Section: Radio-Diagnosis

Research

ASSESSMENT OF EFFICIENCY OF VASCULAR COLOR DOPPLER ULTRASOUND FOR RENAL ARTERY STENOSES

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Abstract

Background: To assess efficiency of vascular color doppler ultrasound for renal artery stenoses. **Materials and Methods:** Fifty- eight suspected patients of renovascular arterial hypertension of both genders were included. In all, vascular color doppler ultrasound was planned according to the direct technique with the patients in the supine position with low-frequency curve transducers (2 to 3.5 MHz) to allow greater penetration (10-12 cm) of the ultrasound beam. **Result:** There were 30 (51.7%) males and 28 (48.3%) females. Color doppler revealed 24 were normal, 14 showed moderate stenosis, 10 were obstructed, 2 were inconclusive and 8 had hemodynamically significant stenosis The difference was significant (P< 0.05). Sensitivity of color doppler found to be 94.2%, specificity 92.3%, positive predictive value (PPD) of 88.4% and negative predictive value (NPV) of 85.1%. **Conclusion:** Color Doppler provides useful information in renal artery stenosis. Early diagnosis of renal artery stenosis may be helpful in preventing renal hypertension.

INTRODUCTION

Renal artery stenosis (RAS) is most commonly caused by either fibromuscular dysplasia or atherosclerosis, and it may occur alone in the form of isolated anatomical RAS or associated with hypertension, renal insufficiency as ischemic nephropathy or both. RAS due to atherosclerotic changes of the RAs has become a serious concern as a cause of hypertension and renal ischemia, resulting frequently in end-stage renal failure.[1-3]

Identification of patients with RAS-induced hypertension has important clinical implications because correction of RAS with angioplasty and stenting can improve blood pressure control in as many as 64% of patients with hypertension resistant to medical treatment. Also, improvement or stabilization of renal function occurs in 79% of patients in whom RAS is associated with worsening renal function. Intraarterial angiography currently is the reference standard for the diagnosis of RAS. However, the morbidity associated with this technique from bleeding, anaphylaxis, and contrast material-induced nephropathy has chiefly restricted its use for verification of RAS in patients in whom the condition is strongly assumed either on clinical grounds or because of a positive screening test result.[4,5]

Duplex sonography has several advantages such as it is widely available, non-invasive, and inexpensive. Duplex sonography, however, is not a simple test. Multiple measurements of several indexes of renal blood flow are possible. Considering this, we planned present study to assess efficiency of vascular color doppler ultrasound for renal artery stenoses.[6-10]]

MATERIALS AND METHODS

After considering the utility of the study and obtaining approval from ethical review committee of the institute, we selected fifty- eight suspected patients of renovascular arterial hypertension patients of both genders. All gave their written consent for the participation in the study.

After case history recording and careful examination of all patients, vascular color doppler ultrasound was planned according to the direct technique with the patients in the supine position with low-frequency curve transducers (2 to 3.5 MHz) to allow greater penetration (10-12 cm) of the ultrasound beam. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

RESULTS

There were 30 (51.7%) males and 28 (48.3%) females. [Table 1]

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Color doppler revealed 24 were normal, 14 showed moderate stenosis, 10 were obstructed, 2 were inconclusive and 8 had hemodynamically significant stenosis The difference was significant (P< 0.05). [Table 2, Figure 1]

Table 1: Patients distribution

Total- 58		
Gender	**Males**	**Females**
Number	30 (51.7%)	28 (48.3%)

Table 2: Assessment of outcome of color doppler

Diagnosis	**Number**	**P value**
Normal	24	0.05
Moderate stenoses	14	
Obstructed	10	
Inconclusive	2	
Hemodynamically significant stenoses	8	

Table 3: Diagnostic accuracy of color doppler

Parameters	**Percentage**
Sensitivity	94.2
Specificity	92.3
PPV	88.4
NPV	85.1

Sensitivity of color doppler found to be 94.2%, specificity 92.3%, positive predictive value (PPD) of 88.4% and negative predictive value (NPV) of 85.1%.

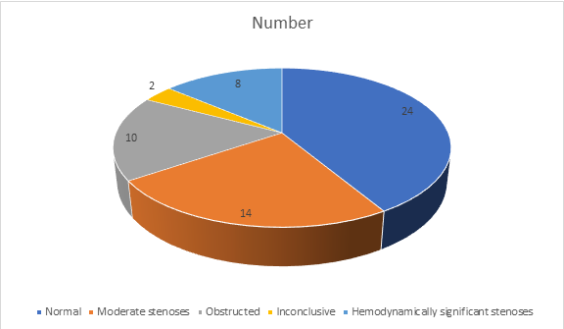

Figure 1: Assessment of outcome of color doppler

DISCUSSION

Atherosclerotic RAS is a progressive disease, particularly in patients with diabetes or other manifestations of atherosclerosis. The ideal imaging procedure for RAS should identify the main RAs as well as the accessory vessels, localize the site of stenosis or disease, provide evidence for the hemodynamic significance of the lesion and identify associated pathologies that may have an impact on the treatment of RAS. Angiography, once considered the "gold standard" for arterial imaging, is invasive, expensive and carries a small but not negligible risk of severe complications such as adverse contrast media reactions, cholesterol embolization or arterial dissection. The present study assessed efficiency of vascular color doppler ultrasound for renal artery stenoses.[11,12]

Our results showed that there were 30 (51.7%) males and 28 (48.3%) females. Hua et al used a cut-off value of 200 cm/s and RA diameter reduction of more than 60% in a series of 107 patients reaching a sensitivity of 91% and a specificity of 75%. A PSV greater than 200 cm/s has been suggested as the threshold for Doppler diagnosis of 60% reduction of the RA diameter.[13-15]

Our results showed that color doppler revealed 24 were normal, 14 showed moderate stenosis, 10 were obstructed, 2 were inconclusive and 8 had hemodynamically significant stenosis. Egglin et al7 found that of the 137 renal arteries assessed on vascular color doppler ultrasound, 43 (31.3%) were considered normal, 11 (8.1%) had moderate stenoses, 70 (51.1%) had hemodynamically significant stenoses, 7 (5.1%) were obstructed, and in 6 (4.4%) arteries the examination was inconclusive. The arteriographic findings were as follows: 50 (36.5%) renal arteries were normal, 10 (7.3%) had moderate stenoses, 67 (48.9%) had hemodynamically significant stenoses, 9 (6.6%) were occluded, and in 1 (0.7%) the examination was inconclusive.[16]

Our results showed that sensitivity of color doppler found to be 94.2%, specificity 92.3%, positive predictive value (PPD) of 88.4% and negative predictive value (NPV) of 85.1%. Soares et al reported that renal-segmental ratio (RSR), i.e. a ratio of PSV measured in the renal artery to that obtained in the segmental artery, was the best parameter (sensitivity 93.33%; specificity 89.47%). Aytac et al showed that if the diameter of a RA measured by US is 4.65 mm or less, the presence of an accessory renal artery can be established with 80% sensitivity and 80.5% specificity. If the diameter of the renal artery is 4.15 mm or smaller, the presence of an accessory renal artery is extremely probable, with 98.8% specificity. It was also interesting that in kidneys with a main RA diameter of 5.5 mm, no accessory RAs were encountered.[17]

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Missouris et al showed that renal duplex scanning using contrast enhancement produces more reproducible spectral waveforms, improves accuracy and reduces the time needed for the examination. They demonstrated a sensitivity of 85% and a specificity of 79% without contrast enhancement, and a sensitivity of 94% and a specificity of 88% with contrast enhancement, besides an important reduction in the duration of the procedure. Several epidemiologic studies have shown the elevated prevalence of ischemic nephropathy in elderly patients mainly due to atherosclerotic RAS. Over the past decade, data have accumulated implicating atherosclerotic RAS as an increasingly significant cause of end-stage renal disease (ESRD) ranging anywhere from 5% to 22% of incident ESRD patients. RAS is the most common potentially reversible and curable cause of secondary hypertension and renal failure.[18,19]

CONCLUSION

Color Doppler provides useful information in renal artery stenosis. Early diagnosis of renal artery stenosis may be helpful in preventing renal hypertension.

REFERENCES

1. Bokhari S.W., Faxon D.P. Current advances in the diagnosis and treatment of renal artery stenosis. Rev Cardiovasc Med. 2004;5:204–215.
2. Williams G.J., Macaskill P., Chan S.F. Comparative accuracy of renal duplex sonographic parameters in the diagnosis of renal artery stenosis: paired and unpaired analysis. Am J Roentgenol. 2007;188:798–811.
3. Hoffmann U., Edwards J.M., Carter S., Goldman M.L., Harley J.D., Zaccardi M.J. Role of duplex scanning for the detection of atherosclerotic renal artery disease. Kidney Int. 1991;39(6):1232–1239.
4. Bude R.O., Forauer A.R., Caoili E.M., Nghiem H.V. Is it necessary to study accessory arteries when screening the renal arteries for renovascular hypertension? Radiology. 2003;226:411–416.
5. Labropoulos N., Ayuste B., Leon L.R., Jr. Renovascular disease among patients referred for renal duplex ultrasonography. J Vasc Surg. 2007;46:731–737.
6. Chain S., Luciardi H., Feldman G., Berman S., Herrera R.N., Ochoa J. Diagnostic role of new Doppler index assessment of renal artery stenosis. Cardiovascular Ultrasound. 2006;25(4):4.
7. Strandeness DE Jr. Duplex scanning in diagnosis of renovascular hypertension. Surg Clin North Am 1990, 70: 109-17.
8. Haimovici H, Zinicola N. Experimental renal artery stenosis: diagnostic significance of arterial hemodinamics. J Cardiovasc Surg. 1962, 3: 259-62.
9. Jaarsveld BC, Pierterman H, Dijik LC, Seijen AJ, Krijinen P et al. Inter-observer variability in the angiographic assessment of renal artery stenosis. J Hyperten 1999, 17: 1731-36.
10. Sigstedt B, Lunderquist A. Complications of angiography examinations. Am J Roentegenol 1978, 130: 455-60.
11. Hessel SJ, Adams DF, Abrams HL. Complications of angiography. Radiology 1981, 138: 273-81.
12. Vaugh JR, Sacharias N. Arteriography complications in DAS era. Radiology 1992; 182: 43-4.
13. Hua H.T., Hood D.B., Jensen C.C., Hanks S.E., Weaver F.A. The use of color flow duplex scanning to detect significant renal artery stenosis. Ann Vasc Surg. 2000;14:118–124.
14. Egglin T, O'Moore PV, Feinstein AR, Waltman AC. Complications of peripheral arteriography: A new system to identify patients at increased risk. J Vasc Surg 1995, 22: 787-94.
15. Aytac S.K., Yigit H., Sancak T., Ozcan H. Correlation between the diameter of the main renal artery and the presence of an accessory renal artery. Sonographic and angiographic evaluation. J Ultrasound Med. 2003;22:433–439.
16. Missouris C.G., Allen C.M., Balen F.G., Buckenham T., Lees W.R., MacGregor G.A. Non-invasive screening for renal artery stenosis with ultrasound contrast enhancement. J Hypertens. 1996;14:519–524.
17. Desberg A, Pausther DM, Lammert GK, Hale J, Troy RB, et al. Radiology, 1990, 12: 227-36.
18. Berland LL, Koslin DB, Routh WD, Keller FS. Renal artery stenosis: prospective evaluation of diagnosis with color duplex ultrasound compared with angiography. Radiology. 1990, 174: 421-3.
19. Hansen KJ, Tribble RW, Reavis SW, Canzanello VJ, Creaven TE, et al. Renal duplex sonography: evaluation of clinical utility. J Vasc Surg. 1990, 12: 250-7.

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