treatment. For the purpose of this survey, only data recorded within 6 months of 1 April 2010 were included. The patient's age was calculated from the date of birth and the date of each measurement. This questionnaire also recorded information for each institution, including the SCr assay method used and prescribed treatment strategies. The respondents were asked to search their medical records for patients with a confirmed diagnosis of CKD or for patients with an abnormal SCr.

The inclusion criteria were as follows: (i) children with CKD aged 3 months to 15 years at the time of 1 April 2010; (ii) stage 3–5 CKD, as determined by the newly established diagnostic criteria and (iii) no prior treatment with dialysis or renal transplantation. Only cases with renal failure that had lasted for >3 months were included and cases with transient increases in creatinine were excluded.

The study was conducted in accordance with the ethical principles set out in the Declaration of Helsinki, and with the ethical guidelines for epidemiological studies issued by the Ministry of Health, Labour and Welfare in Japan. The study was approved by the JSPN ethics board and a central ethics board (the institution of the Principal Investigator, KI) before study commencement. Because, data were reported retrospectively using patient charts, informed consent was not obtained in accordance with the above guidelines.

Statistical analyses

Estimation of the number of patients with stage 3–5 CKD in Japan from the reported number of patients in our survey was conducted as follows. The estimates were derived as the reported number divided by the response rate. Because the response rate tends to be lower in institutions with fewer patients, simple estimates can overestimate the true prevalence. Therefore, the reported patients were stratified according to institution type (i.e. university hospital, children's hospital and general hospital) and the number of beds (<200, 200–500 and >500), based on the assumption that the response rate is independent of the number of patients in each stratified category [16]. Then, the number of reported patients in each category was divided by the response rate and summed to calculate the total estimated number of patients in Japan. The total estimated number of patients was divided by the size of the population at risk in Japan reported by the Statistics Bureau of the Ministry of Internal Affairs and Communications of Japan (http://www.stat.go.jp/english/index.htm) to calculate the prevalence as of 1 April 2010. Weighted κ with 95% confidence interval (CI) was calculated to compare the CKD classification used here with the abbreviated Schwartz equation. All statistical analyses were carried out using SAS system version 9 (SAS Institute, Inc., Cary, NC, USA).

Results

Subject characteristics

A total of 925 of 1190 institutions (77.7%) responded to the first questionnaire. A total of 479 children were identified in the second questionnaire. Of these, 447 children (272 males and 175 females) with stage 3–5 CKD who had not been treated with dialysis/renal transplantation fulfilled the eligibility criteria and were included in this study. Their characteristics are summarized in Table 3. Most of the children (315; 70.5%) had stage 3 CKD, whereas 107 (23.9%) had stage 4 and 25 (5.6%) had stage 5. The number of Japanese children with stage 3–5 CKD was estimated to be 536.5 (95% CI: 493.2–579.8) as of 1 April 2010. On the basis of this, the prevalence of stage 3–5 CKD was calculated to be 2.95 cases/100 000 Japanese children aged 3 months to 15 years. Figure 1 shows the SCr values for males and females according to CKD stage. All of the responding institutions used enzyme immunoassays to determine SCr levels for the assessment of CKD stage; none used other methods, such as the Jaffe method.

Table 3. Patient characteristics according to chronic kidney disease stage

	All subjects	Stage 3	Stage 4	Stage 5
n	447	315	107	25
Age (years)	8.7 ± 4.5	8.7 ± 4.6	8.5 ± 4.3	10.0 ± 4.5
Serum creatinine (mg/dL)	1.6 ± 1.2	1.1 ± 0.4	2.2 ± 0.8	5.3 ± 2.0
Height (cm)	119.8 ± 28.9	121.1 ± 28.7	118.8 ± 27.4	107.8 ± 35.6
Height SDS[a]	−1.6 ± 1.8	−1.3 ± 1.5	−2.2 ± 2	−3.5 ± 3
BUN (mg/dL)	35.6 ± 18.8	28.4 ± 9.8	48.6 ± 18.2	74.9 ± 31.5
CysC (mg/L)	2.1 ± 0.8	1.9 ± 0.5	3.1 ± 1.0	4.1 ± 0.9
eGFR–abbreviated (mL/min/1.73 m^2)[b]	39.5 ± 16	47.2 ± 11.2	22.6 ± 5.5	9.6 ± 3.2
eGFR–complete (mL/min/1.73 m^2)[c]	39.6 ± 12.3	43.7 ± 9.7	24.9 ± 5.3	11.6 ± 4.1

Values are means ± standard deviation.
SDS, standard deviation score; BUN, blood urea nitrogen; CysC, cystatin C.
[a]Height SDS was calculated using data recorded by the Japanese Society for Pediatric Endocrinology in 2000 (http://jspe.umin.jp/ipp_taikaku.htm).
[b]Determined using the abbreviated Schwartz equation.
[c]Determined using the complete Schwartz equation.

Figure 2 shows the frequencies of CKD stage according to the estimated GFR (eGFR) of 412 children in whom height was measured. Stage 3–5 CKD was classified using our diagnostic criteria derived from SCr levels of age- and sex-matched Japanese children, while the eGFR was determined using the abbreviated Schwartz equation, which was recently revised from the original Schwartz equation [17]. This figure also shows the distribution of children classified in each CKD stage determined using both methods. These data indicate that the distribution of CKD stages determined using population-based reference values is comparable with the distribution derived using a method based on the abbreviated Schwartz equation. The weighted κ-value for this comparison was 0.71 (95% CI: 0.65–0.77). For 198 children with cystatin C data, similar distributions were obtained when we compared our new classification with the complete Schwartz equation, which requires cystatin C-values [17] (data not shown).

Primary etiologies of pediatric CKD in Japan

The primary etiologies of CKD in the study population are presented in Table 4. Non-glomerular disease (407/447; 91.1%) was the most common primary cause of CKD, whereas glomerular disease accounted for 7.8% (35/447) of all cases.

Among those with non-glomerular diseases, 278 (68.3%) children had congenital anomalies of the kidney and urinary tract (CAKUT), of which 60 (21.6% of those with CAKUT) had obstructive urological malformations comprising posterior urethral valve, stricture of the urethra, hydronephrosis, hydroureter and cloacal anomaly (Table 4). The three most common causes of glomerular diseases were Alport's syndrome, focal segmental glomerulosclerosis and chronic glomerulonephritis ($n = 8$ each). No children presented with definitively diagnosed IgA nephropathy. Figure 3 shows the distribution of CAKUT and non-CAKUT diseases by age.

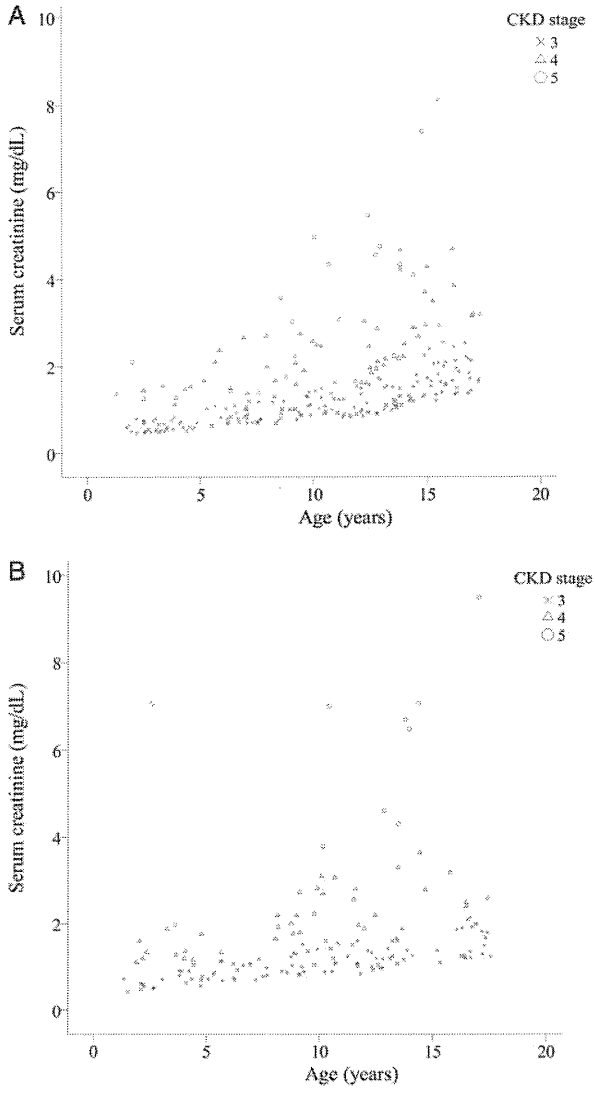


Fig. 1. Serum creatinine levels according to age and CKD stage. Actual serum creatinine levels according to age and CKD stage are plotted separately for males (**A**) and females (**B**).

The diseases included syndromal stigmata [$n=46$ (10.3%)], Down syndrome (OMIN, #190685, $n=6$), VATER association (#192350, $n=4$), Kabuki syndrome (#147920), Wolf–Hirschhorn syndrome (#194190) and Townes–Brocks syndrome (#107480, $n=3$ each), prune belly syndrome (#100100) and branchio-oto-renal syndrome (#113650, 2 each) and others.

Methods of detecting Stage 3–5 CKD

Table 5 summarizes the methods and reasons for the detection of children with stage 3–5 CKD. Table 5 also presents the age at diagnosis for each of the methods. Fetal and perinatal ultrasonography was the most common method, followed by analysis by chance and urinary tract infection. As might be expected, CKD was generally detected at an earlier age in children with CAKUT than in children with other forms of CKD, particularly for analysis by chance (3.9 versus 5.8 years), urinary tract infection (0.7 versus 1.8 years) and failure to thrive (0.3 versus 2.2 years). Annual urinalysis at school detected CKD in 27 children (9.7%; median age, 8.9 years) with CAKUT and 12 children (7.1%; median age, 8.3 years) with other forms of CKD.

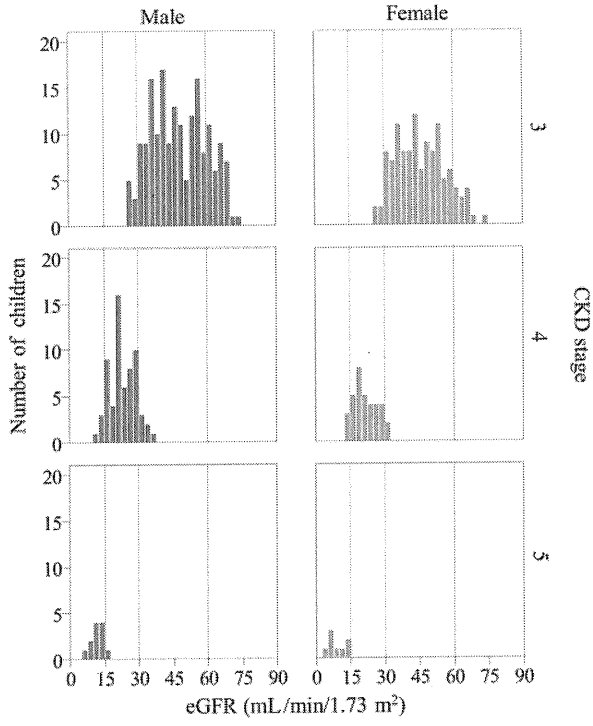
Treatment modalities for pediatric CKD

The treatment modalities for all patients included in this survey, and for patients with CAKUT and those with other forms of CKD, are summarized in Table 6. The most common treatments for CAKUT were angiotensin II receptor blockers (ARBs) and angiotensin-converting enzyme inhibitors (ACEIs) which were used in approximately one-quarter of the patients. Both ARBs and ACEIs together were used in 11 and 23 patients with CAKUT and other forms of CKD, respectively (data not shown). Carbon adsorbents (e.g. AST-120), which are approved as renoprotective agents adsorbing uremic toxins in the gastrointestinal tract [18] and calcium antagonists, were used in 13.0 and 7.2% of patients, respectively.

Discussion

Our findings revealed that the prevalence of stage 3–5 CKD in children in Japan aged 3 months to 15 years is 2.95 cases/100 000 children. Out of 447 CKD cases surveyed, 407 (91.1%) had non-glomerular disease; among them, 278 (68.3%) had CAKUT. To our knowledge, this is the first cross-sectional, nationwide, population-based survey of children with pre-dialysis CKD in Asia. Several reports to date have described the epidemiology of pre-dialysis CKD in children; however, these studies were restricted to Western countries [3–10].

SCr levels were frequently used to estimate the GFR and screen for CKD. The original Schwartz equation has been used extensively in clinical practice for estimating the GFR in children, where GFR (mL/min/1.73 m^2) = age-dependent coefficient $\kappa \times$ height (cm)/SCr (mg/dL) [15]. This equation was recently modified because of the increasing use of enzymatic methods to determine SCr levels, replacing the Jaffe method [17]. However, there are some possible limitations of the original Schwartz equation. First, it requires the patient's height, which is not always measured in routine clinical practice. Secondly, the GFR was reported to be lower in Asian adults than in Caucasians [19], which may have led us to overestimate the GFR when using the Schwartz equation in Asian children. To overcome these perceived limitations, several research groups have sought to establish reference levels in large populations of children [11, 20], which may be more practical and relevant for screening purposes in a specific country. Accordingly, in our present study, we evaluated renal function by comparison with established reference values [11]. In this way, CKD was determined based on SCr, rather than relying on equations adjusted for height and mathematical constants. As a result, children aged <2 years, to whom the normal CKD classification could not



Our classification	CKD classification determined using the abbreviated Schwartz equation				
	2	3	4	5	Total
Males					
3	35 (19.7%)	135 (75.8%)	8 (4.5%)	0 (0.0%)	178 (100.0%)
4	0 (0.0%)	6 (9.5%)	53 (84.1%)	4 (6.3%)	63 (100.0%)
5	0 (0.0%)	0 (0.0%)	1 (8.3%)	11 (91.7%)	12 (100.0%)
Females					
3	13 (11.2%)	99 (85.3%)	4 (3.4%)	0 (0.0%)	116 (100.0%)
4	0 (0.0%)	2 (5.7%)	30 (85.7%)	3 (8.6%)	35 (100.0%)
5	0 (0.0%)	0 (0.0%)	0 (0.0%)	8 (100.0%)	8 (100.0%)

Fig. 2. Distribution of CKD stage in males and females. Stage 3–5 CKD was classified using our newly established diagnostic criteria derived from normal SCr levels of age- and sex-matched Japanese children. The eGFR was determined using the abbreviated Schwartz equation [17]. Stage 3–5 CKD was classified as GFR 30–59, 15–29 and <15 mL/min/1.73 m^2, respectively (<1/2, <1/4 and 1/8 of normal GFR, respectively). Only subjects in whom height was measured were included in this analysis. Values in the table are *n* (%).

be applied, could be included. Similarly, Pottel *et al.* [20] proposed and validated a height-independent, population-normalized equation derived from the patient's SCr and the median SCr for age-matched healthy children. Based on their results, population-based reference levels for renal function and CKD may provide a valid approach to determine CKD stage for screening purposes, as in the present study. Indeed, our newly established CKD classification showed good validity compared with the abbreviated and complete Schwartz equations.

To classify stage 3–5 CKD, we used new diagnostic criteria based on previously determined SCr reference levels in age- and sex-matched Japanese children [11]. In that study, SCr was determined using enzymatic methods; in our current study, the participating institutes only used the enzymatic method to determine SCr. Therefore, our current results are not subject to confounding because of the use of multiple assay types.

The prevalence of pre-dialysis stage 3–5 CKD was estimated to be 2.95 cases/100 000 Japanese children, which was lower than that reported in the ItalKid and REPIR II Projects (7.47 and 7.106 cases/100 000 children, respectively). The reason for this lower prevalence of CKD in Japan in comparison with Western countries is unclear, but differences in the age of the cohort and the method of case definition may account for some of the difference. For example, the ItalKid Project [3] included children aged <20 years, used the original Schwartz equation to determine GFR and included children with eGFR <75 mL/min/1.73 m^2. Similarly, the REPIR II study [4] included children aged <19 years with stage 2 CKD, which accounted for 42% of their cases. Nevertheless, the estimated prevalence of stage 3–5 CKD in Spain, based on data from the REPIR II study, is 4.12 cases per 100 000 children (7.106 × 58%), which is slightly higher than that estimated in our study. The low frequency of pre-dialysis

Table 4. Primary etiologies of stage 3–5 chronic kidney disease in Japanese children aged 3 months to 15 years

Primary disease	Non-glomerular kidney disease ($n=407$, 91.1%) *n* (%)	Glomerular kidney disease ($n=35$, 7.8%) *n* (%)	Unclassified ($n=5$, 1.1%) *n* (%)
CAKUT	278 (68.3)	0 (0.0)	0 (0.0)
CAKUT with obstructive urological malformations[a]	60 (21.6)	0 (0.0)	0 (0.0)
CAKUT without obstructive urological malformations	218 (78.4)	0 (0.0)	0 (0.0)
Cortical necrosis (perinatal period)	40 (9.8)	0 (0.0)	0 (0.0)
Polycystic kidney disease	20 (4.9)	0 (0.0)	0 (0.0)
Nephronophthisis	19 (4.7)	0 (0.0)	0 (0.0)
Drug induced	17 (4.2)	0 (0.0)	1 (20.0)
Other inherited kidney damage	10 (2.5)	1 (2.9)	0 (0.0)
Acute kidney injury	10 (2.5)	0 (0.0)	0 (0.0)
Neurogenic bladder	6 (1.5)	0 (0.0)	0 (0.0)
Other non-inheritable character	4 (1.0)	2 (5.7)	0 (0.0)
Alport's syndrome	0 (0)	8 (22.9)	0 (0.0)
Cystinosis	1 (0.2)	0 (0.0)	0 (0.0)
Wilms tumor	1 (0.2)	0 (0.0)	0 (0.0)
Chronic tubulointerstitial nephritis	1 (0.2)	0 (0.0)	0 (0.0)
Focal segmental glomerulosclerosis	0 (0.0)	8 (22.9)	0 (0.0)
Chronic glomerulonephritis	0 (0.0)	8 (22.9)	0 (0.0)
Congenital nephrotic syndrome	0 (0.0)	3 (8.6)	0 (0.0)
Hemolytic uremic syndrome	0 (0.0)	3 (8.6)	0 (0.0)
Systemic lupus erythematosus	0 (0.0)	2 (5.7)	0 (0.0)
Unknown	0 (0.0)	0 (0.0)	4 (80.0)

[a]Posterior urethral valve, stricture of the urethra, hydronephrosis, hydroureter, and cloacal anomaly.

CKD in our study is consistent with the low frequency of children with ESRD in Japan [7].

A number of factors, such as differences in racial and ethnic distributions, primary cause of CKD and quality of medical care, may contribute to the difference in reported prevalence estimates between Japan and Western countries. Additionally, the prevalence of obstructive uropathy is low in Japan, being detected in just 21.6% of patients with CAKUT; by contrast, in Western countries, obstructive uropathy accounts for many cases of non-glomerular disease in children with CKD [21, 22]. Several factors may explain the differences in the prevalence of CAKUT, including (i) genetic differences that affect the distribution of obstructive diseases (e.g. prune-belly syndrome) and (ii) the diagnosis of these congenital diseases may be difficult, resulting in underestimation of obstructive uropathies. However, despite the lower frequency of obstructive uropathy in Japan, appropriate urological interventions are still an indispensable part of the management of children with CKD, because they are one of very few treatments that can change the outcome of CKD [23].

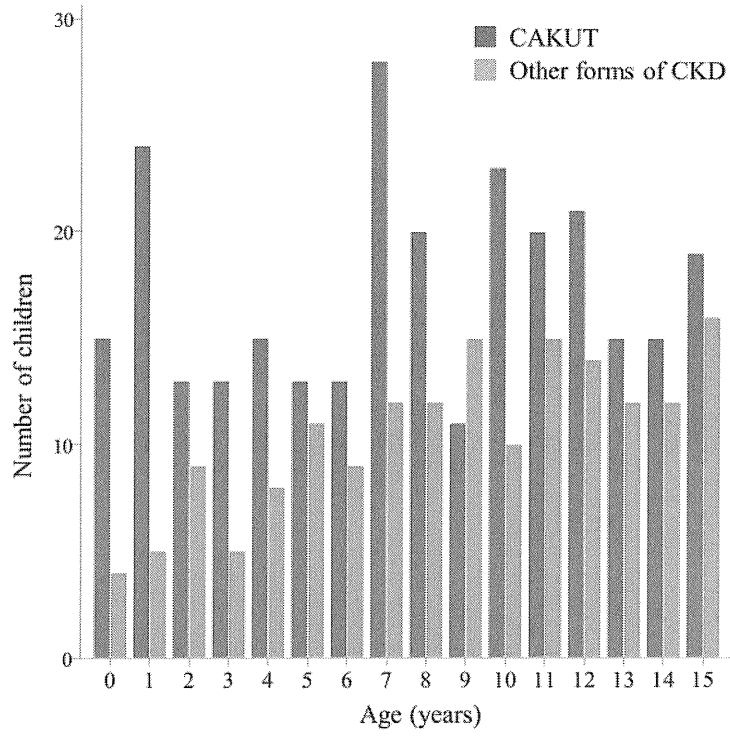
Despite the lower prevalence of CKD in our study compared with European cohorts, we believe that our data accurately represent the current situation in Japan because 1190 institutes, including all institutes belonging to the JSPN, were included in the survey and there was a very high response rate (77.7%). We also stratified institutions by hospital type and the number of beds to improve the accuracy of the estimated prevalence. Because the response rate tended to be lower for institutions with fewer patients, estimates of CKD prevalence that do not take strata (hospital size and type) into account are possibly overestimates. For example, a simple estimate without stratification in the present study would have been 595.7 children rather than the 536.5 estimated with strata taken into account. Thus, the stratified estimation method should correct for a bias between response rates and hospital type/size. Nevertheless, it is possible that some patients with stage 3–5 CKD were treated at other types of institutions not included in this survey.

The majority of Japanese children with CKD presented with non-glomerular disease. CAKUT was the primary cause of CKD (i.e. 62.2% of all CKD cases). This observation was expected. Unlike in adults, in whom diabetes and hypertension are the primary cause of CKD, congenital causes are responsible for majority of pediatric CKD cases [1, 7]. The prevalence of CAKUT in our study is also consistent with that reported in the ItalKid and REPIR II studies (67.5 and 59%, respectively) [3, 4].

Interestingly, there were very few cases of glomerular disease, such as focal segmental glomerulosclerosis, and no confirmed cases of IgA nephropathy (one case was suspected, but diagnosis was not confirmed). In a Japanese registry of pediatric ESRD patients conducted in 1998, 19% of patients had focal segmental glomerulosclerosis and 3% had IgA nephropathy [24]. The present analysis is likely to have underestimated the prevalence of these diseases for several reasons. First, these diseases progress more rapidly than non-glomerular diseases and could have been missed in the survey. Secondly, we restricted our analysis to those aged <16 years, but chronic glomerulonephritis frequently affects patients aged 16–20 years. Furthermore, these diseases respond well to novel treatment regimens that are well established in Japan, including combination therapy for IgA nephropathy [25] and cyclosporine in combination with steroids for steroid-resistant nephrotic syndrome, including focal segmental glomerulosclerosis [26].

Fetal/neonatal ultrasonography was the most frequently used method to detect CAKUT, followed by blood analyses by chance and investigation of urinary tract infection. Only 27 children with CAKUT and 12 with other forms of CKD were detected following annual urinalysis at school. Patients with CKD, particularly children with CAKUT, do not necessarily show abnormal urinalysis, and are missed by the screening. It is also possible that CKD (particularly non-CAKUT forms of CKD) could be detected in the earlier stages (earlier than stage 3) and patients could then receive appropriate intervention to treat the underlying disease. The treatment strategies for CAKUT and other forms of CKD were generally similar (Table 6), although the responding institutions more often reported using carbon absorbents for CAKUT and ACEIs in other forms of CKD (data not shown).

Some limitations of the study merit consideration. First, only 77.7% of the surveyed institutions responded to the questionnaire, which may limit the accuracy of the



Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Population (thousands)[a]	1,078	1,092	1,084	1,072	1,050	1,088	1,111	1,145	1,169	1,159	1,179	1,193	1,186	1,183	1,206	1,208	18,217
CAKUT[b]	15	24	13	13	15	13	13	28	20	11	23	20	21	15	15	19	278
Other forms of CKD[b]	4	5	9	5	8	11	9	12	12	15	10	15	14	12	12	16	169

Fig. 3. Age distribution of children with stage 3–5 CKD in Japan. Children with CAKUT are shown in red bars, while those with other forms of CKD are shown in blue bars. Total numbers of children of each age in Japan derived from national census data (1 April 2010) published by the Statistics Bureau of Ministry of Internal Affairs and Communications in Japan (http://www.stat.go.jp/english/index.htm)[a]. Number of children with CAKUT or other forms of CKD reported in the survey[b].

Table 5. Method of detection of Stage 3–5 CKD

Screening method	CAKUT ($n = 278$)	Other forms of CKD ($n = 169$)		Other forms of CKD ($n = 169$)	Age at which CKD was detected (years)	
	n (%)	Median	IQR	n (%)	Median	IQR
Fetal ultrasonography/ultrasonography in the neonatal period	88 (31.7)	0.0	0.0–0.0	19 (11.2)	0.0	0.0–0.0
Analysis by chance	38 (13.7)	3.9	1.2–6.1	32 (18.9)	5.8	1.7–9.4
Urinary tract infection	38 (13.7)	0.7	0.3–2.0	4 (2.4)	1.8	0.3–3.6
Annual urinalysis at school	27 (9.7)	8.9	7.0–10.3	12 (7.1)	8.3	7.1–10.9
Blood analysis in the neonatal period, asphyxia, neonatal shock and other events	25 (9.0)	0.0	0.0–0.1	31 (18.3)	0.0	0.0–0.0
Failure to thrive, weight loss and general fatigue	25 (9.0)	0.3	0.1–1.0	7 (4.1)	2.2	0.2–12.3
Urinalysis at 3 years	9 (3.2)	3.2	3.0–3.4	7 (4.1)	3.1	3.0–3.6
Routine health check (infants/toddlers)	7 (2.5)	0.3	0.1–1.7	4 (2.4)	2.8	0.4–5.1
Symptoms of glomerulonephritis (edema, oliguria or gross hematuria)	5 (1.8)	3.8	1.0–5.0	13 (7.7)	5.3	2.7–8.7
Analysis because of anomalies and syndromal stigmata	3 (1.1)	0.0	0.0–0.1	1 (0.6)	1.7	1.7–1.7
Detected during the management of other diseases (e.g. heart disease and malignancy)	2 (0.7)	5.3	5.3–5.3	18 (10.7)	3.2	0.2–8.2
Dysuria, including neurogenic bladder and nocturia	2 (0.7)	4.9	4.9–4.9	4 (2.4)	5.7	1.2–9.5
Analysis because of family history	0 (0.0)	—	—	3 (1.8)	6.2	4.5–9.7
Sepsis	0 (0.0)	—	—	3 (1.8)	0.0	0.0–0.1
Others	0 (0.0)	—	—	2 (1.2)	2.2	0.8–3.7
Unknown (not available)	9 (3.2)	—	—	9 (5.3)	—	—

CKD, chronic kidney disease; CAKUT, congenital anomalies of the kidney and urinary tract.

Table 6. Treatment strategies for CAKUT and other forms of CKD for individual patients

	CAKUT ($n=278$) n (%)	Other forms of CKD ($n=169$) n (%)	All patients ($n=447$) n (%)
ARBs			
No	201 (72.3)	115 (68.0)	316 (70.7)
Yes	74 (26.6)	53 (31.4)	127 (28.4)
NA	3 (1.1)	1 (0.6)	4 (0.9)
ACEIs			
No	209 (75.2)	108 (63.9)	317 (70.9)
Yes	66 (23.7)	60 (35.5)	126 (28.2)
NA	3 (1.1)	1 (0.6)	4 (0.9)
Carbon absorbents			
No	237 (85.3)	144 (85.2)	381 (85.2)
Yes	34 (12.2)	24 (14.2)	58 (13.0)
NA	7 (2.5)	1 (0.6)	8 (1.8)
Calcium antagonists			
No	264 (94.9)	147 (87.0)	411 (91.9)
Yes	11 (4.0)	21 (12.4)	32 (7.2)
NA	3 (1.1)	1 (0.6)	4 (0.9)

CAKUT, congenital anomalies of the kidney and urinary tract; CKD, chronic kidney disease; ARB, angiotensin II receptor blocker; ACEI, angiotensin-converting enzyme inhibitor; NA, not available.

estimate. Secondly, although the classification system used for CKD staging in the present study was based on reference SCr levels determined via enzymatic methods from Japanese children, these diagnostic criteria have not been validated globally and reference values would be needed for other populations. Height could have also been determined to estimate GFR via the Schwartz equation; however, because the GFR is inversely proportional to SCr in age- and sex-matched individuals, and because we used age- and sex-matched reference SCr levels established in a previous study with 1151 children, our measurements should be accurate enough and more practical for screening purposes. Indeed, our CKD staging showed good agreement with CKD staging based on the abbreviated Schwartz equation (Figure 2). Because, our CKD staging method is based on the SCr level, CKD may be missed in children with small muscle mass, such as those with spina bifida, neuromuscular disease and short stature.

To our knowledge, this is the first nationwide, population-based survey of children with pre-dialysis CKD in Asia and applied reference levels for CKD derived from a large cohort of Japanese children. This method showed good agreement with the abbreviated Schwartz equation and is practical for screening purposes, including children aged <2 years, as current methods are not appropriate for estimating CKD in this age group. The estimated prevalence of stage 3–5 CKD in Japan was 2.95 cases/100 000 children, which is lower than that in Western countries. Most cases presented with non-glomerular disease, and CAKUT was the most common cause of CKD. Improved management of CAKUT in children with CKD, including renoprotective treatment and urological interventions, is required. We are planning randomized and longitudinal studies to improve the management of pediatric CKD, and better understand its long-term prognosis.

Acknowledgements. This work was supported by the 'Research on rare and intractable diseases, Health and Labour Sciences Research Grants' from the Ministry of Health, Labour and Welfare in Japan. The authors would like to thank Drs Takuhito Nagai (Aichi), Kenichi Satomura (Osaka), Midori Awazu (Tokyo), Toshiyuki Ohta (Hiroshima), Kazumoto Iijima (Hyogo), Takeshi Matsuyama (Tokyo), Mayumi Sako (Tokyo), Hidefumi Nakamura (Tokyo), Shuichiro Fujinaga (Saitama), Hiroshi Kitayama (Shizuoka), Naoya Fujita (Shizuoka), Masataka Hisano (Chiba), Yuko Akioka (Tokyo), Daishi Hirano (Tokyo), Hiroshi Hataya (Tokyo), Yoshinobu Nagaoka (Tokyo), Takashi Sekine (Tokyo), Yoshimitsu Goto (Aichi), Takuji Yamada (Aichi), Yohei Ikezumi (Niigata), Takeshi Yamada (Niigata) and Akira Matsunaga (Yamagata) of The Pediatric CKD Study Group in Japan for their contributions to the study. The authors also would like to thank the institutions listed in the Supplementary Material for their participation in surveys. The results presented in this paper have not been published previously in whole or part, except in abstract format.

Conflict of interest statement. None declared.

References

1. Warady BA, Chadha V. Chronic kidney disease in children: the global perspective. *Pediatr Nephrol* 2007; 22: 1999–2009.
2. McDonald SP, Craig JC. Long-term survival of children with end-stage renal disease. *New Engl J Med* 2004; 350: 2654–2662.
3. Ardissino G, Dacco V, Testa S *et al.* Epidemiology of chronic renal failure in children: data from the ItalKid project. *Pediatrics* 2003; 111: e382–387.
4. Areses Trapote R, Sanahuja Ibanez MJ, Navarro M. Epidemiology of chronic kidney disease in Spanish pediatric population. REPIR II Project. *Nefrologia* 2010; 30: 508–517 (in Spanish).
5. Esbjorner E, Berg U, Hansson S. Epidemiology of chronic renal failure in children: a report from Sweden 1986–1994. Swedish Pediatric Nephrology Association. *Pediatr Nephrol* 1997; 11: 438–442.
6. Furth SL, Cole SR, Moxey-Mims M *et al.* Design and methods of the chronic kidney disease in children (CKiD) prospective cohort study. *Clin J Am Soc Nephrol* 2006; 1: 1006–1015.
7. Harambat J, van Stralen KJ, Kim JJ *et al.* Epidemiology of chronic kidney disease in children. *Pediatr Nephrol.* 2011; 27: 363–373.
8. Mong Hiep TT, Ismaili K, Collart F *et al.* Clinical characteristics and outcomes of children with stage 3–5 chronic kidney disease. *Pediatr Nephrol* 2010; 25: 935–940.
9. Deleau J, Andre JL, Briancon S *et al.* Chronic renal failure in children: an epidemiological survey in Lorraine (France) 1975–1990. *Pediatr Nephrol* 1994; 8: 472–476.
10. US Renal Data System. 2010 Atlas of CKD & ESRD; 2010.
11. Uemura O, Honda M, Matsuyama T *et al.* Age, gender, and body length effects on reference serum creatinine levels determined by an enzymatic method in Japanese children: a multicenter study. *Clin Exp Nephrol* 2011; 15: 694–6990.
12. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis* 2002; 39(2 Suppl 1): S1–S266.
13. Hogg RJ, Furth S, Lemley KV *et al.* National Kidney Foundation's Kidney Disease Outcomes Quality Initiative clinical practice guidelines for chronic kidney disease in children and adolescents: evaluation, classification, and stratification. *Pediatrics* 2003; 111: 1416–1421.
14. Levey AS, Eckardt KU, Tsukamoto Y *et al.* Definition and classification of chronic kidney disease: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int* 2005; 67: 2089–2100.
15. Schwartz GJ, Brion LP, Spitzer A. The use of plasma creatinine concentration for estimating glomerular filtration rate in infants, children, and adolescents. *Pediatr Clin North Am* 1987; 34: 571–590.
16. Hashimoto S, Fukutomi K, Nagai M *et al.* A note on methods for estimating the number of patients in the nationwide epidemiological survey on intractable diseases. *Nihon Koshu Eisei Zasshi* 1990; 37: 768–774 (in Japanese).

17. Schwartz GJ, Munoz A, Schneider MF *et al.* New equations to estimate GFR in children with CKD. *J Am Soc Nephrol* 2009; 20: 629–637.
18. Akizawa T, Asano Y, Morita S *et al.* Effect of a carbonaceous oral adsorbent on the progression of CKD: a multicenter, randomized, controlled trial. *Am J Kidney Dis* 2009; 54: 459–467.
19. Imai E, Horio M, Nitta K *et al.* Estimation of glomerular filtration rate by the MDRD study equation modified for Japanese patients with chronic kidney disease. *Clin Exp Nephrol* 2007; 11: 41–50.
20. Pottel H, Hoste L, Martens F. A simple height-independent equation for estimating glomerular filtration rate in children. *Pediatr Nephrol* 2012; 27: 973–979.
21. Chadha V, Warady BA. Epidemiology of pediatric chronic kidney disease. *Adv Chronic Kidney Dis* 2005; 12: 343–352.
22. Furth SL, Abraham AG, Jerry-Fluker J *et al.* Metabolic abnormalities, cardiovascular disease risk factors, and GFR decline in children with chronic kidney disease. *Clin J Amer Soc Nephrol* 2011; 6: 2132–2140.
23. Nakai N, Asanuma H, Shishido S *et al.* Changing concepts in urological management of the congenital bnormalities of kidney and urinary tract, CAKUT. *Pediatr Int* 2003; 45: 634–641.
24. Hattori S, Yosioka K, Honda M *et al.* The 1998 report of the Japanese National Registry data on pediatric end-stage renal disease patients. *Pediatr Nephrol* 2002; 17: 456–461.
25. Kamei K, Nakanishi K, Ito S *et al.* Long-term results of a randomized controlled trial in childhood IgA nephropathy. *Clin J Am Soc Nephrol* 2011; 6: 1301–1307.
26. Hamasaki Y, Yoshikawa N, Hattori S *et al.* Cyclosporine and steroid therapy in children with steroid-resistant nephrotic syndrome. *Pediatr Nephrol* 2009; 24: 2177–2185.

Received for publication: 23.8.12; Accepted in revised form: 18.12.12

5．各ガイドラインなどの改訂の要点と学校検尿システムに与える影響

2）CKD診療ガイドライン2013

―改訂のポイントと，学校検尿に関する知見―

東京都立小児総合医療センター　腎臓内科　石倉健司（いしくらけんじ）

KEY WORDS　慢性腎臓病（CKD），小児，学校検尿，糸球体性疾患，非糸球体性疾患，先天性腎尿路異常（CAKUT）

はじめに

小児の慢性腎臓病（chronic kidney disease，CKD）はいったん末期腎不全に進行すると，一生にわたる透析や複数回の腎移植などが必要で，また成長・発達の障害や様々な合併症によりQOLも大きく損なう重大な疾患である。したがって早期に発見し，適切な管理によって治癒をめざす，または進行を遅らせることが重要である。また合併症に関しても，適切にコントロールすることが求められる。

近年CKDへの関心が急速に高まり，CKDに関するガイドやガイドラインが国内外で複数整備されている。小児CKDに関する記載も増え，小児CKDの診療レベルの向上に寄与することが期待される。本稿では，2013年に発刊予定であるCKD診療ガイドライン2013（仮称，以下CKDGL2013）の改訂のポイントや，本ガイドラインが学校検尿システムに及ぼす影響について解説する。

なお，現在CKDGL 2013は改訂作業中であり，パブリックコメントを受けている状態である。したがって最終的なガイドラインは，本稿で書かれている内容と一部異なる可能性があることをご了承いただきたい。

Ⅰ．CKDの概念・定義とその意義

CKDは2002年にK/DOQIガイドライン（Chronic Kidney Disease：Evaluation, Classification, and Stratification）が以下のように提唱した疾患概念である[1]。

1）糸球体濾過量（GFR）の値にかかわらず，腎障害を示唆する所見（検尿異常，画像異常，血液異常，病理所見など）が3カ月以上存在すること

2）GFR 60mL/分/1.73m^{2}未満が3カ月以上持続すること

この片方または両方を満たす場合にCKDと診断される。小児領域でも基本的にこの概念が踏襲されている。

CKDという概念が確立し，また広く受け入れられた背景には，非常に多くの患者が存在することと，CKDが原疾患に限らず心血

〒183-8561　東京都府中市武蔵台2-8-29

表1　小児CKDのステージ分類（2歳以上）（文献1を一部改変）

病期ステージ	重症度の説明	GFR mL/分/1.73m^2	
1	腎障害*は存在するがGFRは正常または亢進	≧90	移植治療が行われている場合は1-5T
2	腎障害が存在し，GFR軽度低下	60～89	
3	GFR中等度低下	30～59	
4	GFR高度低下	15～29	
5	末期腎不全	＜15（または透析）	透析治療が行われている場合は5D

*腎障害：蛋白尿，腎形態異常（画像診断），病理の異常所見等を意味する．

管疾患をはじめとしたさまざまな合併症から生命予後に大きく影響することがあげられる。また“chronic kidney disease”という名称に示されるように，“renal”ではなく“kidney”という単語を用いることによって，医療従事者に限らず広く一般社会に認識されていくことを目指している。

その後，成人領域ではステージ3の細分化（G3a，GFR 60mL/分/1.73m^{2}未満45 mL/分/1.73m^{2}以上；G3b，GFR 45mL/分/1.73 m^{2}未満30 mL/分/1.73m^{2}以上）や蛋白尿（アルブミン尿）と原疾患を考慮したリスク分類などの変更が加えられている。しかし，蛋白尿に関しては小児でも疾患進行のリスクである可能性はあるが，さらなる検討を要するとしてCKDGL2013では小児CKDのリスク分類としては採用されなかった。したがってCKDGL2013の小児CKDのステージ分類は，従来と同様である（**表1**）。

Ⅱ．CKDGL2013改訂のポイント

CKDという概念は今や国民病として定着をみせつつあり，また世界的にも注目され，年々さまざまなエビデンスが蓄積されている。そのような状況下でガイドラインが前版から約4年を経て改訂されるのは，当然のことと思われる。CKDGL2013では，小児に関しては前版同様2章にわたって記載された。前半は小児CKDの疫学や診断，後半は治療に関してのクリニカルクエスチョンとそれに対するステートメント，解説が加えられた。

今回の改訂では，前回同様Evidence-based medicine（EBM）の手法に基づいて作成され，さらに推奨グレードの決定などのプロセスが厳密に行われた。推奨の根拠となるエビデンスのレベルと推奨のグレードは，**表2**に示したとおりである。なお疫学的記述や診断に関しては，推奨グレードは明示しなかった。ここでとくに推奨グレードがC1（科学的根拠はないが，行うよう勧められる）あるいはC2（科学的根拠がなく，行わないよう勧められる）のステートメントには，留意が必要である。推奨グレードがC1のステートメント（例：小児CKDにおいて，腎機能障害の進行を抑制する可能性があるため，尿路系異常の適切な評価と泌尿器科的介入を推奨する）は，重要ではあるがレベルの高いエビデンスが乏しいこと，あるいは必ずしも明確な結論が出ていないことを示しており，その中で，少しでも実臨床上の疑問に答えるために，ガイドライン改訂委員の間で議論を重ねて推奨が決定された。一方C2のステートメ

表2　推奨の根拠となるエビデンスのレベルと推奨のグレード

エビデンスのレベル
レベル1：システマティックレビュー/メタ解析
レベル2：1つ以上のランダム化比較試験による
レベル3：非ランダム化比較試験による
レベル4：分析疫学的研究（コホート研究や症例対照研究による）
レベル5：記述研究（症例報告やケース・シリーズ）による
レベル6：患者データに基づかない，専門委員会や専門家個人の意見

推奨グレード
グレードA：　強い科学的根拠があり，行うよう強く勧められる
グレードB：　科学的根拠があり，行うよう勧められる
グレードC1：科学的根拠はないが，行うよう勧められる
グレードC2：科学的根拠がなく，行わないよう勧められる
グレードD：　無効性あるいは害を示す科学的根拠があり，行わないよう勧められる

ント（例：運動制限が小児CKD患者の腎機能障害の進行を抑制するか明らかでないため，推奨しない）に関しては，従来高いレベルのエビデンスがないまま一部で有効性が信じられてきた，あるいは漫然と行われてきたことに対し，そのリスクとベネフィットを委員の間で議論し，推奨に至らなかったことを示している。そしてすべてのステートメントに言えることではあるが，とくにこれらC1，C2の推奨グレードを持つステートメントについては，今後新たなエビデンスの出現により，異なった記載がなされていく可能性がある。

一方ガイドラインの記載の形式としては，前版とCKDGL2013では大きな違いがある。前版は網羅的に記載されたのに対し，CKDGL2013は疫学等の一部の記載を除き［クリニカルクエスチョン形式］で書かれている。これは臨床上の問題点を疑問の形式で提示し，それに対する回答としてステートメントが記載され，さらに解説を加えるという形式である。記載できるクリニカルクエスチョンの数はある程度限りがある。したがってすべての事項を網羅的にカバーするというよりも，小児CKDの領域で重要となっている，あるいは議論が続いている問題点に絞ってクリニカルクエスチョンが作成された。

Ⅲ．小児CKDの頻度と原疾患に関して

CKDGL2013では小児CKDの頻度と原因疾患について，記載されている

ステージ1，2を含んだ小児CKD全体の有病率や罹患率は明らかにされていない。CKDは形態異常から機能異常までを含んだ非常に大きな疾患概念であり，軽症例の有病率を明らかにすることは困難であると思われる。一方，ステージ3～5の重症例に関しては，本邦において100万人あたり29.8人と比較的稀である一方で，その罹病期間の長さや成長発達に及ぼす影響，合併症の重篤さなどから，きわめて重大な病態であることが述べられている。

さらに小児CKDの原疾患についても記載されている。CKDの原疾患は，大きく糸球体性疾患と非糸球体性疾患に分けられる。前者の例として特発性ネフローゼ症候群やIgA腎症を中心とした慢性腎炎があり，後者の例として，先天性腎尿路異常（congenital anomalies of the kidney and urinary

tract, CAKUT）や新生児ショック，多発性嚢胞腎，ネフロン勞などがある。

近年小児糸球体性疾患の治療は進歩が著しい。巣状分節性糸球体硬化症（FSGS）は，末期腎不全に進行する原疾患として糸球体性疾患の中で最も多い。しかし，FSGSを含む小児特発性ステロイド抵抗性ネフローゼ症候群の多くは，シクロスポリンを中心とした治療により高率に寛解導入することが可能になり[2]，また5年間の腎生存率も高いことが示されている[3]。したがって，今後これらの疾患による腎不全進行が減少する可能性がある。また最も頻度の高い慢性腎炎であるIgA腎症に関しても，多剤併用療法により重症例でも高率に寛解にいたり[4]，長期予後も良好であることが示されている[5]。以上の治療法に関しては，CKDGL2013にも，それぞれネフローゼ症候群（巣状分節性糸球体硬化症）とIgA腎症のセクションに詳述されている。これらの疾患に対しては，早期に発見し，適切な治療により治癒を目指すことが重要である。

一方非糸球体性疾患は，全く事情が異なる。本邦の小児末期腎不全患者の原疾患は，CAKUTが28.9%と最も多い[6]。さらに末期腎不全進行のリスクが高いCKDステージ3～5の小児447人を対象にした本邦の疫学研究では，全体の91.1%が非糸球体性疾患であり，そのうちの68.3%がCAKUTであった[7]。これらの疾患は，完全な治癒は望めないため，疾患進行の抑制と合併症の適切な管理が求められる。これらに関して，CKDGL2013では，RA系阻害薬による進行抑制や，骨ミネラル代謝異常（CKDMBD）や貧血，成長障害に対する適切な管理方法が示されている。また腎臓のみならず，膀胱機能障害や後部尿道弁などの尿路系の合併症が，腎機能予後や移植後の管理に影響を及ぼすことも示されている。

小児CKDは種々の原疾患を包括した概念ではあるが，一方でこれらの疫学的情報や，原疾患による治療法や管理法の違いを理解することも重要であると思われる。

Ⅳ．小児CKDの診断について

前版に比較し，CKDGL2013では小児CKDの診断に関して，より詳細な記載がされている。とくに本邦小児の血清クレアチニンの基準値[8]（**表3**）が示されていることが大きな進歩である。これまで糸球体濾過量（GFR）に関する様々な指標が研究されてきたが，依然血清クレアチニンが最も重要な指標であり，本邦小児の基準値が作成された意義はきわめて大きい。

さらに，血清クレアチニン値に基づいたCKDのステージ判定表も示されている。これはGFRが血清クレアチニンの逆数に比例すること，正常のGFRがおおよそ120 mL/min/1.73 m^2であり，CKDステージ3，4，5がそれぞれ60 mL/min/1.73 m^2未満，30 mL/min/1.73 m^2未満，15 mL/min/1.73 m^2未満であることから，血清クレアチニン基準値の2倍，4倍，8倍以上がそれぞれステージ3，4，5に該当することを示した表である。CKDGL2013では2歳までに関して，CKDのステージ判定表が示されているが，原理的には全年齢に関して適用することができる。本稿では15歳以下の全年齢の血清クレアチニンの基準値と，それに基づいたCKDステージ判定表を示しておく（**表3**）。

なおCKDGL2013では，血清クレアチニン値のほかに，血尿，画像検査の重要性に関して記載している。詳細はガイドラインを参照されたい。

Ⅴ．学校検尿に対する影響

CKDGL2013では学校検尿の有用性を示している。学校検尿に関するクリニカルクエス

表3　血清クレアチニンの基準値と小児CKDステージ判定（文献7を一部改変）

Age	2.5th percentile	50th percentile	97.5th percentile	CKD stage 3	CKD stage 4	CKD stage 5
＜2 years						
3～5 months	0.14	0.20	0.26	0.41～0.80	0.81～1.60	≧1.61
6～8 months	0.14	0.22	0.31	0.45～0.88	0.89～1.76	≧1.77
9～11 months	0.14	0.22	0.34	0.45～0.88	0.89～1.76	≧1.77
1 year	0.16	0.23	0.32	0.47～0.92	0.93～1.84	≧1.85
2～11（year）						
2	0.17	0.24	0.37	0.49～0.96	0.97～1.92	≧1.93
3	0.21	0.27	0.37	0.55～1.08	1.09～2.16	≧2.17
4	0.20	0.30	0.40	0.61～1.20	1.21～2.40	≧2.41
5	0.25	0.34	0.45	0.69～1.36	1.37～2.72	≧2.73
6	0.25	0.34	0.48	0.69～1.36	1.37～2.72	≧2.73
7	0.28	0.37	0.49	0.75～1.48	1.49～2.96	≧2.97
8	0.29	0.40	0.53	0.81～1.60	1.61～3.20	≧3.21
9	0.34	0.41	0.51	0.83～1.64	1.65～3.28	≧3.29
10	0.30	0.41	0.57	0.83～1.64	1.65～3.28	≧3.29
11	0.35	0.45	0.58	0.91～1.80	1.81～3.60	≧3.61

Age	2.5th percentile	50th percentile	97.5th percentile	CKD stage 3	CKD stage 4	CKD stage 5
Males（years）						
12	0.40	0.53	0.61	1.07～2.12	2.13～4.24	≧4.25
13	0.42	0.59	0.80	1.19～2.36	2.37～4.72	≧4.73
14	0.54	0.65	0.96	1.31～2.60	2.61～5.20	≧5.21
15	0.48	0.68	0.93	1.37～2.72	2.73～5.44	≧5.45
Females（years）						
12	0.40	0.52	0.66	1.05～2.08	2.09～4.16	≧4.17
13	0.41	0.53	0.69	1.07～2.12	2.13～4.24	≧4.25
14	0.46	0.58	0.71	1.17～2.32	2.33～4.64	≧4.65
15	0.47	0.56	0.72	1.13～2.24	2.25～4.48	≧4.49

チョン（CQ）とステートメントは以下の通りである。

> CQ：学校検尿は小児CKD患者の予後改善に貢献するか？
>
> ステートメント：学校検尿は小児CKD患者の早期発見に貢献しており，特に慢性糸球体腎炎の予後改善に有用である

根拠として，小児の慢性糸球体腎炎の半数以上は学校検尿により発見されており，その多くはCKDステージ1の段階であることが記載されている。さらに間接的に，学校検尿で発見された膜性増殖性腎炎（MPGN）には末期腎不全に至った例のないこと，1974年の学校検尿開始以来，慢性糸球体腎炎による透析導入者が減少していること等が示されている。このように，CKDGL2013では，糸球体性疾患の発見に関して，学校検尿の果たす役割はきわめて大きいことを示している。

一方，CKDステージ3～5に関しては，学校検尿による発見者は少ない。2010年に本邦で行われた疫学研究では，447人の小児CKD患者（ステージ3～5，15歳以下）で，学校検尿で発見されたのはわずか39人であり，さらに3歳児検尿での発見者も16人であった[7]。前述のとおり447人のうち407人（91.1%）がCAKUTを中心とした非糸球体性疾患である。非糸球体性疾患は，必ずしも有意な蛋白尿を呈さないことや，たとえ蛋白尿があっても，希釈尿のため定性検査では発見できないことが原因として考えられる。このことは，現行の3歳児検尿や学校検尿は，必ずしも非糸球体性疾患の発見には適していない制度である可能性があり，画像検査との組み合わせなど今後検討すべき課題は多い。

おわりに

最後に，診療ガイドラインの臨床への適用に関して私見を述べる。CKDGL2013は，EBMの手法によって作成された。EBMに対する誤解には様々なものがあるが，ガイドラインに対する誤解（盲信？）もその一つであると思われる。EBMを行ううえでの重要なステップの中に，［エビデンスの批判的吟味］や［エビデンスと経験，実施可能性，患者の価値観との融合］がある。そしてガイドラインもエビデンスの一つに過ぎず，当然批判的吟味を受けるべきであるし，さらに最も重要な［エビデンスと経験，実施可能性，患者の価値観との融合］がなされて初めて患者に対する診療が決定されるべきである。

文　献

1) National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease：evaluation, classification, and stratification. Am J Kidney Dis 39：S1～S266, 2002
2) Hamasaki Y, Yoshikawa N, Hattori S et al：Cyclosporine and steroid therapy in children with steroid-resistant nephrotic syndrome. Japanese Study Group of Renal Disease. Pediatr Nephrol 24：2177～2185, 2009
3) Hamasaki Y, Yoshikawa N, Nakazato H et al：Prospective 5-year follow-up of cyclosporine treatment in children with steroid-resistant nephrosis. Pediatr Nephrol. 2013, Epub ahead of print
4) Yoshikawa N, Honda M, Iijima K et al：Steroid treatment for severe childhood IgA nephropathy：a randomized, controlled trial. Clin J Am Soc Nephrol 1：511～517, 2006
5) Kamei K, Nakanishi K, Ito S et al：Long-term results of a randomized controlled trial in childhood IgA nephropathy. Clin J Am Soc Nephrol 6：1301～1307, 2011
6) Hattori S, Yosioka K, Honda M et al：The 1998 report of the Japanese National Registry data on pediatric end-stage renal disease patients. Pediatr Nephrol 17：456～461, 2002
7) Ishikura K, Uemura O, Ito S et al：Pre-dialysis chronic kidney disease in children：results of a nationwide survey in Japan. Nephrol Dial Transplant in press

8) Uemura O, Honda M, Matsuyama T et al：Age, gender, and body length effects on reference serum creatinine levels determined by an enzymatic method in Japanese children：a multicenter study. Clin Exp Nephrol 15：694～699, 2011

学会案内

新生児けいれんおよび関連疾患国際シンポジウム
第15回　乳幼児けいれん研究会開催案内

正式名称（英文）：International Symposium on Neonatal Seizures and Related Conditions（ISNS）
—Cutting Edge in Seizure Detection, Management and Neuroprotection—
—The 15th Annual Meeting of Infantile Seizure Society（ISS）—

期　　日：2013年（平成25年）4月12日（金）～14日（日）

会　　場：順天堂大学医学部　有山記念講堂，他（東京都文京区本郷2-1-1）

会　　長：新島新一（順天堂大学附属練馬病院　小児科　教授）

テ ー マ：新生児けいれん，新生児期発症てんかん，背景新生児脳障害の診断，治療，予後，発生予防（神経保護，再生）など

プログラム：国際抗てんかん連盟（ILAE）小児科委員会との共同企画による。すなわち国際的な一流の講師による特別講演，招待講演，教育講演，シンポジウム，一般演題（口演，ポスター），早朝セミナー，ランチョンセミナー，その他

参 加 者：日本全国-世界各国-特にアジア・オセアニア地域の小児神経科医，小児てんかん専門医，周産期医学・新生児学専門医，NICU 担当医，小児神経救急医，発達神経科学基礎研究者，小児保健衛生関係

公 用 語：英語のみ

主　　催：乳幼児けいれん研究会（ISS）

共　　催：国際抗てんかん連盟（ILAE）Pediatrics Commission

連 絡 先：〒177-0033　東京都練馬区高野台3-1-10　順天堂大学附属練馬病院 小児科
大友義之（事務局）isns2013@k-con.co.jp

ウェブサイト：http://www.k-con.co.jp/isns2013.html