A T2* magnetic resonance imaging study of pancreatic iron overload in thalassemia major, thalassemia intermedia and thalasso-drepanocytosis

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Introduction

Thalassemia patients require life-long transfusion chelation to avoid premature death due to organ damage by hemosiderosis. The leading cause of death is cardiac failure, but impairment of the endocrine and exocrine function of the pancreas is a common complication in patients with thalassemia. Despite extensive research on MR imaging of hepatic and cardiac iron overload, there are still few reports on the use of MRI to study iron deposits in the pancreas of patients with β-thalassemia major, thalassemia intermedia or thalasso-drepanocytosis.

Purposes of the study

The goals of our study were:
To evaluate the feasibility of a simple procedure for T2* assessment in the pancreas;
To describe the T2* values of the pancreas in a series of 37 patients with beta-thalassemia major, beta-thalassemia intermedia or thalasso-drepanocytosis;
To explore the correlation between hepatic, myocardial and pancreatic siderosis;
To assess the relationship between pancreatic siderosis and diabetes, serum ferritin and chelation.

Materials and methods

37 consecutive patients, [14-49 years old (35±7); M : F = 16 : 21] with β-thalassemia major, thalassemia intermedia or thalasso-drepanocytosis underwent cardiac and abdominal MRI at our Institution as part of the diagnostic work-up for the estimation of hepatic and cardiac iron overload (Myocardial Iron Overload in Thalassemia project). The patients were examined using a 1.5T scanner (GE Excite). Myocardial iron overload was determined by multislice multiecho T2* technique and a segmental analysis. Cardiac gated breath hold cine b-SSFP sequence was performed and ejection fraction (EF) was analyzed using ReportCARD software (General Electric Medical Systems, Milwaukee, USA). Liver iron overload was measured by a single slice multiecho T2* technique manually drawing a ROI in the hepatic parenchyma. Pancreatic T2* measurement were performed by one radiologist (GR) who was unaware of the clinical status and of the myocardial and hepatic iron overload measurement of the patients. 3 or, at least 2 ROIs were manually drawn over pancreatic head, body and tail. For all the measurements T2* values were obtained by a dedicated software (HIPPO MIOT). A pancreatic visibility score was assessed as follows (0: no visibility; 1: poor; 2: acceptable; 3: good; 4: excellent). Regional pancreatic measurements were compared with each other in the same patient in order to assess the consistency and feasibility of the measurement. Linear regression analysis (Pearson's r) was employed to correlate regional and average global pancreatic T2* measurements were compared to myocardial global and hepatic T2*, cardiac EF, serum ferritin, diabetes and type of chelation. Statistical significance was set at 0.01.

Results

In 31/37 patients (83,8%) it was possible to draw a ROI in each pancreatic region (3 ROIs). In 6/37 patients (16,2%) it was possible to confidently draw only 2 ROIs, because of poor visualization of one of the 3 pancreatic regions. In 36 cases (97,2 %) the pancreas visualization was at least acceptable; in 15 cases (40,5%) it was excellent; only in 1 case (2,7%) it was considered poor. No statistically significant difference in the T2* value was found between the 3 (or 2) ROI drawn over the pancreatic regions in each patient (**Figure 1**).
A strong correlation (p<0,0001; r = 0,34) was found between regional and mean pancreatic T2* values and global heart T2* value (**Figure 2**); no significant correlation resulted between pancreatic T2* and cardiac systolic function (EF).
No correlation was found between pancreatic and hepatic syderosis (**Figure 3**). Significant correlation was found between mean serum ferritin and mean pancreas T2* (p = 0,005) (**Figure 4**). No correlation was found between mean and regional pancreatic T2* and type 1 diabetes. No patient had type 2 diabetes.
No correlation was found between type of chelation and regional or overall pancreatic siderosis.

Conclusions

Pancreatic T2* measurement is feasible, simple, not time-consuming and reliable procedure as part of the diagnostic work-up for the estimation of hepatic and cardiac iron overload
Pancreatic hemosiderosis does not correlate with liver hemosiderosis
There is strong correlation between hemosiderosis of the pancreas and heart.
Diabetes does not correlate as itself with a punctual assessment of pancreatic T2* and a deeper assessment of patient's clinical history and biochemical tests for sub-clinical pancreatic insufficiency are needed to clarify this relationship

FIGURES

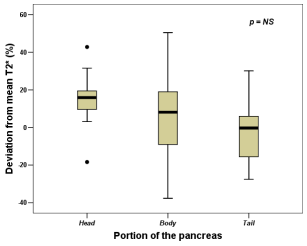

Figure 1

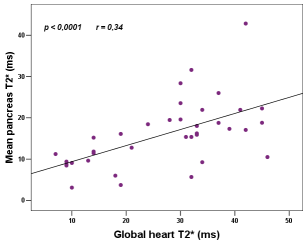

Figure 2

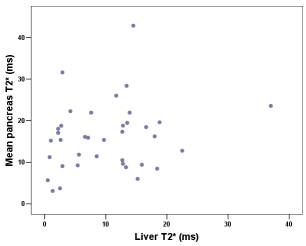

Figure 3

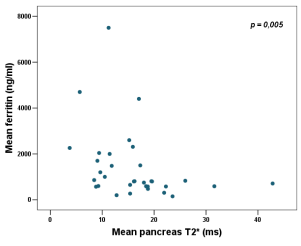

Figure 4