Normal Liver T2* Values in the Fetus

T. Kushnir[1], C. Hoffmann[1], L. Raviv-zilka[1], Y. Salem[1], E. Konen[1], and O. Goitein[1]
[1]Dept. of Diagnostic Imaging, MRI Unit, The Chaim Sheba Medical Center, Tel Hashomer, Israel

INTRODUCTION

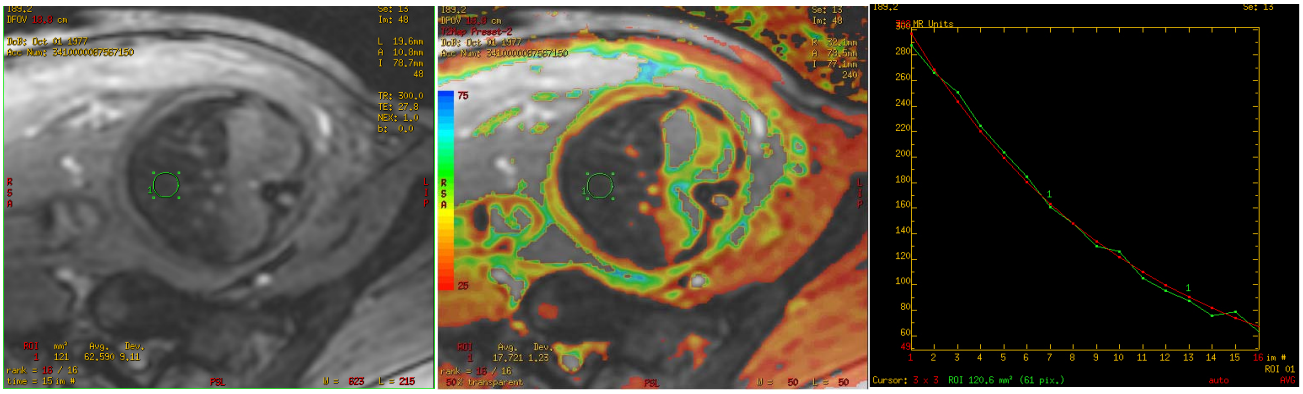
T2* multi-echo gradient echo sequence is a robust validated non-invasive method for the accurate evaluation of tissue iron [1,2]. Low T2* values serve as an early marker of iron deposition in the target organs. Neonatal haemochromatosis (NH) is a rare and often fatal disorder leading to either death in utero or acute liver failure in the neonate [3]. NH Diagnosis is frequently made at autopsy demonstrating intense liver iron deposition along with hepatocellular necrosis, and diffuse hepatic fibrosis with nodular regeneration [4]. Fetal MRI has been addressed in the literature as a modality for intrauterine NH diagnosis. The use of T2 and T2* sequences have been suggested in the literature as non invasive options for the evaluation fetal iron deposition [5]. However, a standartized scale of T2* values for fetal and neonatal iron organ overload have yet to be reported or devised.
The purpose of this stusy was to evaluate, for the first time, normal liver T2* value in the fetus, that could be used for the diagnosis of iron overloads such as in NH cases. As T2* sequnces adds only 2-4 minutes to the whole MRI scan, not exposing the mother or the fetus to ionizing radiation or the administration of contrast material, this study was performed on motheres undergoing fetal MRI for any indication.

METHODS

Subjects and methods: 14 pregnant women underwent fetal MRI. T2* sequnce was applied to the fetus abdomen. T2* values were calculated per fetus. Informed consent was obtained in all the measurements.
MRI: measurements were performed using 1.5T, GE MRI system (Signa HDx Ver 15) using a dedicated 8 channel cardiac phased-array coil. Axial sections were acquired through mid abdomen to include the fetus liver. Breath-hold multi echo gradient echo T2* sequence with: TR 300 ms, FA 30^{o}, 128X128 matrix, FOV 36 cm, SW 6 mm, 16 echos starting with TE 1.2 -1.6 ms, echo interval 1.6 ms. T2* evaluation was based on Anderson et. al (1). T2* values were sampled across regions of interest (ROI), located at areas of liver tissue that were best visualized.

RESULTS AND DISCUSSION

14 pregnant women underwent fetal MRI. Average gestational age was 31.9 ±2.3 weeks (range 28-36). To our knowledge this is the first documentation of T_2* values for fetus. Fig 1 demonstrates a typical measurement of T2* map with the sampled ROI and the resulting exponential plot. T2* for normal fetus liver at the third trimester was found to be 21.5 ± 6.3 ms (range 12.5 -30). For one fetus with NH, the measured T2* value was significantly shorter, (3 ms), compared to our measured normal values, indicating pathologic iron overload. The normal value of an adult is 33 ± 7 ms.



CONCLUSIONS

1. T2* multi-echo gradient echo sequences can be used as non invasive and reliable method for the evaluation of fetal iron deposition.
2. In this small cohort, normal liver T_2* values of fetus at the third trimester were found to be shorter than those of healthy adult subjects.

REFERENCES

1. Anderson et al, Eur Heart J 22, 2171(2001).
2. Tanner MA et al, Haematologica 91,1388 (2006)
3. Goldfischer S. et al, Hepatology (Baltimore, Md) 1, 58 (1981)
4. Knisely AS. Advances in pediatrics: 39, 383 (1992)
5. Chen Q et al Top Magn Reson Imaging 12, 67 (2001)