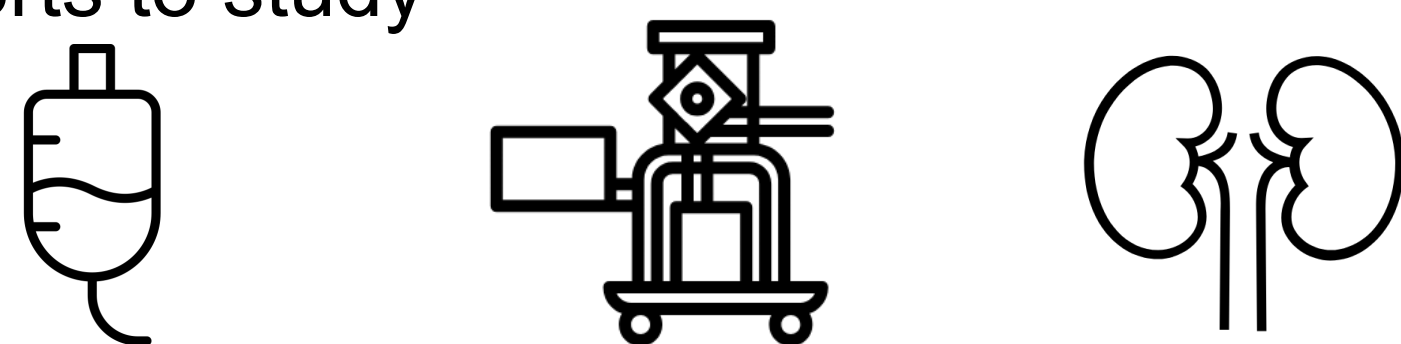


BACKGROUND

- Fluid management during neonatal ECLS is challenging
- Excess fluid balance has been linked to worse outcomes
- For every 10% increase in fluid excess, mortality rates increase by 20%
- CRRT can be used for fluid management, but optimal timing is unclear and has inherent risks
- The NICU at MUSC started an early CRRT protocol in 2014, creating a natural division of cohorts to study



Purpose: evaluate the impact of early CRRT on volume status, nutrition, outcomes and renal recovery in neonatal ECLS

METHODS

Study design: NICU retrospective single-center review, 2011-2023

Experimental groups:

Early CRRT ≤48h vs. Late/No CRRT

Outcomes: fluid balance (days 0-14), ECLS duration, morbidity, complications, nutrition outcomes, renal recovery

Inclusion criteria: neonates (<28 days at cannulation), non-cardiac ECLS indication, 1st ECLS run, all care in the NICU

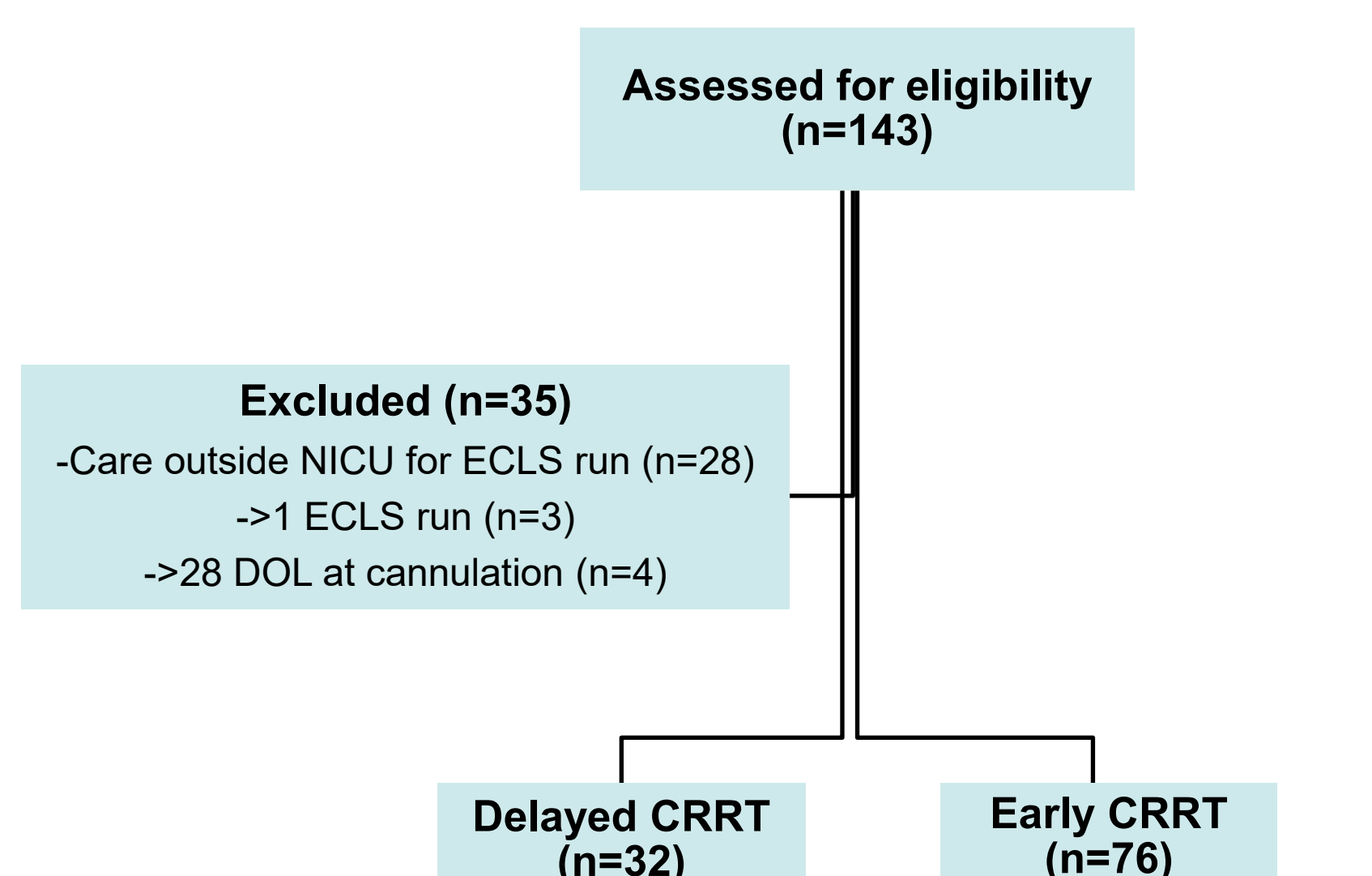


Figure 1. Flow diagram for inclusion. Neonates assessed for eligibility, those excluded from the study, and those included in each group for analysis.

Characteristics	Overall Cohort n=108	Delayed/No CRRT n=32 (30%)	Early CRRT n=76 (70%)	p-value*
Indication for ECLS				0.6
CDH	33 (31)	11 (34)	22 (29)	
MAS	15 (14)	3 (9)	12 (16)	
PPHN	52 (48)	14 (44)	38 (50)	
Sepsis	4 (4)	2 (6)	2 (3)	
Other	4 (4)	2 (6)	2 (3)	
Birth weight, kg	3.1 ± 0.6	3.2 ± 0.7	3.1 ± 0.6	0.06
Gestational age, weeks	38 ± 2	38 ± 2	38 ± 2	0.7
ECLS Mode				0.2
VA	86 (80)	28 (87)	58 (76)	
VV	22 (20)	4 (13)	18 (24)	
ECLS Survival by Diagnosis				0.6
CDH	16	6 (25)	10 (19)	
MAS	15	3 (13)	12 (23)	
PPHN	42	13 (54)	29 (55)	
Sepsis	2	1 (4)	1 (2)	
Other	2	1 (4)	1 (2)	

Table 1. Baseline characteristics of neonates receiving ECLS with and without early CRRT. Continuous data are shown as mean ± 1 standard deviation and categorical data are shown as frequencies and percentages, n (%). * p-value from Chi Square test, Fisher's Exact test, or Wilcoxon Rank Sum test.

Daily Parenteral Nutrition on ECLS

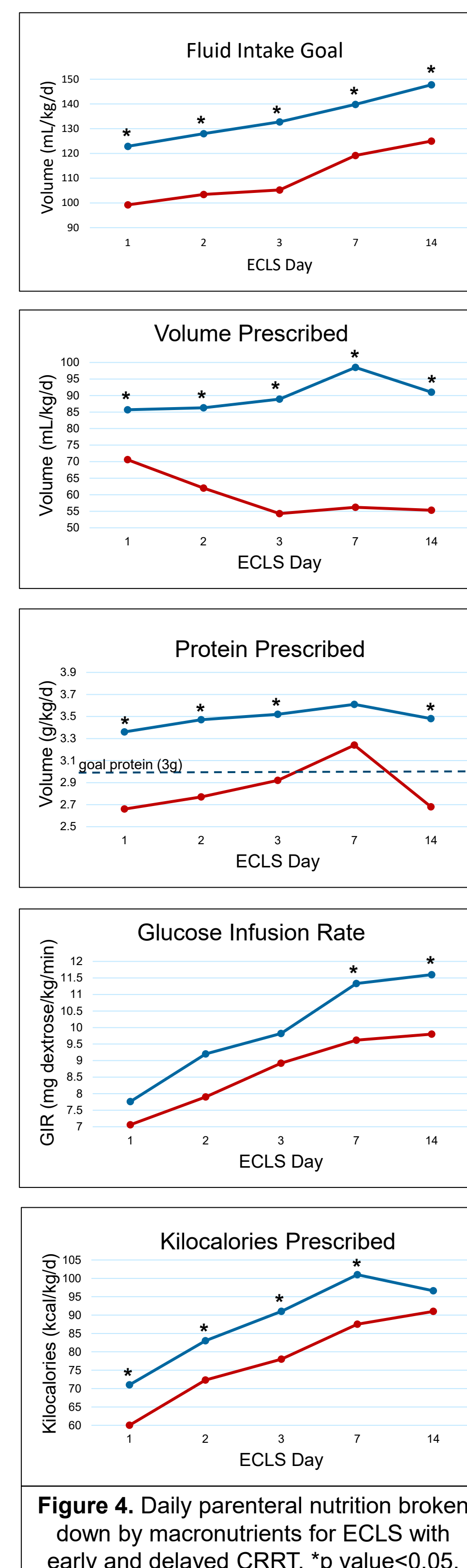


Figure 4. Daily parenteral nutrition broken down by macronutrients for ECLS with early and delayed CRRT. *p value<0.05.

RESULTS

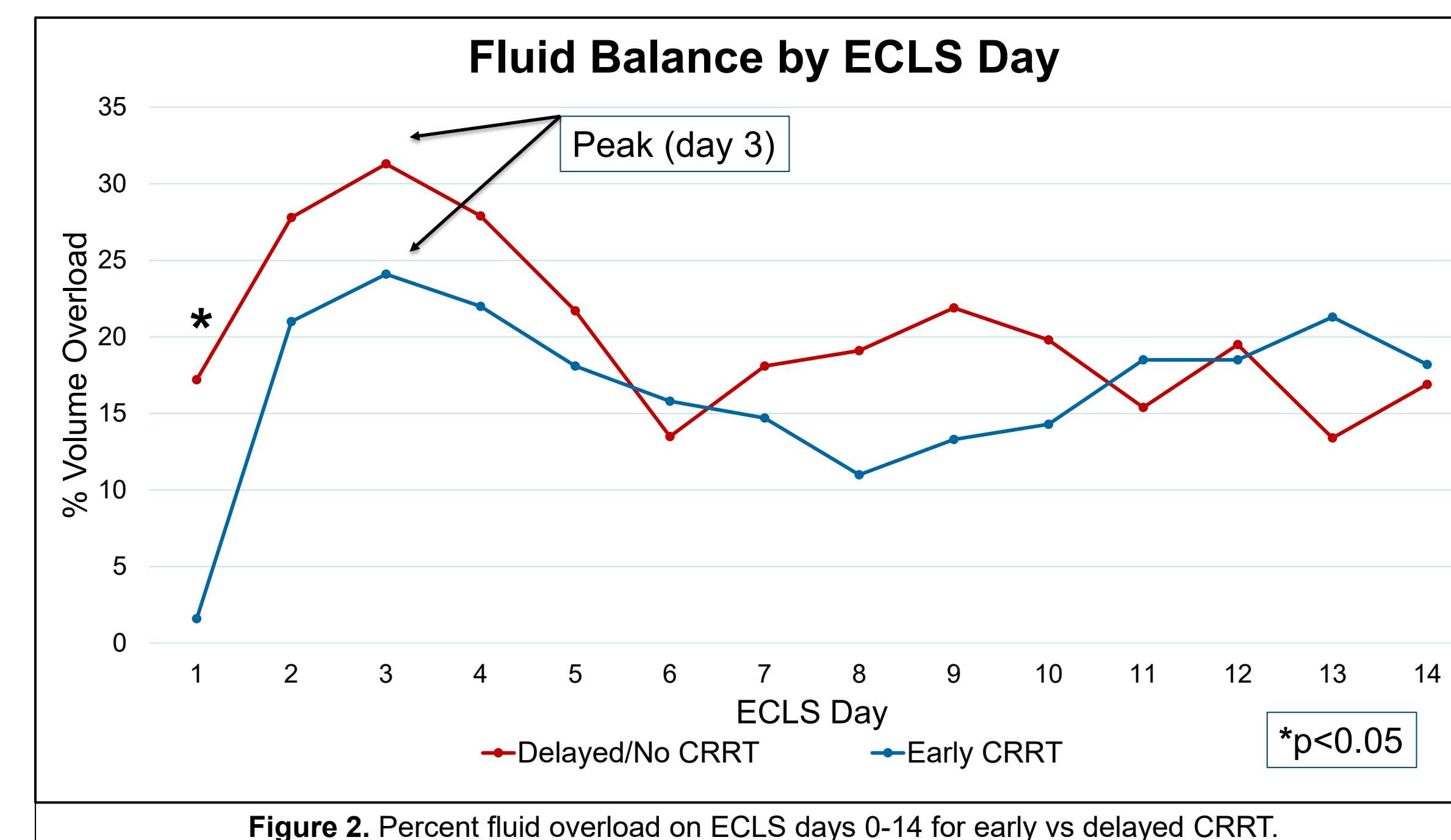


Figure 2. Percent fluid overload on ECLS days 0-14 for early vs delayed CRRT.

$$\text{Fluid balance (\% fluid overload)} = \frac{(\text{weight on day}_x - \text{birth weight}) \times 100\%}{\text{birth weight}}$$

Fluid Balance

- Peak fluid balance: 30% vs. 37% (p<0.05)
- Negative fluid balance by day 3: 80% (early) vs 50% (late) (p=0.03)
- Decannulation day: 16% vs. 21% (p=0.3)

Characteristics	n	Delayed/No CRRT n=32 (29.6%)	Early CRRT n=76 (70.4%)	p-value*
Time from ECLS to CRRT initiation, d	108	4.4 [2.8, 7.6]	0.2 [0.1, 0.5]	<0.0001
Interruption in CRRT	89	4 (31)	13 (17)	0.3
Use of CRRT	108			<0.0001
Used		12 (38)	76 (100)	
Not used		20 (62)	0	
Diuretics used during hospitalization	108	32 (100)	56 (74)	0.0007
Duration of CRRT, d	88	10.7 [8.1, 19.6]	5.9 [3.9, 14.2]	0.01
Required continued CRRT after decannulation	87	1 (8)	5 (7)	0.9
Creatinine at discharge	75	0.2 [0.2, 0.4]	0.3 [0.2, 0.4]	0.1
Creatinine at first follow-up	40	0.3 [0.3, 0.4]	0.3 [0.24, 0.42]	0.9
Creatinine at most recent follow-up	33	0.6 [0.2, 0.7]	0.4 [0.3, 0.5]	0.3
Discharged on PD	108	0	1 (1)	0.9
Discharged on antihypertensive	108	3 (9)	5 (7)	0.7

Table 2. Renal recovery and outcomes in neonates receiving ECLS with and without early CRRT. Continuous data are shown as median [Q1, Q3] and categorical data are shown as frequencies and percentages, n (%). * p-value from Chi Square test, Fisher's Exact test, or Wilcoxon Rank Sum test.

Nutrition

- Early CRRT was associated with improved volume of PN, protein and calories delivery on days 1-7 of ECLS

Renal Recovery

- Renal recovery was similar for early and late CRRT groups (post ECLS CRRT, discharge or f/u creatinine)

ECLS Duration & Complications

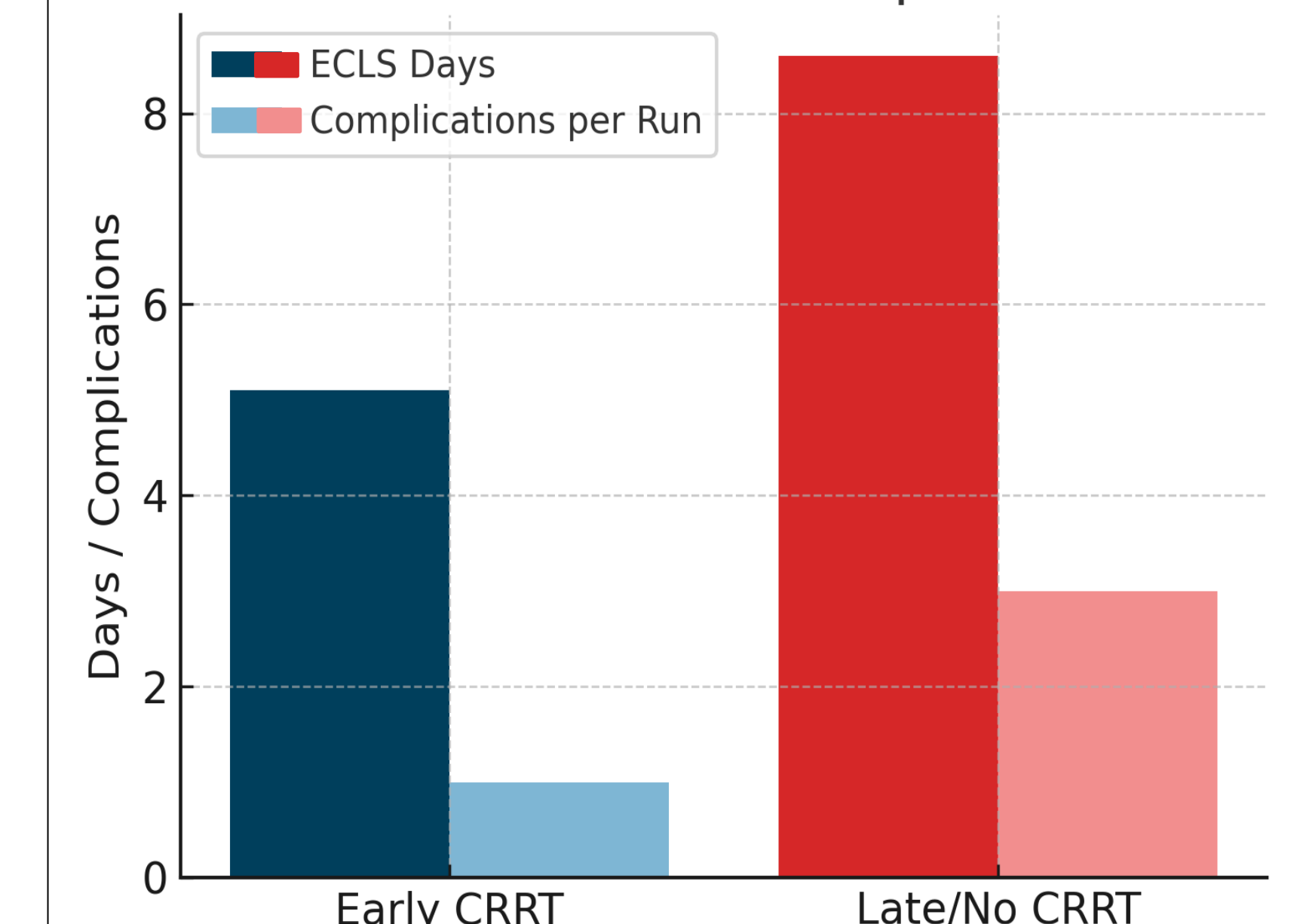


Figure 3. Comparison of early and late CRRT ECLS run times and complications per run.

ECLS Outcomes

- ECLS duration (survivors): 5.1 vs. 8.6 days (p=0.0008)
- ECLS complications: 1 vs. 3 (p=0.001)
- No difference in:
 - Mortality: 30% vs. 25% (p=0.6)
 - Ventilator free days: 8.1 vs. 10.7 days (p=0.9)
 - Hospital LOS: 40.2 vs. 50.4 days (p=0.5)

CONCLUSIONS

Early CRRT is associated with:

- Shorter ECLS runs by 3.5 days
- Fewer ECLS complications
- Improved fluid balance
- Timely and adequate PN delivery

We found no differences in:

- Renal recovery (short or long term)
- Ventilatory free days
- Mortality

Our findings support a proactive, early approach to CRRT in neonatal ECLS, and we hope to see improvement in ventilation time with larger cohorts.