state of consciousness may be the cause or consequence of electrolyte imbalance, or there might be a common underlying mechanism leading to both.<sup>3</sup>

Serum electrolytes may usually fluctuate when long-term medical or surgical illness exists, and polypharmacy also contributes to it.<sup>4,5</sup> Compensatory mechanisms usually encounter short-term changes, but when the patient goes unconscious or into an altered state of consciousness, compensatory mechanisms may have failed.<sup>6,7</sup> Balci *et al.* concluded that electrolyte imbalance in emergency department patients has been a fairly common finding and can present in several ways. One of the common manifestations of electrolyte imbalance has been an altered level of consciousness.<sup>8</sup> A study conducted in India in critical care setting

revealed that electrolyte imbalance had been significantly related to the state of consciousness of the patients, and the imbalance, the low GCS score of the patients.<sup>9</sup> Espay in 2014 gave this phenomenon a broader perspective stating that it is not only conscious level but electrolyte imbalance could lead to multiple neurological presentations including neuropathies, paraneesthesia, paraplegias and encephalopathy like state.<sup>10</sup>

Moreover, the electrolyte imbalance in unconscious patients may be causing harm to another system of the body and disrupting the overall homeostasis. However, limited data is available regarding unconscious patients and electrolyte imbalance in our population. Therefore, we planned this study to look for a pattern of electrolyte imbalance and associated factors among the unconscious hospitalized patients managed at Pak Emirates Military Hospital during study period.

### METHODOLOGY

The cross-sectional study was conducted from September 2019 to February 2020 at the Pak Emirates Military Hospital Rawalpindi Pakistan. The Hospital Ethical Committee approved this study (A/124/EC128). The sample size was calculated using the

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WHO sample size calculator taking electrolyte abnormalities among unconscious patients as 4.74%.<sup>11</sup> Consecutive sampling technique was used to gather the sample from Medicine-Allied Wards, Surgery-Allied Wards and the Critical Care Unit.

**Inclusion Criteria:** Patients of either gender, aged 18-69 years who became unconscious (GCS score <10) while admitted to the hospital for any medical or surgical cause were included in the study.

**Exclusion Criteria:** Patients brought unconscious to the hospital, unconscious patients in the Emergency Department, those not gaining consciousness back after surgery and patients with psychiatric illness or drug overdose. The study did not include those with electrolyte abnormalities well documented before the unconsciousness episode.

The Glasgow coma scale was used to assess the level of unconsciousness. A GCS score <10 was considered significant for cerebral impairment.<sup>9,12</sup> As the patients' level of consciousness fell below the level of GCS 10, blood samples for electrolytes (sodium, potassium, Magnesium, chloride) were taken. In addition, the age and gender of all patients were noted along with other relevant demographic information on a performance specially designed for this study. The same professional did blood samples at the Armed Forces Institute of Pathology (AFIP). Under aseptic precautions, 5ml of venous blood was drawn from each subject and transferred to a clean, dry test tube to clot. Then the sample was centrifuged, and serum was collected in an Eppendorf tube and preserved at -20°C. The normally accepted range for sodium is 135 to 145 mEq/L. The normal range for potassium is 3.5 to 5.5 mEq/L. The normal adult value for chloride is 96-106 mEq/L. The normal range for Magnesium is 1.5-2.5 mEq/L.<sup>13,14</sup>

Statistical Package for Social Sciences (SPSS) version 22.0 was used for the data analysis. Quantitative variables were summarized as Mean±SD and qualitative variables were summarized as frequency and percentages.

## RESULTS

Two hundred and forty patients who became unconscious during the hospital stay were included in the study. The mean age of study participants was 49.10±7.55 years. One hundred eighty-one (75.4%) were males, while 59(24.5%) were females. One hundred and sixty-two (67.5%) patients were from Medicine- Allied Wards, and 78(32.5%) were from

Surgical-Allied Wards. Thirty-eight patients were from the critical care unit (Table). Mean serum sodium was 139.10±11.52 meq/L, while potassium was 4.6 (±1.06) meq/L. Mean chloride was 89.40±53.55 meq /L, and Magnesium was 1.40±1.05 meq /L. Our analysis revealed that advanced age, underlying medical cause and duration of hospitalization were strongly linked with electrolyte imbalance among the unconscious patients.

**Table: Characteristics of Patients who became Unconscious During Hospital Stay (n=240)**

Characteristics	n(%)
<b>Age(years)</b>	
Mean±SD	49.10±7.55 years
<b>Gender</b>	
Male	181(75.4%)
Female	59(24.6%)
Mean serum potassium	4.60±1.06 meq/L
Mean serum magnesium	1.40±1.05 meq/L
Mean serum sodium	139.10±11.52 meq/L
Mean serum chloride	89.40±53.55 meq/L
Mean hospital stay	6.20±3.46 days
<b>Cause of Admission to Hospital</b>	
Medical	162(67.5%)
Surgical	78(32.5%)
<b>Electrolyte Imbalance of any Type</b>	
No	101(42.1%)
Yes	139(57.9%)

## DISCUSSION

The conscious level of the human being is a multidimensional phenomenon and not dependent on one or two parameters. Groover *et al.* in their analysis, called out the number of causes and risk factors for the altered state of consciousness, especially in the elderly and the effective management plan for all of the causes. Electrolyte imbalance was one of them. In our study, we just focused on studying one parameter of electrolyte imbalance. Results showed that more than fifty percent of our patients have electrolyte abnormalities of one kind or another.<sup>15</sup> Dylan *et al.* highlighted the same factor in non-surgical patients that electrolyte imbalance is a potential risk factor for the development of delirium or altered state of consciousness among the patients.<sup>16</sup> Cataleno *et al.* revealed that electrolyte imbalance had been a common finding among the patients admitted with various non-renal or metabolic causes. Even surgical patients showed the presence of imbalance to a considerable extent.<sup>11</sup>

A local study by Rafiq *et al.* was done on patients with traumatic brain injury and focused on similar

electrolytes as we have focused on. Sodium, potassium and Magnesium all show dim balance and fluctuation in many patients who were unconscious due to traumatic brain injury.<sup>17</sup> Results of our study are comparable and similar to this local study. More local studies need to ascertain the magnitude and direction of the relationship between electrolyte imbalance and altered state of consciousness in our population. Schlanger *et al.* have discussed various causes for this association. It may be age-related renal changes or metabolic changes. Multiple comorbid or poly-pharmacy for various illnesses may also contribute. An overall reduced functioning of all the homeostatic mechanisms may cause electrolyte imbalance in old age compared to the young population.<sup>18</sup> Gallagher *et al.* highlighted the fact long ago in their study on surgical patients that long-standing illness and long hospital stay serve as risk factors for electrolyte imbalance among the patients.<sup>19</sup>

Study design poses some issues relating to the generalizability of the results. As baseline electrolytes before the patients went unconscious were not done, it cannot be drawn from the results that electrolyte imbalance was the cause or effect of the altered state of consciousness. Moreover, it could not be differentiated that electrolyte imbalance was a consequence of underlying medical or surgical conditions or the treatments offered in the hospital setting. Future studies addressing these issues may generate more generalizable results.

## CONCLUSION

Electrolyte imbalance was common among the unconscious patients hospitalized in our tertiary care unit. Therefore, patients with advancing age, medical illnesses and long hospitalization should be screened for electrolyte wasting a priority to prevent them from going unconscious.

**Conflict of Interest:** None.

## Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MN & MNAK: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

SUS & AH: Conception, study design, data interpretation, approval of the final version to be published.

MSK & MZH: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated & resolved.

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