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LETTER TO THE EDITOR

Creatinine-based estimated glomerular filtration rate for children younger than 2 years

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To the Editor

Serum creatinine (Cr)-based eGFR may be used for Japanese children aged 2–18 years to evaluate renal function, measuring serum Cr by enzymatic method [1]. In clinical practice, cystatin C (cysC)-based eGFR [2] may be used for younger children. However, cysC data are not always available for retrospective epidemiologic studies or to inform common clinical practice. Consequently, we aimed to establish a Cr-based eGFR for children aged younger than 2 years, using this formula by use of a coefficient. Physiologically, kidney function gradually increases from birth, developing to reach that found in adults by about age 2 years.

Previously, we reported that median normal reference values of GFR were 91.7, 98.5, 106.3, and 113.1 mL/min/1.73 m^2 in children aged 3–5, 6–11, 12–17, and 18 months–16 years, respectively [3]. Therefore, we assumed that the %medians of GFR in children aged 4, 8.5, 14.5, and 24 months were 79.5, 85.4, 92.1, and 100.0%, respectively, and calculated a regression curve using a logarithmic function as follows: $R = 0.107 \times \ln$ [age (months)] + 0.656 (Fig. 1). In other words, a ratio of reference GFR in children aged under 2 years with that in older children can be shown as R.

(1) Reference serum Cr levels (ref Cr) are shown by the following two equations of body length (x):

males: $\text{ref Cr} = -1.259x^5 + 7.815x^4 - 18.57x^3 + 21.39x^2 - 11.71x + 2.628.$

females: $\text{ref Cr} = -4.536x^5 + 27.16x^4 - 63.47x^3 + 72.43x^2 - 40.06x + 8.778.$

2) Provisional GFR = 110.2 × (ref Cr/patient's serum Cr) + 2.93.
3) $R = 0.107 \times \ln$ (age (months)) + 0.656.
4) eGFR = provisional GFR × R.

By these 4 steps, one can calculate Cr-based eGFR in terms of infants aged 3–23 months.

By the way, Pottel proposed a Cr-based eGFR (Flanders Metadata equation) similar to ours as follows [4]: eGFR (ml/min/1.73 m^2) = [0.0414 × ln (Age) + 0.3018] × body length (cm)/serum Cr level (mg/dL). This formula has an inherent problem for use with adolescents by assuming almost inverse proportion to body length, since body length does not always increase in proportion to the marked increase in muscle mass during and following late stages of puberty. However, Pottel's formula may be applicable for children under 2 years, apart from the use in Japanese patients.

Further studies are required to validate our equation in a different data set. Still, this new Cr-based eGFR formula for children younger than 2 years may be applicable for clinical screening of kidney function temporarily and

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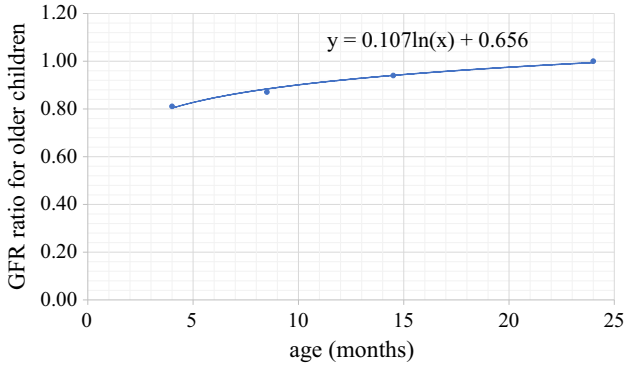

Fig. 1 Age effect on GFR ratio for older children. A logarithmic regression curve between age (months) and ratio of reference GFR values in children under 2 years for older children

retrospective epidemiologic studies after inspection of the validity.

Compliance with ethical standards

Conflict of interest The authors declare no conflicts of interest associated with this manuscript.

Human rights and informed consent This article does not contain any studies with human participants. We treated only the data described in our past article [3], which was approved by the local ethics boards (Approval number in Aichi Children's Health and Medical Center: 200706), and written informed consent was obtained from the parents of each subject.

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