Research Paper

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Role Of Ultrasonography and Renal Doppler for Renal Changes in Diabetes Mellitus

Medical Science

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ABSTRACT

Diabetic nephropathy is a relatively common form of chronic renal disease. It is the most frequent microvascular complication in diabetic patients. Diabetic nephropathy has become the leading cause of chronic renal failure in developing countries. The use of renal ultrasound grey scale as well as colour doppler in patients with diabetes has evolved recently and involves not only an early probable diagnosis of diabetic nephropathy but also the grey scale changes and measurements of various Doppler indices enable us to determine the progression of renal changes in a patient with diabetes.

AIMS AND OBJECTIVES:

- To study the role of USG as an initial diagnostic modality in suspected cases of diabetes mellitus.
- To evaluate the role of USG for detection of renal changes in known cases of diabetes mellitus.
- To correlate the sonographic changes with laboratory changes.

MATERIALS AND METHODS

A prospective study 0f 50 patients (32 males and 18 females) was carried out, using USG (grey scale+colour Doppler) as the investigation tool, the findings of which were compared with the clinical status of the patient and the laboratory findings.

Out of 50 patients, 3 patients were of diabetes mellitus type 1 whereas all others were of type 2.

The transducer used was curvilinear array with a frequency of 3 to 6 MHz. For the Doppler study, the wall filter is set to the minimum and the sample volume is set at 2-5 mm. RI and PI were measured in each kidney using existing software capabilities of the scanner. Intrarenal RI and PI values were obtained from intraparenchymal arteries of both kidneys, either the arcuate or interlober arteries. Three different measurements are obtained for each kidney in different portions of the kidney (upper, middle and lower pole). A mean RI and PI value is obtained for each patient by averaging the two kidneys' mean RI and PI value.

- Values of RI higher than 0.7 were considered pathological.
- Values of PI higher than 1.5 were considered pathological.

EXCLUSION CRITERIA

Patients with nondiabetic or obstructive kidney diseases, the patients with microscpicor macroscopic haematuria, or abnormal urinary sediment, a past history of glomerulonephritis or nephron-ureterolithaisis or dilated renal pelvis on real time USG were excluded from this study. The patients who had severely atrophied kidney(s), either unilateral or bilateral, were also excluded from this study because of poor imaging of blood flow.

OBSERVATION

AGE IN YEARS	TOTAL NUMBER OF PTS	PERCENTAGE OF TOTAL PTS
<30	3	6%
30-<40	9	18%
40-<50	17	34%
50-<60	13	26%
60-<70	6	12%
70-<80	2	4%

This table shows that maximum no of patients belonged to the age of 40-50 followed by 50-60 yrs.

DURATION OF DIABETES	NO OF PTS
0-<5 YRS	10
5-<10 YRS	15
10-<15 YRS	12
15-<20 YRS	5
20-<25 YRS	3
25-35 YRS	5

This table shows that most of patients studied had their disease duration between 5 to 10 yrs.

DURATION OF DIABETES	RENAL SIZE IN MM (% OF TOTAL PTS IN THE SAME DURATION GROUP)				
	<80	80-<90	90-<100	100-<110	110-<120
0-<5 YRS	NONE	NONE	3(30%)	5(50%)	2(20%)
5-<10 YRS	NONE	NONE	NONE	11(67%)	5(33%)
10-<15 YRS	NONE	NONE	1(8%)	5(42%)	6(50%)
15-<20 YRS	1(20%)	NONE	1(20%)	1(20%)	2(40%)
25-30 YRS	2(40%)	1(20%)	NONE	2(20%)	NONE

This table shows that 70% of the patients with disease duration within 5 yrs had renal length more than 100 mm. Almost 100% and 92% of patients with the disease duration between 5-<10 and 10-<15 yrs respectively having their renal length above 100 mm. at a disease duration above 20 yrs majority of the patients had their renal lengths dropper below 80 mm, and all these patients had elevated serum creatinine values.

DURATION OF DIABETES	NORMAL CORTICAL ECHOGENICITY	RAISED CORTICAL ECHOGENICITY
	% OUT OF TOTAL PTS IN THE SAME DURATION GROUP	
0-<5 YRS	10(100%)	NONE
5-<10 YRS	15(100%)	NONE
10-<15 YRS	11(100%)	NONE
15-<20 YRS	3(75%)	1(25%)
20-<25 YRS	NONE	3(100%)
25-30 YRS	1(20%)	4(80%)

This table shows that, cortical echogenicity remains normal up to 15 years of duration of disease. The majority of patients after 20 yrs developed CRF and showed a rise in cortical echogenicity.

DYRATION OF DIABETES	CORTICAL THICKNESS AT MIDPOLE		
	UPTO <12	12-<16	16-<22
	% OUT OF TOTAL PTS IN THE SAME DURATION GROUP		
0-<5 YRS	1(10%)	5(50%)	4(40%)
5-<10 YRS	1(7%)	6(40%)	8(53%)
10-<15 YRS	1(8%)	8(66%)	3(25%)
15-<20 YRS	2(40%)	2(40%)	1(20%)
20-<25 YRS	3(100%) NONE		NONE
25-35 YRS	4(80%) 1(20%)		NONE

	MICROALBUMINURIA		RAISED SERUM CREATININE
	PRESENT	NOT PRESENT	
	NO OF PTS(% OF THE TOTAL PTS IN THE SAME GROUP)		
RI>=0.7	34(100%)		8(23.5%)
RI<0.7	7(47%)	7(53%)	NONE

This table shows that after a period of 20 yrs majority of patients had cortical thickness less than 12 mm which was correlated clinically with CRF and raised serum creatinine values.

This table shows that 100% of patients with RI value>= 0.7 had microalbiminuria on 24 hr urine sample.

	MICROALMINURIA		SERUM CREATININE	
	PRESENT	NOT PRESENT	NORMAL	RAISED
	TOTAL NO OF PT (% OUT OF TOTAL PT IN THE SAME GROUP)			
RI>=0.8	10(100%)		2(20%)	8(80%)
RI<0.8	33(80%)	8(20%)	40(100%)	

This table shows that all patients with RI value <0.8 were found to have normal serum creatinine.

80% of patients with RI>=0.8 has raised serum creatinine value.

DURATION OF DIABETES	PI>1.5	PI<1.5
0-<5	1(10%)	9(90%)
5-<10	7(48%)	8(52%)
10-<15	8(66%)	4(33%)
15-<20	4(80%)	1(20%)
20-<25	3(100%)	NONE
25-35	4(80%)	1(20%)

This table shows that 27 out of 50 patients had elevated PI value and remainder had PI value below

1.5. No significant correlation between PI and duration of diabetes was found.

DISCUSSION:

SIZE: The renal size is in the higher normal range (more than 100 mm) in diabetic nephropathy, which is believed to represent hyperinfiltration induced nephromegaly. In the later stage when the renal function declines the renal size decreases, similar to the chronically failing kidney as found in other disorders.

CORTICAL THICKNESS AT MIDPOLE: The cortical thickness at mid pole increases in the diabetic nephropathy, in the later stages the cortical thickness falls corresponding with the loss of renal volume.

CORTICAL ECHOGENICITY: The cortex is normal in early stages of diabetic nephropathy, as the renal function declines and the size decreases the cortical echogenicity increases.

RESISTIVITY INDEX: In RI>0.7 correlate well with microalbuminuria and RI>0.8 correlate well with serum creatinine values in the present study.

PULSATILITY INDEX: The PI values in diabetic kidneys are not significantly higher than the normal population.

The patients with type 1 diabetes had neither any increase in the renal size or cortical thickness, the cortical echogenicity was normal and even the RI values were within normal limits. Laboratory findings were also normal. These findings represent the delayed onset of nephropathy in type 1 diabetes.

CONCLUSION:

The role of renal ultrasound in diabetes mellitus lies mainly in detecting the progression of changes such as changes in renal size, cortical thickness, cortical echogenicity and Doppler indices. Out of the Doppler indices RI holds the greatest importance.

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