Letters and Replies

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Can creatinine clearance in children clear the indexing GFR with BSA from the charge of errors?

We read with interest the article of Delanaye and colleagues stating that indexing glomerular filtration rate (GFR) with body surface area (BSA) required mathematical prerequisites to be satisfied, even though many studies reported they were not [1].

Although not the gold standard to measure GFR, creatinine clearance (Ccr) is one of the methods most frequently indexed by BSA in hospital. Despite the many reports referred to by the authors, we wished to make certain if the prerequisites were not satisfied because indexing was our routine practice. Ccr was measured with serum and 24-h urine in 74 children between 2 and 12 years old. The values of Ccr before (Ccr-b) and after (Ccr-a) indexing with BSA were plotted respectively with BSA, and the correlation coefficient and regression equation were calculated in each plot. Creatinine was measured by Jaffe method, and BSA was calculated by Mosteller method [2].

Contrary to our worries, the correlation coefficient between BSA and Ccr-b was high enough to satisfy the authors’ first prerequisite. It was also quite different from the value in article [3] as referred (Figure 1A). It seemed as if the low correlation coefficient of the study was drawn from many patients, with chronic kidney disease included among healthy subjects. The y-intercept between BSA and Ccr-b was very close to 0, one of the prerequisite values the authors presented. The slope of regression curve was far from 1, the authors’ other insisting value, but it is hard for the slope to reach this without the same magnitude of two variables, i.e. BSA and Ccr-b. We thought this was an authors’ linguistic flaw. Finally, the relationship between BSA and Ccr-a disappeared almost totally, and the authors’ last prerequisite was fulfilled (Figure 1B).

Turner and Reilly (article [4] referred to by the authors) already accepted that GFR indexing with BSA was good enough, albeit incomplete. They proved that all the assumptions about slopes and y-intercepts of the regression curves between BSA and GFR before and after indexing were satisfied statistically. But they argued the regression model of their own was better than indexing with BSA because their slope was completely 0 [4]. We were afraid that the above completeness might have resulted from applying the regression model to the same subjects who participated in establishing the model.

In conclusion, it was confirmed that all the mathematical prerequisites for indexing with BSA proposed by the authors were satisfied well with Ccr in children. We had a good opportunity to justify our practice of requesting information about height and weight with the patient's specimens in the laboratory.

Conflict of interest statement. None declared.

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Reply

We want to thank Park et al. for their interest in our work [1]. The authors show that the mathematical prerequisites for indexing glomerular filtration rate (GFR) are satisfied in their paediatric population. First of all, we confirm our statement regarding these prerequisites [slope between GFR and body surface area (BSA) not different from 1 and intercept not different from 0]. Moreover, we have two main comments. The authors have not measured GFR but only estimated it by creatinine clearance. Creatinine is a flawed estimation of GFR for several reasons but especially for errors occurring in urine collection [2]. These errors are likely still more relevant in paediatrics, and it is not impossible that the errors and GFR underestimation are more important in younger children (with lower GFR). Nevertheless, even if Park et al. had used a reference method, they could have obtained the same results. Our article about GFR indexation was valuable for adults and especially obese patients. Our demonstration is clearly not transposable to children. Indeed, children are by definition in constant growth. This is particularly true between 2 and 12 years old. Thus, GFR is logically expected to follow growth, i.e. height, weight… and BSA. In children, GFR is indeed strongly correlated to age which, in turn, is strongly correlated to weight and height [3]. The fact that GFR is correlated to BSA is thus not astonishing in children, but this does not make BSA as the best ‘indexator’ in adults (and maybe in adolescents) and in obese adults [4]. Indexations for arm length or toe length will probably give the same results in growing children! Even if mathematical pre-

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Fig. 1. Scatter plot between body surface area (BSA) and A; creatinine clearance (Ccr) before indexing B; Ccr after indexing with BSA ($n = 74$, age $8.3 \pm 2.9$, M:F 36:38, BSA $1.09 \pm 0.27$ m$^2$). A. $r = 0.750$, regression equation $y = 85.19 x - 6.421$. The correlation coefficient ($r = 0.750, P < 0.001$) was high enough to satisfied the first prerequisite and very different from $r = 0.24$, the value from study [3] referred to by the authors. The y-intercept ($-6.421, P = 0.521$) was not statistically different from 0, one of the prerequisites the authors presented. The slope ($85.19, P < 0.001$) was far from 1, another prerequisite value the authors expressed falsely. B. $r = 0.042$, regression equation $y = 4.915 x + 131.5$. Both the correlation coefficient ($r = 0.042, P = 0.718$) and slope ($4.915, P = 0.719$) showed no statistical difference from 0, and the authors’ last prerequisite was fulfilled.