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Review Article

Pancreatic Size, An Objective Evidence for Diagnosing the Type of Diabetes

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Abstract

In emerging countries like India, still, the diagnosis of diabetes mellitus is done on the bases of patient's age due to financial problems, unavailability of instruments, techniques and high cost of diagnostic tests which is not affordable by poor and normal people. Some modem tests include the GAD Antibodies test and the C-peptide test which are used in the diagnosis of type I and type 2 diabetes mellitus. This article shows the findings and Imaging techniques that can be done to identify the type of diabetes mellitus based on the size, echotexture, volume and weight of the pancreas. This imaging is cost-effective and can be afforded by all types of people.

Keywords: *Imagining Study; Diabetes Diagnosis; Type I Diabetes; Type 2 Diabetes; Pancreas Size*

Abbreviations

GAD: Glutamic Acid Decarboxylase; LADA: Latent Autoimmune Diabetes of Adulthood; T1DM: Type 1 Diabetes; T2DM: Type 2 Diabetes; CT: Computed Tomography; US: Ultrasound; MRI: Magnetic Resonance Imaging

Introduction

The pancreas is the major organ that plays a key role in diabetes mellitus. It is a progressive disease which is characterized by chronic hyperglycemia [1] in the conditions of insulin resistance [2] or beta-cell dysfunction [3]. Beta-cell damage is secondary to cell death which leads to a depletion in beta cell mass [4,5]. Post-mortem studies have manifested reduced pancreas size in both type 1 [6] and type 2 diabetic subjects [7].

Insulin deficit and chronic inflammation corresponding with insulitis [8,9] may explain the depletion in pancreas size in type 1 diabetes (T1DM), whereas arterial sclerosis might play a role in type 2 diabetes (T2DM) [10,11]. Even though, the depletion in pancreatic size may also be the source, and not a repercussion of diabetes [12,13].

GAD antibodies test (A Glutamic Acid Decarboxylase Autoantibodies test) is used to find out if someone has either Latent Autoimmune Diabetes of Adulthood (LADA) or type 1 diabetes. A C-peptide test is a blood test that is carried out to find out how much insulin the body is producing. This may be useful for determining type I or type 2 diabetes or whether insulin resistance.

Imaging studies

Imaging studies are likely to produce dependable information regarding pancreas size. Some imaging studies using computed tomography (CT), ultrasound (US), and magnetic resonance imaging (MRI) to assess pancreas size in diabetes have shown decreased pancreatic size in persons with diabetes when compared to controls [19-21], no variations were seen in others [22,23].

CT and MRI are mostly used to estimate liver steatosis [14,15], which is closely associated with obesity and diabetes [15]. Newly, imaging protocols have to build an accurate non-invasive estimation of pancreatic fat content in humans [16,17]. Excess ectopic fat storage has been linked to insulin resistance [15] and pancreatic fat content has been negatively associated with insulin secretion [18].

Findings based on performed studies

- **Study 1:** Implemented on 57 patients in which 14 with Type I (insulin-dependent) diabetes, 10 insulin-tested and 33 tablet-treated patients with Type 2 (non-insulin-dependent) diabetes. and 19 non-diabetic subjects. The pancreas of patients with Type 1 diabetes was evidently reduced than the pancreas in non-diabetic subjects. The pancreas of Type 2 diabetes patients was more reasonable in size: larger than that of Type I diabetic patients but smaller than the pancreas of the control group. Pancreatic size of patients with Type 2 diabetes was also associated to basal insulin secretion with insulin-deficient patients (low or undetectable C-peptide) having smaller pancreases than those with standard insulin secretion. There was no alteration in the size of the pancreas in the different treatment groups of Type 2 diabetic patients. Pancreatic size did not correlate with age, body mass index or the extent of diabetes [19].

- **Study 2:** Seventeen studies with 3,403 subjects (284 T1DM patients, 1,139 T2DM patients, and 1.980 control subjects) were carefully chosen for meta-analyses. Pancreas area, diameter, density, volume, and fat percentage were evaluated. Pancreatic volume was reduced in type 1 and type 2 vs. controls. Fat content was higher in T2DM vs. controls [24].

- **Study 3:** Sixty adult diabetic patients were examined: 22 had insulin-dependent diabetes (group I) and 19 non-insulin dependent diabetes (group 2) and 19 were non-ketotic patients who had to be given insulin for the season of insufficiency of diabetic control with oral hypoglycaemic agents (group 3). Nineteen healthy controls were also considered.

  The controls and patients were scanned in the morning after an overnight fast. Scans were done with the patients standing and upright. A more complete and clearer visualization of the pancreas was accomplished by scanning with the patient erect. The area medial to the superior mesenteric vein (Head) and the body of the pancreas were measured separately since these were often visualized to the best advantage in different views. As the head is often oriented in the longitudinal plane parallel to the inferior vena cava, measurements were made in this plane below the portal vein as well as in the transverse or oblique plane (taking the midpoint of the confluence of the superior mesenteric and splenic veins as the marker point). In normal subjects, the longitudinal section of the head was frequently larger than the transverse sections. This did not occur in any of the diabetic patients. The tail of the pancreas was well seen as it passed anterior to the left kidney, but the more distal portion extending into the splenic hilum (which represents a very small part of the pancreatic mass) was not often seen. The scans were recorded on photographic paper. The outline of the pancreas was plotted out and the areas were computed using a Numonics Graphic Analyzer. Both the head and the body of the pancreas in patients of group 1 and 2 were noticeably smaller than in the controls. The head and body of the pancreas in patients of group 2 were significantly larger than in group 1. In group 3 the sizes of the body and head of the pancreas were intermediate between those in groups 1 and 2. There was no correlation between the size of the pancreas and body weight or duration of diabetes [25].

- **Study 4:** Type 1 Diabetes mellitus the volume and fat portion of the pancreases of 22 children with Type 1 diabetes and 29 controls were determined using MRI in which Pancreas volume was 27% reduced in children with diabetes than in controls. Pancreas volume correlated positively with age in controls, but not in children with diabetes [26].

- **Study 5:** Noted that relative pancreatic weight allows for examination of pancreatic weight differences between study subject groups regardless of differences in age, ethnicity or body weight. In donors with type 1 diabetes, relative pancreatic weight was only 55% that of donors without diabetes [13].

Discussion

Some of the studies revealed that type 1 diabetes were more observed in younger age below 20 [28] and the percentage of type 2 diabetic cases were increased even more over the age of 28, and no type 2 diabetic patients developed diabetes under the age of 9 [29].

The normal size of pancreas is found to be up to 3.0 cm for the head, 2.5 cm for the neck and body and 2.0 cm for the tail [27]. But there is alteration in the size of the pancreas in patients with diabetes, declined in type 1 and increased in type 2. Hence this can be an imaging evidence to detect the type of diabetes.

Conclusion

A decline in the pancreatic size and weight in type 1 diabetic patients was observed, whereas in patients with type 2 diabetes mellitus the pancreas is accustom in size with higher fat content around the pancreas. Hence, differential diagnosis of diabetes mellitus may be carried out by imaging techniques as objective evidence and not only by age criteria.

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