ORIGINAL ARTICLE

EVALUATION OF RENAL EXCRETORY FUNCTION BY INTRAVENOUS UROGRAPHY

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ABSTRACT

Background: Renal excretory function gets impaired by various diseases of the urinary system. This study was conducted to find out the prevalence of diseases causing impairment of renal function by Intravenous urography.

Material & Methods: This cross-sectional study was conducted at Radiology Department, DHQ Teaching Hospital, D.I.Khan, Pakistan, from January 2008 to December 2008. Patients with abdominal pain, lump or hematuria were included. Intravenous urography was performed for all these patients. Ultrasonography was performed in selected patients after proper preparation to correlate with intravenous urographic findings.

Results: Two hundred patients were included in the study, out of which 37(18.5%) were having bilateral renal stones, 9(4.5%) bilateral ureteric stones and left renal stones, 13(6.5%) ureteric stones, 11(5.5%) stag horn stones, 2(1%) tuberculous kidneys, 2(1%) ipsilateral renal stones, 9(4.5%) pyonephrosis, 3(1.5%) nephrocalcinosis, 6(3%) vesical mass, 2(1%) renal agenesis, 7(3.5%) pelviureteric junction obstruction, 2(1%) posterior urethral valves, 2(1%) ureterocele, 11(5.5%) renal masses, 4(2%) crossed ectopic kidney, 5(2.5%) pelvic masses, 2(1%) pneumoureter /pneumonephrosis, 7(3.5%) urethral stricture, 4(2%) were post-traumatic patients and 62(31%) were having bilateral normal kidneys.

Out of 200 patients, 57 were non-excretory, 71 delayed excretory, 10 poor excretory and 62 were having normal excretory functions.

Conclusion: Intravenous urography is a reliable method of determining the renal excretory function.

Key words: Intravenous urography, Renal excretory function, Ultrasonography.

INTRODUCTION

The major function of kidneys is to filter the blood and form urine with removal of nitrogenous substances urea and ammonium compounds, as well as dissolved carbon dioxide. They also get rid of excess water and salts to keep the constant osmotic concentration of blood. Plain x-ray abdomen can outline obstructive radio-opaque stones but intravenous urography (IVU) is the main exploratory radiological technique, allowing morphologic and functional assessment of the urinary system. Other imaging techniques like ultrasonography, computerized tomography (CT) and magnetic resonance imaging (MRI) has partially replaced the IVU especially in patients with allergy to iodinated contrast or renal failure.[1] While performing IVU in normal kidneys, renal parenchymal opacification (nephrogram) appears in one minute after injecting a water soluble, radio-opaque contrast and pelvi-calyceal system (pyelogram) in the next two minutes, followed by the ureters in 5-10 minutes. When CT can not identify the level of obstructive uropathy and when acute obstructive uropathy is thought to be caused by calculi, sloughed papilla, or blood clot, IVU or retrograde pyelography is indicated.[2] Ultrasonography is an important screening test in pregnant patients with acute flank pain and in acute renal failure.[3,4]

There are many diseases that impair the renal excretory function like hydronephrosis, pyonephrosis, renal parenchymal diseases, retroperitoneal fibrosis, renal agenesis, renal neoplasm and polycystic kidney disease. In obstructive uropathy there is obstruction to the drainage of urine at renal, ureteric or urinary bladder level. In childhood, it is mainly due to urethral valves, and stricture /stenosis at uretero-vesical or uretero-pelvic junction. In young adults, the most common cause is stone at pelviureteric junction (PUJ), intra-ureteric or vesico-ureteric junction (VUJ), leading to hydroureter and hydronephrosis. While in men over 60 years, benign prostatic hyperplasia and carcinoma prostate are the common causes. Improper function of VUJ valve will lead to hydroureter and hydronephrosis by vesico-ureteric reflux. Abdominal /pelvic and retroperitoneal tumors, neurologi-

cal defects, retroperitoneal fibrosis, strictures of ureters (congenital or acquired), blood clots, tumor of kidney, ureter or urinary bladder are other causes of obstruction. Ureteric duplication with blockage at lower end of one is also the cause of hydroureter and hydronephrosis. Appropriate radiographic studies are beneficial in the diagnosis of pyonephrosis, renal or peri-renal abscess and emphysematous pyelonephritis.[5,6] In renal tuberculous patients, strictures of draining urinary pathway is the main cause of renal failure.[7]

Retrograde pyelography is used in patients with severely impaired renal function, specially when the kidneys cannot be visualized by IVU.[8] Ultrasonographic findings of pyonephrosis is low amplitude echoes of debris in hydronephrotic kidney & its absence excludes pyonephrosis with a high degree of accuracy.[9] In severe infection like emphysematous pyelonephritis, ultrasonography fails to differentiate between hydronephrosis and early pyonephrosis.[10]

Acute flank pain is the most common urological presentation in the emergency room. The diagnostic workup requires comprehensive history taking, physical examination and radiological investigation.[11] Urinary tract imaging can also determine the site and size of the stone and delineate the intracalyceal anatomy. IVU has been the standard imaging modality in uroradiology since 1930s.[12]

This study was conducted to find out the prevalence of diseases causing impairment of renal function by Intravenous urography.

MATERIAL AND METHODS

This cross-sectional study was conducted at Radiology Department, DHQ Teaching Hospital, D.I.Khan, Pakistan, from January 2008 to December 2008. Patients referred for IVU were suffering from abdominal pain, lump in the flank, dysurea, hematuria or retention of urine. Plain x-ray abdomen (KUB) was taken for all patients. Ultrasonography was performed in selected cases to correlate with the IVU findings.

RESULTS

The results of IVU are depicted in the Table and some of the representative films of IVU given below:

Table : Various diseases and their effect on renal excretory function as evaluated by IVU. (n=200).

Diseases	Excretory function of affected kidney	Number (Percentage)	Diseases	Excretory function of affected kidney	Number (Percentage)
Bilateral renal stones	15 Non-excretory 22 Delayed excretory	37 (18.5%)	PUJ Obstruction	4 Delayed 3 Poor excretory	7 (3.5%)
Bilateral ureteric & ipsilateral renal stones	1 Non-excretory 8 Delayed excretory	9 (4.5%)	Posterior urethral valves	Bilateral delayed excretory kidneys	2 (1%)
Ureteric stones	12 Delayed 1 Non-excretory	13 (6.5%)	Ureterocele	Delayed excretory	2 (1%)
Stag horn stones	5 Non-excretory 6 Delayed excretory	11(5.5%)	Renal masses	Non-excretory	11(5.5%)
Tuberculous kidney	Non-excretory	2 (1%)	Crossed ectopic kidney	Delayed excretory	4 (2%)
Ipsilateral renal stones	Delayed /Poor excretory	2 (1%)	Pelvic masses	Delayed excretory	5 (2.5%)
Pyonephrosis	4 Non-excretory 5 poor excretory	9 (4.5%)	Pneumoureter / pneumonephrosis	Non-excretory	2 (1%)
Nephrocalcinosis	Non-excretory	3 (1.5%)	Ureteric strictures	Delayed excretory	7 (3.5%)
Vesical mass	Non-excretory	6 (3%)	Post traumatic	Non excretory	4 (2 %)
Renal agenesis	Non-excretory	2 (1%)	Bilateral normal kidneys	Bilateral normal excretory	62 (31%)

Fig. 1: Left renal pelvic stone with non-excretory kidney.

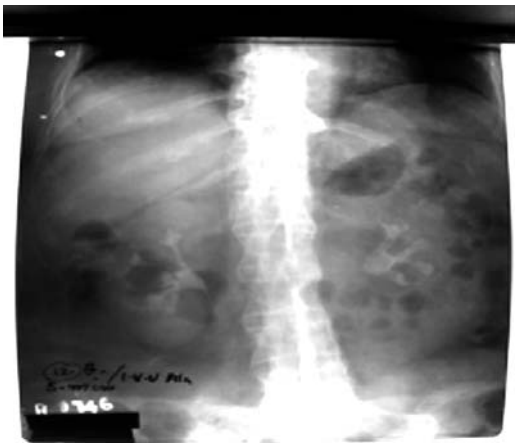

Fig. 2: Left renal pelvi-calyceal stone with non-excretory kidney.

Fig. 3: Right renal pelvi calyceal and distal ureteric stones with non-excretory kidney.

Fig. 4: Left distal ureteric stone with non-excretory kidney.

Fig. 5: non excretory right kidney with nephrocalcinosis.

Fig. 6: Left renal mass with non-excretory kidney.

Fig. 7: Bilateral hydronephrosis /hydroureters due to ureteric strictures at lower ends.

DISCUSSION

In this study of 200 patients, the cases of renal calculi, tuberculous kidneys and nephrocalcinosis were 67. Out of them 53 patients were accurately diagnosed by plain radiography and IVU and this ratio 79% is more than with the compared study[13] which reported 64%.

In our study, the cases of obstructive hydronephrosis were 59 and 55 patients were diagnosed properly by IVU (93%). This figure was more than the compared study in which it was 90%.

In delayed excretory kidneys, initially the IVU outlines the faint nephrogram, then dense nephrogram, then faint pyelogram and lastly fair to sharp pyelogram, mostly in the form of hydronephrosis while in poor excretory function, faint nephrogram appears in late films which is persistent and disappear earlier. In case of non-excretory, nephrogram appears neither in the initial films nor in the delayed films while in completely normal excretory renal function, nephrogram appears in 1-2 minutes post IV contrast film, pyelogram in 5-10 minutes, urogram in 15 minutes and cystogram in 20-25 minutes.

In acute renal pain, the excretory function appears impaired which is mostly false and is due to acute inflammation. At this stage, diagnostic approach by plain x-ray abdomen KUB after proper bowel wash and ultrasonography are more valuable.

Comparing this study with others, the prevalence of stones in the kidneys and ureters are more in this region with increased number of non-excretory kidneys. In rest of the conditions like renal masses, vesical masses, pelvic masses, crossed ectopic kidneys, pneumoureter /pneumonephrosis and post-traumatic cases, the excretory urography remained valuable.

CONCLUSION

Intravenous urography is a reliable method of determining the renal excretory function.

REFERENCES

1. Saxton HM. Review article: Urography. Br J Radiol 1969; 42: 321-46.
2. Ramos deCampos M, Juan Escudero JU, Navalón Verdejo P, Ordoño Domínguez F, Fabuel Deltoro M, Zaragoza, et al. Use of Magnetic Resonance urography versus conventional urography to study the urinary system. Actas Urol Esp 2007; 31: 253-61.
3. Merrilees DA, Kennedy-Smith A, Robinson RG. Obstructive uropathy as the etiology of renal failure in ovarian hyperstimulation syndrome. Fertil Steril July 10, 2007.
4. Beige J, Kreutz R, Rothermund L. Acute renal failure: pathophysiology and clinical management. Dtsch Med Wochenschr 2007; 132: 2569-78.
5. Baumgarten DA, Baumgartner BR. Imaging and radiologic management of upper urinary tract infections. Urol Clin North Am 1997; 24: 545-69.
6. Demertzis J, Menias CO. State of the art: imaging of renal infections. Emerg Radiol 2007; 14: 13-22.
7. Tabakov I,Totsev N, Chervenakov A. The nonfunctioning kidney in renal tuberculosis. Int Urol Nephrol 1976; 8: 189-95.
8. Nourizadeh D, Madaen K, Gaderian N. The clinical study of genitourinary tuberculosis in east Azarbaijan province: a 15 year period (1988-2002). Medical J Tarbiz Univ. Med Sci 2005; 27: 107-12.
9. Vourganti S, Agarwal PK, Bodner DR, Vourganti S, Agarwal PK, Bodner DR, et al. Ultrasonographic evaluation of renal infections. Radiol Clin North Am. Nov 2006; 44: 763-75.
10. Stojadinovic M, Micic S, Milovanovic D. Ultrasonographic and computed tomography findings in renal suppurations: performance indicators and risks for diagnostic failure. Urol Int 2008; 80: 389-97.
11. Yilmaz S, Sindel T, Arslan G, Ozkaynak C, Karaali K, Kabaalioglu A, et al. Renal colic: comparison of spiral CT, US and IVU in the detection of ureteral calculi. Eur Radiol 1998; 8:12-7.
12. Swick M. Demonstration kidneys, ureter, bladder and urethra by x-ray using intravenous administration of new contrast medium uroselectan [German]. *Klin Wschr* 1929, **8:** 2085-7. .
13. Sinclair D, Wilson S, Toi A, Greenspan L. The evaluation of suspected renal colic: ultrasound scan versus excretory urography. Ann Emerg Med 1989; 18: 556-9.

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