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REVIEW ARTICLE

Magnesium sulfate infusion for acute asthma in the emergency department☆

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KEYWORDS
Magnesium sulfate;
High dose infusion;
Severe asthma;
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Abstract

Objectives: To describe the role of intravenous magnesium sulfate ($MgSO_4$) as therapy for acute severe asthma in the pediatric emergency department (ED).

Source: Publications were searched in the PubMed and Cochrane databases using the following keywords: magnesium AND asthma AND children AND clinical trial. A total of 53 publications were retrieved using this criteria. References of relevant articles were also screened. The authors included the summary of relevant publications where intravenous magnesium sulfate was studied in children (age <18 years) with acute asthma. The NAEPP and Global Initiative for Asthma expert panel guidelines were also reviewed.

Summary of the data: There is a large variability in the ED practices on the intravenous administration of $MgSO_4$ for severe asthma. The pharmacokinetics of $MgSO_4$ is often not taken into account with a consequent impact in its pharmacodynamics properties. The cumulative evidence points to the effectiveness of intravenous $MgSO_4$ in preventing hospitalization, if utilized in a timely manner and at an appropriate dosage (50–75 mg/kg). For every five children treated in the ED, one hospital admission could be prevented. Another administration modality is a high-dose continuous magnesium sulfate infusion (HDMI) as 50 mg/kg/h/4 h (200 mg/kg/4 h). The early utilization of HDMI for non-infectious mediated asthma may be superior to a $MgSO_4$ bolus in avoiding admissions and expediting discharges from the ED. HDMI appears to be cost-effective if applied early to a selected population. Intravenous $MgSO_4$ has a similar safety profile than other asthma therapies.

Conclusions: Treatment with intravenous $MgSO_4$ reduces the odds of hospital admissions. The use of intravenous $MgSO_4$ in the emergency room was not associated with significant side

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effects or harm. The authors emphasize the role of $MgSO_4$ as an adjunctive therapy, while corticosteroids and beta agonist remain the primary acute therapeutic agents.

PALAVRAS-CHAVE
Sulfato de Magnésio;
Alta Dose de Infusão;
Asma Grave;
Pediátrico;
Serviço de Emergência;
Custo-benefício

Infusão de sulfato de magnésio para asma aguda no serviço de emergência

Resumo

Objetivos: Descrever o papel do sulfato de magnésio intravenoso ($MgSO_4$) como terapia para asma grave aguda no serviço de emergência pediátrica (SE).
Fonte: As publicações foram pesquisadas no banco de dados PubMed e Cochrane utilizando as seguintes palavras-chave: magnésio E asma E crianças E ensaio clínico. Foi encontrado um total de 53 publicações utilizando esses critérios. As referências de artigos relevantes também foram examinadas. Incluímos o resumo de publicações relevantes quando o sulfato de magnésio intravenoso foi estudado em crianças (idade < 18 anos) com asma aguda. Revisamos também as diretrizes do Programa Nacional para a Educação e Prevenção da Asma (NAEPP) e do painel de especialistas da Iniciativa Global para Asma.
Resumo dos dados: Há uma grande variabilidade nas práticas do SE na administração intravenosa do $MgSO_4$ para asma grave. A farmacocinética do $MgSO_4$ normalmente não leva em conta um impacto posterior em suas propriedades farmacodinâmicas. A comprovação cumulativa aponta para a eficácia do $MgSO_4$ intravenoso na prevenção da internação, se utilizado quando necessário e em uma dosagem adequada (50-75 mg/kg). Uma internação hospitalar pode ser evitada para cada cinco crianças tratadas no SE. Outra modalidade de administração é a infusão prolongada de alta dose de sulfato de magnésio (HDMI) a 50 mg/kg/hora/4 horas (200 mg/kg/4 horas). O uso precoce da HDMI, para asma não infecciosa mediada, pode ser superior a um $MgSO_4$ em bolus para evitar internações e antecipar as altas do SE. A HDMI parece ter bom custo-benefício se aplicada precocemente em uma população selecionada. O MgSO4 intravenoso possui um perfil de segurança semelhante a outras terapias de asma.
Conclusões: O tratamento com $MgSO_4$ intravenoso reduz as chances de internações hospitalares. O uso de $MgSO_4$ intravenoso no pronto socorro não é associado a efeitos colaterais ou danos significativos. Enfatizamos o papel do $MgSO_4$ como uma terapia adjuvante, ao passo que os corticosteroides e as beta-agonistas continuam os agentes terapêuticos agudos primários.

Introduction

Asthma is a reversible, diffuse lower airway obstruction caused by airway inflammation and edema, bronchial smooth-muscle spasm, and mucous plugging. The composite effect leads to expiratory airflow obstruction.[1] Asthma could be life-threatening and must be promptly treated. Severe asthma is often defined as failure to improve after 2 h of conventional emergency department (ED) treatment, and commonly present with moderate hypoxemia. The presence of hypoxemia should be assessed non-invasively with a pulse oximeter. Blood gas, serological or radiological studies are not necessary to define or determine its severity.

Perspective on a health challenge

Asthma is the leading cause of chronic illness in children; 19–24% of Brazilian children have been diagnosed with asthma at some time in their lives.[2] It is the third leading cause of hospitalizations among children under the age of 15 years. Severe asthma is one of the most common severe, reversible conditions in EDs.[1,2] While asthma-related mortality may be improving, one-third of the deaths occurred before medical attention was provided.[3] ED management to revers the progression toward respiratory failure should be structured and aggressive, as invasive mechanical ventilation is fraught with many complications and an elevated mortality.[4] Due to the enormous health care burden of asthma, all medical treatments need to be scrutinized regarding their cost-effectiveness.

Pathophysiology

Asthma involves a complex inflammatory cascade. There is an antigen-mediated activation of epithelial cells and infiltration of the airways by circulating cells releasing soluble transmitters that intensify the inflammatory cascade. The immediate response is bronchospasm (smooth muscle contraction). The continued release of inflammatory mediators leads to airway edema, mucosal injury, and desquamation of the protective epithelium layer. Airway denudation decreases the production of normal mucus and