Body-weight dependency of urea kinetic parameters in adolescent hemodialysis patients

Gotta V[1], Zhang L[2], Marsenic Couloures O[3], Pfister M[1]

[1]Pediatric Pharmacology & Pharmacometrics, Universtiy of Basel Chilren's Hospital (UKBB), Basel, Switzerland
[2]Clinical Pharmacology and Pharmacometrics, Janssen R&D, Titusville, NJ
[3]Pediatric Nephrology, Yale-New Haven Children's Hospital and Yale School of Medicine, New Haven, CT

Introduction and Objectives

- It has been suggested that post-dialysis urea rebound is greater in smaller hemodialysis (HD) patients.
- This is probably explained by prescription related factors, like a frequently more efficient dialysis and shorter dialysis duration in these patients [1].
- Here, we investigate additional physiologic reasons, i.e. the **correlation of patient size** (body weight) **with** individual **physiologic urea kinetic parameters**.

Methods

- This is a post-hoc analysis of data from 13 adolescent patients (12-18 years, 19-59 kg) [2]
- Each three BUN samples (before HD, 70min into HD, at the end of HD) were obtained.
- A mixed effect urea kinetic model ("individual Bayesian urea kinetic model", IBKM), developed in adult patients [3], was used to obtain posterior, i.e. individual urea kinetic parameter estimates.

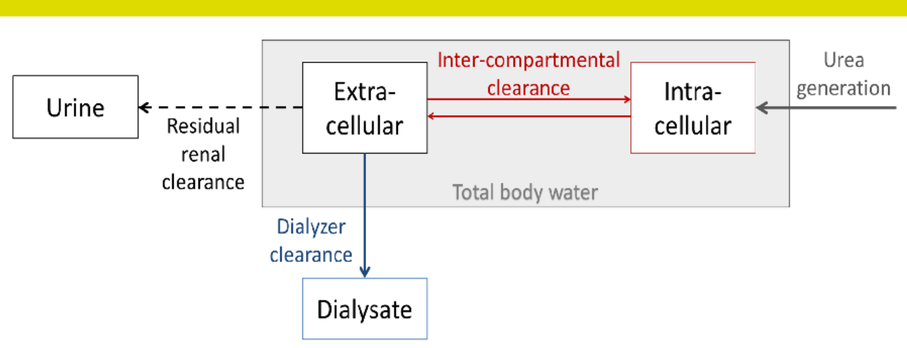

Figure 1: Illustration of the structural urea kinetic model used [3]. The original (adult) values of corresponding model parameters are summarized in the table below. The expected dialyzer clearance is calculated from the prescribed dialyzer flow, blood flow, and the dialyzer mass transfer-area coefficient (KoA). The observed dialyzer clearance was slightly (9%) lower than this expected clearance (correction factor f=0.91).

- The correlation between post-dialysis weight and individual physiologic kinetic parameter estimates was investigated using Pearson's correlation coefficient (ρ).

Results

- Estimated individual (posterior) model parameters:

Model parameter	individual values in adolescents Median (range)	Typical value in adults Median
Urea generation rate	0.16 (0.13 – 0.20) mmol/min	0.17 mmol/min
Total body water (% of body weight)	46% (33-77%)	58%
Extra-cellular water (% of total body water)	23% (13-44%)	36%
Inter-compartmental Clearance	0.62 (0.35 – 0.70) L/min	0.65 L/min
Correction factor for dialyzer clearance	0.91 (fixed)	0.91
Residual renal clearance	0 (fixed)	0 (fixed)
Body weight	38 (19-61) kg	

Results (continued)

- A **significant correlation (ρ) with body weight** was observed **for** individual estimates of **inter-compartmental urea clearance** (i.e. between extra- and intra-cellular water, Fig 2A).
- A **trend for extra-cellular urea distribution volume**, expressed as fraction of total body water was suggested (Fig 2C).
- No significant body-weight dependency could be observed with individual estimates of total body water, expressed as fraction of body weight (Fig 2B), and urea generation rates (Fig 2D).

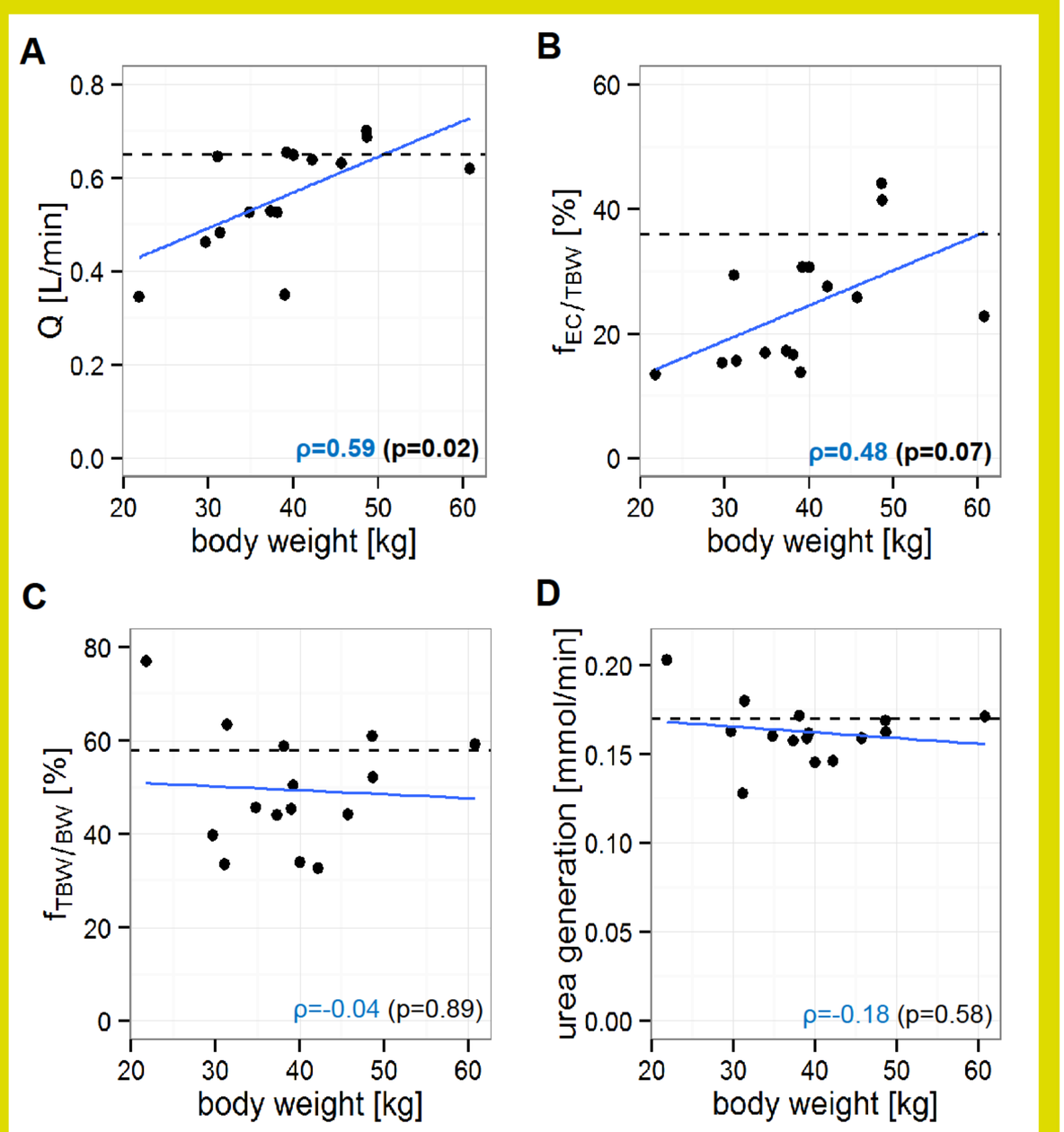

Figure 2: individual (posterior) urea kinetic parameter in adolescent patients and their correlation with body weight (*black dots*). *Blue line*: linear regression line. *Horizontal dashed line*: typical parameter estimate in adults. **A:** intercompartimental clearance (Q). **B**: fraction (f) of extra-cellular water (EC) of total body water (TBW). **C:** fraction (f) of total body water (TBW) of body weight (BW). **D**: urea generation rate.

Conclusions

- This exploratory analysis suggests a **body-size dependency of typical parameters describing urea kinetics in pediatric patients** undergoing hemodialysis.
- Hemodialysis dose evaluation with existing fixed equations, or prior models from adult patients, may thus be further improved for pediatric patients.
- The relevance of considering size and age-dependency of physiologic urea kinetic parameters for dialysis adequacy evaluation should be investigated in a larger group of pediatric patients including also children younger than < 12 years.

References
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Contact:
Verena Gotta
verena.gotta@ukbb.ch

53 ERA
735--SP
Paediatric Nephrology.
Verena Gotta
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