DEM Journal Club

Article Appraisal

Article: High Dose Magnesium Sulfate Infusion for Severe Asthma in the Emergency Department: Efficacy Study

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Background and Study Objective(s):

Asthma is a common reason for paediatric emergency department (ED) visits and hospital admissions. Asthma refractory to first-line therapies can be managed with intravenous magnesium sulphate (IV Mg), an inexpensive bronchial smooth muscle relaxant. This study's objective was to compare the efficacy of a high dose Mg infusion versus an Mg bolus in paediatric patients with moderate to severe non-infectious asthma.

Study Design:

This was a single center, prospective, open-labelled, randomized study in Paraguay in patients aged 6-18 from 2012 to2014. Inclusion criteria were patients who failed to improve after 2 hours of standard therapy for asthma including dexamethasone and salbutamol. Patients with other underlying comorbidities and an infectious etiology including fever or prior antibiotic therapy were excluded. Patients were randomly selected to receive either an Mg bolus (50mg/kg) or an infusion (50mg/kg/hr over 4 hours) via concealed allocation using pre-prepared sealed envelopes. The primary outcome was discharge at 24 hours, and secondary outcome was total length of stay (LOS) and the hospital cost. There was no attempt to contact the family/patient after discharge. The study estimated that at 80% power and p = 0.05 significance, 22 patients would be required in each arm.

Results:

An unplanned interim analysis at n=19 per group revealed statistically significant results and no further patients were enrolled. No protocol violations were reported and no patients were lost to follow up. Between the two groups, there were no significant differences in age, sex, initial asthma severity score, and peak expiratory flow rate. The 24-hour discharge rates were 47% in the Mg infusion group and 10% in the bolus group, ($p<0.05$) for an absolute risk reduction of 37% (95% CI, 10-63%) and a number needed to treat of 2.7 (95% CI, 1.6-9.5). The infusion group had a lower average LOS. (34.1hrs versus 48.1hrs , $p < 0.05$) Estimated hospital costs were lower for the infusion group. ($603.16 vs. $834.37, $p < 0.05$) No patients had Mg-related complications or adverse events and none returned to the same ED in the following week after discharge.

Validity of Results:

This study is small and technically underpowered. At 80% power to obtain a significance of $p<0.05$, the study needed at least 22 patients per group which it did not meet. Additionally, as an open label study, investigators may have been aware of the allocation groups and outcomes, and potentially recorded biased results. In the demographic analysis, confounding variables such as comorbidities, vital signs, body mass index, prior hospitalizations, which may have influenced the results, were not reported.

Generalizability of Results:

This study was carried out in a single center in a developing country, may which make the findings more difficult to generalize in our practice. Additionally, none of the pediatric patients studied were obese, which may be more prevalent in our population. Importantly, our traditional first-line asthma treatments may be different than those used in Paraguay, which make extrapolation difficult. It should also be noted that no patients were admitted to hospital despite the average LOS exceeding 24 hours, and admission criteria may differ from our hospitals.

The Bottom Line:

This study of pediatric Paraguayan ED asthma patients found that an Mg infusion compared to a bolus resulted in significantly higher discharge rates from the ED at 24 hours, and overall decreased length of stay. Limitations include small sample size, inability to generalize results to other centers due to practice differences and socioeconomic status, and insufficient data regarding patient characteristics such as vital signs and comorbidities. This is an interesting hypothesis-generating study, but may difficult to interpret in the context of our practice here in Canada.