Liver R2* Value from Multi-echo IDEAL at 3.0 T: a Potential Biomarker for Adjusting IV Iron Dose and Anemia Management Practices on Maintenance Hemodialysis Patients

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PURPOSE: In recent times, therapy for renal anemia has changed dramatically in that intravenous (IV) iron administration has increased with lower doses of erythropoiesis-stimulating agents (ESAs). Though it is widely considered that iron overload among dialysis patients was more prevalent, there are few data on the risk of hemosiderosis in this setting [1]. Iron overload status seems difficult to be diagnosed than iron deficiency status does using biochemical methods. Although many reasons, other than true tissue iron overload, may lead to increased *serum* ferritin (SF) and transferrin saturation ratio (TSAT), no alternative biochemical parameters have been introduced to look for iron overload[2]. The aim of our work was to verify hepatic iron stores in uremic patients on dialysis as measured by liver R2* value from multi-echo iterative decomposition of water and fat with echo asymmetry and least-squares estimation (IDEAL) gradient-echo (GRE) magnetic resonance (MR) imaging.

METHODS: We measured liver R2* value on 3.0 Tesla MR scanners by means of IDEAL GRE pulse sequence [3,4], in a cohort of 20 fit hemodialysis patients receiving both parenteral iron and ESA. To estimate the hepatic R2* value, one reviewer manually performed regions-of-interest (ROIs) using 9 circles of about 4 cm^2 on 3 slices of the right lobe of the liver in the R2* images (Fig.1). The mean value of the circles presented the hepatic iron content of the patients. All patients underwent blood sampling for biochemical examination in the same month of the hepatic MRI. The values of SF and TSAT were used in this study according to previous studies. The patients were grouped in (1) normal or mild iron overload (SF < 1000 ng/ml); (2) moderate iron overload (>1000 < 2000 ng/ml); and (3) severe iron overload (>2000 ng/ml). Differences between groups were evaluated by analysis of variance (ANOVA) test.

RESULTS: Moderate to severe hepatic iron overload was observed in 15 patients (75%), of whom 67% had severe hepatic iron overload. The liver R2* values were 128±86μg/mL (group1), 464±270 μg/mL (group2), and 541±165μg/mL (group3), respectively. The TSAT values were 25.6±5.7% (group1), 32.2±20.9% (group2), and 44.4±27.9% (group3). Difference of R2* value between groups was significant in univariate analysis (P<.05), while the difference of TSAT was not (Fig.2 and Fig.3).

CONCLUSIONS: Iron overload was observed on liver R2* value from IDEAL in the majority of fit hemodialysis patients receiving both ESA and IV iron. These findings call for a revision of guidelines on actual iron therapy in this setting, notably regarding the iron dose and noninvasive methods, especially R2* IDEAL MRI, for monitoring iron stores.

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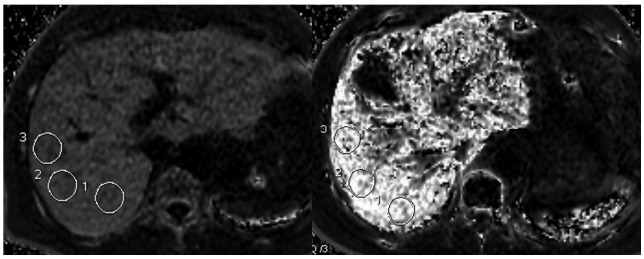

Fig.1. Representative images for mild and sever iron overload.

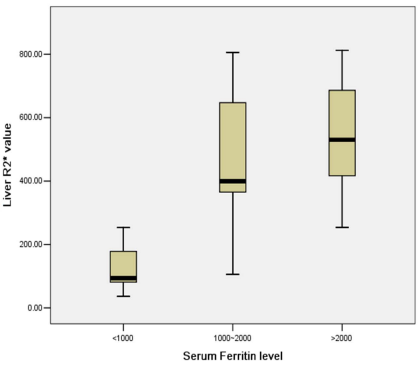

Fig.2. Boxplots for each group showing the Liver R2*value distribution

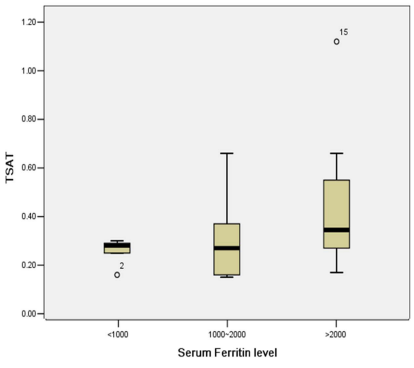

Fig.3. Boxplots for each group showing the transferrin saturation ratio (TSAT) value distribution