Evaluation of Uret.eropelvic Junction Obstruction (UPJO) by Diuretic Renography

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Abstract

Of 52 cases with 56 affected renal units having symptoms and signs suggestive of Ureteropelvic Junction Obstruction (UPJO) evaluated by conventional (F-i-IS) diuretic renography where frusemide is given 15 minutes post-injection of radiopharmaceutical m 99 TC.DTPA. F+15, twelve (21%) showed a good clearance (group A), 16 (28%) showed partial (group B) and 28 (50%) a poor clearance pattern (group C) indicating a definite obstruction. A high flow (F-15) diuretic renography where frusemide is given 15 minutes prior to the radiopharmaceutical m^{99} TC.DTPA, was done in 23 cases with 27 affected renal units. Eleven renal units showed a good clearance (group A). Of these, 7 (64%) showed a persistent good clearance, 3 (27%) converted to poor clearance and 1 (9%) to partial clearance pattern. Of 8 renal units in group B, 5 (63%) converted to poor clearance and two (25%) to good clearance on F-IS and one remained unchanged. All renal units which presented as poor clearance (group C) on conventional (F+15) diuretic renography remained unchanged on high flow (F-15) diuretic renography. In majority of cases conventional (F÷15) renography gave a reliable assessment of the upper tract drainage, however, since equivocal group was resolved by the F-15 and the intermittent obstruction group was definitely diagnosed, highflow (F-IS) diuretic renography was more conclusive in assessment as compared to F+15 (JPMA 46:143, 19%).

Introduction

Ureteropelvicjunction obstruction (UPJO) is a frequent congenital abnonnality of the urinary tract and a common cause of hydronephrosis[1], which can present at any age[2]. It may be due to muscular deficiency in the terminal part of the renal pelvis or proximal urete[3], leading to disorpnisation of propagation of waves of muscular contractions[4].UPJO may occur because of crossing (aberrant) vessels or high insertion of ureteropelvic junction (UPJ) [5].

Not all dilated pelvicalyceal systems are obstructed[6], intermittent obstructions may not always be easily apparent and there may not be any significant abnormality on ultrasonography (US) or intravenous urography (IVU) [7] . Nonetheless, UPJO may cause significant symptoms or deterioration of renal function Diuretic renography[8,9] is frequently used for evaluation of UPJO, being a non-invasive technique as compared to pressure studies[10], It gives, more information on function and emptying rates in individual kidneys than US and IVU. Views differ as to ts true diagnostic value[7]. To improve the accuracy of diuresis renogram in idiopathic hydronephrosis, various modifications of technique and analysis have been introduced[8,18]. This study was undertaken to determine the role of (conventional) F+15 diuretic renography where diuretic given 15-20 minutes after the injection of radiopharmaceutical m^{99}. Technetium diethylenetriaminepetaacetic acid (m^{99} TC. DTPA) and F-15 (highflow) diuretic renography where diuretic is given 15 minutes prior to the injection of radiopharmaceutical (m^{99} TC. DTPA) in evaluation of UPJO[18].

Patients and Methods

Fifty-two cases with symptoms and signs suggestive of ureteropelvic junction obstruction (UPJO) were included in this study. A dilated pelvicalyceal system without ureteric dilatation on ultrasound and intravenous urography (IVU), were the main inclusion criteria.
History was taken and general and physical examination carried out, especially on findings related to UPJO. Specific exclusion criteria were dilated ureters on IVU or sonography, vesicoureteric reflux (VUR), neurogenic urinaiy bladder and lower urinary tract obstruction, history of surgery on the affected side (iaterogenic UPJO) and poor relative renal function (R.F) of the affected renal unit.
Radiological examination included IVU, s6nography of the kidneys and m^{99}. Technetium diethylenetriarninepetaacetic acid (m^{99} TC. DTPA) diuretic renography for further assessment of renal function and the severity of obstruction at UPJ. Initial scans were taken to observe clearance patterns with frusemide given 15-20 minutes post-injection (PI) of radiopharmaceutical DTPA (F+15), following the protocol of O'Reilly 1992[18]. After the initial scans, a second modality was tested, where fnisemide was given 15 minutes prior(F-l5)to the radiophar maceutical DTPA[18]. F-iS scans were possible in23 cases with 27 affected renal units. A comparison of clearance pattern was done in these 27 renal units.

Results

Of 52 cases, 32 were males witha male to female ratio of 1.6 Majority of the patients were in age group 20-40yàrs. Clinical presentations showed flank pain to be commonest (92%) with an even distribution in right and left flank. Six had bilateral flank pain, of these only four bad bilaterally dilated pelvicalyceal system. Other features included generalised abdominal pain (4%). Intermittent renal mass was basically a presentation in children (15%) one infant presented with renal mass as a solitary complaint. Associated features were dysuria in 23% cases, followed by frank haematuria and fever. O*te case with bilateral dilated pelvicalyceal system presented as an incidentalfinding on sonography. Ultrasound examination revealed a dilated pelvicalyceal system in all and hydronephrosis on IVU in 86% cases. Of the remaining 9%presented as non-functioning renal units on IVU and 5% as persistent nephrograms. Clearance pattern on m^{99} TC.DTPA diuretic renography of the 56 affected renal units showed a good clearance in 12 (2 1%) (group A) and partial clearance in 16 (28%).(group B). Twenty-eight (50%) (group C) showed a poor clearance pattern indicating a definite obstruction (Figure la, 2a, 3a).

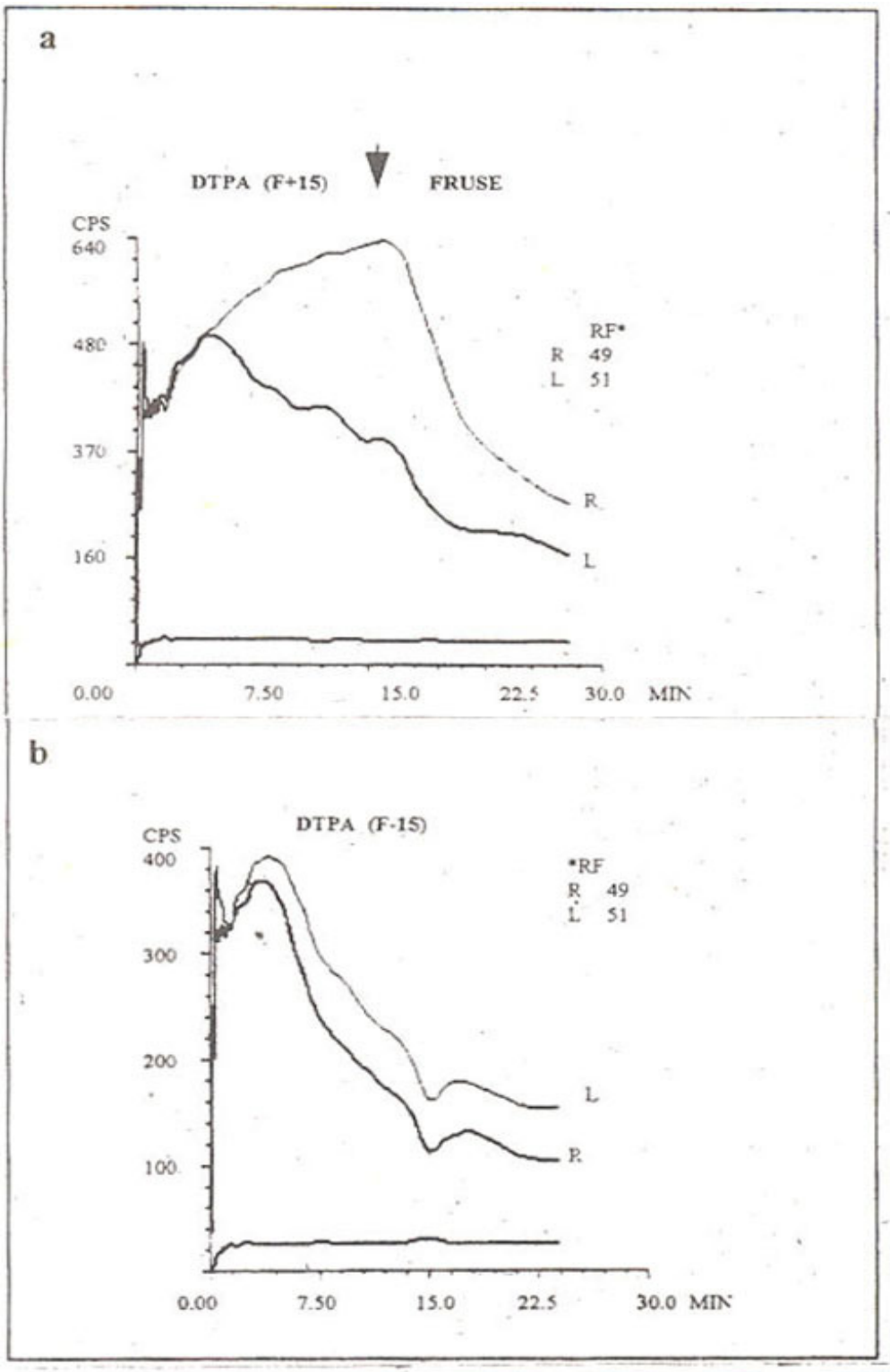

Figure 1a. Both renal units show good clearance on F+15 diuretic renography. Figure 1b. Good clearance (no change) in both renal units on F-15 diuretic renography.

Of 56 renal units, high flow (F-15) diuretic renography were possible in 23 caseswith 27 affected renal units. Eleven renal units showed good clearance (group A) on conventional diuretic renography and 7 (64%) showed a persistent good clearance pattern on high flow (F-iS) diuretic renography (Figure 2a, 2b). Three (27°to) converted to poor clearance (Figure Ia, ib), while 1 (9%) converted to partial

clearance pattern (Figure 2a, 2b).

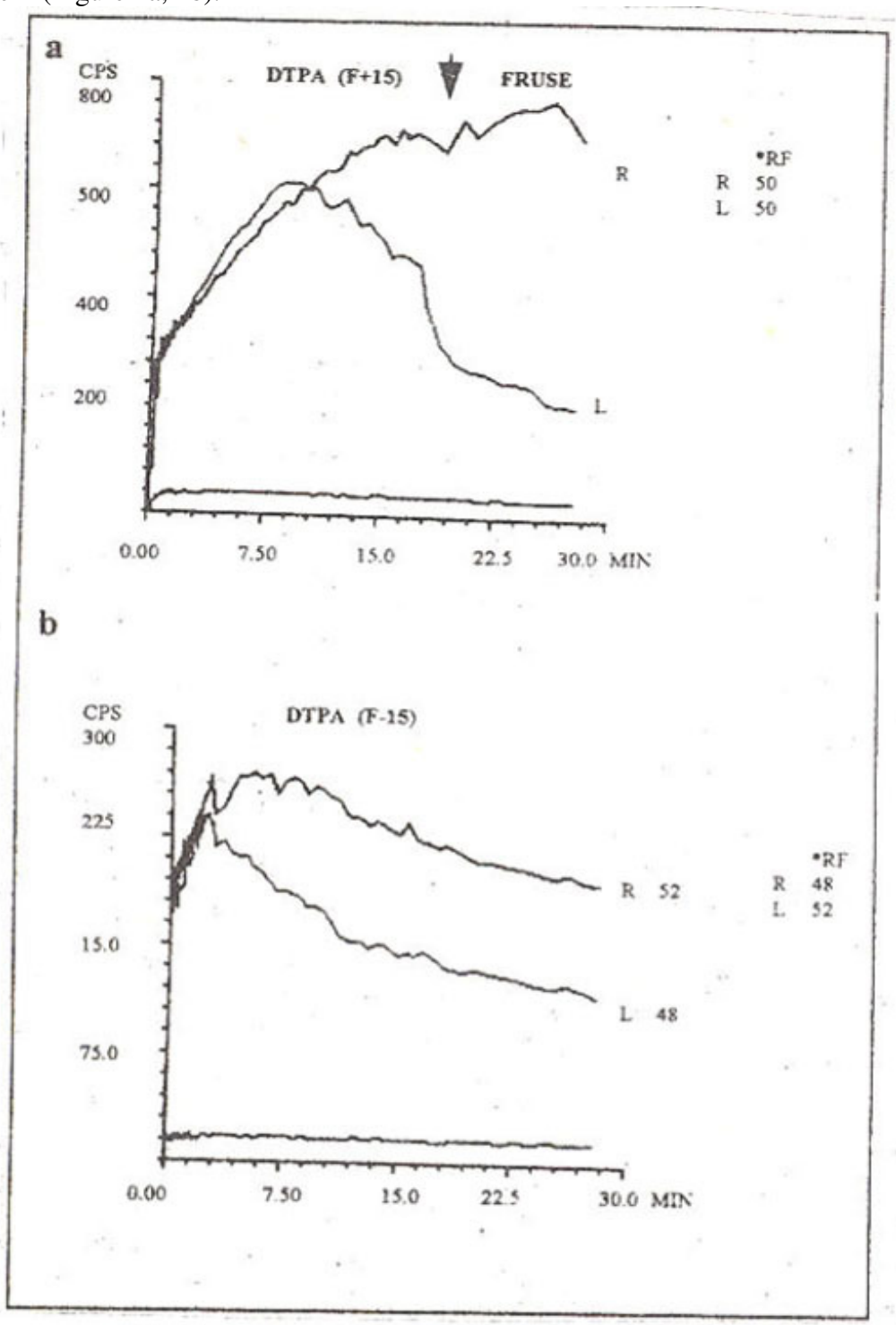

Figure 2a. Partial clearance in right renal unit and good in left renal unit on F+15 diuretic renography. Figure 2b. The right renal unit pattern changed from partial to good clearance in the same patient.

Of 8 renal units which showed partial clearance (group B) on conventional diuretic renography, 5 (t53°/o) converted to poor clearance (Figure 4a, 4b)

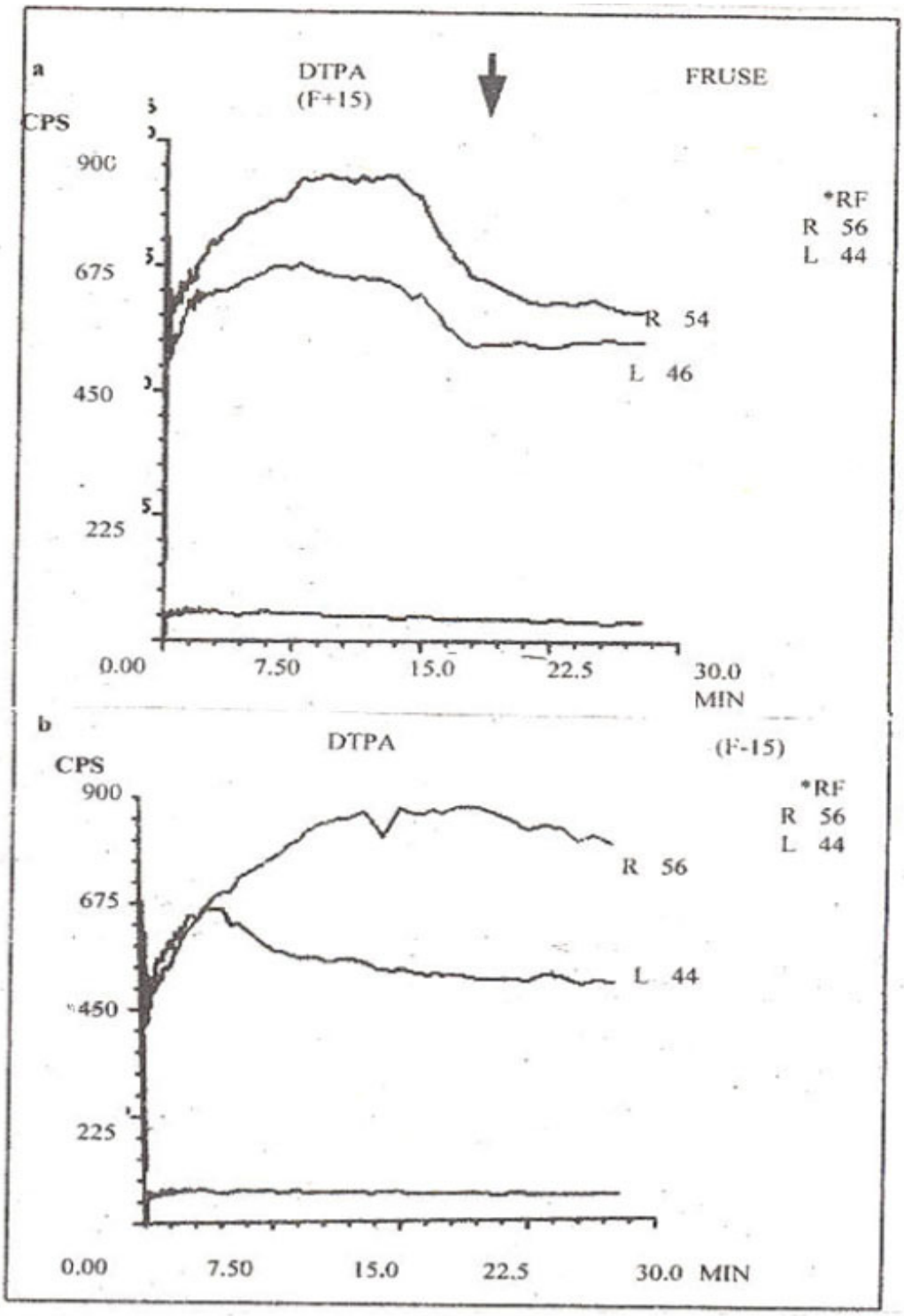

Figure 4a. Partial clearance in both renal units on F+15 diuretic renography. Figure 4b The right has changed to poor clearance on the F-15 diuretic renography in the same patient.

and 2 (25%) converted to good clearance on high flow (F-IS) diuretic renography (Figure 2a, 2b). One remained unchanged as partial clearance. All 8 renal units which presented as poor clearance (group C) on conventional (F+15) diuretic renography remained unchanged on high flow (F-15) diuretic renography (Figure 3a, 3b).

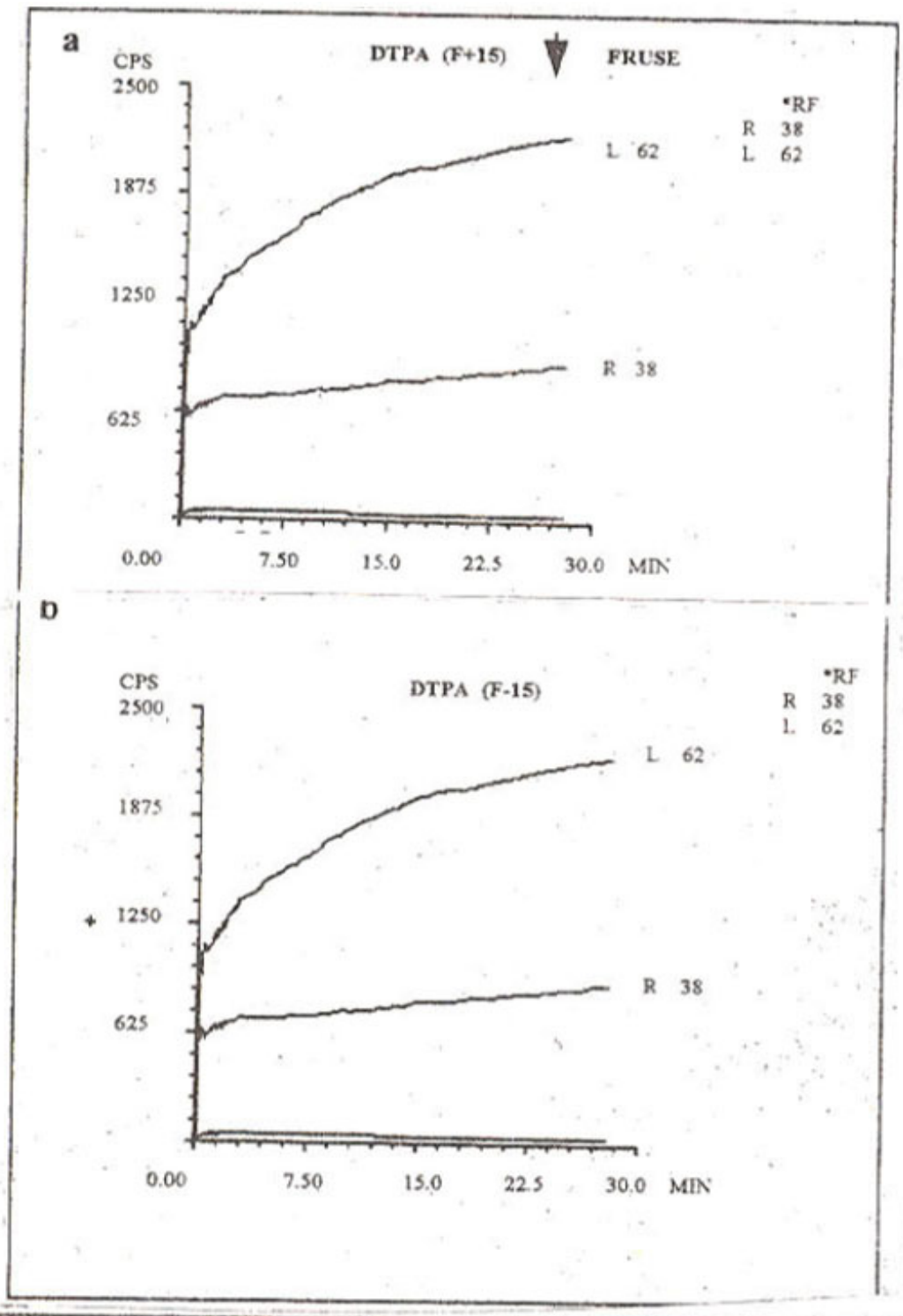

Figure 3a. Poor clearance pattern in both renal units. Figure 3b. The poor clearance pattern in both renal units remained unchanged on F-15 diuretic renography in the same patient.

A comparison of relative renal functions (RF) in the affected and unaffected renal units, assessed by the two methods of diuretic renography, showed no difference.

Discussion

The initial investigation for assessment of UPJO in this study was ultrasonography and a consistent finding was dilated pelvicalyceal System. While intravenous umgraphy showed hydronephrosis in majority of the patients, compared to US, IVU was able to give definite evidence pertaining to obstruction such as delayed excretion, non-visualised ureter, persistent nephrogram or non-functioning kidney. However, all these findings were static and inconclusive in pmviding evidence of dynamics or the functional state of the ureteropelvic junction. In these situations the use of non-invasive isotope renography was found to be attractive as it could monitor individual renal function and emptying rates much more accurately. However, in certain cases it was unclear to make distinction between obstruction and atony. The conventional F+15 diuretic aenography had a considerable false negative rate for obstruction at UPJ in cases of intermittent UPJO[11,19] This was also observed in our study where 56 affected renal units which were evaluated by F+15, only 28 (50%) could give definite obstructive pattern on renography. The remaining had either equivocal pattern (28%) or unobstructed pattern (21%).

Pressure flow studies show that a high urine flow rate is sometimes necessary for obstruction to be apparent[20,21] but not all dilated systems are obstructed[6]. Therefore, modification (F- 15) of the diuresis renography[19] which is designed to increase urine flow rates[16,22] was undertaken, so that excretion could be assessed during maximum flow rates. We observed that patients who presented with typical symptoms of intermittent loin pain or intermittent renal mass, represented the group who obstruct only at high urine flow on F-15 and were not identified by F+15 diuretic renography (Figure 5a, 5b).

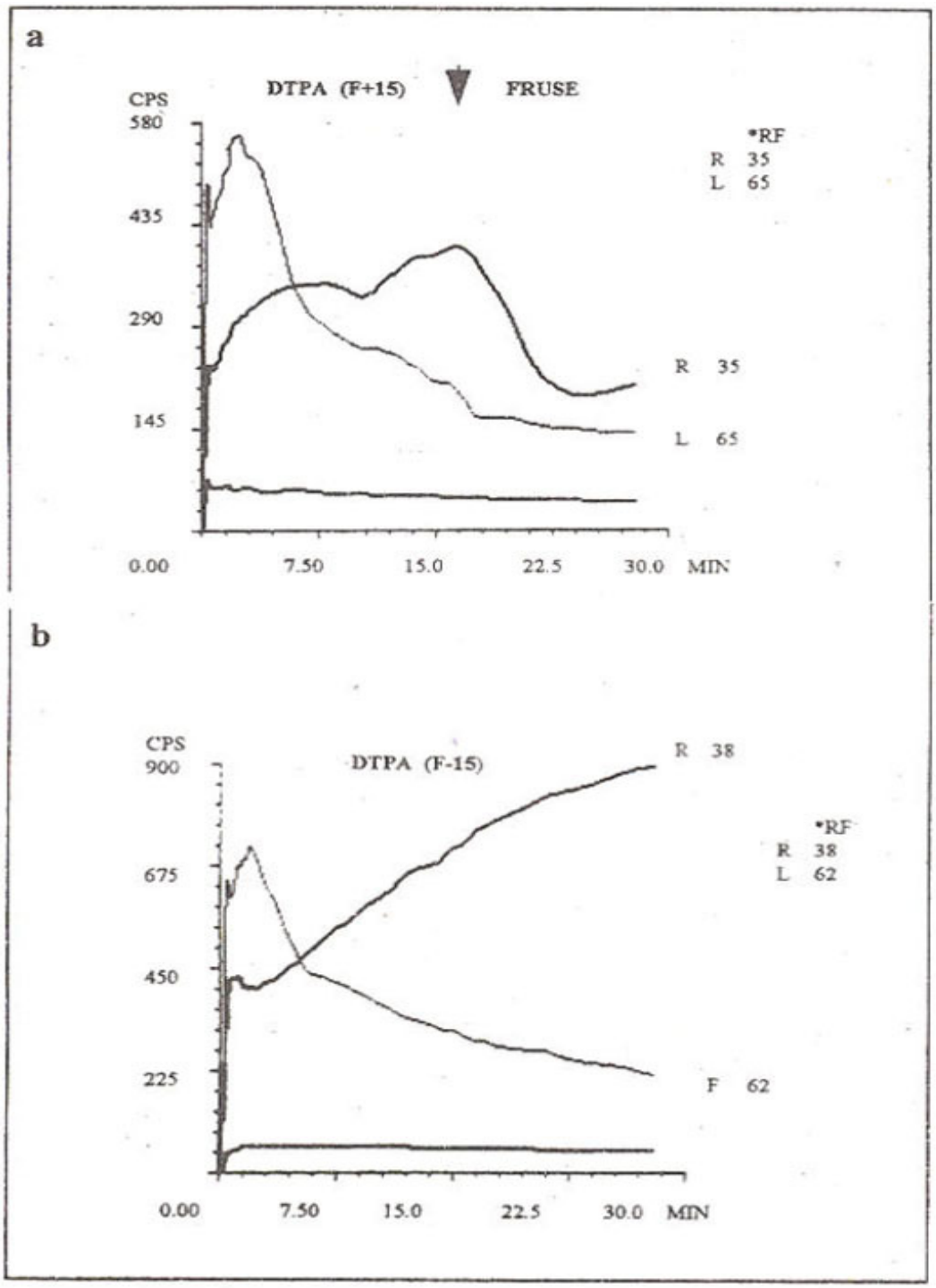

Figure 5a. Good clearance in both renal units while the right also shows a double peak pattern (Homsey's sign), indicative of obstruction. Figure 5b. Persistant good pattern in the left renal unit while the right has changed to poor clearance in the same patient on F-15 diuretic renography.

Those who presented with an equivocal pattern (partial clearance) on F+15 either showed obstructed or clearly unobstructed pattern on F-15 (Figures 2a, 2b, 4a,4b) thus reducing the number of equivocal results. The results of this study show that there was generally good agreement between the conventional F+15 and modified high flow F-15 diuretic renography, when the results of the

conventional renogram were unequivocal, as all 8 cases with obstructed pattern (poor clearance) on F+l5 remained with obstructed pattern on F-15 (Figure 3a, 3b) as well. Similarly 7 (64%) of the 11 renal units which remained unobstructed showed a good clearance pattern (Figure Ia, Ib), reinforcing the concept that not all dilated systems are obstructed[6]. In conclusion although in majority of cases conventional F+15 diuretic renography gave a reliable assessment of the upper tract drainage, however, highflow F-iS diuretic renography was more conclusive, in assessment as compared to F+15, since the equivocal group was resolved by the F-15 and the intermittent obstruction group was definitely diagnosed. Thus, in situations with limitation of facilities F-15 can be used as the first investigation. The argument in favour of F+15 in the context of perfusion and uptake pattern is only of academic interest[19] since the purpose of investigation is primarily to diagnose obstruction via the clearance patterns. Thus it must be emphasised that the diagnostic value of diuretic renography depends on a clear understanding of pathophysiological mechanisms that come into play in urinary tract obstruction.

References

1. Drake, D.P., Stevens, P.S. and Eckstein, H.B. Hydronephrosis secondary to ureteropelvic obstruction in children: A review of 14 years of experience. J. Urol., 1978;119:649-51
2. Kleiner, B., Callen, P.W. and Filly, R.A. Sonographic analysis of the fetus with ureteropelvic junction obstruction. A.J.R., 1987; 148:359-63.
3. Hanna, M.K.. Jeffs, RD., Sturgees, J.M et al. Ureteral structure and ultrastructure II Congenital ureteropelvic junction obstruction and primary obstructive megaureter. 3. Uol., 1976;1 16:725.30.
4. Murnaghan, G.F. The dynamics of the renal pelvis and ureter with reference to congenital hydronephrosis. Br. 3. Urol., 1958;30:32l-9.
5. Johnston, J.H., Evan, J.P., Glass-berg, K.L. et al. Pelvic hydronephrosis in children: A review of 219 personal cases. J. Urol., 1977;117:97.101.
6. Koff, S.A. Problematic ureteropelvic junction. 3. Urol. 1987; 138:390.
7. Whitfield, H.N., Britton, K.E., Hendry, WE et al.Fruscmide intravenous uregraphy in the diagnosis of pelviureteric junction obstruction. Br. 3. Urol. 1979;51 :445-8.
8. O'Reilly, PH., Testa. H.J.,Lawson, R. S. et al. Diuresis renography in equivocal urinary tract obstruction. Br. J. Urol.. 1978;50:76-80.
9. O'Reilly, PH., Lawson, R. S., Shields, R.A. ct al. Idiopathic hydronephrosis. The diuresis renogram: A new non-invasive method of assessing equivocal pelviureteral junction obstruction. J. Urol., 1979;l 21:153-5.
10. Whitaker.R.H. The whitaker test. Urol. Clin. North Am., 1979;6:529-39.
11. Hay, A.M., Norman, W.J., Rice, ML. et al. A comparison between diuresis renography and the Whitaker test in 64 kidneys. Br. J. Urol., 1984;56:561 -4.
12. Britton, K.E.. Nawaz, M.K., Whitfield H.N. et al. Obstructive nepropathy; Comparison between parenchymal transit time index and frusemide diuresis. Br. J. Urol., 1987;59:127-32.
13. English, P.J., Testa, H.J., Lawson, RS. et al. Modified method of diuresis renography for the assessment of equivocal pelviureteric obstruction Br. J. Urol,, 1987;59:10-44.
14. O'Reilly, PH. Diuresis renography 8 years later: An update. j. Urol., 1986;136:993-9.
IS. Upsdcll, SM.. Leeson, SM., Brooman, P.J.C. et al. Diuretic induced urinary flow rates at varying cleamces and their relevance to the performance and interpretation ofdiuresis renography. Br. J. Urol, 1988;61:14-8.
16. O'Reilly. PH, Idiopathic hydronephrosis: Diagnosis, Manageent and outcome. Br. J. Urol., 1989,63:569-74.
17. Kass, E.J. and Fink-Bennett, D. Contemporary techniques for the radloisotopic evaluation of the dilated urinary tract. Urol. Chin. North Am., 1990; 17:273.89.

18. O'Reilly, PH. Diuresis renography: Recent advances and recommended protocols. Br. J. Urol., 1992;69: 113.20.
19. Whitaker RH. and Buxton, MS. A comparison of pressure flow studies and renography in equivocal uppa urinary tact obstruction. S. Urol., 1984;131:446-9.
20. Johnston, J.H., Evan, J.P. and Glass-berg, K.1. The pathogenesis of hydronephrosis in childhood. Br. S. Urol., 1969;41:724-34.
21. Pfister, R.C., New-house, J. and Hendran, W.H. Percutaneous pyeloureteral urodynamics. Urol. Chin. North Am., 1982;9:41-9.
22. Brown, S.C.W., Upsdell S.M. and O'Reilly, PH. The importance ofrcnal function in the interpretation ofdiuresis renography. Br. S. Urol., 1992;69: 121-5.