

Essential Hypertension and Variations in Renal Volume in a Population of Punjab

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ABSTRACT

Objectives: In order to establish a correlation between this parameter and demographic characteristics such as age, gender, body mass index (BMI), body surface area (BSA), and length of hypertension treatment, it is necessary to measure the renal volume of adult patients who are suffering from essential hypertension.

Methods: Sonography was used to examine a total of 46 people who were participants in this prospective trial. All of these people had essential hypertension and normal renal function. Within the population of patients, there were a total of 46 people: 23 males and 23 females. In addition, as a control group, we analysed the blood pressure levels of normal adults (sixty males and sixty females) who did not have hypertension. After that, the renal volume was calculated by applying the formula $LWAP0.523$, which was derived from the length, breadth, and antero-posterior diameter of the kidney. The results of this calculation were then presented.

Results: According to the findings, the range of renal volume that was obtained was 49.52414 ± 0.01 cm³, with a mean of 109.14231 ± 32 cm³ for the left kidney. Meanwhile, the range of renal volume that was acquired for the right kidney was 42.44266 ± 61 cm³, with a mean of 101.23547 ± 23 cm³. Males had significantly greater right and left kidney volumes overall compared to females, who had smaller kidney volumes overall. In men, the volume of the right kidney was determined to be 101.4231 ± 56 cm³, whereas the volume of the left kidney was determined to be 114.2675 ± 23 cm³ (97.4545 ± 04 cm³ and 99.7414 ± 57 cm³, respectively). Although there was a significant relationship between the renal volume and both the body mass index and the body surface area, renal volume decreased with increasing age. There was no correlation found between the amount of urine produced by the kidneys and the length of time the individual had hypertension.

Conclusion: Patients suffering from hypertension, regardless of gender, have a higher amount of fluid in their left kidney compared to their right kidney. In addition, the size of the kidneys in patients who have hypertension and are female is smaller than the size of the kidneys in patients who have hypertension and are male. The researchers discovered a correlation between renal volume, body surface area, and body mass index. In addition, it has been demonstrated that the volume of both kidneys decreases with increasing age. On the other hand, there is no correlation between the size of the kidneys and the duration that hypertension continues to exist in a person's body.

keywords: Essential hypertension, renal volume, ultrasonography

INTRODUCTION

Hypertension is one of the most common non-communicable diseases in the world, particularly essential hypertension, which is a condition characterized by high blood pressure that can be brought on by a variety of various aspects of one's lifestyle. The kidney, which also plays a large role in the regulation of blood pressure, is one of the primary organs that suffers damage as a result of hypertension and is considered to be one of the most vulnerable (BP). Due to the high prevalence of hypertension in Pakistan, which is estimated to affect approximately ten percent of the country's population, it is imperative that research be conducted into the effects that hypertension has on the kidneys. A renal ultrasound scan is a straightforward method that does not require any sort of intrusive procedure in order to measure the size of the kidney while it is still inside the body. It provides a number of benefits that cannot be found in other imaging modalities. These advantages include the utilisation of radiation that is not ionising, patient preparation that is little to nonexistent, and the absence of a necessity for the injection of medicine or contrast fluid. In addition to this, it is simple to copy, even to a substantial degree, can be obtained at a low cost, and is readily available. Renal length and volume are important characteristics to take into consideration in a variety of clinical scenarios, including the evaluation and follow-up of patients who have undergone kidney transplantation, renal artery stenosis, recurrent urinary tract infection, and vesicoureteral reflux. Doppler ultrasonography scans of the renal vasculature, when conducted, can be of great assistance in the diagnosis of renovascular illness as well as renal artery stenosis. In addition to this, it is beneficial in the evaluation of intrarenal hemodynamics in a number of clinical conditions, such

as essential hypertension, acute and chronic renal failure (CRF), and other disorders as well.

When assessing the size of a kidney, the length of the kidney is the measure that can be replicated with the greatest degree of accuracy. However, because the form of the kidney can vary quite a little, renal volume is a better indicator of size than kidney length. This is because the shape of the kidney can change quite a bit. In addition, it has been established that there is a substantial association that exists between the weight of the kidneys and the volume of the kidneys.

There have only been a few of studies done on renal size in Pakistan, the most majority of which used renal length and width as the key parameters for determination. There hasn't been a lot of research done on renal volume in Pakistan, either in people who are healthy or in people who have disorders such as hypertension, diabetes mellitus, and renal sickness. Our goals were to calculate the volume of the kidneys in people with essential hypertension who did not exhibit any indications of chronic renal illness and to evaluate the degree to which age, somatic features, and the duration of hypertension were connected with that volume.

METHOD

Patients who had been determined to have essential hypertension were the subjects of a prospective ultrasonographic investigation of renal volume that was carried out in the Department of Radiology. Sonographic examinations were performed on a total of 46 adult patients who had been diagnosed with essential hypertension and who were attending the outpatient clinic of the cardiology section of the hospital. After obtaining the patients' informed agreement, the examinations were carried out. The size of the sample was decided upon after taking into consideration the

anticipated percentage of residents of Punjab who were suffering from hypertension.

During the selection procedure, a form of random sampling that was used that also took into account the genders of the patients was utilised. The total number of participants that were included in the sample were split into two groups, with each group having 23 males and 23 females represented within it. Patients who had chronic renal disease, which was defined as having a serum creatinine level that was greater than 128 mmol/l or a creatinine clearance that was lower than 100 ml/min, were not permitted to take part in the trial. Patients who had a creatinine clearance that was lower than 100 ml/min were also excluded from the study. In addition, women who were either pregnant or had given birth within the preceding year were not permitted to take part in the study. Patients who were born with congenital anomalies including an ectopic kidney or a kidney shaped like a horse shoe, as well as patients who had renal cysts, were ineligible for participation in this study. In addition, patients who had secondary causes of hypertension such as renovascular stenosis or coarctation of the aorta were excluded from the study since we did not believe that they would have a positive response to the treatment.

Sonographic tests were also carried out on a control group that consisted of forty people (twenty males and twenty females) who were healthy and did not have hypertension. These people were randomly assigned to either the experimental or the control group. These persons were recruited from among the staff of the hospital as well as members of the general public who were patients or visitors at the hospital after an advertisement had been posted on the notice board of the hospital. It was determined through monitoring of the individual in question's blood pressure that they did not have a history of hypertension; this was one of the inclusion criteria, along with the absence of chronic renal illness. Another inclusion criterion was that they did not have diabetes.

During the kidney's longitudinal scan, the superior and inferior poles were able to be detected and marked with relative ease. Using an electronic calliper, we were able to measure the largest distance that existed between the poles, which allowed us to calculate the renal length (L). A measurement of the anteroposterior diameter (AP), or thickness, was also taken during the longitudinal scan. We were able to calculate the AP diameter by finding the spot in the scan where the distance between the kidney's anterior and posterior walls was the greatest. This location

served as the midpoint. On the basis of the transverse scan, it was found that the maximal transverse diameter at the hilum is equivalent to the renal width, which is denoted by the letter "W." The centimetre was used as the unit of measurement throughout the entire process (cm). The following formula was utilised in order to ascertain the volume of each kidney: $LxWxAPx0.523$

RESULTS

We analysed the medical records of a total of 46 patients, 23 of whom were male and 23 of whom were female. The ages of the people ranged anywhere from 20 to 80 years, with 61.6 years being the average age of the people. The participants in the control group ranged in age from 20 to 80 years old, with the mean age of the group being 45 years old. There were 20 males and 20 females in the control group. Only 39 percent of the individuals in the control group fell into this age bracket, but 52 percent of the patients who had hypertension were over the age of 60. The average body mass index (BMI) of male patients was 27.983 ± 0.25 kg/m², which was a very substantial amount greater than the average BMI of female patients, which were 233.69 ± 0.23 kg/m². The change was one that may be considered statistically significant ($p < 0.01$). The mean body mass index (BMI) for girls in the control group came in at 27.564 ± 0.32 kg/m², which was a substantial amount higher than the mean BMI for males, which was 21.467 ± 0.53 kg/m². This discrepancy was noteworthy from a statistical point of view ($p < 0.01$). (Table 1). The male patients had a mean BSA that was statistically significantly higher than that of the female patients ($p < 0.01$; 7341.786 ± 0.54 m²) than that of the female patients 611.654 ± 0.78 m². This was also observed in the control group, where the mean BSA for males was significantly greater than that of females ($p < 0.01$), coming in at 631.59 ± 0.87 m² compared to 619.547 ± 0.86 m² for females. This was due to the fact that males tend to have a larger body mass index than females (Table 1).

The length of time someone has had hypertension can range anywhere from six months to forty years, with 6.6 years being the condition's usual length of time. Only 43.2% of the patients have had hypertension for more than five years, 37.8% have had it for between 1 and 5 years, and 19% have had it for fewer than 12 months. Only around half of the patients had experienced hypertension for the past five years or longer.

Table 1. Comparison of hypertension patients and healthy controls with regard to age and somatic parameter distribution patterns

Age (years)	Gender	Hypertensive patients		Control	
		BSA (m ²)	BMI (kg/m ²)	BSA (m ²)	BMI (kg/m ²)
Total	M	7341.786±0.54	27.983±0.25	631.59±0.87	27.564±0.32
	F	611.654±0.78	233.69±0.23	619.547±0.86	21.467±0.53

Table 2. Comparison between right and left renal volume in male and female hypertensive patients and controls

Age	Gender	Hypertensive patients (23 males, 23 females)		Controls (20 males, 20 females)	
		Right	Left	Right	Left
Total	M	109.0±24.32	124.6±33.41	108.4±22.1	119.4±21.58
	F	100.2±22.05	107.0±23.77	106.1±14.4	109.9±19.66

DISCUSSION

In most cases, essential hypertension contributes to the advancement of renal sickness; yet, essential hypertension has not

been found to be associated with any consistent renal abnormalities. This is despite the fact that essential hypertension is a serious problem in terms of public health.

This correspondence can be seen in a direct proportional connection. Given that the nephron is the functional unit that makes up the kidneys, it is crucial to obtain an accurate estimate of the size of the kidneys in order to determine whether or not kidney transplantation is necessary. The measurement of kidney volume with ultrasound is a straightforward process that does not involve any kind of invasive procedure. Because recent research has shown that the size of the allograft, as measured by the ratio of the kidney weight to the body weight of the donor, has a direct and positive relationship to graft survival, it is impossible to overstate how important it is to take precise measurements of the size of the kidneys. [Citation needed] The importance of this cannot be overstated. It would appear from this that the size of the allograft has a direct and beneficial relationship to the graft's chances of survival. There have been hypotheses proposed to explain the larger size of the left kidney; one of the possible explanations for this phenomenon is that the left kidney has more room for expansion because the spleen is smaller than the liver. Another hypothesis proposed to explain the larger size of the left kidney is that the spleen plays a role in the phenomenon. It is possible that an increase in blood flow in the left renal artery will result in a correspondingly greater size. This is because the left renal artery is shorter and more straight-running than the right renal artery. This is another theory that attempts to explain the phenomenon. We also show that there is a significant decrease in the size of the kidneys associated with advancing age. This was a surprising finding. The results of past investigations lend credence to this contention. The reason for this is that a person's normal kidneys develop fewer nephrons as they age. The number of nephrons that are produced by a single kidney can range anywhere from 400,000 to 1,000,000. Nephron production decreases with age because of the effects of ageing on the kidneys. Renal volume, which has been shown to be the most reliable measurement of renal size, also has a propensity to have the strongest correlation with height, weight, and BSA. This is because renal size is directly related to the amount of kidney tissue that is present. Our findings provide support for the aforementioned assertion, which is compatible with the findings that we obtained, as a strong connection between renal volume and BSA, particularly with the left kidney, was discovered by us. This finding was consistent with the findings that we obtained. In addition, it was discovered that there is a meaningful connection between renal volume and BMI. The association between the volume of the right kidney and body mass index appears to be higher, as indicated by the findings of other investigations. To calculate the length of time that our patients have had hypertension, we began the computation at the instant that hypertension was initially diagnosed in the hospital in a patient. This allowed us to determine the length of time that our patients have had hypertension. It is extremely difficult to make an accurate prognosis of how long the condition will actually continue to exist due to the disease's subtle onset, which makes it possible for it to go undiagnosed for a considerable amount of time. Because of this, it is possible for it to go untreated for a considerable amount of time. Even though the majority of patients (67, or 44.7 percent) were in the groups that have been diagnosed for more than five years, there was no significant link found between the size of the kidneys and the length of time they have had hypertension. This was the case despite the fact that the majority of patients had hypertension for more than five years. According to the research that was conducted in Turkey, the renal volume was shown to be lower in hypertension patients with CRF when compared to non-hypertensive individuals with CRF. This leads one to believe that patients with CRF who also have hypertension experience a greater reduction in renal volume than CRF patients who do not have hypertension. This is in contrast to the findings that are given here, which demonstrate that patients with CRF who do not have hypertension experience a greater reduction in renal volume. This would imply that high blood pressure has an influence on renal volume when there is substantial injury or compromise to the renal parenchyma, which is

the underlying cause of the condition. Because both their serum creatinine levels and their creatinine clearance were normal, none of the people who took part in our study had an underlying renal ailment that required therapy.

CONCLUSION

As a conclusion, given that renal volume is the most accurate evaluation of renal size, we established values of renal volume in individuals in our environment who were diagnosed with essential hypertension. These patients all had high blood pressure. In hypertensive persons, the size of the left kidney is smaller than the size of the right kidney, and the size of the left kidney continues to get smaller as the individual gets older. These are the findings of a study that was conducted. In addition, the kidneys of female patients who have hypertension tend to be smaller than the kidneys of male patients who have the condition. In this particular trial, the researchers did not identify any variations in the mean renal volume that were statistically significant between the group that had hypertension and the group that served as a control. There is a significant favourable correlation between the renal volume, the body surface area, and the body mass index. In addition, there does not appear to be a significant association between the size of the kidneys and the length of time that hypertension has been present in the body.

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