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Objective

Quantitative characterization of carotid atherosclerosis and classification of plaques is crucial in the diagnosis and treatment planning. The degree of carotid stenosis is, up to now, considered one of the most important features for determining the risk of brain stroke (1). Carotid ultrasonography (US) has been shown to be a useful predictor of incident cardiovascular events (2). Magnetic resonance (MR) imaging is an alternative approach that can also be used to identify carotid plaque. Carotid MR imaging can accurately depict plaque components, such as the lipid core, and it can be used to identify and monitor vulnerable plaque (3). Only indirect evidence exists of the anatomical correlate between MR carotid imaging and B-mode ultrasound (US). Underhill, Crowe, and Mani were the first who investigate the relation between carotid MR and US and found MR measurements of the carotid artery wall to be larger than by US. The aim of this study was the evaluation of the ability of US in characterizing plaque morphology and composition compared to the analysis of the same plaque on 3T MR.

Materials

This analysis was conducted on 18 patients that presented stenosis at common (CCA), internal (ICA) and external (ECA) carotid artery between 20% and 60% with about 35% median and have all risk factors that generate the formation of atherosclerotic plaque showed an on US examination of Sovraotic Trunch (as gold standard). From each patient, a varying number of images has been taken to form the final dataset. All patients underwent to a MR examination (Fig. 1). Inclusion criteria are: patients with between 18-80; patients with stenosis carotid and informed consent.

Methods

The US data were obtained as longitudinal cross-sections using a Philips iU22 ultrasound scanner with an L9-3 probe and included B-Mode (i.e. greyscale) and Colour Doppler image sequences. Then all patients underwent to a MR examination on a 3T MR system with Sense Head coil. The same plaque was evaluated by US and MR examination, relatively to size, consistency of plaques, intima-media thickness. Continuous variables are expressed as mean±SD. Statistical significance will be defined as a value of $p < 0.05$. All statistics will be performed using R version 3.0.

Results

The subjects (11 males and 7 females, of 70.77 ± 10.48 years old) presented clinical and vascular risk factors. Two subjects that have hypochoic plaques not highlighted by MR were excluded. The difference between total diameter of US (7.58 ± 1.95) and MR (8.08 ± 2.04) was not statistically significant ($p=0.48$). The obtained results from the US showed a diameter mean reduction of 47.37% mean while the MR showed a diameter mean reduction of 48.85% (Fig. 2).

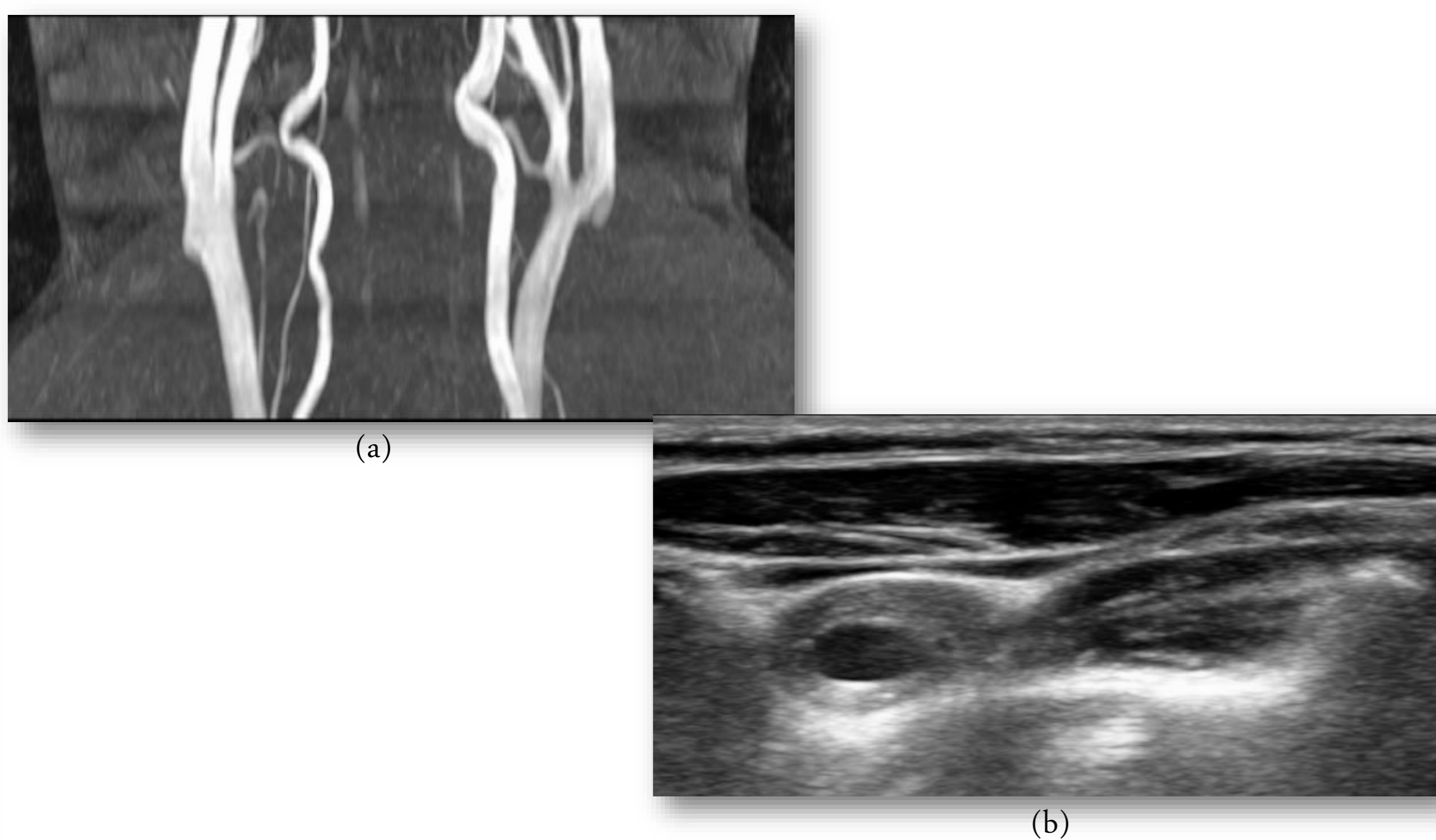


Fig. 1 Images of a patient with pathology of atherosclerotic is located in the carotid bifurcation : a) MR image; b) US image.

Discussions

Our results showed a very high comparison between US and MRI examinations. From the results obtained, there were no significant differences between the two techniques. The minimal difference is, probably, related to the fact that the US and MRI numerical data were obtained by the operator in a total manual modality.

References

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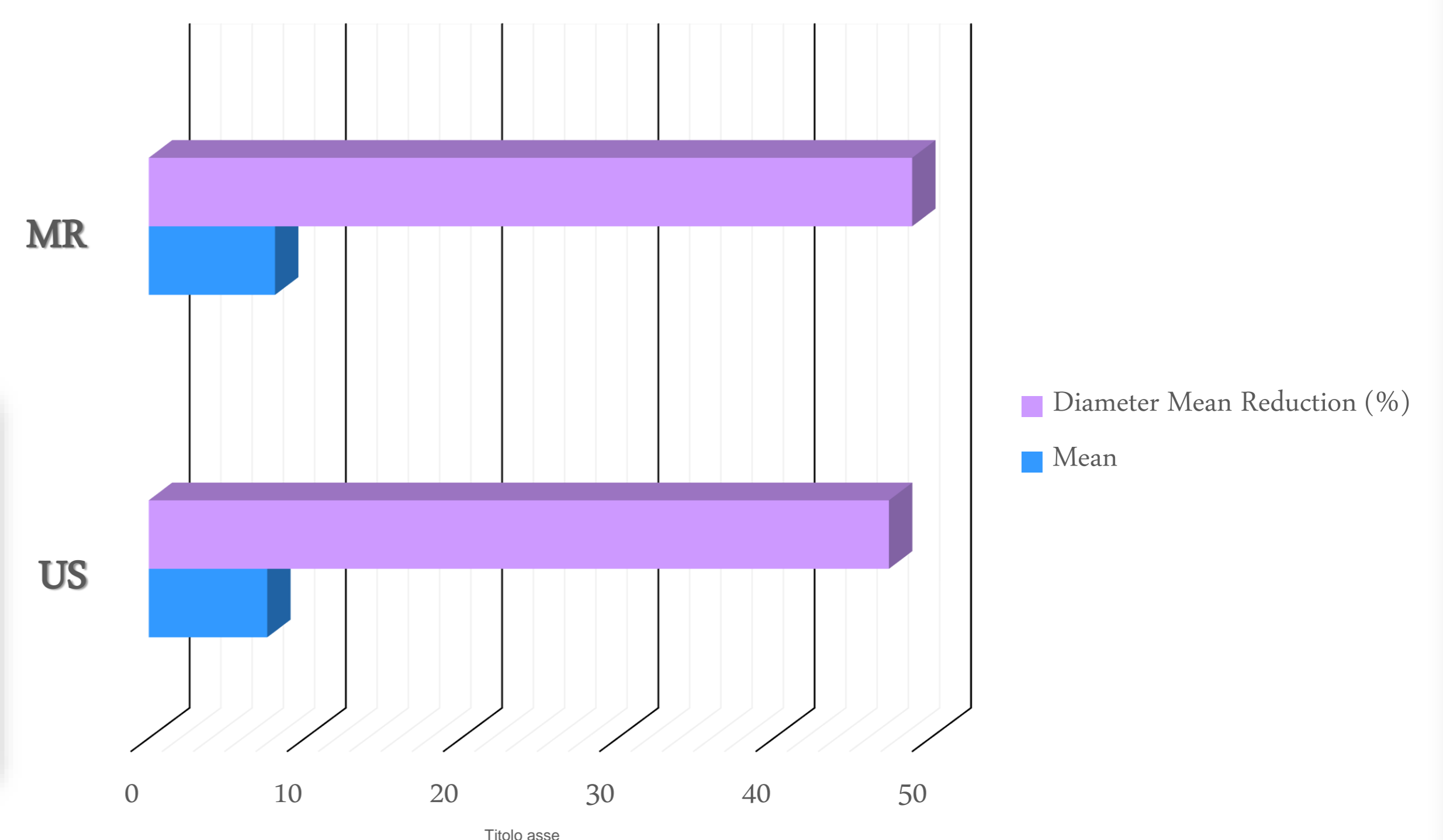


Fig. 2 The difference between total diameter of US and MR and a diameter mean reduction.

Conclusion

However, the measurement variability of the MRI was lower compared with the ultrasound technique. However, a limitation of our study is that hypochoic plaques evaluated with US methodical are difficult to detect by MRI. The obtained results could to argue that MR examination is the most promising objective method.