Original Article

Do Non-Alcoholic Fatty Disease of Liver and Pancreas Have Same Implications / Significance in Type 2 Diabetes and Obesity?

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ABSTRACT

Objective: To check whether Non-Alcoholic Fatty Disease of Liver and Pancreas have same implications / significance in Type 2 Diabetes and Obesity?

Study Design: Observational / cross section study

Place and Duration of Study: This study was conducted at the Department of Medicine,.Rai Medical College, Sargodha from April to December 2021.

Materials and Methods: This study was carried out on the patients presenting in medical College, from 40 to 70 years of age, both genders. Obesity was assessed by the simplest and most practiced parameter of obesity as "Looking Obese" or having a "sacking or protuberant tummy". Type 2 Diabetes Mellitus (T2DM) was confirmed on the basis of available blood sugar and HbA1c record. After applying inclusion (obesity and T2DM) and exclusion criteria, volunteering participants were asked to get an abdominal ultrasound (USG) examination for grading of Hepatic Parenchymal Echogenicity (HPE) Grades (G1-G3) in NAFDL and to measure Pancreatic Parenchymal Echogenicity (PPE), Grades (G0-G3) in NAFDP through the same acoustic window.

Results: 490 females and 217 males who volunteered to participate were included in this study. There were 315 females exhibiting G1 HPE, out of these 27% had G0 NAFDP, 9% had G1 NAFDP, 60% had G2 NAFDP and 4% had G3 NAFDP. There were 175 females exhibiting G2 HPE, out of these 36% had G0 NAFDP, 24% had G1 NAFDP, 32% had G2 NAFDP and8% had G3 NAFDP. No female had G3 HPE. Out of a total of 217 males, there were 119 males exhibiting G1 HPE, out of these 71% had G0 NAFDP, 18% had G1 NAFDP, 12% had G2 NAFDP and none had G3 NAFDP. There were 98 males exhibiting G2 HPE, out of these 50% had G0 NAFDP, 14% had G NAFDP, 29% had G2 NAFDP and 7% had G3 NAFDP. No male had G3 HPE.

Conclusion: USG is most cost-effective due to its wide availability, reliability in diagnosing and reproducibility in following changes both for better or worse, being cheap and non-invasive nature makes it ideal for early diagnosis of HPE in NAFDL and NAFDP. Early detection of HPE changes and sensitization to its future implication as a risk factor for metabolic syndrome (mainly diabetes and obesity), CLD and even HCC among both medical community and general public must be the priority in our professional circles. It shall be highlighted in all clinical conferences because early interventions in terms of lifestyle modifications targeted to not only weight reduction but more importantly weight maintenance have a great potential for reversal of all these changes.

Key Words: Obesity, T2DM, NAFDL, NAFDP, CLD

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INTRODUCTION

Obesity and DM are projected to be the future epidemics consuming a heavy chunk of resources, we are among the top 10.[1] NASH and NAFDL are well related with MS. The pancreatic steatosis and its relationship with obesity and IR is only recently coming to limelight. Obesity or more precisely VAT, NAFDL and FP or more specifically NAFDP are interrelated and are significant mechanism underlying IR characteristic of MS. Literature shows prevalence of FP between 44% and 58% in obese adolescent and adults based on HPE changes on USG.[2-5]

We wanted to study these changes in our local population to highlight the issue and to sensitize both medical community and the general population so that

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early diagnosis and lifestyle modifications can be recommended. Early detection of HPE changes and sensitization to its future implication as a risk factor for metabolic syndrome (mainly diabetes and obesity), CLD and even HCC among both medical community and general public must be the priority in our professional circles.

MATERIALS AND METHODS

DM, Obesity and BMI were defined as per American Diabetes Association (ADA) and World Health Organization.[6-7]

After securing informed consent, basic Bio Data and confirmation of the DM and obesity, B-Mode abdominal USG examination was done to assess HPE Grade (1-3) in NAFDL and to measure PPE Grade (0-3) in NAFDP through the same acoustic window as per standard.[8-10]

Inclusion criteria:

- 10-70 years age, both sexes,
- T2 DM as defined,
- Obesity as BMI above 30

Exclusion Criteria:

- IDDM
- Seriously sick patient or terminally ill patient.
- Untreated Chronic HBV and HCV disease
- Established cirrhosis of liver
- Alcohol use in last 3 months
- Any other cause of hepatomegaly or CLD
- Pregnancy and lactation
- Ascites of any etiology
- Major end organ disease of liver, kidney, heart, lungs
- Active steroid use in last 6 months
- Hypothyroidism

Sample Size and Sampling Technique: A minimum sample size of 285 patients was calculated to maintain a 5 percent margin of error, a 95 percent confidence interval and a 75 percent response distribution, using a Raosoft sample size calculator.

Statistical Analysis: Data analysis was conducted using Microsoft Excel version 2016 and Statistical Package for Social Sciences software version 25. Descriptive statistics (i.e. frequency distribution, percentages, mean and standard deviations) were the primary analytical methods.

RESULTS

490 females and 217 males were included in this study.

There were 315 females exhibiting G1 hepatic parenchymal changes (HPE), out of these 27% had G0 NAFDP, 9% had G1 NAFDP, 60% had G2 NAFDP and 4% had G3 NAFDP.

There were 175 females exhibiting G2 HPE, out of these 36% had G0 NAFDP, 24% had G1 NAFDP, 32% had G2 NAFDP and8% had G3 NAFDP. No female had G3 HPE. In G1 group of HPE changes 26% females and 70% males did not exhibit any change in PPE. Only 8% of females and 17% of males exhibited G1 PPE changes. 60% of females and 11% of females exhibited G2 PPE changes while only 4% females exhibited G3 PPE changes.

Table No.1: Hepatic parenchymal echogenicity grades and pancreatic parenchymal echogenicity grades of fatty changes (NAFDP) on abdominal USG in females (N 490)

Liver Fat Grade	Total Females (490)	Pancreatic Parenchymalse Echogenecity Grades of Fatty Changes (PPE)			
		Grade 0	Grade 1	Grade 2	Grade 3
Grade 1	315	26.67% (SD: ±3.71, Mean: 78.75)	8.89% (SD: ±35.89, Mean: 78.75)	60.00% (SD: ±77.96, Mean: 78.75)	4.44% (SD: ± 45.79, Mean: 78.75)
Grade 2	175	36.00% (SD: ±13.61, Mean: 43.75)	24.00% (SD: ±1.24, Mean: 43.75)	32.00% (SD: ±8.66, Mean: 43.75)	8.00% (SD: ± 21.04, Mean: 43.75)
Grade 3	0	0 (SD: ± 0.00, Mean: 0.00)	0 (SD: ± 0.00, Mean: 0.00)	0 (SD: ± 0.00, Mean: 0.00)	0 (SD: ± 0.00, Mean: 0.00)

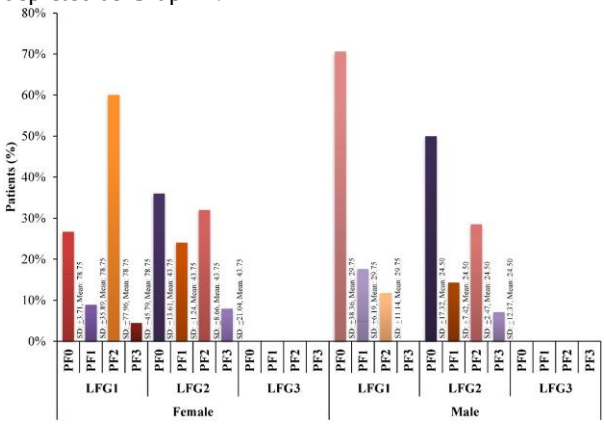
Table No.2: Hepatic parenchymal grades and pancreatic parenchymalse grades of fatty changes (NAFDP) on abdominal USG in males (N 217)

Liver Fat Grade	Total Males (217)	Pancreatic Parenchymalse Echogenecity Grades of Fatty Changes (PPE)			
		Grade 0	Grade 1	Grade 2	Grade 3
Grade 1	119	70.59% (SD: ±38.36, Mean: 29.75)	17.65% (SD: ±6.19, Mean: 29.75)	11.76% (SD: ± 11.14, Mean: 29.75)	0 (SD: ± 0.00, Mean: 0.00)
Grade 2	98	50.00% (SD: ±17.32, Mean: 24.50)	14.29% (SD: ±7.42, Mean: 24.50)	28.57% (SD: ± 2.47, Mean: 24.50)	7.14% (SD: ± 12.37, Mean: 24.50)
Grade 3	0	0	0	0	0

		(SD: ± 0.00, Mean: 0.00)	(SD: ± 0.00, Mean: 0.00)	(SD: ± 0.00, Mean: 0.00)	(SD: ± 0.00, Mean: 0.00)

In G2 HPE group 36% females and 50% males did not exhibit any change in PPE. 24% of females and 14% of males exhibited G1 PPE changes. 32% of females and 28% of males exhibited G2 PPE changes. 8% females and 7% of males exhibited G3 PPE. None of our patient had G3 HPE changes.

Out of a total of 217 males, there were 119 males exhibiting G1HPE, out of these 71% had G0 PPE of NAFDP, 18% had G1 NAFDP, 12% had G2 NAFDP and none had G3 NAFDP. There were 98 males exhibiting G2 HPE, out of these 50% had G0 NAFDP, 14% had G NAFDP, 29% had G2 NAFDP and 7% had G3 NAFDP. No male had G3 HPE. Same is graphically depicted as Graph 1.



Graph No.1: Male female percentage

DISCUSSION

Excess fat deposition was first noticed in autopsies and then it was related with fibrosis and metabolic consequences.[11,12]

Pancreatic steatosis has been defined as nonalcoholic fatty pancreatic disease (NAFPD) due to its close association with NAFDL. It has also been associated with higher risk of post- pancreatoduodenoctomy surgery fistula, severe acute pancreatitis leading to multi-organ failure, mitochondrial fatty acid beta-oxidation linked with carcinogenesis in animal studies and with pancreatic ductal adenocarcinoma in a clinical studies. Both FP or NAFPD and NAFDL have similar risk and association with Obesity, MS and IR.[9]

The excess fat in both organs interfere with cellular functions to induce proinflammatory condition resulting in type II diabetes mellitus (DM), increased cardiovascular disease (CVD) risk and Chronic Liver Disease (CLD).[13]

NAFLD and type 2 DM share multiple metabolic derangements linked with IR. Same is the case with NAFPD, Both prediabetes and DM are much more common in NASH with NAFPD than without it. Waist circumference was consistently found to be higher in patients with NASH + NAFDP.[14]

The relationship of NAFDP with IR becomes even stronger across the board from childhood to pre-adolescent, adolescent and adult obesity, NAFDP is now considered to be an independent predictor of MS, BMI, fasting plasma glucose and total cholesterol being the strongest predictors.[15,16]

DM patients have smaller pancreatic volume reflecting reduced reservoir of beta Islets cell replaced by higher proportion of pancreatic fat.[17]

Chemical shift encoded MRI (CSE-MRI) is an excellent quantitative method to calculate fat in the body. It is robust, accurate, reproducible, vendor and operator independent method that is able to quantify body, pancreatic and hepatic fat content. Very limited studies have examined the relationship among fatty pancreas, other ectopic fat deposition areas in the abdomen and the risk of developing metabolic syndrome and insulin resistance in adolescents using magnetic resonance imaging. Most of the available studies used Ultrasound.[18]

NAFDP is following same trajectory as NAFDL, from an incidental or benign finding on USG to an imaging biomarker of metabolic abnormalities characteristic of MS necessitating early interventional on priority. Targeting obesity shall have a ripple effect on organ fat, notably liver and pancreas. "Screening" by USG is recommended once the waist circumference and BMI cross the normal range. Total cholesterol and plasma fasting glucose shall be part of the same screening. Both NAFDL and NAFDP can be assessed during the same scanning session.[19]

After reviewing the literature and interpreting this study, it is very clear that HPE changes in the NAFLD is not only a simple reflexion of excess fat deposition like in other tissues like subcutaneous tissue and around the abdominal viscera. Though the pattern is not linear from G1 to G3 for HPE changes and there is no clear-cut relationship emerging between HPE and PPE grades from this study, it is very clear that echo-changes do occur in both liver and pancreas. Multiple hormonal and genetic/ epigenetic factors are known to play their role in a complex manner in Obesity and DM. This can reasonably explain this absence of linear trends and can be the subject of future studies. USG is most cost-effective due to its wide availability, reliability in diagnosing and reproducibility in following changes both for better or worse, being cheap and non-invasive nature makes it ideal for early diagnosis of HPE in NAFDL and NAFDP. Early detection of HPE changes and sensitization to its future implication as a risk factor for CLD and even HCC among both medical community and general public must be the priority in our professional circles. It shall be highlighted in all clinical conferences because early interventions in terms of lifestyle modifications targeted to not only weight reduction but more importantly weight maintenance have a great potential for reversal of all these changes.

CONCLUSION

USG is most cost-effective due to its wide availability, reliability in diagnosing and reproducibility in

following changes both for better or worse, being cheap and non-invasive nature makes it ideal for early diagnosis of HPE in NAFDL and NAFDP. Early detection of HPE changes and sensitization to its future implication as a risk factor for metabolic syndrome (mainly diabetes and obesity), CLD and even HCC among both medical community and general public must be the priority in our professional circles. It shall be highlighted in all clinical conferences because early interventions in terms of lifestyle modifications targeted to not only weight reduction but more importantly weight maintenance have a great potential for reversal of all these changes.

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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