



Original Article

Evaluation of Renal Functional Status Using Probe Renogram Technique and USG

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Abstract

Renal disorder is one of the most common problems in Bangladesh. Probe renogram is a very sensitive, specific, non-invasive and cost-effective procedure for the evaluation of renal function. Ultrasonography gives good anatomical information. It is cheap, non-time consuming and non-invasive procedure that requires no extra-preparation for studying kidneys. Combined renogram and USG were found to be very useful techniques for the evaluation of kidney's functions. Biochemical parameters do not reflect the appropriate functional status of individual kidneys. Probe-renogram could reveal precisely the renal differential function. Retrospectively 129 patients were studied, of which 80 (62.02%) were male and 49 (37.98%) were female, age between 8-78 years had come at the NMC, Rajshahi during the period of April 2000 to July 2001 for radionuclide renography. The main objective of the study was to evaluate the response of combined renogram and USG for preliminary screening of renal disorders in patients before going to other high cost and invasive investigations. Renal obstructions were found in 42 (LK-26 and RK-16) cases and functional impairment of varying degrees was in 55 patients. Results were correlated well with clinical findings and other available diagnostic parameters.

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Introduction

Renal function evaluation in kidneys with the use of radio nuclide scanning is very helpful technique. Among all the imaging modalities, ultrasound is the safest and provides excellent anatomic information.¹ Probe renography is a technique that causes a minimum of inconvenience to the patient and carries no appreciable radiation risk. It is easily revealed by renogram curve in patients with suspected renal diseases, with disturbances of the renal circulation, with functional obstruction of the upper urinary tract,

and specially in impairment of tubular function. This diagnostic technique is also useful for follow-up studies after drug treatment or surgery.

Materials and Methods

One hundred and twenty-nine patients (M80, F49) of age ranging from 8 to 78 years attending at Nuclear Medicine Center, Rajshahi had undergone ultrasonographic examinations and isotopic renograms using ¹³¹I-hippuran under a computerized probe renogram. The procedures of the examinations are described below in brief:

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a) Kidney's shape, size and positions were reviewed and marked by experienced nuclear medicine physician using sonography. Position marking was essential for proper setting of the Probe-detector in the backside of the patients.

b) All patients were well hydrated before examinations.

c) Before study energy window corrections were done using ^{131}I -hippuran of activity $\sim\mu\text{Ci}$ and adjust the two energy peaks by probe-gain setting.

d) After micturition, patients were in sitting position in a chair with comfortable backrest.

e) Renogram probes were placed from backside according to surface marking on both kidneys.

f) According to age and body build, the dose of about 30-50 μCi ^{131}I -hippuran were injected per patient intravenously and then immediately started the renography study and continued for next 15-20 minutes.

g) Diuretic was administered after the 8-10 minutes during the study, when needed.

Results

In this study, patients age was between 8-78 years, where male (80) were more in number with more aged than female (49) [Fig.]. Total patients studied 129. Renal obstructions were found in 42 (32.56%) patients. Of which, obstruction in left kidneys [26 (61.90%)] were found more than that of the right kidneys [16 (38.10%)]. Renal

obstructive cases at different age group had shown graphically in Fig-2. According to the Fig-2, it was seen that the left kidneys (17) were more affected than that of the right kidneys (7) in the age range between 31 to 60 years. Unilateral normal functioning kidneys were found in 73 (56.59%) patients. Out of 73 patients, 31 (42.47%) were found for the left kidneys, which was less than that of the right kidneys 42 (57.53%). Bilateral normal functioning kidneys were found in 19 (14.73%) cases.

Twenty-four non-functioning cases were observed. Among them, 12 (50%) cases were found for left kidneys and same number of cases was accounted for the right kidneys. Diuretic was administered to the 21 patients in the study. Among them, 9 (42.86%) were changed after diuretic injection and unchanged cases were in 12 (57.12%) cases. Renal parenchymal insufficiency was seen in 55 cases. Gross renal functional impairment was observed in 45 (34.88%) patients. Out of 45 patients, 23 (51.11%) showed for bilateral, 14 (31.11%) for left and 8 (17.78%) for right kidneys. Out of 10 mild functional impairment cases, 4 (40%) showed for left and 6 (60%) for right kidneys. Renal parenchymal insufficiency at different age group was shown in Fig-3. All of the above cases correlated well with other available diagnostic parameters. Summary of the results were shown in Table-1.

Table 1: Number of patients at different age group and their functional status.

Age Group	Total Patients	Male	Female	Non-functioning		Obstructive		Normal		BN	DA	CDA	NC-DA	BG-FI	GFI	MFI	
				LK	RK	LK	RK	LK	RK								
1-10	2	1	1	-	-	-	-	1	-	-	-	-	-	1	1	-	-
11-20	17	10	7	3	2	3	4	7	4	1	5	3	2	1	1	-	1
21-30	19	11	8	3	1	4	4	5	8	3	3	-	3	3	1	-	-
31-40	31	21	10	3	5	6	1	7	12	5	6	4	2	6	4	1	2
41-50	30	16	14	1	2	9	5	8	10	5	4	-	4	2	5	3	1
51-60	16	11	5	1	1	2	1	2	3	2	2	1	1	6	1	3	-
61-70	12	8	4	1	1	1	1	2	4	2	1	1	-	3	1	1	-
>70	2	2	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-
Total:	129	80	49	12	12	26	16	31	42	19	21	9	12	23	14	8	4

DA= Diuretic Administration;

CDA= Change after diuretic administration;

NCDA= No change after diuretic administration;

LK= Left kidney

RK= Right Kidney

BGFI= Bilateral gross functional impairment;

MFI= Mild functional impairment;

BN= Bilateral normal

GFI= Gross functional impairment;

Discussion

All the patients in our study referred to us for the evaluation of individual kidney function, as because they have already performed routine ultrasonography of kidneys. In routine practice for any preliminary renal examination, ultrasonic-rape of KU region was usually done and if any minor pathology was detected then functional study was done, like serum urea and creatinine level estimation. Majority portions of patient did not go further evaluation.² In ultrasound, an extra renal pelvis must not be misdiagnosed as hydronephrosis-only the renal pelvis appears prominent, but no caliectasis was seen.³

In our study, three phases of the time-activity curve in Probe-renogram were considered. These were- i) arterial or vascular, ii) glomerular or secretory, iii) clearance or excretory phases. Due to urinary tract obstruction existed in some kidneys of our study; the radio nuclide was filtered but not excreted. The retention within the kidney was reflected by the time-activity curve for such study. In the cases of possible obstruction at the pelviureteric junction, diuretic injection was given intravenously during the study. In our observation, approximately 43% cases showed positive result due to diuretic administration. Sometimes this diuretic washes out the radionuclide from a dilated but non-obstructed renal pelvis. The obstructions of upper urinary tract may cause acute renal diseases such as pre-renal anuria due to shock. A small reduction in urinary drainage revealed that the renogram had a slower decrease of the counting rate during the evacuation phase. We also observed that the counting rate trends were high with the increasing severity of obstruction. This continues to increase beyond the end of secretory phase when the urinary flow was completely obstructed.

From the physiological point of view we know that about one third of nephron is active in our normal healthy life.⁴ In diseased condition rest of the nephron become active and try to maintain normal renal function. So in minor pathological condition nephrons in both kidneys can maintain

normal serum urea, creatinine level but still there is functional loss of affected kidney.⁵ IVU needs pre-examination preparation; it is invasive; there is more radiation hazards and it is time consuming. While renogram needs no pre-examination preparation and it can be performed within 20 minutes.

Conclusions

Combined Renogram and USG would be the preliminary diagnostic procedures of choice for screening of renal disorders. To save the patients from further deterioration who have been suffering from renal disorder, the urologist should give proper treatment after evaluation of the results of sonography and renography.

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