An 8-month-old Male Infant with High Grade Vesicoureteral Reflux who Developed Incomplete Kawasaki disease after Recurrent Pyelonephritis

Kawasaki disease (KD) is a systemic vasculitis that can affect many organ systems. Renal manifestations include pyuria, hematuria, proteinuria, tubulointerstitial nephritis, acute renal failure, hemolytic uremic syndrome, or renal scarring. Although its precise pathogenesis remains unknown, it is considered an autoimmune disease. In the literature, it has been reported that KD may develop in conjunction with urinary tract infections. However, many of these previous studies did not use imaging methods such as renal sonograms, dimercaptosuccinic acid renal scans, and voiding urethrocystograms. We report a case of an 8-month old male infant with high grade vesicoureteral reflux, who developed incomplete KD after recurrent pyelonephritis. Acute pyelonephritis can be an early manifestation of KD. Such cases require the evaluation of urinary tract anomalies according to the guidelines for the management of urinary tract infections.

Key words: Kawasaki disease, Pyelonephritis, Urinary tract infection, Vesicoureteral reflux

Introduction

About 10–15% of patients with Kawasaki disease (KD) present with sterile pyuria in the acute phase due to non-specific vasculitis of the urethra [1]. However, previous reports suggest that pyuria in KD is not always sterile, as it can develop in association with urinary tract infections (UTI) [2, 3]. The limitation of these findings is that the acute pyelonephritis diagnosis at initial manifestation could not be confirmed in these KD patients due to normal $^{99m}$Tc-dimercaptosuccinic acid (DMSA) scan.
results. KD is an autoimmune disease. It has been reported that UTI has a role in the pathogenesis of some autoimmune diseases like autoimmune cholangitis, rheumatoid arthritis, autoimmune liver disease, thrombotic thrombocytopenic purpura, and lupus nephritis [4-8].

We report a case of an 8-month-old boy with high grade vesicoureteral reflux (VUR), who developed incomplete KD after recurrent pyelonephritis.

Case report

An 8-month-old boy was admitted to our hospital with a 3-hour history of high fever and no associated symptoms. His past medical history revealed two prior admissions. At 3-month-old, he was first admitted due to acute pyelonephritis, confirmed by abnormal urinalysis (specific gravity, <1.005; pH, 6.0; occult blood, 2+; leukocyte esterase, 1+; RBC, 1-4/high power field (HPF); WBC, 10-30/HPF; and bacteria, some), urine culture (growth of *Klebsiella oxytoca* with more than 10⁵ colony forming unit (CFU)/mL) sampled by urine bag, C-reactive protein (CRP) 9.78 mg/dL, and renal sonogram (US) (hydronephrosis of both kidneys; right, 7.8 mm, Society for Fetal Urology (SFU) grade 2; left, 10.6 mm, SFU grade 2-3; otherwise unremarkable findings). At 6 month-old, he was admitted for a second time due to Kawasaki disease and the following associated symptoms: 5-day history of fever, lip redness, strawberry tongue, bilateral non-purulent conjunctivitis, erythematous induration on BCG site, and swelling of both hands and feet. Urinalysis revealed pyuria, while urine culture sampled by urine bag revealed the growth of *Pseudomonas aeruginosa* with more than 10⁵ CFU/mL.

Imaging studies consisting of a posterior–anterior chest radiograph were normal. Following the diagnosis of recurrent pyelonephritis, he was treated with antibiotics (ceftriaxone + amikacin). However, his high fever persisted for 4 days after admission. On the third and fifth hospital day (HD), follow-up CRP values were 11.6 mg/dL and 2.7 mg/dL, respectively. Other values that were recorded include: creatinine kinase, 64 U/L (38-160 U/L); troponin-T, 0.006 ng/mL (0-0.1 ng/mL); and proBNP, 376.8 pg/mL (0-320 pg/mL). Imaging studies that were ordered during this admission include US, DMSA scan and voiding urethrocystography (VCUG). Ultrasound findings were as follows: right, 7.7 mm, SFU grade 2; left, 28 mm, SFU grade 2-3 (Fig. 1A), otherwise no remarkable finding. A DMSA scan revealed cortical defects on the right kidney with normal relative renal uptake ratio (Fig. 1B). A VCUG revealed bilateral grade 4-5 VUR (Fig. 1C). He was discharged on the seventh HD with cefixime. When he visited our clinic one week after discharge, he was doing well overall, although he had developed desquamation of both hands and feet. Two months after the KD diagnosis, a follow-up echocardiogram revealed mild ectasia and luminal irregularity of the left middle coronary artery (1.8–2.6 mm) with mild TR and MR. He was transferred to pediatric urologist in our hospital. Then, bilateral ureteroneocystostomy is supposed to be done after the cessation of aspirin.

Discussion

According to the diagnostic criteria of incomplete KD
established by the American Heart Association (AHA), children ≥6 months of age with incomplete presentation might have unexplained fever for ≥5 days associated with 2 or 3 of the principle clinical features in the acute phase [9]. In addition, the AHA recommended a diagnostic algorithm of incomplete KD which comprises of 6 supplemental laboratory and echocardiographic criteria. More than 3 laboratory criteria (serum albumin ≤3.0 g/dL, anemia for age, elevation of alanine aminotransferase, platelets after 7 days ≥450,000/mm³, WBC ≥15,000/mm³, urine WBC ≥10/HPF) support the diagnosis of incomplete KD [9]. For this case, although there was one associated principle clinical feature (desquamation) besides fever, 3 laboratory findings support the diagnosis of incomplete KD.

Although there has been reports about KD in association with UTI, there was no radiographical evidence of pyelonephritis in these KD patients because their DMSA scans did not be performed or were normal [2, 3]. Meanwhile, Wang et al. [10] reported that among 50 patients with KD, a DMSA renal single-photon emission computed tomography (SPECT) revealed renal inflammatory foci in 52% of them in the acute phase, 46% of which had renal scarring on the 6-month follow-up DMSA renal SPECT. This study excluded patients with a previous history of UTI, coincident urinary tract anomaly, UTI between the initial and follow-up scintigram, space-occupying lesion at US, and positive urine culture. However, they did not evaluate lower urinary tract anomalies in patients with renal scarring by VCUG, so a possibility that renal scarrings in these KD patients were originated from congenital renal scarring associated with VUR could not be excluded. Furthermore, Oh et al. [11] reported that no abnormal DMSA renal SPECT were detected among 15 patients in the acute phase of KD.

In this case, the diagnosis of recurrent pyelonephritis in the initial stage was favored by the urine culture results, DMSA scan, the presence of a high grade bilateral VUR, as well as the defervescence with antibiotics as the sole treatment. On the other hand, the diagnosis of incomplete

![Fig. 1. (A) Bilateral hydronephrosis on renal sonogram. (B) Multiple cortical defects in the right kidney with a normal relative renal uptake ratio on dimercaptosuccinic acid renal scan. (C) Bilateral high grade vesicoureteral reflux on voiding urethrocystogram.](image-url)
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KD at the third admission was favored by a change in fever pattern during admission, an increased CRP on the third HD, a UTI caused by antibiotics-sensitive bacteria, desquamation on both hands and feet, and the follow-up echocardiogram results.

Although the etiology of KD remains unknown, it is currently classified as a systemic vasculitis syndrome, caused primarily by an invasion of medium-sized muscular arteries by infiltrating monocytes, macrophages, and lymphocytes [12]. Therefore, the renal involvement seen in some KD cases may be explained by an invasion of medium-sized muscular renal arteries. A hypothetical pathogenesis of KD is proposed under the premise of a protein homeostasis system; where innate and adaptive immune cells control pathogenic proteins that are toxic to host cells at a molecular level [13]. After an infection of unknown KD pathogen, pathogenic proteins produced from unknown focus, spread and bind to endothelial cells of coronary arteries as main target cells [13]. To control the action of pathogenic proteins, immune cells are activated [13]. Pseudomonas aeruginosa causing acute pyelonephritis in this case may be a KD pathogen through immune modulation in renal parenchyma. However, it can not completely exclude a possibility that recurrent febrile UTI may accidentally accompany with incomplete KD, and urine culture (Pseudomonas aeruginosa) was contaminated in this case.

In conclusion, acute pyelonephritis can be an initial manifestation of early KD. In such a case, the evaluation of urinary tract anomaly is needed according to the guideline for the management of UTI. We report a case of an 8-month old boy with high grade VUR who developed incomplete KD after recurrent pyelonephritis.

요약

가와사키병은 전신성 혈관염을 일으키는 질환의 하나로 여러 장기를 침범할 수 있다. 신장증세로는 농뇨, 혈뇨, 단백뇨, 간질성 신염, 급성 신부전증, 용혈성 요독 증후군, 신반혼 등이 있다. 가와사키병의 신장침범에 대한 병리 기전은 아직 알려져 있지 않지만, 자기면역질환으로 인한 것으로 사료된다. 가와사키병이 요로감염 이 후에 발생한

References


