SHOULD SERUM MAGNESIUM LEVELS BE EVALUATED IN INTENSIVE CARE UNIT?

YOĞUN BAKIM ÜNİTESİNDE SERUM MAGNEZYUM DÜZEYİ DEĞERLENDİRİLMELİ Mİ?

Özlem EDİBOĞLU[1], Pınar ÇİMEN[1], Dursun TATAR[1], Canan DOĞAN[1], Gülru POLAT[2], Ceyda ANAR[2], Defne ÖZBEK[3]

[1]Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Yoğun Bakım Ünitesi, İzmir, Türkiye
[2]Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Göğüs Hastalıkları Kliniği, İzmir, Türkiye
[3]Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Biyokimya Laboratuarı, İzmir, Türkiye

Anahtar sözcükler: Magnezyum, yoğun bakım ünitesi, mortalite

Key words: Magnesium, intensive care unit, mortality

Geliş tarihi: 20 / 12 / 2012 Kabul tarihi: 22 / 03 / 2014

ÖZET

Amaç: *Elektrolit dengesizlikleri yoğun bakım hastalarında sıklıkla görülür. Hipomagnezemi yeterince tanımlanmamakla birlikte YBÜ mortalitesine katkıda bulunabilir. Bu çalışmanın amacı kritik hastalarda hipomagnezemi sıklığını saptamak ve mekanik ventilasyon günü, YBÜ'de kalış süresi ve mortalite ile ilişkisini saptamayı amaçladık.*

Yöntem ve Gereç: *Ocak 2008-Temmuz 2008 arasında solunum yetmezliği ile YBÜ'ne başvuran 60 hasta alındı. Prospektif çalışmada başvuru sırasında hastaların serum total Mg düzeyi, elektrolit düzeyleri, total protein, albumin ve laktat düzeyi ölçüldü. Hastaların demografik özellikleri, eşlik eden nörolojik ve kardiyak bulguları, APACHE II skoru, mekanik ventilasyon süresi, YBÜ'de kalış süresi ve mortalite oranı kaydedildi.*

Bulgular: *Hastaların % 27'sinde başvuru sırasında hipomagnezemi saptandı. Serum Mg ile Ca düzeyleri arasında pozitif korelasyon bulundu (p=0.03), ancak diğer laboratuar testleri arasında ilişki saptanmadı. Hipomagnezemi ile mekanik ventilasyon süresi, YBÜ'de kalış süresi ve mortalite oranı arasında ilişki saptanmadı (p>0.05).*

SUMMARY

Aim: *Electrolyte disturbances are often seen in patients in intensive care unit (ICU). Hypomagnesemia is not enough discribed but can be contributed in ICU mortality.The aim of this study was to define the prevalance of hypomagnesemia in critically ill patients and to evaluate its relationship with duration of mechanical ventilation day, length of ICU stay, and mortality.*

Material and Methods: *A prospective study was done on 60 patients with respiratory failure admitted to the ICU between January 2008 and July 2008. Total serum magnesium (Mg) level, electrolyte levels, albumin, total protein, and lactate levels were evaluated at the admission. Patients demographic features, accompanying neurological and cardiac symptoms, Acute Physiology and Chronic Health Evaluation (APACHE II) score, duration of mechanical ventilation, and the length of ICU stay and mortality were recorded.*

Results: *At admission 27% of patients had hypomagnesemia. A positive correlation was found between serum Mg and calcium (Ca) level (p=0.03), but there was no relationship between other laboratory tests. Also there was no relationship determined between hypomagnesemia and duration of mechanical ventilation,and the length of ICU stay and mortality (p>0.05).*

Sonuç: *Elektrolit düzeylerinin monitorizasyonu kritik hastalarda önemlidir. Ancak Mg düzeyinin rutin ölçülmesinden ziyade, hipomagnezemiye ait klinik bulguları olan hastalarda Mg düzeyinin ölçülmesinin uygun olacağı görüşündeyiz.*

Conclusion: *Monitoring of electrolyte levels is important in critically ill patients.However the routine measurement of the level of serum Mg rather than the measurement of the level of Mg in patients with clinical signs of hypomagnesemia believe to be appropriate.*

INTRODUCTION

Magnesium (Mg) is the fourth most common mineral salt in the body after phosphorus, calcium and potassium, and the fourth plasma cation after sodium, potassium and calcium. Mg is required as a cofactor in numerous important enzymatic systems (1,2,3) The plasma Mg concentration is 1% of the total body content (1,3,4). In serum, Mg is divided into three fractions: ionized (active form-65%), protein-bound (27%) and that is contained in anionic complexes (8%) (1). For many years regarded as the forgotten ion magnesium practical importance in intensive care is raising nowadays. The reason for the growing interest is the high incidence of hypomagnesemia in intensive care Patients taken to the intensive care unit (ICU)(5).

Hypomagnesemia is commonly occurs in critical illnesses, and if it is not considered it can be easily overlooked. It can be correlated with a higher mortality and worsen clinical outcome in the ICU patients (6). The clinical features of hypomagnesemia are uncommon (4). Mg has been directly implicated in hypokalemia, hypocalcemia, tetany, and dysrhythmia (7).

In this study we aimed to define the prevalance of hypomagnesemia in critically ill patients and to evaluate its relationship with duration of mechanical ventilation day, length of ICU stay, and mortality.

MATERIAL AND METHOD

In this prospective study we evaluated 60 patients who had received mechanical ventilation with respiratory failure admitted to the 29 bed, level III respiratory ICU between January 2008 and July 2008. All patients had mechanical ventilated. At admission, especially in the first 24 hour, serum Mg level, electrolyte levels, total protein, albumin, and lactate levels were measured. Serum Mg level measured on Olympus AU 2700 oto analis ateurby Xylidyl Blue method. Patients' demographic features, APACHE II scores, accompanying neurological, cardiac symptoms were recorded. Patients separated into two groups, hypomagnesemia group was included serum Mg level was below 2.0 mg/dl, and normal group was included 2.0 mg/dl or above. The difference between the each groups' duration of mechanical ventilation, length of ICU stay, and mortality rate were recorded. SPSS (Statistical Package for the Social Sciences) 17.0 was used for analysis. Continuous variables were expressed as medians within terquartile range (IQR) and categorical variables were expressed as numbers with percentages. Medians were compared by Mann Whitney U test and frequencies were compared by Fisher's exact test. Results were evaluated with Pearson's correlation test.

RESULTS

On admission 27%(16/60) patients had hypomagnesemia. Patients' median age was 65(60-75) in hypomagnesemia group and 71(63-77) in normal group. There was no difference between two groups median age ($p>0.05$). Female/male ratio was 3/13 in hypomagnesemia group and 6/38 in normal group. At admission to ICU patients' APACHE II scores were similar ($p>0.05$).

The most common symptoms related hypomagnesemia was arrythmia, and it was mostly ventricular premature beats, and did not require any addition treatment. In our study, the main neurological finding was weakness. In two groups we didn't see any difference between arrhythmia (43.8% v.s 27.3%), and neurological symptom (43.8% v.s 34.1%) ($p=0.34$ and $p=0.55$). Patients' datas are shown in Table 1.

	Age (mean)	APACHE II
Group 1 (n=16)	64.38	18.94 ±4.72
Group 2 (n=44)	69.07	18.45 ± 6.21
P value	ns	ns

Table 1.

	Hypomagnesemia group(n=16)	Normal group(n=44)	p value
Age	65(60-75)	71(63-77)	0.27
Gender(F/M)	3/13	6/38	0.68
APACHE II score	19(14-22)	18(15-22)	0.47
Serum Mg	1.7(1.6-1.9)	2.5(2.2-2.9)	0.0001
Serum Na	137(133-140)	138(135-142)	0.26
Serum K	4.4(3.6-4.9)	4.5(3.6-4.9)	0.79
Serum Ca	8.0(7.5-8.6)	8.3(7.8-8.8)	0.21
Serum P	2.7(2.3-3.6)	3.5(2.6-4.2)	0.17
Lactate	1.6(1.1-2.7)	1.8(1.2-2.5)	0.48
Total protein	6(5-7)	6(5-7)	0.38
Albumin	3(2-3)	3(2-3)	0.53

	COPD %	Pneumonia %	ILD %
Group 1	81,3	12,5	6,3
Group 2	88,6	9,1	2,3
P value	=ns	=ns	=ns

Table 2.

	Hypomagnesemia group	Normal group	p value
Reason ICU Admission, n(%)			
COPD	13(81)	39(88)	
Pneumonia	2(13)	4(10)	0.68
ILD	1(6)	1(2)	
Symptoms Related Hypomagnesemia(%)			
Arrythmia	43.8	27.3	0.34
Neurological Symptom	43.8	34.1	0.55
ICU Data			
Duration of IMV, day	14(7-24)	11(5-28)	0.68
Length of ICU stay, day	22(13-26)	15(7-37)	0.48
Mortality rate(%)	68 n=11	47 n=21	0.24

Table 3.

	Arrythmia (%)	Neurological Symptom (%)
Group 1	81,3	12,5
Group 2	88,6	9,1
P value	>0.05	>0.05

Table 4.

	Mechanical ventilation day	ICU day	Mortality (%)
Group 1	17.81	22.07	62.5 n=10
Group 2	23.52	28.56	45.5 n=20
P value	>0.05	>0.05	>0.05

The reason ICU admission mainly chronic obstructive pulmonary disease (COPD) (81% v.s 88%), pneumonia (13% v.s 10%) and interstitial lung disease (ILD) (6% v.s 2%) were found. There was no relationship between two groups (p>0.05).

There was a positive correlation between serum Mg and calcium (Ca) level (p=0.03), as correlated with as expected. The relationship between serum Mg and Ca levels are shown in Figure 1.

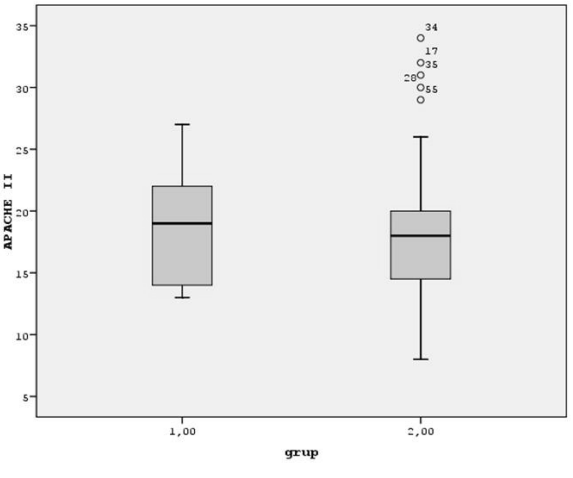

Figure 1.

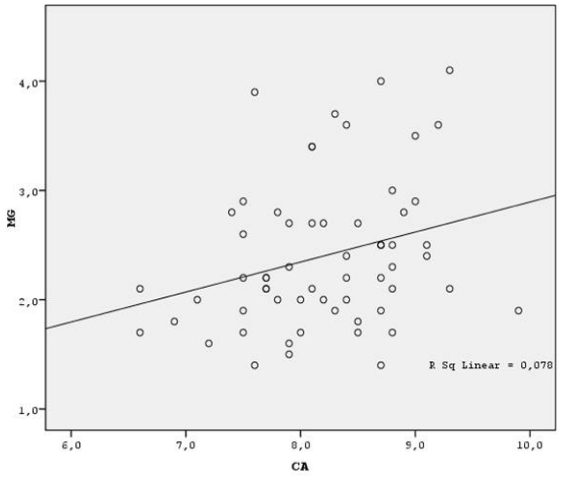

Figure 2.

The median mechanical ventilation day was found 14 (7-24) day in hypomagnesemia group, and 11 (5-25) day in normal group. ICU day was seen 22 (13-26) day in hypomagnesemia group, and 15(7-37) day in normal group. In our study there was no relationship determined in two groups between hypomagnesemia and duration of mechanical ventilation, and the length of ICU stay. Mortality rate was found 68% v.s 47% in groups and there was no statistical significance (p=0.24).

DISCUSSION

Mg plays an important role in homeostasis and requiring as a cofactor in the body (3,8). Although Mg is considered as the fifth forgotten ion nowadays there is raising interest because of frequency of hypomagnesemia in the ICU. In the literature, the prevalance of hypomagnesemia varies between 4.5%-65% (8-13). Inn the present study 27% patients had hypomagnesemia in the ICU.

Mg deficiency may cause several clinical manifestations such as alterations in potassium, calcium and phosphate balance, cardiacarrythmias, alterations in vascular tone and blood pressure, neuromuscular manifestations, and neuropsychiatric manifestations (3). Because these findings are not unique for hypomagnesemia, clinical diagnosis can be overlooked. In some cases weakness, tremors, seizures, hypokalemia, andhypocalcemia can be seen (14). The most common finding of hypomagnesemia which we found was cardiac arrythmias, especially ventricular premature beats. There was no relationship between hypomagnesemia and cardiac finding in our study. In our study, there was significant correlation between hypocalcemia and hypomagnesemiaas correlated with the literature ($p<0.05$).

In most of the studies Mg levels are measured by the total serum Mg level which actually does not reflect hypomagnesemia (3,15). There are no readily test to determine intracellular/total body magnesium status. In some studies, Mg has been measured in peripheral blood cells (red and mononuclear blood cells) (9,16), muscle (17) and in the bones (18).

Hypomagnesemia is known to cause muscle weakness and respiratory failure. It can be cause difficult weaning from the ventilator. In the literatüre, patients with hypomagnesemia had longer duration of mechanical ventilation than normomagnesemic patients (8,20). The length of mechanical ventilation and ICU day is found similar in both groups ($p>0.05$).

The mortality rates of hypomagnesemia was found 35%-80% in different studies(12,19). In our study, the mortality rate was found 68% in hypomagnesemia group similar to the other studies in literature, there is no significant difference between two groups.

As a result we think that to measure serum Mg level is important in some ICU patients. We should investigate the patients whether if there is clinical finding or suspect of hypomagnesemia, but should not be in routine.

CONCLUSION

In routine, serum Mg level measurement is not necessary, but the patients with respiratory failure if there was a clinical finding such as arrythmia, and neurological symptoms, hypomagnesemia should be kept in mind and clinical evaluations must be done carefully.

REFERENCES

1. DubeL, Granry JC.The Therapeutic Use of Magnesium in Anesthesiology, Intensive Careand Emergency Medicine: AReview. Can J Anesth 2003; 50(7): 732-46.
2. DelhumeauA, Granry JC. Indicationsfor The Use of Magnesium in Anesthesia and Intensive Care. Ann Fr Anesth Reanim 1995; 1485): 406-16.
3. Berkelhammer C, Bear RA. A clinicalapproachto comm. One lectrolyte problems: 4. Hypomagnesemia. Can Med Assoc J. 1985; 132(4): 360-8.
4. Connolly E, Worthley L. I. G. Intravenous magnesium. Critical Careand Resuscitation 1999; 1: 162-72.
5. Ryzen E, WagersPW,Singer FR, Rude RK. Magnesiumdeficiency in a medical ICU population. CritCareMed 1985; 13: 19-21.
6. Rubeiz GJ, Thill- Baharozian M,Hardie D, Carlson RW. Associationof hypo magnesemia and mortality in acutelyillmedicalpatients. Crit Care Med 1993; 21: 203-9.
7. Tong GM, RudeRK. Magnesium deficiency in criticalillness. J Intensive Care Med 2005; 20(1): 3-17.
8. Limaye CS,LondheyVA,NadkarMY,Borges NE. Hypomagnesemia in Critically Ill Medical Patients. JAPI 2011; Vol 59: 19-22.
9. Croker JW, Walmsley RN. Routine plasma magnesiu mestimation: auseful test? Med J Aust. 1986; 145(2): 74-6.
10. Verive MJ, Irazuzta J. Evaluatingt hefrequency rate of hypomagnesemia in criticall yillpediatricpatientsbyusingmultipleregessionanalysisand a computer-based neuralnetwork. CritCare Med 2000; 28(10): 3534-9.
11. Ryzen E. Magnesiumhomeostasis in criticallyillpatients. Magnesium 1989; 8(3-4): 201-12.
12. Guerin C, Cousin, Mignot F. Serumanderythrocyte magnesium in criticallyillpatients. Intensive Care Med 1996; 22(8): 724-7.
13. Reinhart RA, Desbiens NA. Hypo magnesemia in patient senteringthe ICU. Crit Care Med 1985; 13(6):506-7.
14. Elin RJ. Magnesium metabolism in healthanddisease. Dis Mon 1988; 34(4):161-218.
15. Huijgen HJ, Soesan M, Sanders R. Magnesium levels in criticallyill patients. What should wemeasure? Am J ClinPathol 2000; 114:688-95.
16. Arnold A, Tovey J. Magnesium deficiency in critically illpatients. Anaesthesia 1995; 50(3): 203-5.
17. Fiaccadori E, Del Canale S .Muscleand serum magnesium in pulmonary intensive care unit patients. Crit Care Med 1988; 16(8): 751-60.
18. Escuela MP, Guerra M. Totalandionized serum magnesium in criticallyill patients. Intensive Care Med 2005; 31(1): 151-6.
19. Soliman HM, MercanD.Development of ionized hypomagnesemia is associated with higher mortality rates. Crit Care Med 2003; 31(4): 1082-7.
20. Safavi M,Honarmand A. Admission hypomagnesemia-impact on mortalityormorbidity in criticallyill patients. Middle East Anesthesiol 2007; 19(3): 645-60.

Yazışma Adresi:

Dr. Özlem EDİBOĞLU
Dr. Suat Seren Göğüs Hastalıkları ve Cerrahisi Eğitim ve Araştırma Hastanesi, Yoğun Bakım Ünitesi, İzmir, Türkiye
ozlemediboglu@gmail.com