

About the Misdiagnosis of Magnesium Deficiency

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The experience of our self-help organisation shows that the reason patients with symptoms of magnesium (Mg) deficiency do not get Mg therapy is acceptance of an inappropriate lower limit of the reference values for serum Mg concentration. The commonly designated low limit of the normal range seems to have been selected from values obtained for symptomatic patients. It is below levels that exist in patients with marginal deficiencies that can predispose to development of pathologic findings, so that the prevalence and importance of this disease is insufficiently considered. The lower reference limit of the normal population is erroneously regarded as a diagnostic criterion that excludes Mg deficiency when the serum level is even slightly above the reference limit that only excludes normality at lower levels. It is a statistical error to use the confidence limits of the normal population as the exclusion limit for those with abnormal Mg status.

THE ERRORS

Mg deficiency is widespread, but under-detected because of the role of Mg, not only is the plasma, but intracellularly.

- The first diagnostic error is failure to recognize relevant symptoms as part of a Mg deficiency syndrome (MDS) [1]
- The second error is to interpret symptoms due to Mg deficiency as irrelevant, because associated with decline of somatic functions with age.
- The third error: misinterpretation of significance of serum Mg levels, as the test of validity of diagnosis of Mg deficiency is considered in more detail below.
- The fourth error pertains more to inadequate Mg repletion than to diagnosis. When the practitioner has been convinced to start Mg on the basis of his diagnosis or through insistence of the patient, the often recommended dose of 300 mg per day is insufficient. Experience of successful therapy indicates that no less than 600 mg per day is required.
- Mg is a normal component of the body, rather than a drug, that is normally absent in the body. Thus its metabolism is regulated, and the immediate effect of supplemented Mg is moderate. Mg therapy usually requires at least one or two weeks for notable improvement to become manifest.

THE TEST

Let us assume that the practitioner has identified the symptoms as part of the MDS and intends to start a test based on the value of the serum Mg concentration.

In the literature, among the different critical values mentioned are: 0.8 mmol/l Mg [2] (Fig. 1), 0.75 mmol/l Mg [3], and 0.7 mmol/l Mg [4], but most of them without correct statistical foundation. We derive, from the data published by von Ehrlich, 1997 [5] that:

- the average value for the magnesium deficient patient is probably higher than 0.75 mmol/l Mg;
- when the distribution is symmetric, a critical value of 0.8 mmol/l Mg misses about 10% of affected patients.

The estimation of the mean value for the normomagnesemic persons without clinical symptoms varies around the value of 0.9 mmol/l Mg. When the distribution for the affected is Gaussian, a critical value of 0.9 mmol/l Mg misses only 1% of those affected.

Von Ehrlich had diagnosed 366 (9.4%) patients, among 3894 who had symptoms of a clinically relevant MDS and whose serum values were less than 0.8 mMol/l Mg [2]. If patients with more than the low limit of 0.7 mmol/l Mg [2] were considered as normomagnesemic, more than 329 Mg-deficient patients would be erroneously declared as normomagnesemic. In these cases (that amount to 90% of the affected patients!) unfortunately, no Mg therapy would be started. Accepting 0.75 mmol/l Mg as the critical value [3], von Ehrlich

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How to detect magnesium deficient patients through a serum test?
Data by von Ehrlich [2] for 366 patients in a sample of 3894 persons/l

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| <p>proven frequency of erroneous diagnosis 90% (329 of 366) with a critical value of 0.7mmol/l</p> | <p>proven frequency of erroneous diagnosis 50% (183 of 366) with a critical value of 0.75mmol/l</p> | <p>no error in the chosen sample with a critical value of 0.8mmol/l/190% (329 of 366)</p> |
| <p>only 10% found</p> | <p>only 50% found</p> | |
| <p><0.7mmol/l</p> | <p><0.75mmol/l</p> | <p><0.8mmol/l</p> |

Fig. 1. Illustration of the data published by von Ehrlich [2].

missed 183 (50%) of the affected patients. When one accepts that at least some of the undiagnosed 3528 person in the sample of 3894 persons showing symptoms of MDS really had magnesium deficiency, the critical value of 0.7 mmol/l Mg is more than 90% wrong for the ill!

STATISTICS

It is a common statistical error to use the confidence limits of the normal population as exclusion limits for the affected (see the diagram below).

In any decision between two alternatives (i.e.: normal person and patient) there is the potential of making two distinct errors. First, a person without Mg deficiency can erroneously be diagnosed as having a deficiency (error of the first kind). Second, a patient with a deficiency can erroneously be declared normal and remain undetected (error of the second kind).

The decision procedure entails selection of the condition to be treated. Because it can be determined by calculation, the error of the first kind is usually chosen to be 0.05 or 0.01. However, the smaller the error of the chosen first kind, the larger the error of the second kind will necessarily be [6]. In most cases, the error that implies higher risk or higher costs should be minimized. The decision through use of the serum concentration must respect the distribution of this value for affected patients, and must not use the distribution for normal persons.

CONCLUSIONS

Based on experience, it is our on conviction that many patients with so-called exclusion diagnoses (as for example, attention deficit hyperactivity disorder (ADHD) or chronic fatigue syndrome (CFS) would have their symptoms improved through Mg therapy.—Similarly, patients with diagnoses of depression, epilepsy, diabetes mellitus, tremor, Parkinsonism, arrhythmias, circulatory disturbances (stroke, cardiac infarction, arteriosclerosis), hypertension, migraine, cluster headache, cramps, neuro-vegetative disorders, abdominal pain, osteoporosis, asthma, stress dependent disorders, tinnitus, ataxia,

confusion, preeclampsia, weakness, might also be consequences of the magnesium deficiency syndrome.

- Patients with symptoms that can be part of the Mg deficiency syndrome should have their Mg serum values determined.
- In patients with Mg serum values lower than 0.9 mmol/l Mg, magnesium supplementation is recommended; for patients with values lower than 0.8 mmol/l, starting Mg supplementation is necessary. We recommend that a mMg serum value of 0.9 mmol/l Mg be considered as the lower reference limit, in evaluating symptoms or diseases suspected as being associated with Mg deficiency. In this case, Mg has to be used as a first choice therapy. When symptoms of the MDS are found, patients with serum values of less than 0.8 mmol/l Mg, or better 0.9 mmol/l Mg, ought not be erroneously declared normomagnesemic.
- When Mg substitution is started, the minimum dose to be applied is 600 mg Mg per day.
- The therapy should proceed for more than one month, and then continue with a dose that holds the serum value not lower than 0.9 mmol/l Mg.

REFERENCES

1. Durlach J: "Magnesium in der klinischen Praxis." Jena und Stuttgart: Fischer-Verlag, 1992.
2. Thomas L: Klinisch relevante Laborwerte. In Harrison: "Innere Medizin," 13th ed. New York: McGraw-Hill, pp 2915–2920, 1995.
3. Dörner K: Magnesium. In Thomas L (ed): "Labor und Diagnose." Frankfurt/Main: TH-Books VG, 2000.
4. Köhler H: Störungen des Wasser- und Elektrolythaushaltes. In Wehrauch TR (Hrsg): "Wol. und Wehrauch: Internistische Therapie 2000–2001." München, Jena: Urban & Fischer-Verlag, pp 299–317, 2000.
5. Publierte Patientendaten: Von Ehrlich B: Magnesiummangelsyndrom in der internistischen Praxis. Magnes Bulletin 19:29–30, 1997.
6. Lehmann EF: "Mathematical Statistics." New York: J Wiley, 1960.

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