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ORIGINAL ARTICLE

Sensitivity and Specificity of Color Duplex Ultrasound Measurement in the Estimation of Internal Carotid Artery Stenosis

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ABSTRACT

Background: Stroke is that the world's leading reason for death and major incapacity. Arterial sclerosis is answerable for over half-hour of all ischemic strokes. Plaque morphology has recently been discovered to assist within the prediction of arterial sclerosis clinical behavior and stroke risk.

Purpose: The goal of this study was to gauge the frequency and diagnostic exactitude of artery Doppler imaging to detect arterial blood vessel pathology.

Methods: This cross-sectional study was conducted in Combined Military Hospital, Peshawar from1st August 2019 to 31st March 2020. A total of 120 patients were randomly selected. The inclusion criteria was having ischemic cerebrovascular stroke. Doppler ultrasound was performed in every patient by a consultant radiologist. Doppler ultrasound findings were compared with Carotid artery stenosis reports.

Results: Mean age in this study was 63.07±3.76 years. Mean duration of disease was 1 year ±3.32 months. Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Doppler Ultrasound were 89.5, 76.20, 45.5, 93.88 and 76.9% respectively. The areas under the ROC curves ranged between 0.89 and 0.90 for the laboratory A device and between 0.90 and 0.92 for the laboratory B device. In laboratories A and B, the areas under the ROC curves for ICA PSV were 0.90 and 0.92, respectively. Similar effects were observed when occlusion-affected patients were omitted (0.89 to 0.91, laboratory A; 0.90 to 0.93, laboratory B). Despite the fact that the diagnostic accuracy of the two devices was equivalent, two points on the ROC curves corresponding to the same cut point were infrequently near.

Practical implication: The study compared the techniques of Doppler ultrasound for the diagnosis of carotid artery stenosis in patients and measured the best predicted percent angiographic stenosis differed between two vascular laboratories and paved the way for clinicians to focus of the diagnosis of carotid artery stenosis by DU.

Conclusion: With the advancement in technology, the accuracy of carotid artery stenosis diagnosis has significantly improved over the decades. From measuring the narrowing carotid artery diameter to evaluating the increased velocity field near the obstruction/lesion site, the identification of additional parameters to characterize plaque vulnerability has become more important in the carotid artery.

Keywords: Angiography; Carotid artery stenosis; Cerebrovascular ischemia; Doppler ultrasound sensitivity.

INTRODUCTION

Cardiovascular diseases area unit sicknesses that affect the heart, blood vessels, or both. arteria disease, arterial blood vessel carotid disease, and peripheral tube illness area unit all common CVD manifestations in clinical medication. arteria stenosis, at intervals which a coronary-artery disease plaque forms as a result of a physical or metabolic injury, may lead to a disabling stroke; thus, early detection, prevention, and treatment area unit essential. Consistent with the yank Heart Association, stroke was the second leading reason behind death worldwide in 2013 (6.5 million) [1].

Over a 5-year amount, patients with sixty % or a lot of pathology area unit expected to own a sixteen % likelihood of getting a stroke [2]. Men area unit a lot of affected than ladies by moderate/severe arterial blood vessel pathology, that will increase with age, significantly once the age of fifty [3]. The most common imaging procedure want to diagnose artery illness is Doppler ultrasound [4-6]. This system has many benefits, together with the very fact that it's a quick, noninvasive, and wide offered screening technique for artery pathology with high diagnostic accuracy. arterial blood vessel pathology may be wont to assess the severity of pathology within the arterial blood vessel [7].

Cardiovascular disease is one in each of the primary causes of death and morbidity around the world. Correct prediction of a person's risk of developing a vessel event is needed for preventive treatment of bad well people. As a result of arterial sclerosis underpins the prevalence of vessel events, develops over decades, and contains a protracted well section throughout that it's potential to alter the disease's course, higher vessel risk prediction is needed. this might be achieved by together with a live of presymptomatic arterial sclerosis in risk prediction algorithms [8-9]. In recent years, artery intima–media thickness has gotten several attentions as a predictor of vessel events. The variability in activity and thus the shortage of proof for its utility in clinical risk prediction limit the employment of CIMT in associate passing clinical surroundings, as a result of patients with sort two polygenic disease area unit at a high risk of vessel events [10, 11].

Atherosclerotic lesions in coronary arteries area unit well till they advance to the aim wherever they generate a hemodynamically substantial flow limiting lesion, resulting in heart muscle anemia symptoms. However, coagulum formation following acute rupture or erosion of non-stenotic plaques causes a giant proportion of individuals to travel from no symptoms to an infarction or death [12]. The intima-media thickness of the blood vessel is changing into a lot of wide used as a surrogate marker of early arterial sclerosis. A recent review found that CIMT could also be a powerful predictor of future tube events like MI and stroke, that it's joined to quality, age, sex, ancient and non-traditional risk factors. per bound analysis, a value of CIMT of zero.8 metric linear unit is connected with traditional healthy individuals, whereas a price of CIMT of one metric linear unit or on top of is alleged with arterial sclerosis and a greatly elevated risk of upset in individuals of any cohort [13].

As antecedently expressed, CIMT activity is associate economical noninvasive tool that will assist in distinguishing individuals with polygenic disease World Health Organization area unit at higher risk of developing small and macro tube complications, still as evaluating numerous treatment ways want to treat patients with polygenic disease, which we have a tendency to were unable to find associate native studies throughout this regard once conducting an intensive literature search. This study was provided US with native statistics regarding high CIMT in diabetic people and additionally the results of this study area unit compared

with alternative internationally offered literature to draw suggestions for future analysis and follow up patients

MATERIAL AND METHODS

This Cross-sectional validation study was conducted in Combined Hospital, Peshawar, from1st August 2019 to thirty first March 2020. A total of one hundred twenty patients were consecutively hand-picked. The inclusion criteria were all the patients having anemia neural structure, age eighteen and on top of having each gender were enclosed. All the Patients antecedently operated on for artery diseases. Those with already verified occlusion at intervals the ventricle and/or auricle. Patients with verified tumour, Patients with neural structure hemorrhages. Patients allergic to distinction agents and Patients with half-crazed nephritic operate tests were excluded from the study. Once obtaining approval from the hospital ethical committee (Ref no;CMH/Ethical/PG/123) to conduct the study, knowledge was collected of all those patients with stroke (diagnosed on clinical grounds) presenting to patient department of this hospital. associate consent was taken from the patient attendants World Health Organization full fill the inclusion criteria.

Patients on top of eighteen years were excited with careful history. Risk factors were evaluated by history, physical examination, and sonogram and laboratory investigation throughout hospitalization. This enclosed age, sex, cardiovascular disease, DM, lipoidaemia, smoking and anemia cardiovascular disease. A Mitsubishi e HD ultrasound system with 7-MHz linear-array transducers was used for the examinations. in associate passing supine position, the artery arteries were scanned with the highest slightly raised and turned to the opposite facet. Grey scale, colour, and undulation were accustomed study arteries. With associate angle of insonation however or up to sixty degrees, the Doppler undulation was obtained MDCTA of the supra-aortic vessels was performed exploitation 160-slice X-radiation (Prime Aquilion -Toshiba). associate influence gadget with a rate of flow of 4-5 mL/s associated an eighteen-gauge endovenous tube were used to inject one.2 mL/Kg of contrast medium (Omnipaque) into associate ginglymus vein. The slice distance zero.5mm and section thickness zero.5 cm could also be exaggerated up to 10mm. The data was entered and analyzed on SPSS 20. Frequency and percentages were calculated for all categorical variables like sex and presence /absence of carotid plaque. Mean + variance was calculated for continuous variables like age. All the information were presented in tables and graphs (frequency tables and bar charts). The 2×2 contingency table was used to calculate sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy. Post stratification was used through Chi- square test keeping <0.05 level of significance to compare the difference between the two groups

RESULTS

Age range is the current study was from 30-80 years with mean age of 63.07±3.76 years. Mean duration of disease was 1 Years ±3.32 months. Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Doppler Ultrasound is 89.5%, 76.20%, 45.5%, 93.88% and 76.9% respectively.

Out of 120 patients, 75 (62.5%), 22 (18.3%), and 23 (19.16%) of the sixty carotid arteries scanned by DU in laboratory A exhibited angiographic stenoses ranging from 0% to 69%, 70% to 99%, and 100%, respectively. The areas under the ROC curves for each of the five velocity parameters ranged between 0.89 and 0.90 for the laboratory A device and between 0.90 and 0.92 for the laboratory B device, depending on the velocity parameter. In laboratories A and B, the areas under the ROC curves for ICA PSV were 0.90 and 0.92, respectively. Similar effects were observed when occlusion-affected patients were omitted (0.89 to 0.91, laboratory A; 0.90 to 0.93, laboratory B). Despite the fact that the diagnostic accuracy of the two devices was equivalent, two points on the ROC curves corresponding to the same cut point were infrequently near.

Significant curvilinear relationships (either quadratic or cubic) were discovered between the proportion of angiographic stenosis and each of the five velocity parameters. The velocity characteristics ICA EDV, ICA/CCA EDV, and (ICA PSV)/(ICA PSV) varied significantly between laboratories (CCA EDV). P=.056 indicates a marginally significant difference between ICA and CCA PSV. In addition, the effect's direction was uniform across all velocity parameters. Angiographic stenosis projections for laboratory A were greater than those for laboratory B by an absolute increase of 5.1% for ICA PSV to 13.0% for ICA/CCA EDV.

The best criteria for identifying persons with 70% to 99% angiographic stenosis were based on (1) the optimization of diagnostic accuracy and (2) the minimization of the predicted 2-year risk of stroke in symptomatic patients. Laboratory B consistently exhibited higher optimum DU cutoff criteria values. The optimal ICA PSV conditions for both optimization procedures were >229 cm/s for the laboratory A device and >340 cm/s for the laboratory B device. The optimal criteria for (ICA PSV)/(CCA EDV) differed not only between laboratories, but also based on the optimization objective pursued. The diagnostic accuracy-maximizing threshold for laboratory A was a ratio >10.5, whereas the 2-year stroke risk-minimizing criterion was a ratio >5. For laboratory B, a ratio greater than 21,7 maximized diagnostic accuracy, whereas a ratio greater than 13,7 reduced the projected 2-year risk of stroke.

We used three published duplex criteria to determine 70% to 99% angiographic stenosis and found that the sensitivity and specificity estimates for the two DU machines varied considerably. The criterion discovered by Hunink et al.10 to best predict a 70% angiographic cutoff (ICA PSV >230 cm/s) produced the highest accuracy of the three criteria considered for the laboratory A device; however, applying this criterion to the laboratory B device produced the lowest accuracy of the three. Using the criteria given by Faught et al.9 (ICA PSV >130 cm/s and ICA EDV >100 cm/s), the laboratory B DU device had the highest accuracy while the laboratory A DU device had the lowest accuracy.

Table 1: Participants' baseline demographic and clinical characteristics

Age, mean (SD)	**63.07±3.76**
Gender, *n* (%)	
Male	70 (58.3%)
Female	50 (41.6%)
Co morbidities, *n* (%)	
Smoker	69 (57.5%)
IHD	90 (75%)
HTN	77 (64.1%)
AF	26 (21.6%)
DM / IGT	91 (75.8%)
Dyslipidemia	103 (85.8)
Ischemic stroke/TIA	93 (41%)

Table 2: Reliability of color Doppler Ultrasonography

Stenosis	*P value*	*Cronbach's alpha*	*Sensitivity*	*PPV*	*NPV*
Small CS	<? 0.001	0.571	89.5%	35.4%	98.0%
Large CS	0.014	0.382	83.3%	45.5%	76.9%

DISCUSSION

Atherosclerosis-related tube-shaped structure issues square measure variety one reason for morbidity and mortality in sort a pair of polygenic disease patients, notably in Asian nation, wherever the population of diabetics is speedily increasing. The diabetes accelerates hardening of the arteries, which can be a significant risk issue. The arteriosclerosis risk project claims that the arteriosclerosis method happens at the same time inside the arteries, cerebral, and coronary arteries. B mode prenatal diagnosis will assess the membrane media thickness (IMT) of the artery (CIMT) with a high degree of accuracy and consistency, providing a reliable and valid estimate of the blood vessel wall thickness [14].

The use of non-invasive B mode designation} to live arteria membrane media thickness will observe hardening of the arteries at associate degree early diagnosis stage and aid within the diagnosis of well upset, associate degreed whether or not exaggerated CIMT is joined to an exaggerated risk of arteriosclerosis events is of nice interest [15]. The use of non-invasive B mode designation} to live artery membrane media thickness will observe hardening of the arteries at associate degree early diagnosis stage and aid inside the diagnosis of well disorder, associate degreed whether or not exaggerated CIMT is joined to an exaggerated risk of arteriosclerosis events is of nice interest [15].

CIMT was well higher in men than in girls in associate degree extremely study of healthy Taiwanese individuals (0.558 vs 0.527 mm, P = 0.012). This result was replicated by Kablak-Ziembicka et al in participants while not CVD (men vs. women 1.05 vs. 0.93 mm, P0.001)92. In our investigation, CIMT was over in Taiwanese healthy individuals, however but in individuals while not CVD92 or with traditional aldohexose tolerance [16]. As a result, they underline the link between IMT and symptom and therefore the agglomeration of ancient risk variables. CCA-IMT was joined to age, high blood pressure, dyslipidemia, polygenic disease period, and smoking habits, consistent with Kawamori et al. a spread of vas risk factors are joined to IMT in epidemiological research; Temelkova Kurktschiev et al. found a link between the next variety of risk variables and a thicker intima-media thickness 17.

CONCLUSION

Mechanical advancements have greatly improved the accuracy of CAS determination over the years. The evident verification of extra metrics to identify plaque helplessness at intervals the artery channel has adult in importance, starting from assessing the decreasing artery route breadth to evaluating the inflated speed field close to the obstruction/lesion location. The use of computer-aided programs has improved the predictability, accuracy, and precision of CAS conclusions using various imaging modalities.

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