Comparison of Evaluation of Degree of Carotid Stenosis with Color Doppler Ultrasound and Seldinger Angiography

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SUMMARY
Objective: Comparison of detection and determination of critical carotid stenosis between two radiological methods: color doppler ultrasound and Seldinger angiography. Methods: This is retrospective study that has included 64 patients that were hospitalized at the Clinic for Vascular surgery, Clinical Centre of University of Sarajevo, from 2006-2008. 43 patients had carotid artery stenosis from 50-99%, all patients confirmed of having carotid stenosis greater than 60% were subjected to Seldinger angiography. Results confirming critical stenosis of both methods were compared. Degree of carotid stenosis with color doppler was determined on basis of peak systolic velocity and in the case of angiography stenosis was determined by measuring stenotic segment with millimeter tape and comparing it to diameter of normal segment. Results: according to color doppler investigation 32/43 patients had critical carotid stenosis ≥70%. In case of Seldinger angiogram ratio of positive cases was 37/43. In 86% of cases critical stenosis was confirmed by both methods. 5 angiograms showed greater degree of carotid stenosis than color doppler investigation. Out of 2 complete occlusions of internal carotid artery detected by color doppler only one was confirmed by Seldinger angiography, the other was described as stenosis of very high degree. Discussion: Compatibility of successful recognition of critical carotid stenosis for both methods is 86%, that figure does not deviate significantly from results pointed out by other studies where compatibility was reported to be 91%. Conclusion: Both methods should be combined in order to make sound indication for operative treatment since beside having segmental stenosis of carotid artery, imperative for carrying out successful operation is regular appearance of distal portion of internal carotid artery that is best visualised by one of available angiographies. Key words: Carotid stenosis, Color Doppler Ultrasound, Seldinger Angiography.

1. INTRODUCTION
Carotid artery disease is the leading cause of stroke. More than 50% of stroke patients present no warning signs. After the age of 55, the risk of stroke doubles every 10 years. Most significantly, 97% of the adult population cannot name a single warning sign of a stroke. The risk of developing carotid artery stenosis increases with high blood pressure, high blood cholesterol levels, high stress levels, diabetes mellitus, diabetes, cigarette smoking, obesity, lack of exercise, and advanced age.

Color doppler ultrasound and Seldinger angiography are used frequently to evaluate stenotic changes of carotid arteries in our set up. Both methods have their advantages and disadvantages. With color Doppler ultrasound a stenosis with a high level of risk will occasionally be incorrectly reported as a low-risk finding. Conversely, a stenosis with a low level of risk will sometimes be reported as a high level of risk. In carefully calibrated ultrasound laboratories, ultrasound studies can be up to 95 percent accurate and offer visualization of the anatomy, evaluation of the blood flow rate and turbulence, and characterization of the plaque. Performing an ultrasound study requires a great deal of skill which is not always available. On the other hand during seldinger angiography procedure, patient must remain still during this invasive procedures which is more expensive and it can carry it’s own small risk of causing stroke.

Carotid endarterectomy carried out in institutions with low incidence of perioperative morbidity and mortality is of benefit for patients who have stenosis ≥70%.

Studies published so far evaluated quality of detection and determination of stenotic carotid changes but with contradicting evidence 1.

2. AIM
Our aim is to compare the rate and quality of detection of carotid stenosis amounting to ≥70% in patients who have undergone diagnostic evaluation for carotid symptomatology with both color doppler ultrasound ang Seldinger angiogram at the Clinic for Vascular surgery Sarajevo during the period 2006-2008.

3. METHODS
This is a retrospective study. We compared the rate of detection of carotid artery stenosis ≥70% in patients who have undergone color doppler ultrasound and Seldinger angiography examination.

During the period 2006-2008, 64 diagnostic evaluations were performed for suspicion or clinical evidence of carotid artery disease.

| Table 1: Analysis of data regarding sex, number and age of patients |
|-------------|---------|----------|-----------|
| sex         | No      | Age span | (average age) |
| males       | 34      | 42-71    | 61 +/-4    |
| females     | 9       | 56-69    | 63 +/-5    |

Indications for diagnostic evaluation of carotid arteries were: routine ultrasound scan for abdominal aortic aneurysm evaluation, presence of carotid bruit during clinical examination of hos-
pitalised patients for vascular pathology other than carotid artery disease, vertigo, TIA, previous stroke, amaurosis.

All patients were examined with color doppler ultrasound. Patients that had carotid stenosis > 65% were additionally subjected to transfemoral Seldinger angiogram.

Obtained data were analysed and processed, thereafter categorised as follows: stenosis 70-99%, stenosis 50-69% and stenosis less than 50%

Stenotic changes on Seldinger angiogram were measured with milimeter tape, degree of carotid stenosis was quantified as follows:
- <50% if PSV was <150 cm/s, EDV <50 cm/s, and relation of PSV in internal carotid artery (ICA) to common carotid artery (CCA) i.e. (ICA/CCA) <1.8.
- Stenosis of 50% do 70% was diagnosed if PSV was 150 to 250 cm/s, EDV 50 to 90 cm/s, and ICA/CCA 1.8 do 2.8.
- Stenosis of 70% to 90% was confirmed if PSV was 250 to 400 cm/s, EDV - 90 to 150 cm/s, and ICA/CCA 2.8 do 5.0.
- Stenosis from 90% to 99% was confirmed if PSV >400 cm/s, EDV >150 cm/s, and ICA/CCA >5.0.

4. RESULTS

We performed paired t test and combination „AUB”method with every single diagnostic method that was used. Combination method of both diagnostic investigations with significant statistical difference detects stenosis > 70% more effectively than when stenotic changes were detected by each method separately. Combination of investigation method against Seldinger angiography revealed p=0.0416 while combination of investigation method against color Doppler ultrasound revealed p=0.0017.

Correlation between two method is not prominent, p=0.2254.

Out of 64 patients, 43 patients had stenotic changes of one or both carotid arteries at the level of carotid bifurcation extending to internal carotid artery spanning from 50-99% so additional Seldinger angiography was performed. Patients having stenosis less than 50% were discharged with adequate therapy and advised for regular follow up.

According to color doppler ultrasound 9 patients had stenotic changes of internal carotid artery or bifurcation of common carotid artery from 50-69%, 32 patients had stenotic changes from 70-99% and 2 patients were diagnosed with complete occlusion of internal carotid artery.

We compared incidence of recognition of stenosis of carotid bifurcation or internal carotid artery ≥70% with color doppler ultrasound and Seldinger angiography. Recognising above mentioned percentage of stenosis represents difference between conservative and operative treatment 2-4.

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id artery that explains why color doppler diagnosed case as occlusion while angiogram revealed stenosis of very high degree.

6. CONCLUSION

This study concludes that two methods with significant statistical difference detect stenotic changes more frequently than when compared to detection of carotid stenosis by single method separately.

Their compatibility in recognition of stenosis in 86% of cases does not greatly differ from published results. Since Seldinger angiogram gives better insight into outline of extracranial carotid vessels (information that is important for making indication or contraindication for surgical treatment) we hold that these two methods are valuable tool in evaluation of type of operation to be performed for all patients planned for surgical treatment.

Both methods should be combined in order to make sound indication for operative treatment since beside having segmental stenosis of carotid artery, imperative for carrying out successful operation is regular appearance of distal portion of internal carotid artery that is best visualised by one of available angiographies.

REFERENCES


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