

Correlation Between Ionized and Total Magnesium in Children on Continuous Renal Replacement Therapy

Shruthi Mohan, MBBS, MD¹; Denise C. Hasson, MD²; James E. Rose, BS¹; Stuart L. Goldstein, MD, FAAP, FNKF^{1,3}; Charles D. Varnell Jr., MD, MPH^{1,3}; Stefanie W. Benoit, MD, MPH^{1,3}.

¹Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio

²Hassenfeld Children's Hospital at NYU Langone

³University of Cincinnati, Cincinnati, Ohio

INTRODUCTION

- Abnormal magnesium (Mg) levels are associated with poor outcomes, including 28-day mortality in critically ill children.
- Regional citrate anticoagulation (RCA) during continuous renal replacement therapy (CRRT) may cause Mg depletion by chelating ionized Mg (iMg), potentially leading to negative Mg balance.
- iMg data in critically ill children undergoing CRRT is lacking, and existing data between iMg and total Mg (tMg) levels are conflicting.

PURPOSE

- Assess associations between iMg and both tMg and ionized calcium (iCa) in critically ill children during CRRT with RCA.
- We hypothesized that iMg will not correlate with tMg but will with iCa.

METHODS

- Prospective cohort of critically ill children undergoing CRRT with RCA from September 2021 - September 2023
- Admitted to the Cincinnati Children's Hospital Medical Center's pediatric and cardiac intensive care units.
- Excluded if on other concomitant extracorporeal therapy like Molecular Adsorbent Recirculating System and Extracorporeal Membrane Oxygenation.
- Collected prospective blood samples to measure iMg immediately before, 1-2, and 18-24 hours after CRRT initiation.
- Compared them to tMg and iCa concentrations obtained for clinical purposes.
- Categorized iMg, tMg, and iCa based on normal reference ranges of 0.44-0.65, 0.66-1.07 and 1.0-1.3 mmol/l respectively.

Figure 1. iMg trend over time; iMg levels before, at 1-2h and 18-24h after CRRT start

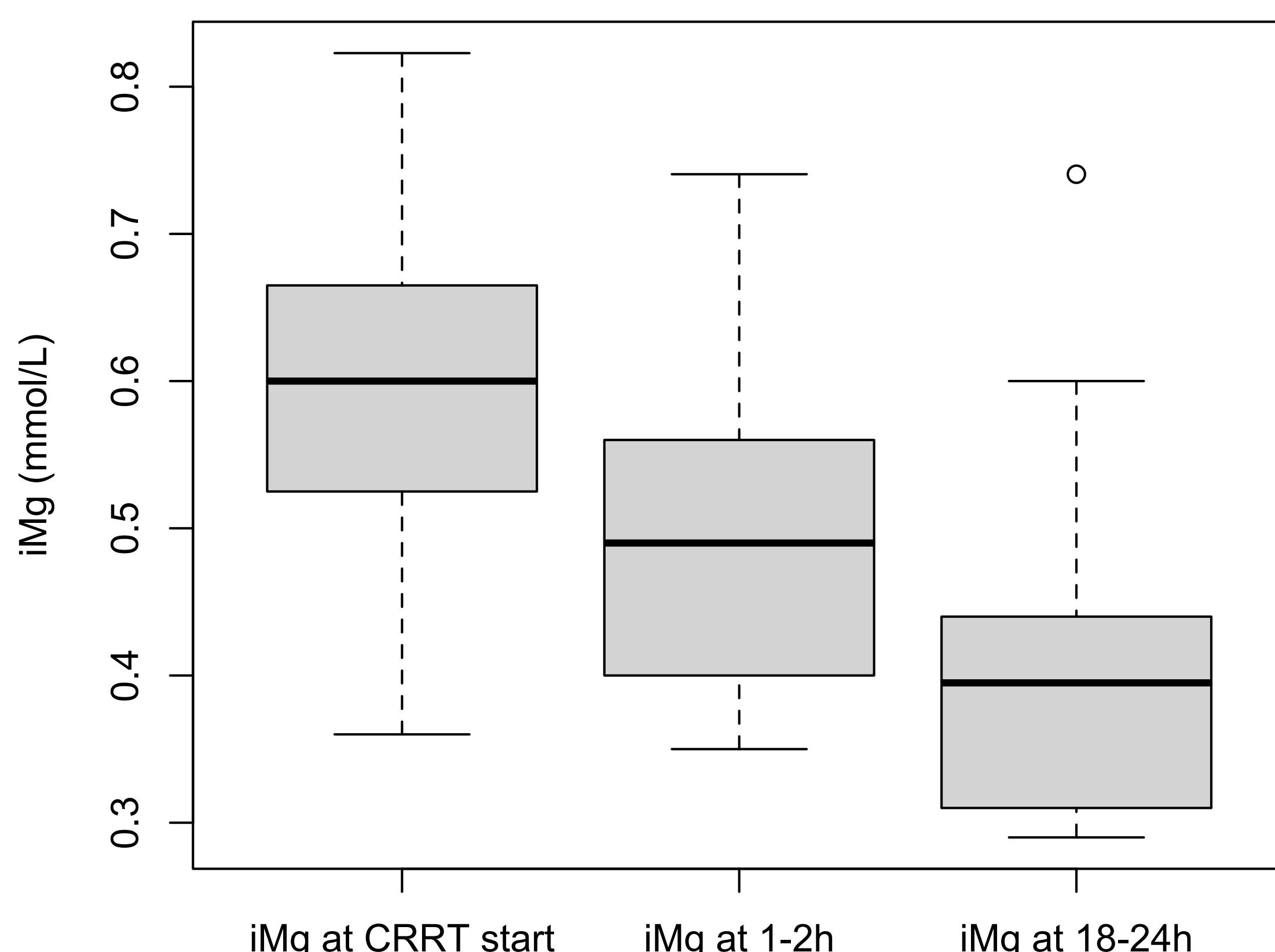
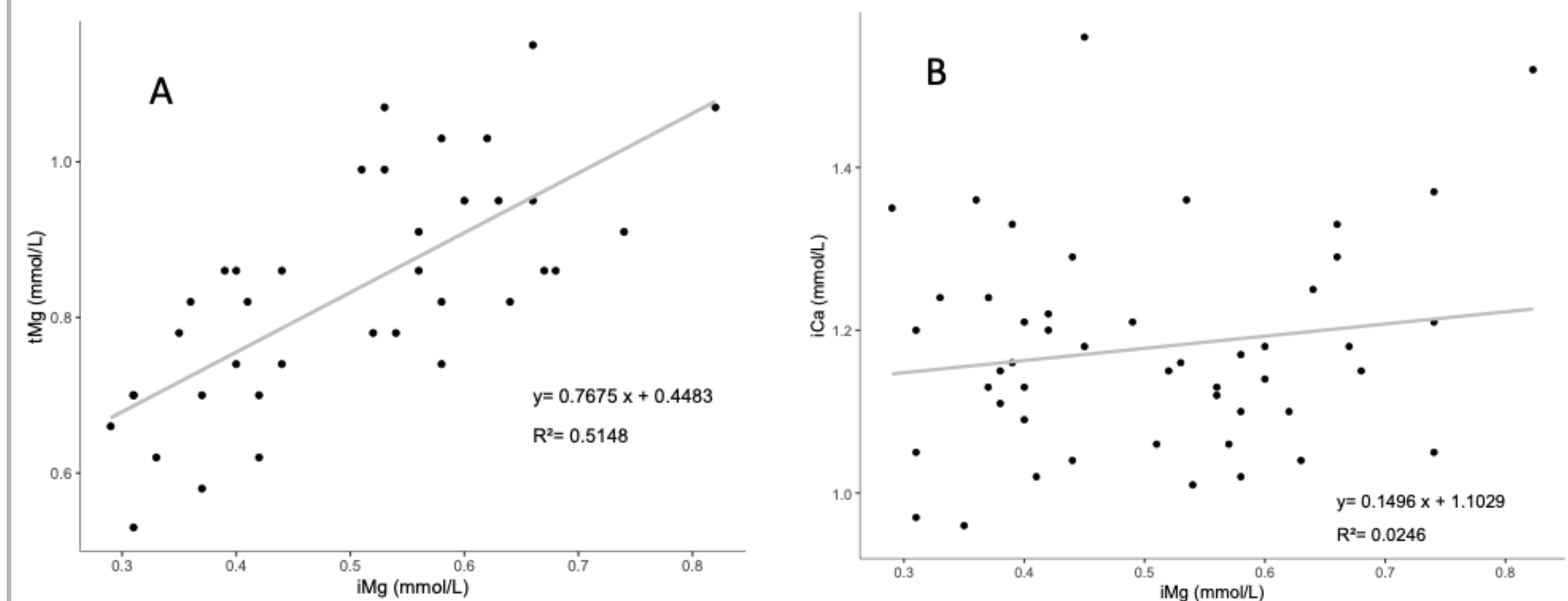


Figure 2. Correlation between iMg with tMg (A) and iCa (B) in CRRT



RESULTS

- Seventeen patients** contributed to 48 iMg, 37 tMg and 49 iCa samples, respectively.
- Incidence of low iMg levels was 12% (n = 2/17) at CRRT start, increased to 35% (n = 6/17) at 1-2 hours, and 70% (n = 12/17) at 18-24 hours.
- A progressive decrease in iMg was observed over time (Coefficient = -0.005, p < 0.001) as in Figure 1.
- iMg and tMg levels showed moderate correlation (r=0.71, p < 0.0001, Figure 2A)** and demonstrated category agreement (p=0.019, Table 1)
- iMg and iCa levels showed no correlation (r=0.15, p=0.28, Figure 2B)**, nor category agreement (p=0.069, Table 1).
- Within 24 hours of CRRT onset, 4/17 patients received supplemental Mg added in their parenteral nutrition compared to baseline; one patient received Mg bolus.

Table 1. Category agreement between iMg and tMg/iCa in CRRT

Variable		iMg		
		Low	Normal	High
tMg	Low	4	0	0
	Normal	11	16	5
	High	0	0	1
iCa	Low	2	0	0
	Normal	14	20	5
	High	3	1	3

DISCUSSION

- We showed a moderate correlation between iMg and tMg (but not with iCa) in critically ill children receiving CRRT with RCA.
- Increased prevalence of ionized hypomagnesemia within 24 hours of CRRT initiation highlights the need for vigilant magnesium level monitoring.
- The results are limited by the small size of the study.
- Future research can explore the risk factors associated with hypomagnesemia in CRRT.

CONTACT

- Shruthi Mohan- Shruthi.Mohan@cchmc.org

