Original Article

Evaluation of renal functions using isotopic renogram and biochemical tests

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Abstract

Introduction: Radionuclide renography is now very important diagnostic tool comparable to other diagnostic modalities for the evaluation of renal diseases. **Aim:** This study was carried out to assess the role of radionuclide renography and biochemical test in the evaluation of the renal function. **Materials and Methods:** A total of 50 samples with a history of renal disease were included in this study. Out of a total 50, 31 were males and 19 were females, their age ranged between 9 and 79 years and most of the patients were in the age group above 46 years, weight ranged from 22 to 97 kg, mean (standard deviation [SD]) 67.32 (17.203). Height ranged from 125 to 185 cm, mean (SD) 163.07 (12.573). Radionuclide renography and biochemical test were done for all patients in the Radiation and Isotope Center of Khartoum in the period from March 2011 to October 2011. **Results:** In case of radionuclide renography, total glomerular filtration rate (GFR) ranged from 6.64 to 130.70, mean (SD) 65.87 (31.30) and the biochemical test showed that (10%) of patients with abnormal serum creatinine level and (12%) with abnormal serum urea level. The serum urea level was normal in 44 patients, but in the renogram 19 patients were abnormal (both kidneys GFR), 14 patients were abnormal (right kidney GFR) and 8 patients were abnormal (left kidney GFR). A total of 45 patients had normal serum creatinine level, but in the renogram 18 patients were abnormal (both kidneys GFR), 16 patients were abnormal (right kidney GFR) and 8 patients were abnormal (left kidney GFR). **Conclusion:** It is concluded that both isotopes renogram technique and biochemical test are very important in the evaluation of renal function.

Key words: Glomerular filtration rate, nuclear medicine, Radiation and Isotope Center of Khartoum, radionuclide renography, renal functions

INTRODUCTION

Radionuclide renography is now very important diagnostic tool comparable with other diagnostic modalities for the evaluation of renal diseases.

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This technique causes a minimum of inconvenience to the patient and carries no appreciable radiation risk. The importance of isotope renogram for evaluating individual kidney's function were previously reported.[1,2]

Renogram curve can be revealed easily 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. Creatinine level analysis from the blood sample gives a useful indication of the degree of renal failure. The blood urea, which is to more readily affected by dietary protein, tissue breakdown and hydration, is a less reliable guide to overall renal function.[3]

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The main aim of the present study is to evaluate the role of radionuclide renogram and biochemical test in the evaluation of renal functions.

MATERIALS AND METHODS

A total of 50 subjects with a history of renal disease were included in this study, 31 males and 19 females, their age ranged between 9 and 79 years. 99mTc-diethylene triamine pentaacetic acid (DTPA), serum creatinine and serum urea were done for all patients. This study was done in Radiation and Isotope Center of Khartoum in the period from March 2011 to October 2011 and dose of 99mTc-DTPA about 3-5 mCi according to their age and weight. The patients were injected intravenous and then immediately started the isotopic renogram study. Several images were taken, each lasting 1 or 2 s. The total scan time took about 30 min.

RESULTS

The 50 patients, 31 males and 19 females with history of renal disease, their age ranged between 9-79 years and most of patients in age group above 46 years. biochemical test showed that (10%) of the patients with abnormal serum creatinine level and (12%) with abnormal serum urea level [Figure 1]. The serum urea level [Figure 2] found normal in 44 patients but in renogram found 19 patients were abnormal (both kidney GFR), 14 patients were abnormal (right kidney GFR) and 8 patients were abnormal (left kidney GFR). The 45 patients with normal serum creatinine level but in renogram 18 patients were abnormal (both kidney GFR), 16 patients were abnormal (right kidney GFR) and 8 patients were abnormal (left kidney GFR) [Table 1].

DISCUSSION

The renal function status was evaluated biochemically (blood urea and serum creatinine) and by renogram. All patients underwent a dynamic renal radioisotope scan using 99mTc-DTPA to quantify the total and split renal functions and estimate the GFR using single injection.

Creatinine clearance, serum creatinine and serum urea are commonly used parameters in the initial and follow-up evaluation of several renal diseases. Serum creatinine is the most widely used as an indirect measure of GFR, it is simple and inexpensive.

This study included subject of subjects of age between 9 and 79 years most of the patients were in the age group of more than 46 years. The percentage of patient's gender was 62% males and 38% females, in agreement with Ahasan *et al*.[4]

In this study, false normal results were obtained by the biochemical test regarding functional loss of individual kidney.

Table 2 shows a negative correlation (−0.389**) which explained firstly, GFR estimation is age dependent, secondly, the type of relation shape is inverse the GFR is decreased with age and thirdly the correlation is week which may mean that the GFR is age dependent. This result in agreement with Amany[5] and Jansen *et al*.[6]

The serum urea level was normal in 44 patients but in the renogram 19 patients were abnormal (both kidneys GFR), 14 patients were abnormal (right kidney GFR) and 8 patients were abnormal (left kidney GFR) [Figure 2]. 45 patients were with normal serum creatinine level but in the renogram 18 patients were found abnormal (both kidneys GFR), 16 patients were abnormal (right kidney GFR) and 8 patients were abnormal (left kidney GFR) [Figure 1].

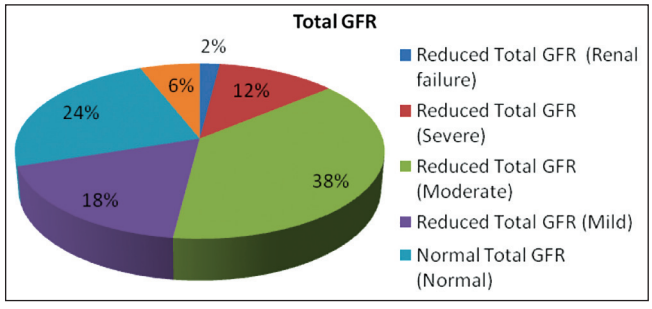

Figure 1: Percentage of patient's total glomerular filtration rate

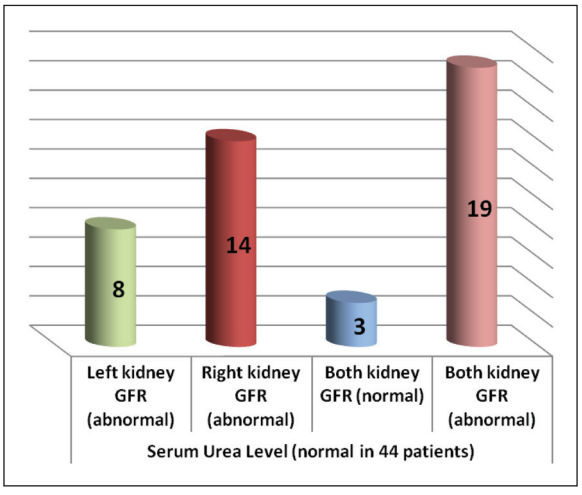

Figure 2: The result of isotopic renogram (right and left kidney glomerular filtration rate) and serum urea level

Table 1: The patient's age, weight, height and correlation with GFR, total GFR, split function and serum urea level

Variables	N	Minimum	Maximum	Mean	Standard deviation
Age	50	9	79	45.16	19.192
Weight	50	22	97	67.32	17.203
Height	50	120	185	163.07	12.573
Serum urea level (mg/dl)	50	6	121	38.32	17.311
Right kidney (GFR)	50	0.53	126.16	31.3212	28.36857
Right kidney (split function %)	50	1.12	98.65	44.2472	28.92982
Left kidney GFR	50	1.72	90.00	34.1692	22.68122
Left kidney (split function %)	50	1.35	98.88	55.7290	28.70679
Total GFR	50	6.64	130.70	65.8670	31.30455

GFR = Glomerular filtration rate

Table 2: Correlations between the patient's age, weight, height and with total GFR

Variables	Age	Height	Serum urea level (mgLdl)	Total GFR
Age				
Pearson correlation	1	0.341*	0.136	−0.389**
Significant (2-tailed)		0.015	0.346	0.005
N	50	50	50	50
Height				
Pearson correlation	0.341*	1	0.155	−0.044
Significant (2-tailed)	0.015		0.282	0.762
N	50	50	50	50
Serum urea level (mgLdl)				
Pearson correlation	0.136	0.155	1	−0.174
Significant (2-tailed)	0.346	0.282		0.227
N	50	50	50	50
Total GFR				
Pearson correlation	−0.389**	−0.044	−0.174	1
Significant (2-tailed)	0.005	0.762	0.227	
N	50	50	50	50

*Correlation is significant at the 0.05 level (2-tailed), **Correlation is significant at the 0.01 level (2-tailed). GFR = Glomerular filtration rate

CONCLUSION

Radionuclide techniques in the present study were confirmed as the appropriate to assess renal functions than the biochemical test alone. This study revealed that isotopic renogram is sensitive, readily available and non-invasive and is more reliable for the evaluation of renal functional status. A comparative finding in the study emphasize the importance of the renogram technique and biochemical test in the evaluation of kidney function with maximum accuracy. Therefore, renogram should be used as an initial recommendable technique for the diagnosis of renal differential function. The performance of isotopic renogram is useful because it gives informative diagnosis of renal disease and it's more accurate, effective in the evaluation of renal function.

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