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Original Article

Ultrasonographic alterations of pancreas in diabetic patients

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Abstract

BACKGROUND: Pancreas as the insulin-producing gland is subjected to destruction and change in the diabetes-producing process. Real-time sonography can assess the gland in 95% of cases and its accuracy in diagnosis of pancreatic disease matches that of CT-scan. The purpose of this study was to evaluate pancreatic diameter and echogenicity by sonography and to examine the correlation of these two factors with duration of disease in diabetes types I and II in comparison with controls.

METHODS: In two groups of 60 diabetic patients and healthy controls, diameter and echogenicity of pancreas was determined.

RESULTS: Diameter of pancreas was significantly different in diabetic patients and correlated with duration of disease.

CONCLUSIONS: In type I diabetes, decrease in the size of pancreas was more prevalent than in type II diabetes and these changes become more prominent over time.

KEY WORDS: Diabetes mellitus, sonography, pancreas.

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Diabetes mellitus (DM) comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. The worldwide prevalence of DM has risen dramatically over the past two decades [1]. Now the prevalence of DM is more than 2 million in Iran [2]. There are two types of DM: type I which is an autoimmune disorder with infiltration of inflammatory cells in Islets of Langerhans and distraction of pancreatic beta cells [3] and type II which is characterized with disturbance in insulin secretion, peripheral resistance to insulin and overproduction of glucose by liver [4]. Pancreas as the insulin-producing gland is changed and destroyed in the process that leads to diabetes. Pancreatic markers in type I diabetic patients are infiltration of inflammatory cells in islets showing chronic inflammation and production of new beta cells. Otherwise, morphologic study of pancreas in type I DM shows significant decrease in total island mass which can be due to atrophy or decrease in growth of pancreas as the disease progresses [5]. Also in type two DM, disturbance in Insulin secretion is due to decrease in beta cell mass [6]. According to the Butler study, elevated apoptosis of beta cells leads to disturbance in insulin secretion in these patients [7].

Up to now, the main methods for evaluation of DM have been different laboratory tests, and radiology to study the complications of disease in other organs. Nevertheless, sonography, as a non-invasive method has an effective role in the evaluation of normal pancreas and different disorders of this gland. Real-time sonography in 95% of cases can assess the

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gland [8] and its accuracy in diagnosis of pancreatic disease is equivalent to that of CT-scan [9]. Given its reasonable accuracy, cost effectiveness and lack of side effects, many authors introduce this technique as the primary method of assessment of probable pancreatic disease [10]. Ultrasonographic findings of pancreas were controversial in previous studies [11-13] so considering the changes in pancreas in DM and the advantages of sonography compared to invasive and expensive methods, as well as its probable efficacy in predicting disease severity, this study was performed to evaluate the diameter and echogenicity of pancreas by sonography and examine the relationship of these factors with duration of disease in three groups of diabetic patients type I, II, and healthy controls.

Methods

This case-control study was conducted on 60 patients with DM (type I and II) presenting to Alzahra and Kashani Hospitals. The subjects' disease status was confirmed based on history and laboratory findings. Subjects with other chronic diseases including cirrhosis, thalassemia, pancreatitis, pancreatic tumors or cystic fibrosis were excluded. An equal-sized control group was chosen from among healthy individuals presenting to the said hospitals. The control group was matched with the case group in terms of age and sex. To examine the pancreas, the patients had to be in fasting state during the night before the test. Pancreas head and body diameter was measured by 3.5 MHZ curve transducer. The echogenicity of pancreas was compared to that of liver (as a reference). One-way ANOVA test and Student's T-test were used to compare the size of head and body of pancreas and pancreas echogenicity in different groups. Pearson correlation was used to evaluate the relationship of these two variables with the duration of disease.

Results

A statistically significant difference in mean pancreas head anterior-posterior diameter was observed between case (all diabetic patients) and control groups (P = 0.001). Likewise, comparing mean pancreatic body size of diabetic patients group (type I and II) to that of control group demonstrated a significant difference (P = 0.001). Mean pancreatic head and body size were 17.2 ± 2.8 mm and 7.9 ± 1.6 mm, respectively, in insulin-dependent diabetic patients, whereas these measurements were 20.9 ± 3.6 mm and 9.4 ± 2.1 mm, respectively, in non-insulin dependent diabetic patients, and 24.2 ± 4 mm and 13.5 ± 2.1 mm, respectively, in the control group. There was a statistically significant difference among the three groups (P<0.001).

A direct correlation was observed between the pancreas head and body size (r = 0.69, P<0.001). An inverse correlation was observed between the size of pancreas head and duration of disease (r = -0.45, P<0.001). Likewise, an inverse correlation was seen between the size of pancreas body and duration of disease. Pancreas head and body size were different among the three groups. Of the three groups, the control group had the largest, and type I diabetic patients had the smallest pancreas head and body size. No significant difference in pancreas echogenicity was observed among the three groups.

Discussion

Like other investigations in this area, anterior-posterior diameter of head and body of pancreas had significantly diminished in the diabetic group compared with healthy controls [14,15]. A study on autopsy samples by Foulis et al demonstrated that in type I diabetic patients, regardless of whether or not greater than 23 percent of island cells are affected by insulitis (inflammatory cell infiltration), significant decreases occur in the size and weight of pancreas [11]; other studies have suggested lack of the trophic effect of insulin as the cause [15]. Our results showed that the mean diameters of head and body of pancreas in patients with types I and II DM were significantly different from healthy controls; type I diabetic patient had the smallest and healthy controls had the largest mean values. In the study of Goda et al

and also Alzaid et al, diameters of pancreas were greatly lower in type I DM than in type II and both were significantly lower than in the normal group [12,15]. According to the results of our study and other mentioned articles, we conclude that ultrasonography can be a suitable technique for distinguishing two types of DM; for functional uses, however, more comparative evaluation of the two groups is necessary. Unlike type II diabetic patients, pancreatic head diameter in type I diabetic patients was less than 15 mm.

In this study, there was a direct correlation between head and body of pancreas; also an inverse correlation was seen between these two diameters and duration of disease. A study performed by Altobelli demonstrated that longer duration of disease is accomplished by greater decrease in pancreatic size [13], but the study of Foulis did not confirm this [11]; echogenicity of the pancreas was significantly different, but Walls study showed that increased echogenicity of the gland is greater in type II DM than in type I of the disease [9]. For careful investigation of this theory, studies with greater sample size are needed.

In view of the varying results of previous works, this study attempted to evaluate ultrasonographic changes of pancreas in diabetic patients and compare them with other results. In type I diabetes, decrease in the size of pancreas was more prevalent than in type II diabetes and these changes become more prominent over time.

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