Original Research Article

To Assess the Role of Non Contrast Enhanced Spiral CT in Patients of Chronic Renal Failure

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International Archives of Integrated Medicine, Vol. 4, Issue 1, January, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 04-01-2017 **Accepted on:** 09-01-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Joshi AG. To Assess the Role of Non Contrast Enhanced Spiral CT in Patients of Chronic Renal Failure. IAIM, 2017; 4(1): 116-121.

Abstract

Introduction: Conventional USG/ Doppler is considered investigation of choice in patients of chronic renal failure. However when multi-systemic involvement is suspected so also for technical reasons when sonography fails to give optimal required information we feel that spiral CT should be implemented. The present study focused on its benefit over sonography in certain conditions.
Aim: Role of non-contrast enhanced spiral ct in patients of chronic renal failure.
Materials and methods: The study design was a cross-sectional study done in 96 patients who were suspected to have chronic renal diseases.
Results: In the present study, we have found most commonly affected age group was 38-47 years, with male dominance. Chronic and end-stage parenchymal diseases, males were more affected than females. By occupation farmers were most affected group. It was observed that 27% of the patients had no specific history; the disease progressed silently until the symptoms appeared. The most common etiological cause of renal parenchymal diseases was Hypertension and diabetes (36%). Pleural effusion was most common associated finding in this series.
Conclusion: Spiral CT is a reliable and supportive investigation in management of chronic renal disease when associated multi-systemic pathologies are suspected.

Key words

Renal parenchymal diseases, Spiral CT, Pleural effusion.

Introduction

Most common causes of chronic renal failure are poorly controlled diabetes, high blood pressure and chronic glomerulonephritis. In recent years, multiple studies have demonstrated a clear role for utilizing CT to assess renal failure. CT has promising role in assessment of the functional parameters such as perfusion [1]. The golden standard to determine differential renal function is the nuclear imaging. Non-invasive method carry less hazards and the need for a reliable non-invasive method for studying individual kidney function is important [2]. Previous studies suggested that the non–contrast-enhanced computerized tomography (CT) scan is a highly reliable tool for the diagnosis of renal disease. The renal parenchymal diseases are most common causes of acute and chronic renal diseases which may lead to end stage renal diseases if not manage and treat properly. The treatment of these cases, if develops - is very expensive and it may be fatal if it is ignored. The purpose of present study is to evaluate the renal changes that are associated with renal parenchymal diseases using non contrast enhanced spiral CT in patients of chronic renal failure.

Materials and methods

The present cross sectional observational study included 96 patients from Bharati Vidyapeeth Deemed University Medical College and Hospital – Sangli, over the period of last one year (2015 - 16) after approval by the Committee for Ethics in Research. The 96 patients with a chronic renal failure diagnosis were scanned on spiral CT. The scanning technique and time was adjusted according to clinical need. The scans were independently reported and analyzed by two qualified radiologists.

Inclusion criteria

Patients aged 18 years or older, clinically diagnosed cases of stable chronic renal insufficiency.

Exclusion criteria

CRF of post renal etiology (e.g. Hydronephrosis), autosomal dominant polycystic kidney disease, terminal renal insufficiency undergoing dialysis, acute on chronic renal insufficiency.

The renal cortical thickness was measured in the coronal plane, above the medullary pyramid, perpendicular to the capsule, in the upper, middle and lower third of kidney. The bipolar length was measured from the upper to the lower pole, in the sagittal plane.

Non contrast Enhanced CT was performed with a multi-detector helical scanner from the level of domes of diaphragm to the pubic symphysis in breath-hold status, with the following parameters: beam collimation 5 mm × 1.25 mm; pitch 6; scan time about 20 s. Subsequent curved three-dimensional multi-planar reconstruction (MPR) focusing on the ureter of the symptomatic side was performed on a compatible workstation by an experienced CT technologist. By manually selecting a point within the center of the ureteric lumen on sequential axial images, the renal collecting system could be demonstrated completely from the level of the renal pelvis. Axial scans were obtained in a single breath hold from L2 vertebral level to the symphysis pubis with 5-mm collimation and a pitch of 1.5. All scans were obtained without administration of oral, intravenous, or rectal contrast materials. Two radiologists who were not aware of the surgical findings assessed CTs.

Results

It was observed that 13 patients had no relevant clinical history; Hypertension and diabetes were more common diseases that were associated with renal parenchymal disease. Renal parenchymal diseases were most common in the age group of 38-47 years.

Most common age group in study was 38-47 years, and males are most affected. In Chronic and end-stage parenchymal renal diseases, males

were more affected than females. By occupation farmers were most affected group (**Table – 1**).

Table - 1: Demographic distribution in the present study.

Age Group (Years)	**Chronic Renal Parenchymal Disease N = 96**	
	Number of Patients	**%**
18-27	09	09.3
28-37	18	18.6
38-47	38	39.5
48-57	17	17.7
58-67	10	09.6
68-77	02	2.08
78-87	02	2.08
Total	96	
Gender		
Male	70	73.33
Female	26	26.67
Occupation		
Farmer	51	53.1
Field worker	02	04.1
Industrial worker	07	07.2
Office Worker	13	13.5
Housewife	23	23.9

It was observed that that 26% of the patients had no specific history; the disease progressed silently until the symptoms appeared. 36% of patients were with Hypertension and Diabetes which was most common history found in patients in present study (**Table – 2**). Renal measurements were as per **Table – 3**. Grading of Renal Cortical CT Attenuation was as per **Figure – 1.** Associate abnormalities were as per **Table – 4.** Bipolar length and width of chronically diseased right kidney was as per **Figure – 2**. Images of associated diseases were as per **Figure - 3**.

Discussion

Non-invasive imaging techniques have been developed considerably in recent years, allowing improved detection of renal morphology in chronic renal failure patients. Ultrasonography (US) and nuclear medicine examinations make up the vast majority of radio-diagnostic procedures used to study renal parenchyma in their diseases. The new helical computed tomographic (CT) techniques and less nephrotoxic nonionic iodine contrast material allow low-risk, accurate evaluation in renal diseases at a lower cost and with greater availability than is possible with magnetic resonance (MR) imaging; thus, they are useful in cases in which US or nuclear medicine examinations yield non-diagnostic findings. Helical CT scan depict parenchymal, perirenal, renal sinus, pyeloureteral, and vascular diseases in great detail.

Table - 2: Distribution according to History.

History	**Frequency**	**%**
No patient history	26	27.08
Hypertensive	18	18.75
Diabetic	13	13.5
Diabetic and hypertensive	12	12.5
Other	08	8.3
renal stone	02	2.08
recurrent UTI	08	8.6
Bloody diarrhoea		
Atherosclerosis	09	09.3
Total	96	100

Table - 3: Renal measurements.

Renal measurements(mean)	
Bipolar length	7.6 cm (Range 5.8 to 8.7 cm)
Renal width at midcortex	3.6 cm (Range 2.8 cm to 4.1 cm)
Cortical thickness (mean)	
Upper pole	0.65 cm
Mid cortex	0.71 cm
Lower pole	0.68 cm

Renal parenchymal diseases are one of the most common health problems that cause severe

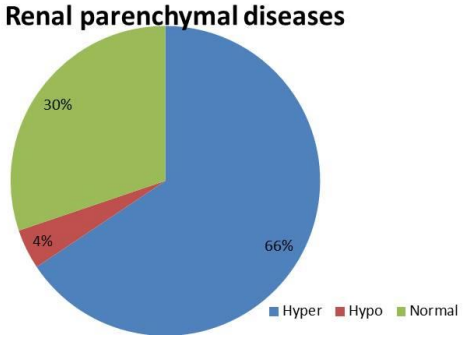
morbidity and mortality. Ultrasound is an essential imaging method for the evaluation of patients. Several authors have studied sonographic renal parameters in an attempt to establish their relevance in evaluation of specific renal disease processes [3]. It was observed that 43.33% of the patients had no specific history; the disease progressed silently until the symptoms appear. It was observed that Diabetes and hypertension were the most common causes of renal parenchymal diseases according to the present study.

Table - 4: Associated Abnormalities.

Diseases	Number of patients N= 96	%
Acute gastroenteritis	003	03.1
Pancreatitis	11	11.4
Cirrhosis	13	13.5
Fatty liver	17	17.7
Ascites	09	09.3
Pnemonia/ Lung parenchymal pathologies	04	04.1
Pleural effusion	27	28.1
No associated diseases	12	12.5

(Pleural effusion was a most common finding associated with renal disease)

Figure - 1: Grading of Renal Cortical CT Attenuation.



Above findings were consistent with the observations in the study done by Preston, et al. [4]. Chronic kidney disease and systemic hypertension were interrelated. However persistent hypertension is an essential cause of chronic renal disease, while renal parenchymal diseases were common causes of secondary hypertension.

In our study we found that hypertension was the most common finding (60%) while diabetes was the second most common cause (43.33%) of renal parenchymal disease. This finding is consistent with a study performed on diabetic nephropathy which reported that, diabetes mellitus (type 1 and 2) affect the renal function such as glomerular filtration [5].

Shreyer [6] Marineck [7] and Tamm, et al. [8] describe the high accuracy rate of helical CT scan in detecting urolithiasis, They found that helical non-contrast CT is a sensitive, specific and quick investigation for evaluation of urolithiasis, with additional benefit of detecting nonurinary causes [9]. Hackstein, et al. [10] demonstrated that GFR can be measured accurately with CT scan. In their study they found a strong linear relationship between differential renal function by dynamic CT using modified Patlak graphic analysis, nuclear renal scan and 24-hour creatinine clearance. Other study by Herts, et al. [11], who compared the estimated GFR by CT-based parenchymal volume with GFR measurement by 125 Iiothalamate clearance imaging, found that CT is comparable to GFR assessment by nuclear medicine method. So they recommend spiral CT with non-contrast medium as a single radiological diagnostic modality for the assessment of patients with chronic renal failure and abnormal serum creatinine [12, 13].

Conclusion

Spiral CT is a reliable investigation in establishing linear relationship between renal cortical thickness, bipolar length, and parenchymal attenuation in chronic renal disease. Though conventional method used for detection of these findings is Sonography/ Doppler, in following conditions, CT still proved to be a

better and speedy solution. (a) In critically ill and breathless patients, skin edema, skin wounds, obese (b) patient with bowel distention, (c) echogenic small kidneys / ectopic kidneys, Sonography and color Doppler studies are difficult to perform, in such conditions. CT plays a major and reliable role in arriving at precise diagnosis. Hence Spiral CT is a reliable and supportive investigation in management of chronic renal disease when associated multi-systemic pathologies are suspected.

Figure - 2: Bipolar length and width of chronically diseased right kidney.

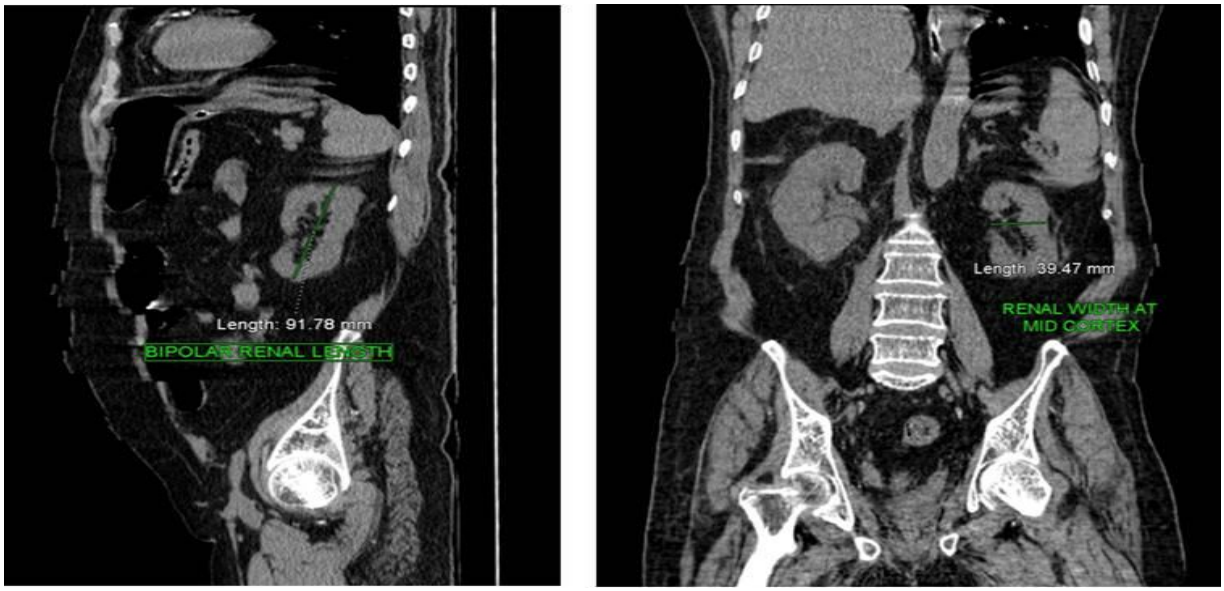
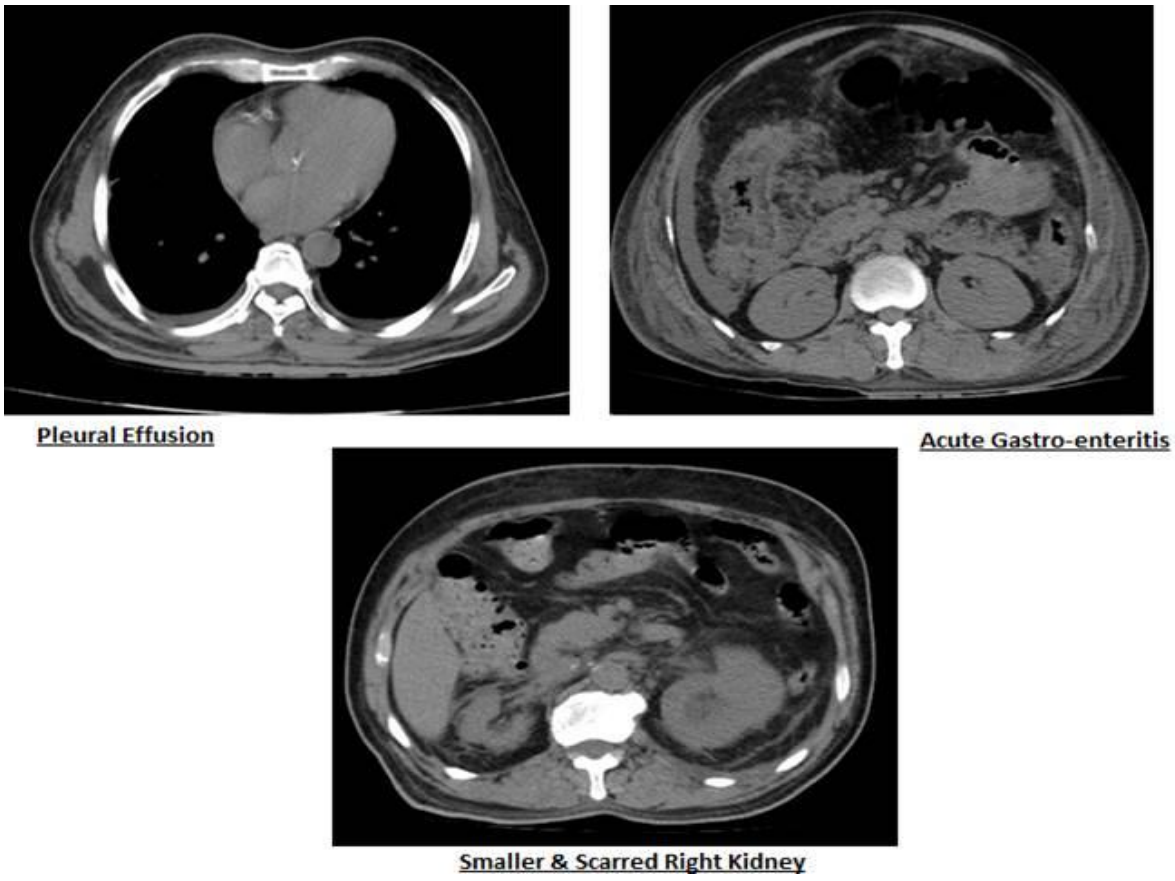
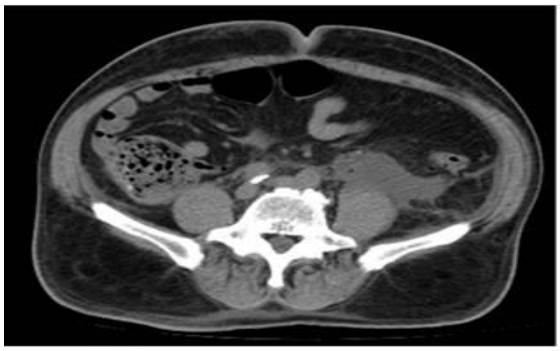
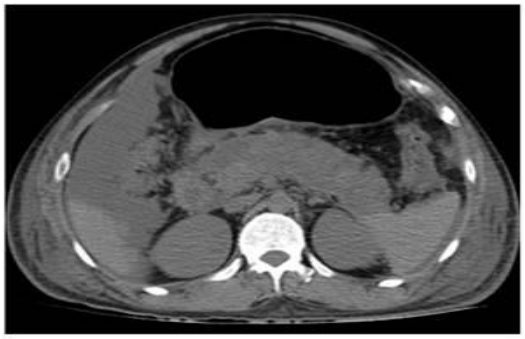


Figure - 3: Images of associated diseases.





Ascites



Pancreatitis

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