**International Journal of Medical Imaging**
2024; 12(1): 5-10
http://www.sciencepublishinggroup.com/j/ijmi
doi: 10.11648/j.ijmi.20241201.12
ISSN: 2330-8303 (Print); ISSN: 2330-832X (Online)

# Possible Renal Damage and Its Relation with Cholesterol Level Among the Hypertensive and Non-Hypertensive Patients by Using Ultrasonographic Parameters

**Taibatul Kubba[1], Md. Murshed Ali[2], Tanvir Ahmad[3], Md. Abdul Awal[4, *], Narayan Roy[5]**

[1]Department of Radiology and Imaging, Rangpur Medical College and Hospital, Rangpur, Bangladesh
[2]Institute of Nuclear Medicine and Allied Sciences, Rangpur, Bangladesh
[3]Department of Surgery, Rangpur Medical College, Rangpur, Bangladesh
[4]Department of Public Health, Varendra University, Rajshahi, Bangladesh
[5]Department of Biochemistry and Molecular Biology, University of Rajshahi, Rajshahi, Bangladesh

## Email address:
taibatul36@gmail.com (Taibatul Kubba), tanvirahmad35th@gmail.com (Tanvir Ahmad), murshedali505@hotmail.com (Md. Murshed Ali), limonawal@gmail.com (Md. Abdul Awal), nroy_64@yahoo.com (Narayan Roy)
[*]Corresponding author

## To cite this article:
Taibatul Kubba, Md. Murshed Ali, Tanvir Ahmad, Md. Abdul Awal, Narayan Roy. (2024). Possible Renal Damage and Its Relation with Cholesterol Level Among the Hypertensive and Non-Hypertensive Patients by Using Ultrasonographic Parameters. *International Journal of Medical Imaging*, *12*(1), 5-10. https://doi.org/10.11648/j.ijmi.20241201.12

**Received**: December 4, 2023; **Accepted**: December 14, 2023; **Published**: January 23, 2024

**Abstract:** *Background:* Renal disease is a leading cause of death and morbidity in Bangladesh, and hypertension and dyslipidemia are important risk factors for this condition. *Objective:* The objective of this study was to find out the possible renal damage and its relation with cholesterol level among the hypertensive and non-hypertensive patients by using ultrasonographic paramaters. *Methods:* This was a case control study. The sample size was 135 in each group (Hypertensive and normotensive) which was selected purposively. Data were collected on different renal parameters, blood pressure, smoking status, and lipid profile, including total cholesterol (TC), triglyceride (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL). *Results:* Relationship between TC, TAG, HLD, LDL and different renal parameters (Renal bipolar length, Renal anterior-posterior diameter, Renal cortical thickness, Renal cortical echogenecity, Corticomedullary differentiation) were found statistically significant. This indicates that increased cholesterol levels among the hypertensive patients there were possibility of renal damage. We need to identify it earlier and protecting the renal conditions. This finding provides more evidence that hypertension patients with high cholesterol levels are at increased risk for developing kidney impairment down the road. Ultrasonographic parameters showed the variations between the two groups. *Conclusion:* Patients with hypertension in Bangladesh should undergo routine blood pressure and ultrasonography examinations of renal parameters and lipid profiles to detect and prevent renal disease, which is frequently associated with high cholesterol.

**Keywords:** Renal Damage, Cholesterol Level, Hypertensive, Non-Hypertensive, Ultrasonographic Parameters

## 1. Introduction

Around the world, hypertension is the most significant risk factor for developing chronic diseases [1]. Myocardial infarction, stroke, heart failure, and renal failure are all conditions that are more likely to occur in individuals who have hypertension [2]. Although hypertension is a risk factor for the advancement of kidney disease in people who have chronic kidney disease (CKD) [3], there have been relatively few studies that have investigated the connection between hypertension and the possibility of renal injury in patients who have high cholesterol levels. When assessing patients who may have renal illness, it is crucial to measure the size of the kidneys using ultrasound. The use of radiographs is also essential in making a differential diagnosis. For imaging the kidneys, ultrasonography provides a straightforward, easy-to-use, non-invasive, and cheap option. Ultrasound diagnostics rely on four key parameters: volume, length, echogenicity, and cortical thickness [4]. The bilateral renal length is typically reported in the US since renal length has been extensively utilized as a predictor of CKD [5]. Although assessing renal volume is challenging and demands expertise, it has been utilized in prior research as a direct indication of kidney size, bypassing the need to measure kidney length. Additional tools for the identification of chronic kidney disease (CKD) include renal cortical thickness (RCT) and echogenicity. Echogenicity rises and RCT falls as the disease advances. In addition to the aforementioned measures, laboratory assays are useful for monitoring the disease's course throughout follow-up [6, 7]. On the other hand, specialist judgment is key when it comes to echogenicity, which can lead to subjective findings. What's more, there aren't any set normal range values for echogenicity just yet, and a normal result for renal echogenicity doesn't rule out the chance that the patient has kidney damage [8]. There is a correlation between dyslipidemia (high triglycerides, low HDL-cholesterol, and changed lipoprotein composition) and chronic kidney disease (CKD). The incidence of hypertension was positively and strongly correlated with renal alterations. One way to assess the severity of renal illness in hypertensive patients with high cholesterol is through sonographic examination of renal parameters.

# 2. Methods

The current time frame for this case-control observational study is from January 2018 through December 2020. The study population included all male and female patients with hypertension or normotension who visited the Hypertension and Research Center or the Institute of Nuclear Medicine and Allied Sciences in Rangpur, Bangladesh, throughout the study period. After calculating, the sample took into consideration 135 people from the case group and 135 people from the control group. This research made use of a purposive sampling technique.

*Inclusion & Exclusion Criteria*

Adults (i.e., those above the age of 18) with hypertension or normotension visited the research centers. Inclusion in the trial was contingent upon the absence of patients with haemoglobinopathies, diabetes mellitus, liver disease, or renal illness. Also not included were those who had clear renal abnormalities detected by ultrasound, such as polycystic kidney disease, renal tumors, or hydronephrosis.

We used IBM's SPSS program, version 21.0, to do the statistical analysis.

# 3. Results

According to our findings, people with high cholesterol levels are more likely to experience kidney impairment. Ultrasound has the ability to identify specific indicators of kidney disease. Over time, renal health may be affected by atherosclerosis and other disorders caused by elevated cholesterol levels. Atherosclerosis affects blood arteries. Hypertensive individuals may be at a higher risk of developing kidney damage and high cholesterol. Relationship between TC, TAG, HLD, LDL and different renal parameter (Renal bipolar length, Renal anterior-posterior diameter, Renal cortical thickness, Renal cortical echogenecity, Corticomedullary differentiation) were found statistically significant (Tables 1-4).

***Table 1.*** *Relationship with TC and different renal conditions.*

| TC | No | df | Case | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | SD | t value | Sig. | Mean | SD | t value | Sig. |
| TC | 135 | 134 | 184.62 | 43.89 | 13.705 | 0.000 | 170.18 | 15.63381 | 38.328 | 0.000 |
| Blood Pressure | 135 | 134 | 130.76 | 20.96 | | | 114.23 | 7.82300 | | |
| TC | 135 | 134 | 184.62 | 43.89 | 48.374 | 0.000 | 170.18 | 15.63381 | 125.021 | 0.000 |
| Smoking status | 135 | 134 | 1.73 | 0.44386 | | | 1.7259 | 0.44771 | | |
| TC | 135 | 134 | 184.62 | 43.89 | 45.818 | 0.000 | - | - | - | - |
| Duration of hypertension | 135 | 134 | 10.2963 | 10.29496 | | | - | - | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 46.294 | 0.000 | 170.18 | 15.63381 | 117.891 | 0.000 |
| Renal bipolar length (Right) | 135 | 134 | 9.4164 | .91748 | | | 9.4761 | 1.23087 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 46.218 | 0.000 | 170.18 | 15.63381 | 119.397 | 0.000 |
| Renal bipolar length (Left) | 135 | 134 | 9.7201 | .85299 | | | 9.8364 | 0.60506 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 47.764 | 0.000 | 170.18 | 15.63381 | 122.970 | 0.000 |
| Renal anterior-posterior diameter (Right) | 135 | 134 | 3.9376 | .66267 | | | 3.7312 | 0.65692 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 47.695 | 0.000 | 170.18 | 15.63381 | 123.254 | 0.000 |
| Renal anterior-posterior diameter (Left) | 135 | 134 | 4.1768 | .75772 | | | 3.8270 | 0.55550 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.639 | 0.000 | 170.18 | 15.63381 | 125.738 | 0.000 |
| Renal cortical thickness (Right) | 135 | 134 | .7668 | .18597 | | | 1.0220 | 0.12976 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.641 | 0.000 | 170.18 | 15.63381 | 125.757 | 0.000 |
| Renal cortical thickness (Left) | 135 | 134 | .8016 | .17924 | | | 1.0649 | 0.16566 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.938 | 0.000 | 170.18 | 15.63381 | 126.194 | 0.000 |
| Right renal cortical echogenecity | 135 | 134 | 1.3778 | .72139 | | | 1.0370 | 0.22551 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.945 | 0.000 | 170.18 | 15.63381 | 126.194 | 0.000 |
| Left renal cortical chogenecity | 135 | 134 | 1.3778 | .71097 | | | 1.0370 | 0.22551 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.754 | 0.000 | 170.18 | 15.63381 | 125.732 | 0.000 |
| Right corticomedullary differentiation | 135 | 134 | 1.1704 | 0.41503 | | | 1.0000 | 0.00000 | | |

| TC | No | df | Case | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | SD | t value | Sig. | Mean | SD | t value | Sig. |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.761 | 0.000 | 170.18 | 15.63381 | 125.732 | 0.000 |
| Left corticomedullary differentiation | 135 | 134 | 1.1704 | 0.41503 | | | 1.0000 | 0.00000 | | |
| TC | 135 | 134 | 184.62 | 43.88602 | 48.204 | 0.000 | 170.18 | 15.63381 | 123.502 | 0.000 |
| Presence or absence of other renal pathology | 135 | 134 | 3.1852 | 1.05226 | | | 4.0000 | 0.00000 | | |

***Table 2.*** *Relationship with TAG and different renal conditions.*

| TAG | No | df | Case | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | SD | t value | Sig. | Mean | SD | t value | Sig. |
| TAG | 135 | 134 | 160.99 | 61.62900 | 5.713 | 0.000 | 137.13 | 25.738 | 9.860 | 0.000 |
| Blood Pressure | 135 | 134 | 1.3076E2 | 20.96051 | | | 1.1423E2 | 7.82300 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 29.971 | 0.000 | 137.13 | 25.738 | 61.125 | 0.000 |
| Smoking status | 135 | 134 | 1.7333 | 0.44386 | | | 1.7259 | 0.44771 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 28.706 | 0.000 | - | - | - | - |
| Duration of hypertension | 135 | 134 | 10.2963 | 10.29496 | | | - | - | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 28.567 | 0.000 | 137.13 | 25.738 | 57.618 | 0.000 |
| Renal bipolar length (Right) | 135 | 134 | 9.4164 | 0.91748 | | | 9.4761 | 1.23087 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 28.545 | 0.000 | 137.13 | 25.738 | 57.738 | 0.000 |
| Renal bipolar length (Left) | 135 | 134 | 9.7201 | 0.85299 | | | 9.8364 | 0.60506 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 29.628 | 0.000 | 137.13 | 25.738 | 60.052 | 0.000 |
| Renal anterior-posterior diameter (Right) | 135 | 134 | 3.9376 | 0.66267 | | | 3.7312 | 0.65692 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 29.607 | 0.000 | 137.13 | 25.738 | 60.084 | 0.000 |
| Renal anterior-posterior diameter (Left) | 135 | 134 | 4.1768 | 0.75772 | | | 3.8270 | 0.55550 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 30.198 | 0.000 | 137.13 | 25.738 | 61.462 | 0.000 |
| Renal cortical thickness (Right) | 135 | 134 | 0.7668 | 0.18597 | | | 1.0220 | 0.12976 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 30.197 | 0.000 | 137.13 | 25.738 | 61.443 | 0.000 |
| Renal cortical thickness (Left) | 135 | 134 | 0.8016 | 0.17924 | | | 1.0649 | 0.16566 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 30.330 | 0.000 | 137.13 | 25.738 | 61.798 | 0.000 |
| Right renal cortical echogenecity | 135 | 134 | 1.3778 | 0.72139 | | | 1.0370 | 0.22551 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 30.316 | 0.000 | 137.13 | 25.738 | 61.798 | 0.000 |
| Left renal cortical chogenecity | 135 | 134 | 1.3778 | 0.71097 | | | 1.0370 | 0.22551 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 30.255 | 0.000 | 137.13 | 25.738 | 61.455 | 0.000 |
| Right corticomedullary differentiation | 135 | 134 | 1.1704 | 0.41503 | | | 1.0000 | 0.00000 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 30.241 | 0.000 | 137.13 | 25.738 | 61.455 | 0.000 |
| Left corticomedullary differentiation | 135 | 134 | 1.1704 | 0.41503 | | | 1.0000 | 0.00000 | | |
| TAG | 135 | 134 | 160.99 | 61.62900 | 29.767 | 0.000 | 137.13 | 25.738 | 60.101 | 0.000 |
| Presence or absence of other renal pathology | 135 | 134 | 3.1852 | 1.05226 | | | 4.0000 | 0.00000 | | |

***Table 3.*** *Relationship with HDL and different renal conditions.*

| HDL | No | df | Case | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | SD | t value | Sig. | Mean | SD | t value | Sig. |
| HDL | 135 | 134 | 36.6593 | 7.84187 | -49.816 | 0.000 | 37.7852 | 5.75674 | -84.801 | 0.000 |
| Blood Pressure | 135 | 134 | 130.76 | 20.96051 | | | 1.1423E2 | 7.82300 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 50.828 | 0.000 | 37.7852 | 5.75674 | 72.094 | 0.000 |
| Smoking status | 135 | 134 | 1.7333 | .44386 | | | 1.7259 | 0.44771 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 24.347 | 0.000 | - | - | - | - |
| Duration of hypertension | 135 | 134 | 10.2963 | 10.29496 | | | - | - | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 39.194 | 0.000 | 37.7852 | 5.75674 | 55.125 | 0.000 |
| Renal bipolar length (Right) | 135 | 134 | 9.4164 | 0.91748 | | | 9.4761 | 1.23087 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 39.054 | 0.000 | 37.7852 | 5.75674 | 55.606 | 0.000 |
| Renal bipolar length (Left) | 135 | 134 | 9.7201 | 0.85299 | | | 9.8364 | 0.60506 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 48.299 | 0.000 | 37.7852 | 5.75674 | 68.610 | 0.000 |
| Renal anterior-posterior diameter (Right) | 135 | 134 | 3.9376 | 0.66267 | | | 3.7312 | 0.65692 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 48.222 | 0.000 | 37.7852 | 5.75674 | 68.367 | 0.000 |
| Renal anterior-posterior diameter (Left) | 135 | 134 | 4.1768 | 0.75772 | | | 3.8270 | 0.55550 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 52.985 | 0.000 | 37.7852 | 5.75674 | 74.260 | 0.000 |
| Renal cortical thickness (Right) | 135 | 134 | 0.7668 | 0.18597 | | | 1.0220 | 0.12976 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 53.113 | 0.000 | 37.7852 | 5.75674 | 74.484 | 0.000 |
| Renal cortical thickness (Left) | 135 | 134 | 0.8016 | 0.17924 | | | 1.0649 | 0.16566 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 52.272 | 0.000 | 37.7852 | 5.75674 | 74.281 | 0.000 |
| Right renal cortical echogenecity | 135 | 134 | 1.3778 | 0.72139 | | | 1.0370 | 0.22551 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 52.285 | 0.000 | 37.7852 | 5.75674 | 74.281 | 0.000 |
| Left renal cortical chogenecity | 135 | 134 | 1.3778 | 0.71097 | | | 1.0370 | 0.22551 | | |

| HDL | No | df | Case | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | SD | t value | Sig. | Mean | SD | t value | Sig. |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 52.514 | 0.000 | 37.7852 | 5.75674 | 74.244 | 0.000 |
| Right corticomedullary differentiation | 135 | 134 | 1.1704 | 0.41503 | | | 1.0000 | 0.00000 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 52.520 | 0.000 | 37.7852 | 5.75674 | 74.244 | 0.000 |
| Left corticomedullary differentiation | 135 | 134 | 1.1704 | 0.41503 | | | 1.0000 | 0.00000 | | |
| HDL | 135 | 134 | 36.6593 | 7.84187 | 48.794 | 0.000 | 37.7852 | 5.75674 | 68.189 | 0.000 |
| Presence or absence of other renal pathology | 135 | 134 | 3.1852 | 1.05226 | | | 4.0000 | 0.00000 | | |

***Table 4.*** *Relationship with LDL and different renal conditions.*

| LDL | No | df | Case | | | | Control | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | SD | t value | Sig. | Mean | SD | t value | Sig. |
| LDL | 135 | 134 | 85.2889 | 16.31722 | -20.953 | 0.000 | 80.3037 | 9.65778 | -31.974 | 0.000 |
| Blood Pressure | 135 | 134 | 1.3076E2 | 20.96051 | | | 114.23 | 7.82300 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 59.193 | 0.000 | 80.3037 | 9.65778 | 94.164 | 0.000 |
| Smoking status | 135 | 134 | 1.7333 | .44386 | | | 1.7259 | 0.44771 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 46.161 | 0.000 | - | - | - | - |
| Duration of hypertension | 135 | 134 | 10.2963 | 10.29496 | | | - | - | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 53.359 | 0.000 | 80.3037 | 9.65778 | 84.055 | 0.000 |
| Renal bipolar length (Right) | 135 | 134 | 9.4164 | .91748 | | | 9.4761 | 1.23087 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 53.255 | 0.000 | 80.3037 | 9.65778 | 84.401 | 0.000 |
| Renal bipolar length (Left) | 135 | 134 | 9.7201 | .85299 | | | 9.8364 | 0.60506 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 57.583 | 0.000 | 80.3037 | 9.65778 | 91.531 | 0.000 |
| Renal anterior-posterior diameter (Right) | 135 | 134 | 3.9376 | .66267 | | | 3.7312 | 0.65692 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 57.165 | 0.000 | 80.3037 | 9.65778 | 91.663 | 0.000 |
| Renal anterior-posterior diameter (Left) | 135 | 134 | 4.1768 | .75772 | | | 3.8270 | 0.55550 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 60.083 | 0.000 | 80.3037 | 9.65778 | 95.287 | 0.000 |
| Renal cortical thickness (Right) | 135 | 134 | .7668 | .18597 | | | 1.0220 | 0.12976 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 60.110 | 0.000 | 80.3037 | 9.65778 | 95.584 | 0.000 |
| Renal cortical thickness (Left) | 135 | 134 | .8016 | .17924 | | | 1.0649 | 0.16566 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 60.524 | 0.000 | 80.3037 | 9.65778 | 95.740 | 0.000 |
| Right renal cortical echogenecity | 135 | 134 | 1.3778 | .72139 | | | 1.0370 | 0.22551 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 60.530 | 0.000 | 80.3037 | 9.65778 | 95.740 | 0.000 |
| Left renal cortical chogenecity | 135 | 134 | 1.3778 | .71097 | | | 1.0370 | 0.22551 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 60.342 | 0.000 | 80.3037 | 9.65778 | 95.408 | 0.000 |
| Right corticomedullary differentiation | 135 | 134 | 1.1704 | .41503 | | | 1.0000 | 0.00000 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 60.346 | 0.000 | 80.3037 | 9.65778 | 95.408 | 0.000 |
| Left corticomedullary differentiation | 135 | 134 | 1.1704 | .41503 | | | 1.0000 | .00000 | | |
| LDL | 135 | 134 | 85.2889 | 16.31722 | 58.634 | 0.000 | 80.3037 | 9.65778 | 91.798 | 0.000 |
| Presence or absence of other renal pathology | 135 | 134 | 3.1852 | 1.05226 | | | 4.0000 | 0.00000 | | |

## 4. Discussion

Renal parameters might be affected by hypertension. Renal artery constriction, decreased blood flow, and eventual injury can result from persistently high blood pressure. Proteinuria, a decrease in glomerular filtration rate (GFR), and changes in electrolytic levels are all potential effects of this strain on renal parameters. Preventing kidney damage and ensuring adequate renal function requires careful management of hypertension. The results showed a statistically significant correlation between TC and various renal parameters (Table 1). Despite the fact that the left kidney is larger than the right, there were substantially different renal volume metrics between the two kidneys in the cooperation study ($p<0.01$) [9]. Researchers discovered that there was a statistically significant relationship between TAG, HDL, LDL and a variety of kidney parameters (Tables 2-4). In the group of people with normal blood pressure, the variance in the right and left renal sonographic parameters was statistically significant; however in the group of people with hypertension, this was not the case. The incidence of hypertension, which is a well-known modifiable risk factor of renal failure in recent times, as well as the absolute burden of this risk factor, is rapidly increasing all over the world, particularly in countries with low and intermediate incomes. It is possible to indirectly evaluate renal function or status using renal sonographic measures, as hypertension can indirectly affect the kidneys. When it comes to assessing the kidneys, ultrasound is a safe and low-cost option. Statistical analysis revealed a notable difference in cortical echogenicity between the hypertensives and controls; although 74.0% of hypertensives and 75.3% of controls exhibited elevated cortical echogenicity on the right and left kidneys, respectively, normotensives exhibited 28.0% and 26.0% [10]. In another study, there was also a statistically significant positive correlation between hypertension and renal echogenicity ($P = 0.006$), parenchymal thickness, and renal echogenicity ($P = 0.009$), and cortical thickness and renal echogenicity ($P = 0.008$) [11]. In our study, most of the respondents from urban area with high BMI which is similar with another study, the results showed that, whereas 52.6% of the case group lived in urban areas, 47.4% lived in rural areas. The control group consisted of 50.4% city dwellers and 49.6% country bumpkins. In this particular case group, it was discovered that 51.11 per cent of the participants had a body mass index (BMI) higher than 26, 36.26% had a BMI between 22 and 26, and 9.63 per cent had a BMI below 22. Between 84.44% and 15.56% of the individuals in the control group had a body mass index (BMI) ranging from 22 to 26 [12].

Worldwide, hypertension is acknowledged as a critical contributor to the development of cardiovascular disease, stroke, diabetes, and renal diseases [13]. Obesity, glucose intolerance, and abnormalities in lipid metabolism are among the comorbidities that around 80% of hypertension patients experience. A study conducted in northern Bangladesh compared the lipid profile status of hypertension patients to healthy normotensive controls. The results showed that all three lipids, TC, TG, and LDL, were also high in the former group [14]. There is a substantial correlation between hypertension and dyslipidemia in the Bangladeshi population, although very little research has assessed this. According to a study conducted in rural parts of Bangladesh, approximately 17% of the population has a "high" total cholesterol concentration (>240 mg/dL or >6.2 mmol/L), 2% have a "high" low-density lipoprotein concentration (≥160 mg/dL or ≥4.2 mmol/L), and 67% have a "low" HDL concentration (<40 mg/dL or <1.04 mmol/L) [15].

## 5. Conclusions

Here, the research has established baseline values for renal parenchymal volume and cortical thickness in both hypertensives and non-hypertensives. Renal characteristics including renal parenchymal volume, cortical thickness, and renal length were associated with significantly higher TC, TAG, HDL, and LDL levels. The cerebral echogenicity was noticeably greater in hypertensives as compared to normotensives. Results demonstrate that essential hypertension significantly alters both cortical thickness and cortical echogenicity. In conclusion, we advise hypertension individuals to coordinate their sonographic results and to manage and avoid the adverse effects of excessive cholesterol on their kidneys.

## ORCID

Md. Abdul Awal: 0000-0003-1863-1380

## Authors' Contribution

Taibatul Kubba, Narayan Roy, and Murshed Ali devised the concept, conducted the statistical analysis, and composed the text. Examined and revised by Tanvir Ahmed and Abdul Awal. Revised and materials provided by the teaching assistant. The final manuscript was read and approved by all writers.

## Ethics Approval and Consent to Participate

The study got ethical clearance from the Ethical Review Board from Institute of Biological Sciences (IBSc), University of Rajshahi, Bangladesh.

## Conflicts of Interest

The authors declare that they have no competing interests.

## References

[1] Stephens-Shields AJ, Spieker AJ, Anderson A, Drawz P, Fischer M, Sozio SM, Feldman H, Joffe M, Yang W, Greene T; CRIC Study Investigators. Blood pressure and the risk of chronic kidney disease progression using multistate marginal structural models in the CRIC Study. Stat Med. 2017 Nov 20; 36(26): 4167-4181.

[2] Black HR. The burden of cardiovascular disease: following the link from hypertension to myocardial infarction and heart failure. Am J Hypertens. 2003 Sep; 16 (9 Pt 2): 4S-6S.

[3] Muntner P, Carey RM, Gidding S, Jones DW, Taler SJ, Wright JT Jr, Whelton PK. Potential US Population Impact of the 2017 ACC/AHA High Blood Pressure Guideline. Circulation. 2018 Jan 9; 137(2): 109-118.

[4] El-Reshaid W, Abdul-Fattah H. Sonographic assessment of renal size in healthy adults. Med Princ Pract. 2014; 23(5): 432-6.

[5] American Institute of Ultrasound in Medicine. AIUM practice guideline for the performance of an ultrasound examination of the abdomen and/or retroperitoneum. J Ultrasound Med. 2008 Feb; 27(2): 319-26.

[6] Moghazi S, Jones E, Schroepple J, Arya K, McClellan W, Hennigar RA, O'Neill WC. Correlation of renal histopathology with sonographic findings. Kidney Int. 2005 Apr; 67(4): 1515-20.

[7] Khati NJ, Hill MC, Kimmel PL. The role of ultrasound in renal insufficiency: the essentials. Ultrasound Q. 2005 Dec; 21(4): 227-44.

[8] Lamont AC, Graebe AC, Pelmore JM, Thompson JR. Ultrasound assessment of renal cortical brightness in infants: is naked eye evaluation reliable? Invest Radiol. 1990 Mar; 25(3): 250-3.

[9] Zewdu M, Kadir E, Berhane M, Alemayehu T. Variation of Ultrasonic Renal Volume between Hypertensive and Non-Hypertensive Individuals in Relation to Body Size Parameters. Ethiop J Health Sci. 2021 Jul; 31(4): 857-866.

[10] Nwafor NN, Adeyekun AA, Adenike OA. Sonographic evaluation of renal parameters in individuals with essential hypertension and correlation with normotensives. Niger J Clin Pract. 2018 May; 21(5): 578-584.

[11] Siddappa JK, Singla S, Al Ameen M, Rakshith SC, Kumar N. Correlation of ultrasonographic parameters with serum creatinine in chronic kidney disease. J Clin Imaging Sci. 2013 Jun 30; 3: 28.

[12] Taibatul K, Tanvir A, Murshed A, Abdul A, Narayan R. Ultrasonographic Evaluation of Renal Parenchyma in Bangladesh: A Comparative Study. World Journal of Public Health. 2022; 7(4): 153-159.

[13] Saha MS, Sana NK, Shaha RK. Serum lipid profile of hypertensive patients in the northern region of Bangladesh. J Bio-Sci. 2006; 14: 93–98.

[14] Islam AK, Majumder AA. Hypertension in Bangladesh: a review. Indian Heart J. 2012; 64(3): 319–323.

[15] Mostafa Zaman M, Choudhury SR, Ahmed J, Yoshiike N, Numan SM, Sadequl Islam M, Parvin K, Hakim F. Plasma lipids in a rural population of Bangladesh. Eur J Cardiovasc Prev Rehabil. 2006 Jun; 13(3): 444-8.