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Editorial

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Editorial: There Is Still a Need for Kidney Volume Reference Intervals in Large Children, Adolescents, and Young Adults

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Editorial on: Sonographic Evaluation of the Morphology of Kidneys Among Apparently Healthy Children in Northwest Ethiopia, 2021: The Normal Limits and Percentile Curves by Tsehay and Seyoum

Introduction

Kidney measurements indexed to height and body surface area (BSA) are used for evaluation, diagnosis, and longitudinal assessment in children,[1,2] but the normative data used in kidney dimension calculators may not be accurate for children from around the globe.[3] Moreover, the 1916 formula for the calculation of the BSA by Dubois and its recalculation by Mosteller seems to also be outdated due to growth acceleration and obesity.[3] For instance, Korean men gained 20.6 cm in height over the past 100 years.[3] The latest BSA formula is from a 1978 study with only 81 participants[4]: BSA = weight $(kg)^{0.5378} \times$ height $(cm)^{0.3964} \times 0.024265$. Population-based heights have continuously increased since. Marzuillo et al[5] evaluated the degree of kidney volume underestimation in obese children, which leads to unnecessary and costly evaluations.

Currently, there are normative data for kidney length, and the consensus is that only height-based assessment of kidney length should occur.[3,6] However, kidney volume is a validated prognostic biomarker for conditions such as autosomal dominant polycystic kidney disease.[7] Kidney volumes and kidney length have been shown to have low agreement in the evaluation of prematurely born children.[8] In this context, we are delighted to see the recent publication with new normative data for both kidney length and kidney volume by Tsehay and Seyoum in the *Canadian Journal of Kidney Health and Disease*.[9]

The Paper by Tsehay and Seyoum[9]

The authors analyzed 403 seemingly healthy children aged 7 to 15 years in 2 hospitals in Ethiopia who had rigorous anthropometry and kidney ultrasound measurements. They used the Mosteller formula for the estimation of BSA, which was acceptable because the range of the BSA was 0.8 to 1.4 m^2. They established centiles for kidney length and volume based on height (112-159 cm). A considerable strength of the manuscript is the listing of several tables based on the right and left kidneys. The left kidney tends to be more elongated, likely owing to the usually larger liver pushing the right kidney downward, making it more plump.[8] The authors performed a Pearson correlation analysis that highlights the difference between the right and left kidneys whereby the right kidney was best correlated with the participant's height, whereas the left kidney was best correlated with their weight. They also performed Box-Cox transformations to normality for height and BSA for both the right and left kidneys. These figures can serve as nomograms for kidney length and kidney volume.

The work by Tsehay and Seyoum offers a rich data set with more detailed analysis of kidney length and kidney volume than the recent reference interval study for kidney length from North-Eastern Europe.[6] Their study limitations include (1) the narrow range of height and BSA, which essentially bound the information for children aged 7 to 15; (2) only Eastern Ethiopian children; and (3) 1% of children were significantly underweight and 18% were overweight and obese,

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which tends to overestimate the kidney volumes in slender patients and underestimate them in obese patients.[3]

What Is the Best Way to Estimate Kidney Volumes?

The kidneys adjust the size to the extracellular volume, rather than the BSA. Extracellular volume correlates strongly with lean body mass.[10] There is also a sex difference, especially during puberty, when adolescent men have the lowest fat mass. When accounting for sex differences, we can use BSA-based estimation using ideal body weight.[3] Like estimated glomerular filtration rate, kidney volumes should also be calculated using the ideal body weight, which can be quickly determined using the Traub formula.[3]

Asymmetrical Acceleration of Stature Over Time Favoring the Femur

The existing BSA formulae do not include the tall heights that we currently observe in some adolescents. The study by Tsehay and Seyoum does not include participants >159 cm. We have pointed out that the trunk size remains mostly preserved while the height of a person is directly proportional to the femur length regarding the acceleration of body length.[3] In other words, the acceleration of body length occurs mostly in the femur, and the impact of this on BSA is unknown.[3] We urgently need new data on BSA to accommodate the trend toward taller children in every new generation.

Conclusion

The detailed study by Tsehay and Seyoum contributes to the literature and offers new kidney dimension reference intervals for 7- to 15-year-old children.[9] It would be helpful to expand the age range and to include children from multiple countries from well- and less-resourced parts of the world. The differences between the left and right kidneys warrant further study.[8] For the entire pediatric age range, we agree with Marzuillo et al[5] that only height be used to assess normal kidney length using the Obrycki normative values.[6] We urgently need to confirm the BSA equations or develop new ones in large individuals. We need inclusive multicountry, multiethnic reference intervals for kidney dimensions.

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