Association of obesity with fatty infiltration of the pancreas diagnosed at MRI

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Background: Obesity levels are rising rapidly in the United States, with an estimated 50 million Americans now having a BMI > 30. In addition to being linked to several metabolic disturbances, including insulin resistance and type 2 diabetes mellitus (DM), obesity is known to cause fat infiltration of multiple organs, including heart, kidneys, liver, and skeletal muscle. The relationship between obesity and pancreatic fat infiltration has not been well characterized. The metabolic risks of obesity are more closely correlated with a central (visceral) fat distribution than with a peripheral or subcutaneous (gluteo-femoral) distribution.

Purpose: To determine the clinical association of fatty infiltration of the pancreas, as determined at magnetic resonance imaging (MRI), with indices of obesity such as BMI, central fat distribution, and peripheral fat distribution.

Materials and Methods: In this IRB-approved retrospective study, all patients undergoing abdominal MRI from January to March 2009 were included. From our primary patient cohort, patients with either diagnosis or history of pancreatic disease, pancreatic surgery, or hemochromatosis were excluded. 45 patients constituted our final study cohort; 23 females (51.1%) and 22 males (48.9%), with median age was 54.6 years (range 22 - 81 yrs). MR imaging was performed at 1.5 T. Axial T1 dual echo in and out of phase images were evaluated by an experienced observer blinded to the clinical information. Signal loss on out of phase images was considered diagnostic of fatty infiltration of the pancreas. Using commercially available image analysis software program (slice-O-matic version 4.2, Tomovision, Montreal, CA), another blinded observer calculated both the peripheral and central fat volumes (cm^3) for all patients utilizing axial T1 weighted images and segmentation algorithm. Fat volumes were calculated for three consecutive slices, beginning at the level of the upper pole of the right kidney. Mean representative values for peripheral and central fat were obtained as the average of the 3 measures for each patient. Patients with and without pancreatic fatty infiltration were compared with respect to demographic and clinical features including: age, BMI, central and peripheral fat volumes, and the presence or absence of type 2 DM.

	Fatty pancreas	Non-fatty pancreas	P value
BMI kg/m^2	29.2 ± 5.1	24.7 ± 3.5	0.0017
Mean Central (visceral) fat volume cm^3	122.5 ± 57.5	57.6 ± 47.4	0.0002
Mean Peripheral (SQ) fat volume cm^3	178.2 ± 76	122.7 ± 62.3	0.012

Results: 15 of the 45 patients (33%) had pancreatic fat infiltration. Patients with fatty pancreas were significantly older (p= 0.003) with mean age of 62.4 years (range 50-81 years) compared to patients without pancreatic fat infiltration who had mean age of 50.7 years (range 22-75 years). BMI, central fat volume, and peripheral fat volumes (measured on representative slices at mid abdomen) were significantly higher in patients with fatty pancreas when compared to patient without pancreatic fatty infiltration (Table). One patient in both groups had type 2 DM.
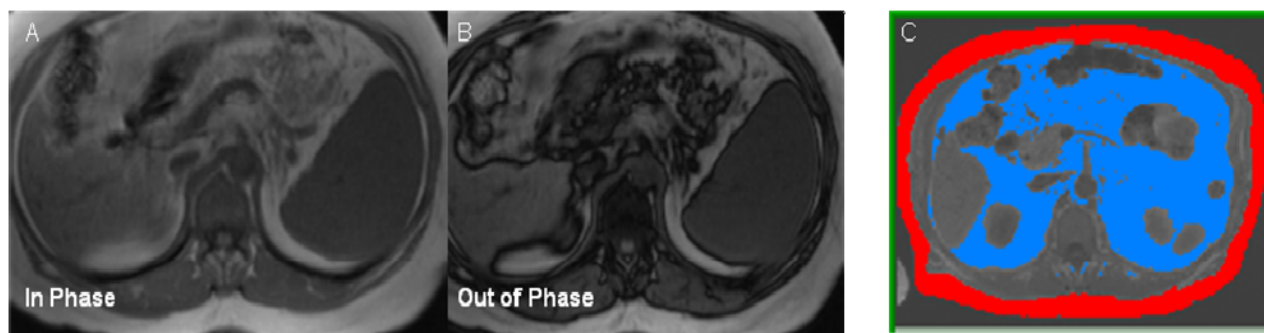

Figure: 60 year old male with pancreatic fatty infiltration as demonstrated on opposed phase image (A&B). C. Visceral (blue) and subcutaneous(red) fat distribution in the same patient on a representative axial slice.

Conclusion: Our results suggest that pancreatic fatty infiltration is significantly associated with older age and indices of obesity including BMI, central, and peripheral fat volumes. This study is not large enough to detect an association between pancreatic fat infiltrations and type 2 DM, but this remains a work in progress. Other researchers have postulated that pancreatic fat infiltration and the concomitant β-cell lipotoxicity may play an important role in the generation of type 2 DM. Demonstrating a correlation between pancreatic steatosis and obesity may contribute in elucidating the link between obesity and metabolic disturbances.

References:
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