# Hyperglycemia and Kidney Outcomes in Critically ill Children and Young Adults on Continuous Renal Replacement Therapy (CRRT)

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## BACKGROUND/OBJECTIVE

- Hyperglycemia is common in critically ill children and young adults and may be exacerbated by their illness
- Studies investigating hyperglycemia in this group have shown neutral mortality outcomes with conflicting results
- Sparse data on the associations and effects of hyperglycemia in young persons needing CRRT

Our objective was to to investigate the association of hyperglycemia and kidney outcomes in critically ill children treated with CRRT

## METHODS

Secondary analysis of the multicenter retrospective WE-ROCK collaborative

Exposure variables included:

- Glucose control during the first 7 days on CRRT
- Hyperglycemic group defined by average serum glucose of >150mg/dL per Pediatric Organ Dysfunction Information Update Mandate criteria
- Euglycemic group defined by average serum glucose <150mg/dL

Primary outcome was MAKE 90*

## RESULTS / CONCLUSION

Total 989 participants

- 48% (477/989) hyperglycemic during their first 7 days on CRRT.
- 3 participants had pre-existing diabetes mellitus (**Table 1**)
- Hyperglycemic group
  - 24% of participants used insulin
  - Higher rates of death (44%, p<0.001)
  - Longer length of stay (46 days, p=0.018) (**Table 2)**
  - Higher odds of MAKE-90 (OR 1.40, CI 1.02-1.8) (**Table 3)**
    - association did not remain in multivariable analysis
- Euglycemic group
  - 6.8% of participants used insulin
  - Lower rates of death (32% p<0.001)
  - Shorter length of stay (24 days p=0.018)

***Hyperglycemia is associated with increased mortality and worse kidney outcomes among children and young adults on CRRT for AKI or fluid overload.***

- However these associations were blunted by critical illness
- Further studies needed to further define the optimal glucose ranges to improve outcomes.

**Table 1: Demographics characteristics of euglycemia and hyperglycemia groups**

| Characteristic | N | Euglycemia N=512 | Hyperglycemia N = 477 | p-value |
|---|---|---|---|---|
| Female sex – no. (%) | 989 | 218 (43%) | 233 (49%) | 0.048 |
| Age categories- no. (%) | 989 | | | <0.001 |
| < 1 month | | 37 (7.2%) | 13 (2.7%) | |
| 1 month-1 year | | 80 (16%) | 48 (10%) | |
| 1-5 year | | 130 (25%) | 96 (20%) | |
| 5-15 year | | 161 (31%) | 175 (37%) | |
| 5-21 year | | 93 (18%) | 124 (26%) | |
| >21 year | | 11 (2.1%) | 21 (4.4%) | |
| BMI | 984 | 19 (16, 22) | 20 (17, 25) | <0.001 |
| Race- no. (%) | 874 | | | 0.125 |
| Asian/Pacific Islander | | 40 (8.8%) | 22 (5.3%) | |
| Black | | 57 (13%) | 67 (16%) | |
| More than one race | | 7 (1.5%) | 10 (2.4%) | |
| Native Americans | | 10 (2.2%) | 6 (1.4%) | |
| White | | 341 (75%) | 314 (75%) | |
| Clinical Characteristics | | | | |
| Admission Category- no. (%) | 989 | | | 0.004 |
| Shock/Infection/Major Trauma | | 186 (36%) | 187 (39%) | |
| Respiratory Failure | | 82 (16%) | 109 (23%) | |
| Primary Cardiac | | 67 (13.1%) | 52 (10.9%) | |
| Pain/Sedation Management | | 5 (1.0%) | 3 (0.6%) | |
| Post-surgical/minor trauma | | 20 (3.9%) | 29 (6.1%) | |
| Other | | 132 (26%) | 79 (17%) | |
| Sepsis | 989 | 210 (41%) | 250 (52%) | <0.001 |
| PRISM III | 906 | 14 (10, 19) | 14 (9, 18) | 0.066 |
| Endocrinologic diagnoses- no. (%) | 63 | | | 0.689 |
| DM 1 | | 0 (0%) | 1 (2.3%) | |
| DM 2 | | 0 (0%) | 3 (6.8%) | |
| Other | | 19 (100%) | 40 (91%) | |
| Baseline SCr | 989 | 0.40 (0.28, 0.63) | 0.45 (0.26, 0.66) | 0.509 |
| eGFR at ICU admission | 959 | 45 (21, 90) | 58 (30, 91) | 0.006 |
| Fluid overload categories | 755 | | | >0.999 |
| <10% | | 294 (75%) | 275 (75%) | |
| 10-20% | | 96 (25%) | 90 (25%) | |
| DIR (Days spent in range)* | 989 | 100 (75, 100) | 20 (0, 38) | <0.001 |
| Insulin used | 988 | 35 (6.8%) | 115 (24%) | <0.001 |
| Highest insulin rate (7 days) | 259 | 0.08 (0.05, 0.14) | 0.10 (0.05, 0.20) | 0.075 |
| Citrate anticoagulation use | 988 | 250 (49%) | 357 (75%) | <0.001 |

*Days spent in range (DIR): denotes proportion of days that glucose readings remained in range (<150mg/dL)

**Table 2: Clinical outcomes of euglycemia and hyperglycemia groups**

| Characteristic | N | Euglycemia N=512 | Hyperglycemia N = 477 | p-value |
|---|---|---|---|---|
| In hospital mortality | 989 | 162 / 512 (32%) | 210 / 477 (44%) | <0.001 |
| Successful of initial CRRT liberation | 636 | 198 / 347 (57%) | 143/ 289 (49%) | 0.056 |
| KST dependence at discharge | 617 | 57 / 350 (16%) | 45 / 267 (17%) | 0.851 |
| KST dependence at 90 days | 621 | 51 / 351 (15%) | 41 / 270 (15%) | 0.820 |
| SCr at 90 days | 479 | 0.40 (0.26, 0.65) | 0.46 (0.29, 0.73) | 0.127 |
| Length of stay | 97 | 24 (10, 45) | 46 (28, 98) | 0.018 |
| CRRT duration (days) | 989 | 12.0 (7.3, 14.0) | 5.5 (3.0, 11.0) | 0.048 |

**Table 3: Association between MAKE 90 outcomes and Hyperglycemia**

| Characteristic (N=978) | Unadjusted OR | 95% CI | p-value | Adjusted OR | 95% CI | p-value |
|---|---|---|---|---|---|---|
| Hyperglycemia | 1.40 | 1.02,1.80 | 0.038 | 1.23 | 0.91,1.66 | 0.169 |

Adjusted for age, PELOD score prior to CRRT initiation, and presence of sepsis.

*90-day mortality, or persistent kidney dysfunction [eGFR>125% baseline or dialysis dependence)

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