

IMPACT OF CALCIUM CONCENTRATION ON THE DETERMINATION OF MAGNESIUM IN INDIVIDUALIZED PARENTERAL NUTRITION PREPARATIONS FOR NEONATAL INTENSIVE CARE SERVICE AT A GENERAL HOSPITAL

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INTRODUCTION

Our hospital pharmacy prepares personalized parenteral nutrition bags for neonatal intensive care service. Cation assay (Na⁺, Ca²⁺, K⁺, Mg²⁺) is one of the release controls performed by enzymatic method in the biochemistry laboratory. Abnormally high levels of magnesium [Mg²⁺] were observed in some preparations, including those that contain none. The refabrication of these pockets by excluding each component one by one which highlighted the impact of the addition of calcium gluconate on the dosages of Mg²⁺. The aim of this task is to indicate that the observed deviation in Mg²⁺ assay is correlated with calcium [Ca²⁺] concentrations in the bag, and to analyse this interference in order to define rules for the pharmaceutical validation of the Mg²⁺ results.

MATERIAL AND METHOD

The study focuses on bags produced between March 2017 and December 2018. Production was manual (Group 1) until December 2017 and then automated (Group 2). The [Ca²⁺] and [Mg²⁺] theoretical and dosed values were extracted from the Hesiod® software. Cancelled, bags-test, or whose results were not found were excluded. The study was carried out in 3 steps:

1) CHECKING THE INTERACTION'S NATURE

→ Comparison of Mg assay with enzymatic method and reference method (atomic emission spectrometry) from manually prepared pockets by varying the [Ca²⁺] and [Mg²⁺]

2) ANALYSING Mg²⁺ DOSAGES OF PREPARED BAGS WITHOUT Mg²⁺

3) INVESTIGATING THE IMPACT OF Ca²⁺ ON Mg²⁺ DETERMINATION + AND PRECISION OF THE DIRECTION OF THIS EFFECT

→ Calculation of correlation coefficients (site BiostaTGV)

3384 pockets were studied: 1105 from Group 1 and 2279 from Group 2 :

RESULTS

1) WHEN THERE IS ONLY Ca²⁺ IN THE BAG, THE ENZYMATIC METHOD DETECTS Mg²⁺ NOT DETECTED BY THE REFERENCE METHOD

2) IN THE POCKETS WITHOUT Mg²⁺ OF THE 2 GROUPS (N=279), THE RESULT OF THE Mg²⁺ ASSAY INCREASES WITH THE [Ca²⁺] (LINEAR PLOT, R²=0.9)

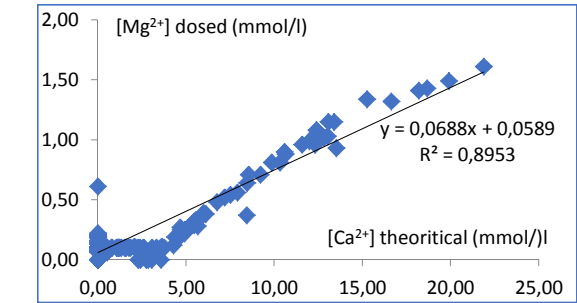
3) IN PRÉSENCE OF Mg²⁺ :

→ CORRELATION BETWEEN [Ca²⁺] AND THE ERROR IN THE DOSAGE OF Mg²⁺

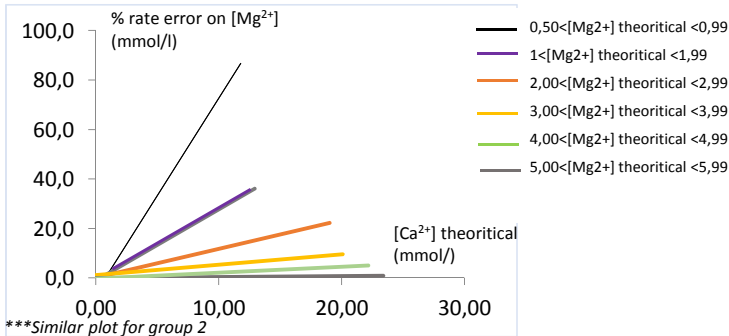
The Pearson correlation test gives [Mg²⁺] (mmol/L) values between (0.5-0.99), (1-1.99), (2-2.99), (3-3.99), (4-4.99) respectively a coefficient of 0.91-0.81-0.66-0.3-0.02 for group 1 and 0.82-0.87-0.84-0.33-0.37 for group 2. P-values are significant and < 0.05

Composition of the preparation		[Mg ²⁺] (mmol/L)	[Mg ²⁺] (mmol/L)
[Mg ²⁺] Théoritical (mmol/L)	[Ca ²⁺] Théoritical (mmol/L)		
		Enzymatic method	Reference method
0	12.3	1.09	0.06
0	0	1.16	0.2
1.4	12.3	1.9	1.27
1.4	0	1.27	1.37
0*	227.2*	17.35	0.23

Comparison of Mg assay with enzymatic method and reference method (atomic emission spectrometry)



**Similar plot for group 2
Détermination of [Mg²⁺] as a function of theoretical [Ca²⁺] in prepared bags without Mg²⁺ of group 2**



***Similar plot for group 2
[Mg²⁺] rate error as a function of theoretical [Ca²⁺] in group's 1 prepared bags***

DISCUSSION/CONCLUSION

There is a strong correlation (relationship) between the rate error observed on the Mg²⁺ assay and the [Ca²⁺]. When [Mg²⁺] increase, the interaction is prone to disappear. This analysis will allow us to develop decision rules for the pharmaceutical pockets release. The advantage of keeping Mg²⁺ dosage in our release controls is to be able to detect a tangible error in volume taken by the automaton.