

# THE EFFECT OF MAGNESIUM SULFATE IN COMPARISON TO OPIOIDS IN THE MANAGEMENT OF RENAL COLIC THAT IS UNRESPONSIVE TO NON-STEROIDAL ANTI-INFLAMMATORY DRUGS

Ahmed Abdelfatah Sabry, Asmaa Mohamed Abdelmoteleb Alkafafy, Mohamed Hasan Ali, Marwan Mohamed Hesham Ahmed Mohamed Elemarey  
Department of Emergency Medicine, Faculty of Medicine, Alexandria University.

## Introduction

Acute renal colic is characterized by sudden, severe flank pain radiating to the groin or testicle, often caused by urinary tract obstruction due to kidney stones. This condition is frequently associated with nausea and vomiting, with pain severity depending on the degree of obstruction rather than stone size. Kidney stones affect 5-15% of the population, with recurrence rates of 50% within 5-7 years without preventive measures. Risk factors include obesity, hypertension, diabetes, family history, and irritable bowel syndrome.

### Therapeutic Approaches

- NSAIDs like (Ketorolactomethamine) are First-line treatment for renal colic, reducing pain and hydrostatic pressure at the glomerulus. Patients who do not respond to NSAIDs will receive other drugs like the following:
- Opioids: Effective for severe pain but associated with dependency risks and side effects, including respiratory and cardiovascular complications.

### Emerging Alternatives

Magnesium sulfate (MgSO<sub>4</sub>) shows analgesic potential by regulating calcium influx and blocking NMDA receptors. Magnesium deficiency is linked to increased pain sensitivity, suggesting MgSO<sub>4</sub> could be a promising option for managing acute renal colic while avoiding opioid-related drawbacks.

## Aim of the Work

The aim of this study was to identify the alternative treatment to relieve colic in emergency department through comparing IV magnesium sulfate to opioids in renal colic patients who do not respond to NSAIDs according to the following parameters; time to relieve renal colic, failure of treatment, cases requiring admission, any complications encountered as anaphylaxis induced), drug dependence..etc

## Patients and Methods

This randomized control study involved 116 patients who presented with renal colic to the Emergency Medicine Department of Alexandria main university hospital. The sample size was determined with the assistance of the biostatistics department at the High Institute of Public Health. Inclusion criteria required participants to be adults aged 18 years or older, presented with renal colic and did not respond to NSAIDs. Exclusion criteria included patients with hypotension, brady apnea, hypersensitivity reaction to NSAIDs, opioids or magnesium sulphate, patients who had cardiac or renal history or any history of GIT bleeding or bronchial asthma, patients with drug abuse history or addiction.

This study involved a thorough assessment of all selected patients by a researcher, with their management carried out by the emergency medicine resident responsible for their care. Ethical approval was granted from Alexandria University Ethical Committee (Reference number 0107400). The study involved a comprehensive assessment of selected patients, encompassing the following steps:

- Detailed history taking included age, sex, primary complaint, and past medical history and pain score was assessed for all patients.
- Upon admission, vital signs were thoroughly assessed, including respiratory rate; oxygen saturation; circulation through blood pressure and heart rate measurements. Laboratory biomarkers measured included a complete blood count, serum creatinine, blood urea levels, and urine analysis. Arterial blood gases (ABG) were analyzed to assess pH, partial pressures of carbon dioxide (PaCO<sub>2</sub>) and oxygen (PaO<sub>2</sub>), bicarbonate (HCO<sub>3</sub>). Abdominal-pelvis scans were done for all patients.
- All patients not responding to NSAIDs (Ketorolac tomethamine) (pain assessment score > 6 after 30 minutes after 1 dose of 30 mg ) were divided into two groups:

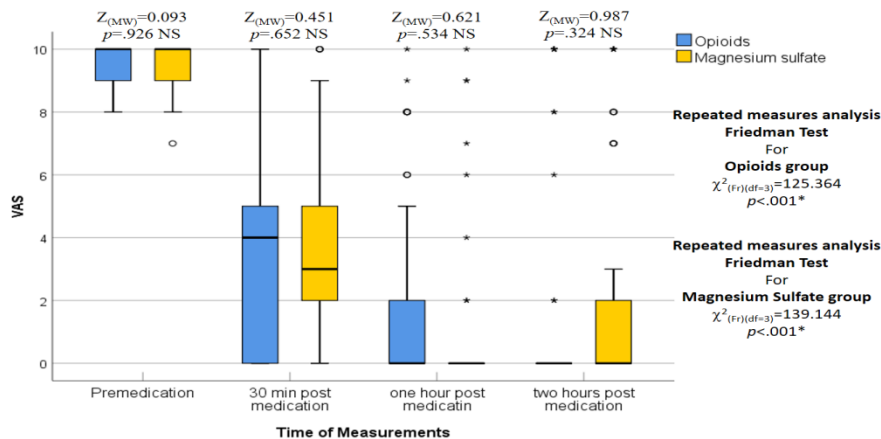
**Opioids Group:** Receiving Nalbuphine (0.1-0.2 mg/kg. Maximum: 20 mg)

**Magnesium Sulfate Group:** Receiving magnesium sulfate (50mg/kg. maximum: 2000mg)

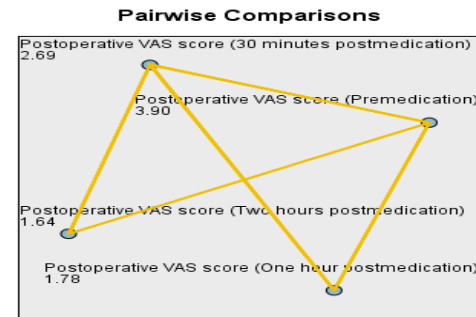
## Results

Table 1: The Complication in the two studied groups

Complication	Groups		Test of Significance p-value
	Opioid (n=58)	Magnesium Sulfate (n=58)	
No complication	57 (98.28%)	57 (98.28%)	
Hypotension	1 (1.72%)	1 (1.72%)	NA



**Figure1:** Box and whisker graph VAS in the studied group, the thick line in the middle of the box represents the median, the box represents the inter-quartile range (from 25<sup>th</sup> to 75<sup>th</sup> percentiles), the whiskers represents the minimum and maximum after excluding outliers (circles) and extremes (asterisks).



Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Postoperative VAS score (Two hours postmedication)- Postoperative VAS score (One hour postmedication)	.138	.240	.575	.565	1.000
Postoperative VAS score (Two hours postmedication)- Postoperative VAS score (30 minutes postmedication)	1.052	.240	4.387	.000	.000
Postoperative VAS score (Two hours postmedication)- Postoperative VAS score (Premedication)	2.259	.240	9.421	.000	.000
Postoperative VAS score (One hour postmedication)- Postoperative VAS score (30 minutes postmedication)	.914	.240	3.812	.000	.001
Postoperative VAS score (One hour postmedication)- Postoperative VAS score (Premedication)	2.121	.240	8.846	.000	.000
Postoperative VAS score (30 minutes postmedication)- Postoperative VAS score (Premedication)	1.207	.240	5.034	.000	.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .05. Significance values have been adjusted by the Bonferroni correction for multiple tests.

**Figure2:** Pairwise comparison of VAS in the Magnesium sulfate group

## Conclusion

Based on the findings of the present study, magnesium sulfate demonstrated a comparable effect and success rate in alleviating acute pain from renal colic in ED patients when compared to opioids.

Given the results of this study, which showed no significant side effects with magnesium sulfate, it could be a useful adjunct in treating acute renal colic in the ED. Magnesium sulfate can help reduce pain severity and minimize the need for opioid medications, thereby potentially decreasing opioid-related side effects.