

Urosepsis Occurred in an Infant with Uteropelvic Junction Obstruction and Severe Hydronephrosis

Chia-Ning Chang, Kao-Hsian Hsieh, Yi-Ming Hua, Ke-Chi Chen,
Chih-Chien Wang^{1*}, and Wen-Tsung Lo^{2*}

*Department of Pediatrics, Tri-Service General Hospital, National Defense Medical Center,
Taipei, Taiwan, Republic of China*

To present a case of severe hydronephrosis, left demonstrated by antenatal sonography in a 1-month-old male infant who took prophylactic antibiotics with amoxicillin for one month since the 3rd day after his birth. Fever occurred after discontinuing the prophylactic antibiotics for 2 days while no vesicoureteral reflex (VUR) was confirmed. Urosepsis with *Escherichia coli* was later found. Ureteropelvic junction obstruction (UPJO), left with grade 4 hydronephrosis was diagnosed after performing percutaneous nephrostomy and antegrade pyelography. Then, dismembered pyeloplasty was done to cleave the ureteropelvic junction obstruction. The treatment in infants with UPJO, including the options of prophylactic antibiotics and indication of surgery, is discussed in this essay.

Key words: UPJO, congenital hydronephrosis, urosepsis

INTRODUCTION

Ureteropelvic junction obstruction (UPJO) is a common cause of upper urinary tract obstruction. Recent data have shown the rate of urinary tract infection (UTI) among children with upper urinary tract obstruction not treated with prophylactic antibiotics is over 36%.¹ These findings prompted the investigators to conclude prophylactic antibiotics should be used in children with severe hydronephrosis. However, even if prophylactic antibiotics are prescribed, UTI might still occur. Here, we report a case of UPJO, left with grade 4 hydronephrosis infected with *Escherichia coli*, resulting in urosepsis after taking prophylactic antibiotics with amoxicillin for one month since the 3rd day following his birth. Appropriate

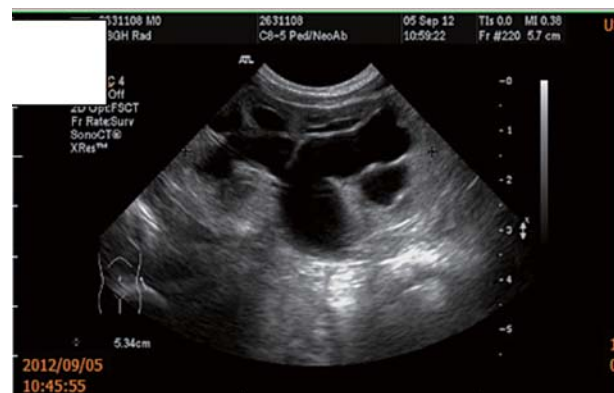


Fig. 1 Sonography of kidney revealed marked hydronephrosis of the left kidney; the size of left kidney: 5.3cm in long axis.

antibiotic prophylaxis and indication of corrected surgery are discussed in this article.

CASE REPORT

A 1-month-old male infant was admitted to our neonatal intensive care unit due to fever (ear temperature 38.4°C) for several hours. Prenatal ultrasonography in the 37th week of gestation had indicated left hydronephrosis with a renal pelvic diameter of 17mm. He was born at full term delivery from a 37-year-old mother by cesarean section. The mother had no special history. Postnatal renal sonography was performed on the third day after his delivery. It revealed grade 4 hydronephrosis (on the left side) (Figure 1) with the patient taking prophylactic an-

Received: December 17, 2012; Revised: March 4, 2013;
Accepted: March 6, 2013

*Corresponding author: ¹Chih-Chien Wang, Department of Pediatrics, Tri-Service General Hospital, National Defense Medical Center, No. 325, Sec. 2, Cheng-gong Road, Taipei 114, Taiwan, Republic of China. Tel: +886-2-87927025; Fax: +886-2-87927293; E-mail: ndmccw@yahoo.com.tw

²Wen-Tsung Lo, Department of Pediatrics, Tri-Service General Hospital, National Defense Medical Center, No. 325, Sec. 2, Cheng-gong Road, Section 2, Taipei 114, Taiwan, Republic of China. Tel: +886-2-87927025; Fax: +886-2-87927293; E-mail: drluoped@yahoo.com.tw



Fig. 2 Voiding cysto-urethrography: No evidence of vesico-ureteral reflux on the both sides could be identified.

tibiotics with amoxicillin (15 mg/kg/day) since that day. Because the patient had no clinical symptoms, the neonatologist did not arrange urine analysis or culture data before using the prophylactic antibiotics.

Voiding cystourethrography (VCUG) was implemented after using prophylactic antibiotics for 28 days (Figure 2). According to the guideline established by Laurence S Baskin et al, antibiotic prophylaxis should be started after delivery in infants with high-grade antenatal hydronephrosis until the diagnosis of VUR or obstructive uropathy is excluded.² Hence, the prophylactic antibiotics were discontinued while no vesicoureteric reflex (VUR) was confirmed. However, fever (ear temperature 38.4 °C) occurred two days later and the patient was sent to our pediatric emergency department. The blood chemistry results showed C-Reactive Protein 20.58 mg/dl. Urinalysis revealed pyuria and the specimen of urine culture was collected by sterile catheterization. Both the blood culture and urine culture demonstrated that the pathogen was *E. coli* (among them, the bacterial number in the urine culture was over 10000 colonies/ml), which was resistant to ampicillin, cefazolin, ampicillin/sulbactam, and Trimethoprim-sulfamethoxazole; susceptible to gentamicin, amikacin, ceftazidime, ceftriaxone, imipenem, cefepime, nitrofurantoin, and ertapenem. As a result, we shifted the antibiotics from ampicillin and aminoglycosides to ceftriaxone after the positive blood culture was

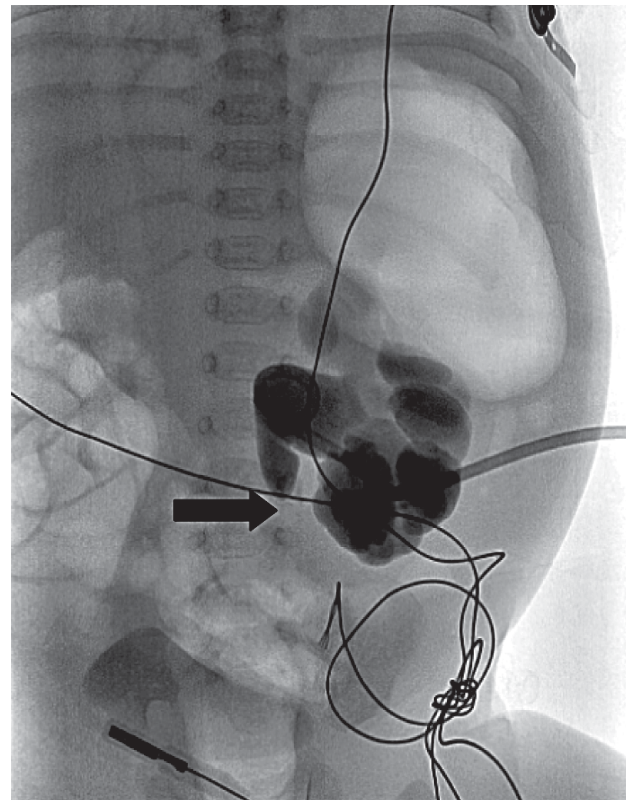


Fig. 3 UPJO, left side, diagnosed by antegrade pyelography. Arrow: the position of the obstruction.

ascertained. On the same day, the patient received dynamic renal scan with Tc99mMAG3 which manifested decreased blood flow of the left kidney (Effective Renal Plasma Flow, ERPF was 32 ml/min) and normal blood flow of right kidney (ERPF was 99 ml/min). Severe obstruction of left kidney was highly suspected.

Two days later, he underwent percutaneous nephrostomy with antegrade pyelography of the left kidney (Figure 3), and UPJO was diagnosed. When the infection was under control (after using parenteral antibiotics for 11 days), dismembered pyeloplasty was performed. In the surgery, moderate angulation and narrowing of the ureteropelvic junction were found, and the diagnosis of UPJO was confirmed.

Three months later, the patient received a follow-up antegrade pyelography which revealed dilatation of the left collecting system with partial obstruction level at UPJ (Figure 4). The condition showed improvement as compared with prior studies.

DISCUSSION

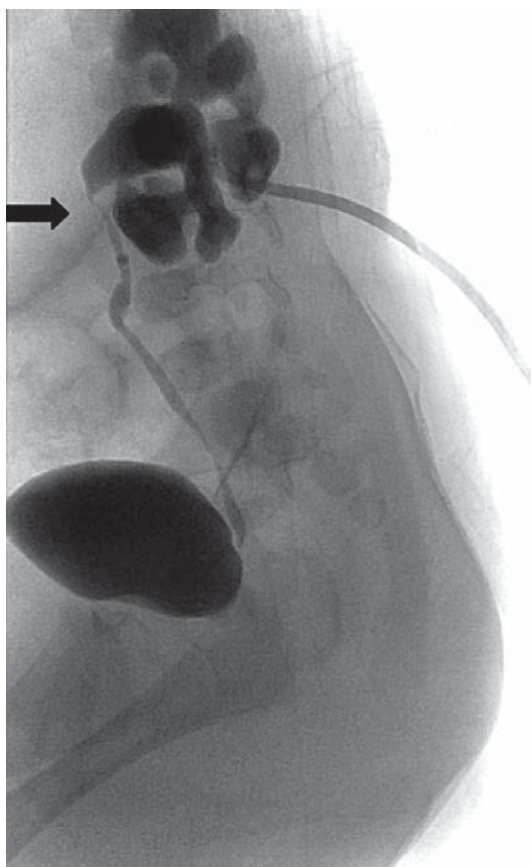


Fig. 4 Antegrade pyelogram after the operation of dismembered pyeloplasty showed dilatation of the left collecting system with partial obstruction level at UPJ. Arrow: the position of UPJ.

Prenatal hydronephrosis is the most common malformation found on prenatal screening ultrasound scans, occurring in 1% of those analyzed.⁴ Hydronephrosis can be caused by many urologic conditions. Because we do not discern how to predict the final outcome of an individual patient, the management of prenatal hydronephrosis usually includes serial radiographic imaging and possible antibiotic prophylaxis.⁵ Postnatal sonography ought to be performed < 48 hours of life in infants with severe bilateral prenatal hydronephrosis and >48 hours of life in infants with severe unilateral prenatal hydronephrosis.⁶ With confirmed postnatal hydronephrosis, a VCUG is routinely accomplished to detect anomalies such as VUR and ectopic ureterocele.² The patient underwent VCUG when he was 1-month-old. No VUR was noted. Diuretic renography is used to diagnose urinary tract obstruction in infants with abiding hydronephrosis, usually ordered after a VCUG has demonstrated no VUR.² In the case

of unilateral hydronephrosis and a normal contralateral kidney, functional renal scans may be postponed until the infant reaches 4 to 6 weeks of age.⁶ The patient received diuretic renography with Tc99mMag3 when he was 5-week-old; the time was proper.

Although the use of antibiotic prophylaxis in patients with prenatally diagnosed hydronephrosis whom is subsequently confirmed to be ureteropelvic junction (UPJ) type hydronephrosis remains controversial, most investigators suggest that antibiotic prophylaxis is given until the time of the VCUG. If the VCUG does not show reflux, antibiotics are discontinued generally.² However, in cases of the most severe grade 4 hydronephrosis or in patients with a solitary kidney, antibiotics are continued until surgical correction is executed or a decrease in the severity of hydronephrosis is detected by sonography.⁷ In our case, the prophylactic antibiotics should be used until surgical correction, not just until no VUR was confirmed.

According to the guideline suggested by Laurence S Baskin *et al.*,² antibiotic prophylaxis (amoxicillin, 12 to 25 mg/kg once daily) is suggested in infants with severe hydronephrosis who are at greater risk of underlying urologic malformation. Diuretic renography (renal scan and the administration of a diuretic) is used to diagnose urinary tract obstruction in infants with abiding hydronephrosis, usually ordered after a VCUG has showed no VUR. If the VCUG does not reveal reflux, antibiotics are discontinued. Reciprocally, Islek A *et al.*¹⁸ reported that prophylactic antibiotic usage is not suggested in infants with UPJO, despite the severity of hydronephrosis, as the risk of UTI is low in this population; Parents of such infants should be called attention to the early warning symptoms and risk of UTI, with regular review of symptoms and signs of UTI. Jack SE¹⁹ recommends that antibiotic prophylaxis is not suggested for children with mild hydronephrosis. Because the use of prophylactic antibiotics was controversial, the clinician chose to follow the guideline suggested by Laurence S Baskin *et al.*²

Coelho GM *et al.*³ declared that prophylactic antibiotics should be begun after delivery until the diagnosis of VUR or obstructive uropathy is excluded. Our patient took prophylactic antibiotics for one month since the 3rd day after his birth and discontinued while no VUR was confirmed. However, urosepsis occurred two days later after discontinuing antibiotics. This fact prompted us to consider the timing, choice, and duration of the prophylactic antibiotics. First, the clinician should continue the prophylactic antibiotics until obstructive uropathy is excluded not just no VUR was confirmed. Second, selecting effective prophylactic antibiotics is difficult,

because no prospective studies have sketched the effects of antimicrobial therapy on urologic infections in terms of the rates of antibiotic drug resistance. According to our previous study,⁹ the resistance to antimicrobial agents for overall pathogens in the early and late study periods, respectively, was as follows: 68.8% and 88.0% to ampicillin, 48.9% and 46.6% to co-trimoxazole, 26.8% and 28.9% to cephalothin, 16.2% and 19.8% to gentamicin, and 8.7% and 9.0% to nitrofurantoin. Parenteral first-generation cephalosporins, gentamicin, and oral nitrofurantoin should be considered for first-line agents, given the resistance patterns of this study. In addition, *E. coli* is the most common uropathogen in children, and antimicrobial resistance in this species has confounded the management of pediatric UTIs. The resistance of *E. coli* to ampicillin increased significantly, from 70.8% to 91.7%, during the past 15 years. Gaspari et al. found that the most common co-resistance in all age groups was ampicillin and co-trimoxazole. Resistance to ampicillin was as great as 52% and to trimethoprim-sulfamethoxazole was > 24%.⁸ In the study by Tseng MH *et al* and Ipek IO *et al.*, nitrofurantoin was also recommended for empiric treatment of uncomplicated UTIs, due to the low resistance rate (9% and 6.4%).^{9,15} In the study by Abelson Storby *et al*, nitrofurantoin was suggested as a good initial empiric treatment for uncomplicated UTIs because of its low level of resistance (< 2%).¹⁶ In our case, the pathogen was also resistant to ampicillin and co-trimoxazole, but susceptible to nitrofurantoin. If we had initially chosen the prophylactic antibiotic nitrofurantoin, perhaps the urosepsis may not have subsequently occurred.

For those with suspected UPJO, debate is ongoing regarding the optimal management. Historically, most children with high-grade hydronephrosis were treated surgically. The risks of observation versus surgical management has often focused on the preventable loss of renal function.¹¹ Reviews of many groups of children concerning cardiovascular and respiratory comorbidities suggest that the risk of a harmful event owing to anesthesia in children near 1 month of age is at least double that of children around 1 year of age.^{12,13} Laparoscopic pyeloplasty which fast becomes a standard of care at many institutions, is best performed on children >1 year of age.¹⁴ The presented data support conservative treatment of suspected UPJO in the case of an initial renal function >30%. The median improvement of hydronephrosis on sonography for those who received immediate surgery from before to after the intervention was from grade 4 to grade 3. For those who did not undergo surgery, it improved from grade 4 to grade 2.25 and for those who un-

derwent delayed surgery, from grade 4 to 3.¹¹ However, in our case, the result of diuretic renal scan, left kidney revealed <30% total ERPF combined with urosepsis soon after discontinuation of antibiotic prophylaxis. The occurrence of a culture-positive febrile UTI is an indication of clinically significant obstruction; in these children, surgery is advised immediately.^{10,11}

CONCLUSION

The goal of postnatal management of infants with antenatal hydronephrosis is to find the cause of the hydronephrosis as soon as possible for well-timed treatment. From this case, we concluded that prophylactic antibiotics should be pondered in infants with severe hydronephrosis and commenced after delivery until the diagnosis of VUR or obstructive uropathy is excluded; nitrofurantoin should be deliberated due to the significant percentage of co-resistance between the two most commonly used antibiotics (ampicillin and co-trimoxazole). U.S. Food and Drug Administration categorizes nitrofurantoin as class B which is mostly safe in children for the long-term prophylactic therapy, except patients with G6PD deficiency. Serious side effects are extremely rare and most are reversible with discontinuation of therapy.¹⁷ In addition, Immediate surgery is advocated when urinary tract obstruction is clinically significant.¹⁰

DISCLOSURE

The authors declare that this study has no conflict of interest.

REFERENCES

1. Song SH, Lee SB, Park YS, Kim KS. Is antibiotic prophylaxis necessary in infants with obstructive hydronephrosis? J Urol 2007;177:1098-1101.
2. Baskin LS, Wilcox D, Kim MS. Postnatal management of antenatal hydronephrosis. UpToDate 2012.
3. Coelho GM, Bouzada MC, Lemos GS, Pereira AK, Lima BP, Oliveira EA. Risk factors for urinary tract infection in children with prenatal renal pelvic dilatation. J Urol 2008;179:284-289.
4. Lee RS, Cendren M, Kinnamon DD, Nguyen HT. Antenatal hydronephrosis as a predictor of postnatal outcome: a meta-analysis. Pediatrics 2006;118:586-593.
5. Yiee J, Wilcox D. Management of fetal hydronephrosis. Pediatr Nephrol 2008;23:347-353.

6. Apocalypse GT, Oliveira EA, Rabelo EAS, Diniz JS, Marino VS, Pereira AK, Simal CJ, Gazolla LP, Fagundes TA. Outcome of ureteropelvic junction obstruction identified by investigation of fetal hydronephrosis. *Int Urol Nephrol* 2003;35:441-448.
7. Hubert KC, Palmer JS. Current Diagnosis and Management of Fetal Genitourinary Abnormalities. *Urol Clin N Am* 2007;34:89-101.
8. Gaspari RJ, Dickson E, Karlowsky J, Doern G. Multidrug resistance in pediatric urinary tract infections. *Microb Drug Resist* 2006;12:126-129.
9. Tseng MH, Lo WT, Lin WJ, Teng CS, Chu ML, Wang CC. Changing trend in antimicrobial resistance of pediatric uropathogens in Taiwan. *Pediatr Int* 2008;50:797-800, doi: 10.1111/j.1442-200X.2008.02738.x.
10. Roth CC, Hubanks JM, Bright BC, Heinlen JE, Donovan BO, Kropp BP, Frimberger D. Occurrence of Urinary Tract Infection in Children With Significant Upper Urinary Tract Obstruction. *Pediatric Urology* 2009;73:74-78, doi: 10.1016/j.urology.2008.05.021.
11. Heinlen JE, Manatt CS, Bright BC, Kropp BP, Campbell JB, and Frimberger D. Operative versus nonoperative management of ureteropelvic junction obstruction in children. *Pediatric Urology* 2009;73:521-525, doi: 10.1016/j.urology.2008.08.512.
12. Ungern-Sternberg V, Habre W. Pediatric anesthesia - potential risks and their assessment. Part I. *Paediatr Anaesth* 2007;17:206.
13. Cohen MM, Cameron CB, Duncan PG. Pediatric anesthesia morbidity and mortality in the perioperative period. *Anesth Analg* 1990;70:160-167.
14. Smaldone MC, Sweeney DD, Ost MC, Docimo SG. Laparoscopy in paediatric urology: present status. *BJU Int* 2007;100:143-150.
15. Ipek IO, Bozaykut A, Arman DC, Sezer RG. Antimicrobial resistance patterns of uropathogens among children in Istanbul, Turkey. *Southeast Asian J Trop Med Public Health* 2011;42:355-362.
16. Abelson SK, Osterlund A, Kahlmeter G. Antimicrobial resistance in *Escherichia coli* in urine samples from children and adults: a 12 year analysis. *Acta Paediatr* 2004;93:487-491.
17. Song SH and Kim KS. Antibiotic prophylaxis in pediatric urology. *Indian J Urol* 2008;24:145-149.
18. Islek A, Güven AG, Koyun M, Akman S, Alimoglu E. Probability of urinary tract infection in infants with ureteropelvic junction obstruction: is antibacterial prophylaxis really needed? *Pediatr Nephrol* 2011 Oct;26:1837-1841, doi: 10.1007/s00467-011-1889-7.
19. Jack SE. Obstruction of the urinary tract. In: Kliegman RM, Stanton BF, St. Geme III JW, Schor NF, Behrman RE. *Nelson's textbook of pediatrics*, 19th edition. Philadelphia: WB Saunders Company, 2011;1838-1847.