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Ultrasonographyical Study of Kidneys Length Correlation in Various Clinical Stages of Chronic Type II Diabetes

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Authors' contributions

This work was carried out in collaboration among all the authors. All the authors read and approved the final manuscript.

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ABSTRACT

The aim of the study was to use ultrasound imaging technique to differentiate between acute and chronic kidney diseases in type 2 diabetes. The renal length of left and right kidneys was compared and a detailed documentation was made. The study was carried out in Sree Balaji Medical College and Hospital, Chennai, Tamilnadu, India. Our study included adult male and female population who were known case of Diabetes Mellitus, above 18 years of age and biochemically diagnosed for nephropathy. All patients were subjected to ultrasonography evaluation of the renal parenchymal thickness and the findings were documented.

Keywords: Kidney; ultrasonography; clinical stages; diabetes.

1. INTRODUCTION

In the longitudinal scan plane, the kidney has the characteristic oval bean-shape. The right kidney is often found more caudally and is slimmer than the left kidney, which may have a so-called dromedary hump due to its proximity to the spleen. The kidney is surrounded by a capsule separating the kidney from the echogenic perirenal fat, which is seen as a thin linear

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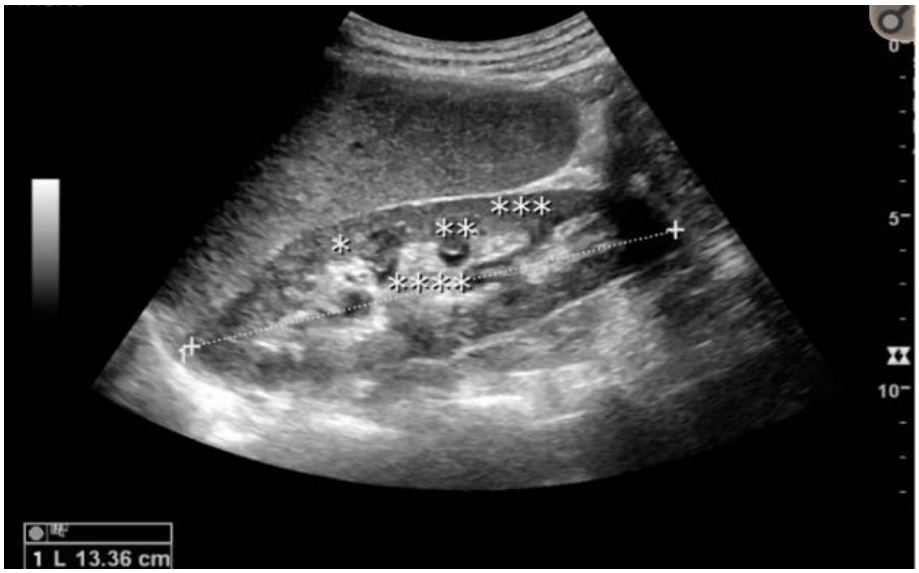

Fig. 1. Normal adult kidney measurement of kidney length on the US image is illustrated by '+' and a dashed line

** Column of Bertin; ** pyramid; *** cortex; **** sinus. [2]*

structure. The length of the adult kidney is normally 10–12 cm, and the right kidney is often slightly longer than the left kidney. The adult kidney size is variable due to the correlation with body height and age [1]. In the early stage of diabetic nephropathy, the arteriolar vasoconstriction increases glomerular pressure causing glomerular hypertension leading to hyper-filtration-induced nephromegaly. In the later stage of the disease, however, the progressive damage of the kidney results in the shrinkage of the kidneys and reduction in its functionality. The determination of kidney size is important, because it can help in the detection of renal abnormalities and predict renal function. Renal ultrasound typically assesses kidney size and parenchymal echogenicity [2]. The aim of this study is to compare renal volume in diabetics using ultrasonography.

2. MATERIALS AND METHODOLOGY

This was a prospective comparative cross-sectional sonographic study of renal volume among 150 confirmed diabetic adults. The study included both adult male and female population with type 2 Diabetes Mellitus, above 18 years of age and biochemically diagnosed for nephropathy. The relevant medical history and physical examination findings were entered into the questionnaire [3]. For diabetics, blood and urine samples were collected for biochemical estimation of plasma creatinine levels, HbA1c, FBS analysis. All of them were subjected to ultrasonographic evaluation of the length of kidneys and the findings were documented. The scans were taken in supine or prone position using an ultrasound machine, with a 2–8 MHz variable frequency curvilinear transducer. The right and left kidneys were scanned in longitudinal, transverse, and oblique planes with measurements of the renal length, width, and thickness performed [4,5].

Data analysis was performed using Statistical Package for Social Science (SPSS-version 24). The proportions were compared using One-way Analysis of Variance (ANOVA).

3. RESULTS AND ANALYSIS

The distributions of renal length among various groups were given in Table 1.

4. DISCUSSION

The study subjects were equally dispersed between all the groups with 30 in each of those. In diabetic nephropathy group III, the sub-classifications included group IIIA, group IIIB, group IIIc and maximum representation were from group III B (46.6%) and it was minimum by group IIIc (13.3%).

Table 1. Distribution of Renal Length between the groups of Right Kidney (in cm)

Groups	Min	Max	Mean	SD	Median	IQ Range
Control	10.7	11.1	10.8	.11	10.9	10.8, 11.0
Diabetic nephropathy Group I	11.6	12.1	11.8	.14	11.9	11.7, 12.0
Diabetic nephropathy Group II	10.9	11.5	11.2	.15	11.3	11.1, 11.4
Diabetic nephropathy Group III A	10.7	11.2	10.9	.15	11.0	10.9, 11.1
Diabetic nephropathy Group III B	9.8	10.1	9.9	.18	10.0	9.9, 10.02
Diabetic nephropathy Group III C	9.1	9.3	9.2	.08	9.2	9.12, 9.27

One-way ANOVA with LSD post-hoc test used;
F-value= 543.7, p<.001

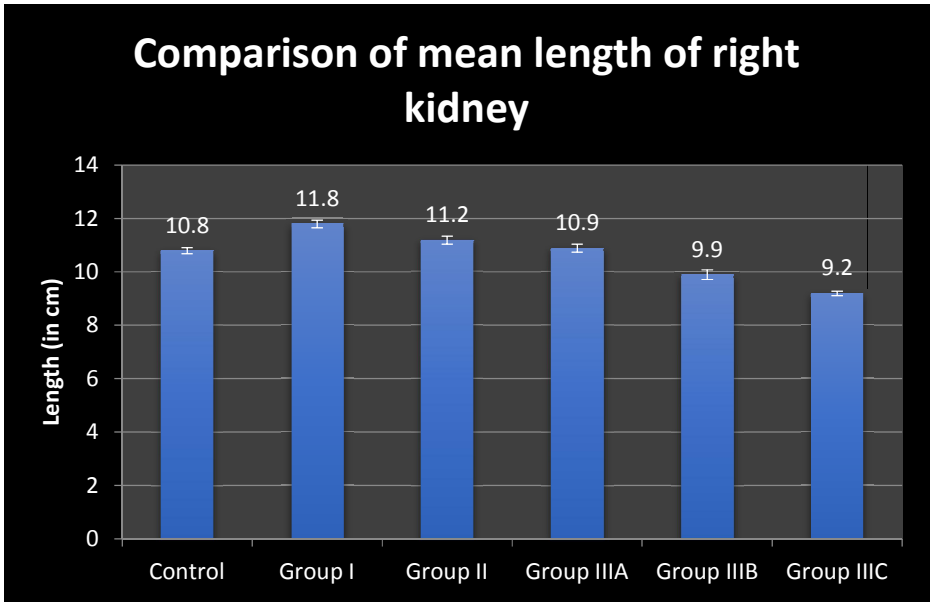

Fig. 2. Comparison of mean length of right kidney

Table 2. Distribution of Renal Length between the groups for Left Kidney (in cm)

Groups	Min	Max	Mean	SD	Median	IQ Range
Control	10.9	11.5	11.15	.18	11.15	11.0, 11.3
Diabetic nephropathy Group I	11.7	12.4	12.01	.15	12.0	11.9, 12.1
Diabetic nephropathy Group II	11.1	11.9	11.53	.17	11.55	11.4, 11.62
Diabetic nephropathy Group III A	10.9	11.4	11.14	.16	11.15	11.0, 11.3
Diabetic nephropathy Group III B	10.1	10.7	10.42	.13	10.45	10.3, 10.52
Diabetic nephropathy Group III C	9.4	9.6	9.5	.09	9.5	9.42, 9.57

One-way ANOVA with LSD post-hoc test used;
F-value= 293.2, p<.001

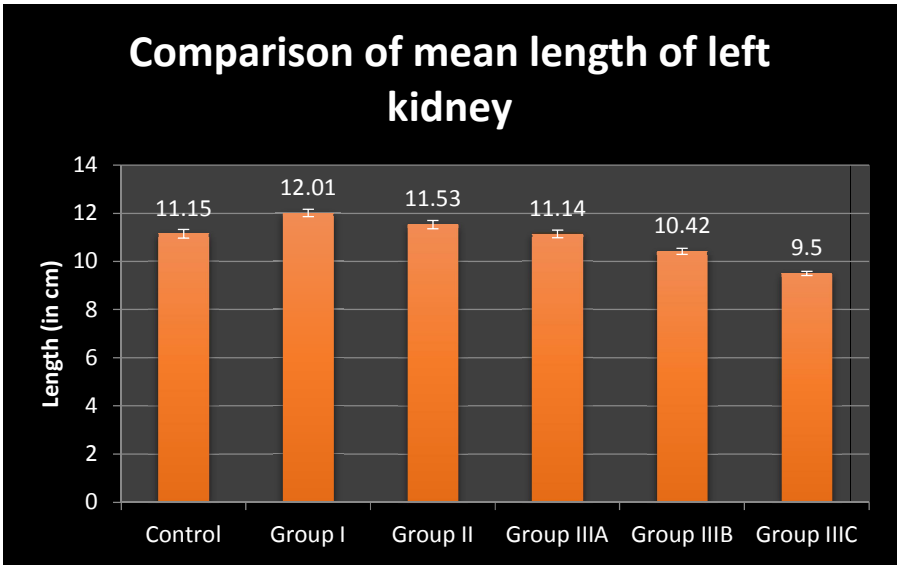

Fig. 3. Comparison of mean length of left kidney

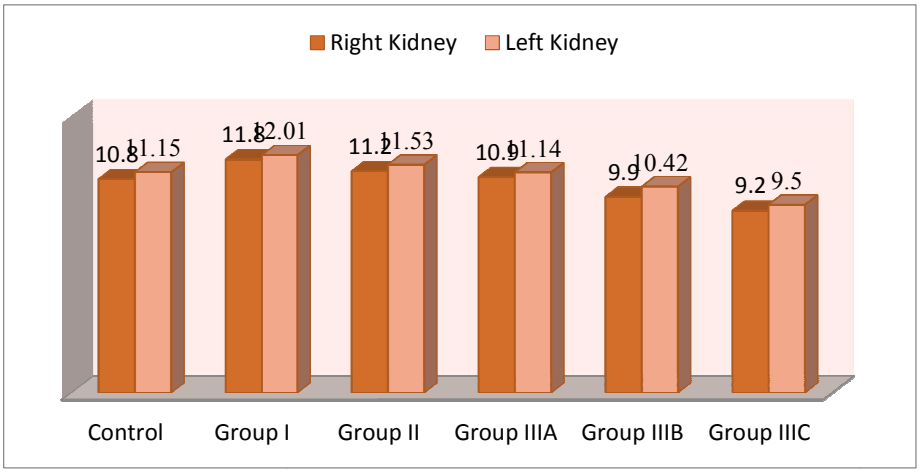

Fig. 4. Comparison of Renal Length in both kidneys (in cm)

For the right kidney, the mean length (centimeters) and SD of controls, group I, group II, group IIIA, group IIIB, group IIIc were 10.8 ± .11, 11.8 ±.14, 11.2 ± .15, 10.9 ± .15, 9.9 ± .18, 9.2 ± .08 respectively. Their lengths ranged from 10.7 to 11.1, 11.6 to 12.1, 10.9 to 11.5, 10.7 to 11.2, 9.8 to 10.1 and 9.1 to 9,3 among the controls, group I, group II, group IIIA, group IIIB, group IIIc respectively. The median (50th percentile) renal length (inter-quartile range, i.e between 25th percentile and 75th percentile) fluctuated with values of 10.9 (10.8, 11.0), 11.9 (11.7, 12.0), 11.3 (11.1, 11.4), 11.0 (10.9, 11.1), 10.0 (9.9, 10.02) and 9.2 (9.12, 9.27) respectively among controls, group I, group II, group IIIA, group IIIB, group IIIc that have been included in this study. The mean kidney length was (14.5 cm) was higher in diabetic patients of one study,[2] which is contrary to that of our study subjects. This might be explained due to that there are differences in ethnicity between the groups as well as the duration of diabetes that will be differing in both the groups. Having most of the studies, dealing the renal length with progression of the disease, there was an interesting study which correlated the length with the type of diabetes which found was a significantly higher proportion of larger kidneys (11 cm or more) in the IDDM group than in the NIDDM group [6]. Even they postulated that the

mean length of kidneys was inversely related to the serum creatinine levels as was the correlation observed in our study.

For the left kidney, the mean length (centimeters) and SD of controls, group I, group II, group IIIA, group IIIB, group IIIc were 11.15 ± .18, 12.01 ±.15 11.53 ± .17, 11.14 ± .16, 10.42 ± .13, 9.5 ± .09 centimeters respectively. Their lengths ranged from 10.9 to 11.5, 11.7 to 12.4, 11.1 to 11.9, 10.9 to 11.4, 10.1 to 10.7 and 9.4 to 9.6 among the controls, group I, group II, group IIIA, group IIIB, group IIIc respectively. The median (50th percentile) renal length (inter-quartile range, i.e between 25th percentile and 75th percentile) fluctuated with values of 11.15 (11.0, 11.3), 12.0 (11.9, 12.1), 11.55 (11.4, 11.62), 11.15 (11.0, 11.3), 10.45 (10.3, 10.52) and 9.5 (9.42, 9.57) respectively among controls, group I, group II, group IIIA, group IIIB, group IIIc that have been included in this study. The results in our study were comparable to one study where the proportion of small kidneys were significantly higher in the cases group than controls. In that study,[4] the control group had 33 patients (75%) with normal size kidneys and 11 patients (25%) had small kidneys (Length <9cm) with post-inflammatory changes. In cases group 9 patients (18.8%) had normal size kidneys and small kidneys were found in 39 patients (81.2%).

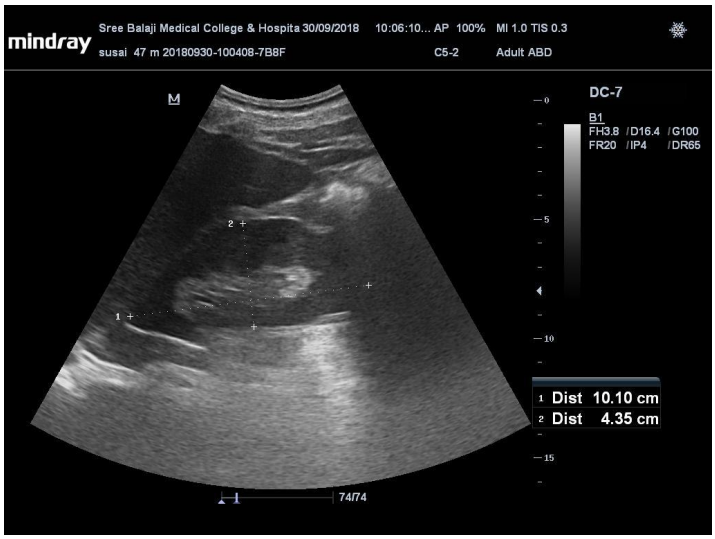

Fig. 5. Ultrasound image of the measurement of right kidney

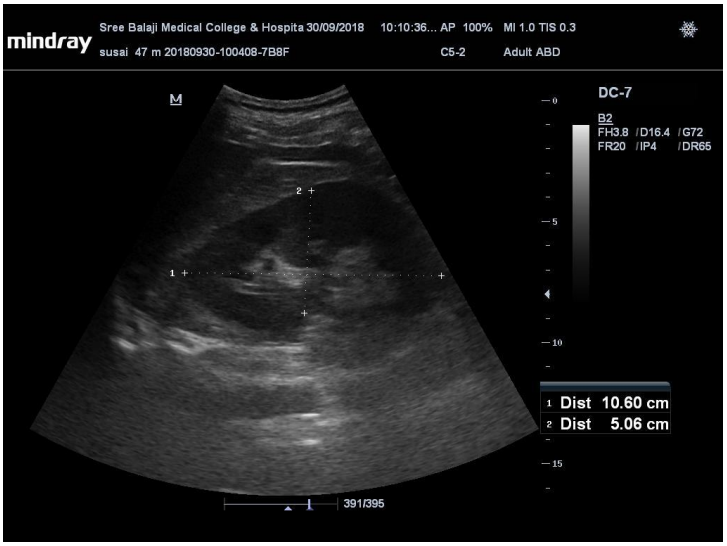

Fig. 6. Ultrasound image of the measurement of left kidney

In a previous report, the renal length did not show linear variation with progression in severity of diabetic nephropathy, but the biggest kidneys were found in preclinical subgroup. And also in asymptomatic diabetic nephropathy, renal length and parenchymal thickness were significantly increased [7]. Another comparative study demonstrated elevated glomerular filtration rate and increased renal volume accompanied by normo-albuminuria or micro-albuminuria. The increase in renal volumes in diabetics in this study is probably due to the pathophysiology of diabetic nephropathy [8].

5. CONCLUSION

Based on the measurement of right and left renal length sonologically in diabetic nephropathy subjects, it was interpreted that the length diminished while the disease was getting progressed.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Approval for this study was granted by the Ethics and Research Committee of Sree Balaji Medical College and Hospital, Chennai, Tamilnadu.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Osterby R, Tapia J, Nyberg G, Tencer J, Willner J, Rippe B, Torffvit O. Renal structures in type2 diabetic patients with elevated albumin excretion rate. APMIS. 2001;109:751-61.
2. Ritz E, Orth SR. Nephropathy in patients with type2 diabetes mellitus. N Engl J Med. 1999;341:1127-33.
3. Schmitz O, Hansen HE, Orskov H, Mogensen CE, Posborg PV. End-stage renal failure in diabetic nephropathy: Pathophysiology and treatment. Blood Purif. 1985;3:120-39.
4. Majdan M, Kurowska M, Orłowska - Kowalik G, Drop A, Ultrasonographic evaluation of kidneys in type -2 diabetes patients without overt nephropathy and with chronic renal failure. 2005;58(1–2):25–8.
5. Emamian SA, Nielsen MB, Pedersen JF. Tenth percentiles of kidney length in adult volunteers. Am J Roentgenol. 1994;163(3):748–748.
6. Hansen KL, Nielsen MB, Ewertsen C. Ultrasonography of the kidney: a pictorial review. Diagnostics. 2016;6(1):2.
7. Padman A, Jacob V, Retnakumari VL. Role of renal doppler in early detection of diabetic nephropathy. Journal of Evolution of Medical and Dental Sciences. 2013;2(30):10270-76.
8. Platt JF, Rubin JM, Ellis JH. Diabetic nephropathy: Evaluation with renal duplex doppler US. Radiology. 1994;190:343-46.

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