(e) ISSN Online: 2321-9599

(p) ISSN Print: 2348-6805

# ORIGINAL ARTICLE

## Clinical efficacy of gray scale renal ultrasound in diagnosing acute kidney injury

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***ABSTRACT:***

**Background:** Acute kidney injury (AKI) is defined by a rapid increase in serum creatinine, decrease in urine output, or both. The present study evaluated clinical utility of gray scale renal ultrasound in acute kidney injury. **Materials & Methods:** 56acute kidney injury (AKI) patients of both genders were selected. Group I had AKI patients and group II had healthy subjects. The USG was evaluated for renal parenchyma thickness, parenchymal echogenicity, the length, width, and thickness of each kidney. **Results:** The group I had 36 males and 20 females and group II had 28 males and 28 females. The mean serum creatinine in group I and group II was 311.5 µmol/L and 102.2 µmol/L. The mean length of right kidney was 108.5 mm and 103.9 mm, width of right kidney was 58.2 mm and 50.0 mm, thickness of right kidney was 48.5 mm and 45.2 mm, volume of right kidney was 144.6 $cm^3$and 111.8 $cm^3$ and thickness of right parenchyma was 16.8 and 16.1 respectively. The mean length of left kidney was 106.2 mm and 103.3 mm, width of left kidney was 59.4mm and 52.1 mm, thickness of left kidney was 49.6 mm and 42.2 mm, volume of left kidney was 147.3 $cm^3$ and 116.7 $cm^3$, thickness of left parenchyma was 17.9 and 17.1 respectively. The difference was significant (P< 0.05). **Conclusion:** Grey scale ultrasonography has been demonstrated to be useful in cases of acute renal damage assessment.

**Key words:** Acute kidney injury, Gray scale ultrasound, Parenchyma

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**This article may be cited as:** Bhatnagar VK. Clinical efficacy of gray scale renal ultrasound in diagnosing acute kidney injury. J Adv Med Dent Scie Res 2017;5(10):119-121.

### INTRODUCTION

Acute kidney injury (AKI) is defined by a rapid increase in serum creatinine, decrease inurine output, or both. AKI occurs in approximately 10–15% of patients admitted to hospital, while its incidence in intensive care has been reported in more than 50% of patients. AKI is frequently observed in hospitalised individuals.[1] AKI is present upon admission in 1% of all hospital admissions in the US. If not the only reason for hospitalisation, it is frequently a crucial consideration when deciding to treat additional disorders. Acute kidney injury occurs between 2% and 5% of the time during hospitalisation, and it can occur in as many as 67% of patients hospitalised to the intensive care unit.[2]

Ultrasonography (US) can easily distinguish between the acoustic properties of the renal cortex, medulla, and collecting system.[3] The USG is very helpful for evaluating renal disorders. Previous research has shown a correlation between sonographic observations and kidney histological abnormalities.2 Compared to ultrasound, computed tomography (CT) is more sensitive in detecting neoplasms, stones, and calcifications. The ability to better visualise the blood vessels is a unique advantage of magnetic resonance imaging (MRI), on the other hand. However, when compared to US, neither CT nor MRI has any clear advantages over kidney failure.[4]

USG is non-invasive, meaning that it doesn't involve penetrating the skin, and it doesn't employ ionising radiation.[5] USG imaging can provide details on kidney morphology, physical characteristics, function, and any anomalies in both acute care and ambulatory settings.4 The first-line imaging technique for previously undetected native and transplanted impaired kidney function is ultrasound scanning (USG).[6] With more portable, even handheld, USG at the point of care, it is easier to access and more common. A detailed grasp of the technology and its variations is necessary, particularly in the setting of chronic kidney disease (CKD), to employ USG as a helpful adjunct to clinical decision making.[7] The present study evaluated clinical utility of gray scale renal ultrasound in acute kidney injury.

### MATERIALS &METHODS

The present study consisted of 56acute kidney injury (AKI) patients of both genders. Patients' consent was obtained before starting the study.

Data such as name, age, gender etc. was recorded. Two groups were formed. Group I had AKI patients and group II had healthy subjects. Serum creatinine levels following medication and the highest serum creatinine levels in AKI were among the parameters that were gathered. An Evolution E10 scanner was used to perform renal ultrasonography (US) using a 3.5-5.0 MHz wide-frequency spectrum. The USG was evaluated for renal parenchyma thickness, parenchymal echogenicity, RRI, and other abnormalities, such as calculus, nodules, cysts, stones,

urine retention, and hydronephrosis. The USG was also evaluated for kidney size (the length, width, and thickness of each kidney). If present, hepatic echogenicity was also noted.The results were statistically analysed. P value less than 0.05 was set significant.

## RESULTS

**Table I Distribution of patients**

| Groups | Group I | Group II |
|---|---|---|
| Status | AKI | Control |
| M:F | 36:20 | 28:28 |

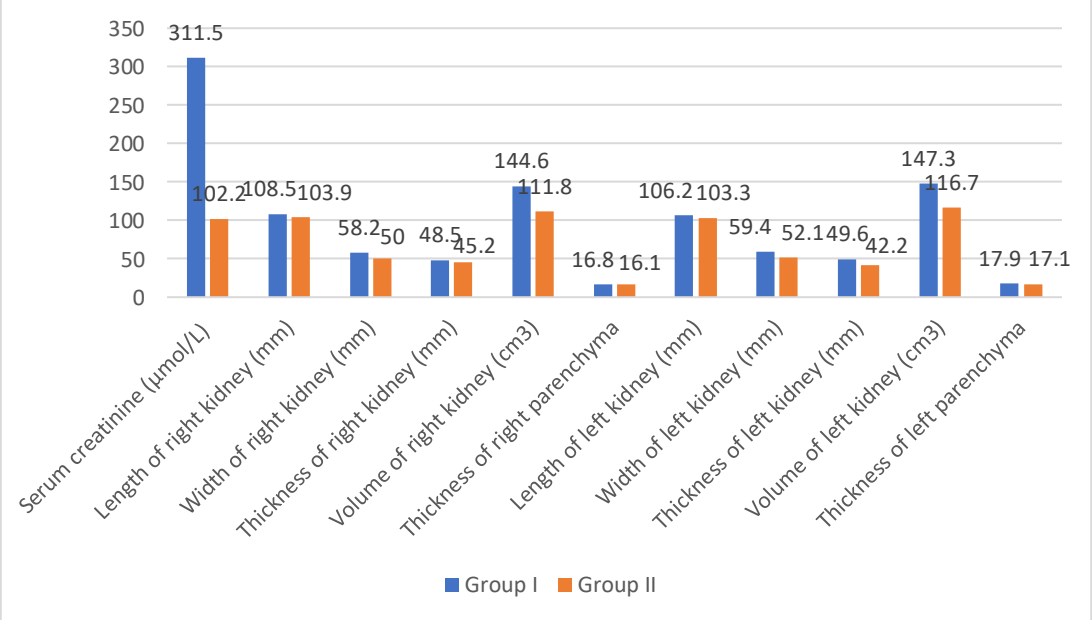
Table I shows that group I had 36 males and 20 females and group II had 28 males and 28 females.

**Table II Comparison of parameters**

| Parameters | Group I | Group II | P value |
|---|---|---|---|
| Serum creatinine (µmol/L) | 311.5 | 102.2 | 0.01 |
| Length of right kidney (mm) | 108.5 | 103.9 | 0.05 |
| Width of right kidney (mm) | 58.2 | 50.0 | 0.04 |
| Thickness of right kidney (mm) | 48.5 | 45.2 | 0.05 |
| Volume of right kidney (cm3) | 144.6 | 111.8 | 0.02 |
| Thickness of right parenchyma | 16.8 | 16.1 | 0.05 |
| Length of left kidney (mm) | 106.2 | 103.3 | 0.05 |
| Width of left kidney (mm) | 59.4 | 52.1 | 0.04 |
| Thickness of left kidney (mm) | 49.6 | 42.2 | 0.04 |
| Volume of left kidney (cm3) | 147.3 | 116.7 | 0.01 |
| Thickness of left parenchyma | 17.9 | 17.1 | 0.92 |

Table II, graph I shows that the mean serum creatinine in group I and group II was 311.5 µmol/L and 102.2 µmol/L. The mean length of right kidney was 108.5 mm and 103.9 mm, width of right kidney was 58.2 mm and 50.0 mm, thickness of right kidney was 48.5 mm and 45.2 mm, volume of right kidney was 144.6 $cm^3$and 111.8 $cm^3$ and thickness of right parenchyma was 16.8 and 16.1 respectively. The mean length of left kidney was 106.2 mm and 103.3 mm, width of left kidney was 59.4mm and 52.1 mm, thickness of left kidney was 49.6 mm and 42.2 mm, volume of left kidney was 147.3 $cm^3$ and 116.7 $cm^3$, thickness of left parenchyma was 17.9 and 17.1 respectively. The difference was significant (P< 0.05).

**Graph IComparison of parameters**




## DISCUSSION

An essential diagnostic tool for evaluating human kidneys is ultrasound (USG) imaging. Transmitting radiofrequency sound waves into the body is how a USG transducer functions.[8,9] These waves alter the tissues and tissue interfaces they pass through, altering them, and sending echoes back to the transducer.[10] It responds by vibrating its piezoelectric crystals, which transform the echoes into electrical signals that are then processed by sophisticated

algorithms to provide cross-sectional photographs of the body's underlying tissue layers.[11,12]The present study evaluated clinical utility of gray scale renal ultrasound in acute kidney injury.

We found that group I had 36 males and 20 females and group II had 28 males and 28 females. Moghazi et al[13]in their study 207 individuals' histological alterations of glomerulosclerosis, renal tubular atrophy, interstitial fibrosis, and interstitial inflammation were correlated with ultrasonography parameters. Cortical histopathological alterations are determined by factors such as interstitial inflammation and renal tubular atrophy rather than interstitial fibrosis. This is due to the fact that the glomerulus only makes about 8% of the cortical volume and that glomerular illnesses are not always accompanied by an increase in parenchymal echogenicity. On the other hand, Keyserling et al discovered that only one case of hydronephrosis was discovered out of 100 renal ultrasounds performed for AKI in individuals without clinical signs indicative of blockage.

We found that the mean serum creatinine in group I and group II was 311.5 µmol/L and 102.2 µmol/L. The mean length of right kidney was 108.5 mm and 103.9 mm, width of right kidney was 58.2 mm and 50.0 mm, thickness of right kidney was 48.5 mm and 45.2 mm, volume of right kidney was 144.6 $cm^3$and 111.8 $cm^3$ and thickness of right parenchyma was 16.8 and 16.1 respectively. The mean length of left kidney was 106.2 mm and 103.3 mm, width of left kidney was 59.4mm and 52.1 mm, thickness of left kidney was 49.6 mm and 42.2 mm, volume of left kidney was 147.3 $cm^3$ and 116.7 $cm^3$, thickness of left parenchyma was 17.9 and 17.1 respectively. Liu et al[14]examined the use of ultrasonography (US) in patients with acute kidney injury (AKI) and the correlation between US results. 111 patients with AKI's US features were assessed. AKI patients had larger kidneys in terms of volume and length when compared to the control group (P 0.05). In comparison to the control group, patients with AKI also had thicker parenchyma, although only the difference in the right kidney was shown to be statistically significant. Of the 111 AKI patients, 38 showed positive US results, including increased renal resistance index (RRI), increased parenchymal echogenicity, and hydronephrosis, while only 5 patients had increased RRI.

In Mounier- Vehier et al.'s[15] study, the kidneys of 49 patients with hypertension were assessed by spiral CT. Although the size of the kidneys was still within the normal range, the thickness of the cortex after renal artery stenosis was reduced.

## CONCLUSION

Authors found that grey scale ultrasonography has been demonstrated to be useful in cases of acute renal damage assessment.

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