

21. **Internal Carotid Stenosis B-Mode Ultrasound Gray Scale Median (GSM) Analysis: Relationship to Symptoms and Age**

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OBJECTIVE: We have previously demonstrated an inverse correlation between the GSM value of internal carotid artery (ICA) plaque echolucency and the ex vivo degree of carotid plaque structural vulnerability. We investigated the relationship between the in vivo GSM value of ICA stenoses >50% by carotid duplex ultrasound (CDU) and the presence of symptoms, demographics, and atherosclerosis risk factors to identify asymptomatic patient subsets at risk for ischemic events.

METHODS: Consecutive CDU studies of 524 carotids with hemodynamically significant ICA stenosis $\geq 50\%$ were analyzed. 85% of patients received statin therapy. Images of each ICA plaque were normalized utilizing blood (0-5) and adventitia (185-195) to determine the respective GSM value. Multivariate logistic regression was used to investigate the relationship between the GSM value and symptoms, while controlling age, sex, race, smoking, diabetes (DM), hypercholesterolemia, hypertension, and coronary artery disease. Linear regression was used to examine the association between GSM and the demographic and atherosclerosis risk factors.

RESULTS: Of 524 CDU studies with significant carotid stenosis $\geq 50\%$, 19% were excluded due to calcification. For the remaining 422 patients, 21% were symptomatic. The GSM value is significantly higher in symptomatic patients (mean 46, 95%CI: 40-52) than in asymptomatic patients (mean 59, 95% CI 55-63). The presence of symptoms is significantly associated with GSM, even after controlling for demographics and atherosclerosis risk factors ($p = 0.001$). ROC analysis shows an area under curve of 0.61 (95% CI: 0.55-0.68), with a sensitivity of 58% and a specificity of 61% for a cutoff of 45 in GSM. In asymptomatic patients, only age is significantly associated with GSM (<75 yrs old, mean GSM = 54, 95% CI 49-59; ≥ 75 yrs old, mean GSM 65, 95% CI 59-70; $p = 0.004$).

CONCLUSIONS: A GSM of 45 or lower is predictive of symptomatic plaques with reasonable accuracy. The GSM is significantly higher in asymptomatic patients 75 years or older. This is consistent with observations that plaques become more fibrocalcific with age. By inference, asymptomatic patients younger than 75 years harboring critically stenotic ICA plaques with a GSM of 45 or less are likely to be at higher risk for future ischemic events and will benefit from intervention.