ORIGINAL ARTICLE

# THE FREQUENCY OF HYPOMAGNESAEMIA IN PATIENTS PRESENTING WITH ACUTE CORONARY SYNDROME

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## ABSTRACT

**Objectives:** To determine the frequency of hypomagnesemia in patients presenting with Acute Coronary Syndrome. **Materials and Methods:** A descriptive cross-sectional study was carried out at the department of cardiology, Hayat Abad medical complex, Peshawar from 07 March 2021 to 20 September 2021 after approval from the Institutional ethical board. All patients (a total of 185) admitted to the CCU with Acute Coronary Syndrome were included in the study. After informed consent, using an aseptic 3cc BD syringe, 5ml of blood was drawn and was sent for assessment of magnesium level using an automated analyzer machine. All the information, along with the patient's demographics, was recorded in the proforma attached.

**Results:**The maximum number of patients were in the age group 51-70 years i.e. 77.83% (144) patients. About 22.16% (41) of patients were recorded in the 35-50 years age group. Mean and SDs for age were 62+7.11 years and BMI was 27.2+1.56 kg/m2. Mean and SDs for the magnesium level was 0.79+0.04 mmoles, 44 (23.78%) patients had unstable angina, 124 (67.02%) patients had NSTEMI, and 17 (9.18%) patients had STEMI. Fifteen (8.10%) patients were found to have hypomagnesemia.

**Conclusion:** A significant number of patients with Acute Coronary Syndrome were found to have hypomagnesemia and this should be screened while treating such patients. Hypomagnesemia may result in deadly consequences such as coronary artery spasms, ventricular arrhythmia, and sudden death.

**Keyword:** Hypomagnesaemia, Parathyroid Hormone, Acute Coronary Syndrome

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## INTRODUCTION

Acute coronary syndrome (ACS) refers to a group of myocardial ischemia states that include unstable angina, non-ST-elevated myocardial infarction (MI), and ST-elevated MI. ACS is associated with significant morbidity and death, as well as a significant financial load on the healthcare system. [1]

The data regarding the accurate burden of acute coronary syndrome in 3rd world countries are not available up till today. [2] The traditional modifiable risk factors of acute coronary syndrome is smoking, hypertension, dyslipidemia, diabetes mellitus, and obesity. [3] Contrary to hyponatremia, hypokalemia, and hypocalcemia, hypomagnesemia has received comparatively little attention in the medical literature despite being the body's second and fourth-most common intracellular and extracellular cations, respectively. [4]

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It is essential for numerous processes that regulate cardiovascular function, including controlling vascular tone, endothelial function, and myocardial excitability. It also controls glucose and insulin metabolism. [5]

Magnesium (Mg) is necessary for life and is important for a number of biochemical and physiological activities in the body. Hospitalized patients (7–11%) frequently have hypomagnesemia, and those who also have other electrolyte disorders tend to have it more frequently. Hypomagnesemia may result in deadly consequences such as coronary artery spasms, ventricular arrhythmia, and sudden death. [6]

It also associates with increased mortality and prolonged hospitalization. [7] Anjum et al. in 2014 reported the frequency of hypomagnesemia as 8.2% in patients presenting with ACS. [8] Maciejewskiet al. 2014 reported the frequency of hypomagnesemia to be 22 % in acute coronary syndrome patients. [9]

Alzamani et al. (2006) observed the frequency of hypomagnesemia to be 12.5% of STEMI among Malaysian patients with the acute coronary syndrome. [10] However, Mir Mohammadi et al. in 2013 reported a much higher frequency of hypomagnesemia to 24.7% among Iranian patients with ACS. [11]

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The goal of this study is to determine how frequently hypomagnesemia occurs in ACS patients. Literature has shown that the frequency of hypomagnesemia was low (8.2%)[8] in ACS patients but controversial evidence has also been observed in the literature showing high frequency (24.7%) of hypomagnesemia in ACS patients. [11] Therefore, we aim to carry out this study to confirm the severity of the issue in the local community.

## MATERIALS AND METHODS

A descriptive cross-sectional study was carried out at the department of cardiology, Hayat Abad medical complex, Peshawar from 07 March 2021 to 20 September 2021 after approval from the Institutional ethical board. All patients (a total of 185) admitted to the CCU with Acute Coronary Syndrome were included in the study. After informed consent, 5ml of blood was drawn and was sent for assessment of magnesium level using an aseptic 3cc BD syringe. All the information including ages, gender, type of acute coronary syndrome, and the levels of Mg was recorded in the proforma attached.

## RESULTS

The Mean and SDs for age were 62+7.11 and BMI was 27.2+1.56. Mean and SDs for the magnesium level was 0.79+0.04. (Table No. 1). Forty-one (22.16%) patients were in the 35-50 years' age group, and 144 (77.83%) patients were in the range 51-70 years. 136 (73.51%) patients were males whereas 49 (26.48%) patients were female patients. 44 (23.78%) patients had unstable angina, 124 (67.02%) patients had NSTEMI, and 17 (9.18%) patients had STEMI. (Table No. 2). Fifteen (8.10%) patients were recorded with hypomagnesemia. Stratification of hypomagnesemia with gender, age, and type of ACS is recorded in Table 3 and Table 4. the mean age of participants was 62 years with a mean BMI of 27.2 km/m$^2$ and the mean S. Mg levels were 0.79 mmol/l. the frequencies of different types of Acute coronary syndrome are shown in table-1. Hypomagnesemia was seen in 15 patients (8.1%), the stratification of which has been shown in table 2 among different genders.

**Table 1: The frequency and percentages for types of ACS**

| Type of ACS | Frequency | Percentage |
|---|---|---|
| Unstable | 44 | 23.78% |
| NSTEMI | 124 | 67.02% |
| STEMI | 17 | 9.18% |
| Total | 185 | 100% |

**Table 2: The stratification of Hypomagnesemia with gender**

| Gender | Hypomagnesaemia | Frequency | Percentage | P value |
|---|---|---|---|---|
| male | Yes | 12 | 6.48% | 0.552 |
| | No | 124 | 67.02% | |
| female | Yes | 03 | 1.62% | |
| | No | 46 | 24.86% | |

**Table 4: Stratification of hypomagnesemia with gender (n=185)**

| Gender | Hypomagnesaemia | Frequency | Percentage | P value |
|---|---|---|---|---|
| male | Yes | 12 | 6.48% | 0.552 |
| | No | 124 | 67.02% | |
| Female | Yes | 03 | 1.62% | |
| | No | 46 | 24.86% | |

**Table 3: Hypomagnesaemia (n=185)**

| Hypomagnesaemia | Frequency | Percentage |
|---|---|---|
| YES | 15 | 8.10% |
| NO | 170 | 91.89% |
| TOTAL | 185 | 100% |

## DISCUSSION

Anjum et al. 2014 reported the frequency of hypomagnesemia as 8.2% in patients presenting with ACS [8]. Maciejewskiet al. 2014 reported the frequency of hypomagnesemia to be 22 % in acute coronary syndrome patients Hypomagnesaemia. [9]

Alzamani et al. (2006) observed the frequency of hypomagnesemia to be 12.5% of STEMI among Malaysian patients with acute coronary syndrome. [10] However, Mirmohammadi et al. in 2013 reported a much higher frequency of hypomagnesemia to be 24.7% among Iranian patients with ACS. [11] In the study, 44 (23.78%) patients had unstable angina, 124 (67.02%) patients had NSTEMI, and 17 (9.18%) patients had STEMI.

Fifteen (8.10%) patients were recorded with hypomagnesemia. Atherosclerosis is accelerated by magnesium shortage because it increases vascular endothelial injury, low-density lipoprotein concentration, and oxidative modification. [12, 13] It also influences myocardial infarction risk factors like blood pressure, lipid levels, and glucose metabolism. [14,15]

In my study, 44 (23.78%) patients had unstable angina, 124 (67.02%) patients had NSTEMI, and 17 (9.18%) patients had STEMI while 15 (8.10%) patients were recorded with hypomagnesemia. Moreover, prolonged magnesium deficit may be proarrhythmic, whereas magnesium has antiarrhythmic properties. [16]

Recent researchers have attributed low blood magnesium levels to a higher risk of atrial fibrillation and sudden cardiac death. [17, 18] Our findings confirmed this hypothesis by identifying an inverse relationship between serum Mg level and MACEs in patients having DES implantation for acute myocardial infarction, with a median follow-up of 24 months for ACS patients.

The physiological Ca antagonist is Mg, and in healthy humans, its blood content is remarkably stable. Endothelial function is adversely affected by low Mg levels which trigger the Ca excess that follows reperfusion. [19, 20]. Mg was revealed to be negatively associated with platelet aggregation and adenosine triphosphate release and to be implicated in platelet-dependent thrombosis. [21, 22]. Mg supplementation has been proven to reduce acute platelet-dependent thrombosis in clinical trials. [21]

Additionally, Mg can inhibit the growth of smooth muscle cells and promote the growth of endothelial cells, which may have a positive impact in the case of vascular damage brought on by stents. [23]

These might be possible explanations for the lower MACEs seen in the patients who had low magnesium levels. In my study, 44 (23.78%) patients had unstable angina, 124 (67.02%) patients had NSTEMI, and 17 (9.18%) patients had STEMI.

It still needs to be determined why the relationship was only observed in patients suffering from acute myocardial infarction and not unstable angina. The primary limitation is that the majority of the endpoints required PCI repeatedly. Second, the sample size was limited. Further studies of this kind are needed in an older population and with a high sample size in multiple centers.

## CONCLUSION

A significant number of patients (up to one in 10 patients) with Acute Coronary Syndrome were found to have hypomagnesemia and this should be screened while treating such patients. Hypomagnesemia may result in deadly consequences such as coronary artery spasms, ventricular arrhythmia, and sudden death.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

**Khan ZA:** Concept, Design, and drafting of initial manuscript

**Ullah F:** Acquisition and critical review

**Ullah H:** Analysis and interpretation of data

**Ahmad S:** Data collection, Bibliography, and proofreading

**Hakeem Y:** Data Collection

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 and resolved.