Research Article

Study of prevalence and clinical presentation of fibrocalculous pancreatic diabetes in and around Jabalpur (Madhya Pradesh), Central India

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Abstract

Background: Fibrocalculous pancreatic diabetes (FCPD) is an uncommon form of diabetes secondary to nonalcoholic chronic calcific pancreatitis of uncertain etiology predominantly found in tropical regions of the world, characterized by abdominal pain and pancreatic calcification. The term "Fibrocalculous Pancreatic Diabetes" was introduced by the World Health Organization Report in 1985.

Objective: To study prevalence and clinical presentation of FCPD in and around Jabalpur (Madhya Pradesh) Central India.

Materials and Methods: A total of 891 cases of diabetes mellitus came from in and around Jabalpur and were presented at the OPD of Department of Medicine, Sukh-Sagar Medical College and Hospital between December 2014 and April 2016 and they were included in the study with informed consent. Subjects were put to detailed history, clinical, and laboratory workup including body mass index, blood sugar level (fasting, postprandial), HbA1c, USG, and plain X-ray abdomen and defined criteria were used for diagnosis of FCPD.

Result: Of the total enrolled cases of 891, 94.05% of cases of T2DM, 5.61% of cases of T1DM, and only 0.34% of cases of FCPD were found. All 100% of cases of FCPD belonged to 35–45 years of age group, low socioeconomical status, and consumed high percentage of carbohydrates as a main source of diet. Abdominal pain was one of the main complaints found in all three patients of FCPD whereas two (66.6%) cases whose plain X-ray abdomen revealed pancreatic calcification were chronic alcoholic. When we investigated further, we found that all the three cases of FCPD had the highest basal, postprandial blood glucose levels, as well as poor glycemic control (HbA1c>7), and mainly (66.6%) responded to insulin therapy.

Conclusion: The prevalence rate of FCPD was found to be 0.34% in and around Jabalpur (Central India) that is lower than Southern India's prevalence rate, probably on account of the economic development, difference in dietary habits, and better levels of malnutrition. Even though the etiology remains unknown more studies need to be conducted to understand the exact nature of the pancreatic pathology in FCPD, what triggers it and if, and how, the process can be arrested, before the development of diabetes.

KEY WORDS: Fibrocalculous pancreatic diabetes (FCPD), secondary diabetes, chronic pancreatitis, tropical chronic (calcific) pancreatitis

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Introduction

Fibrocalculous pancreatic diabetes (FCPD) is an uncommon form of diabetes secondary to nonalcoholic chronic calcific pancreatitis of uncertain etiology predominantly found in tropical regions of the world, characterized by abdominal pain and pancreatic calcification. In India, the frequency of FCPD is higher in the South than the North. Several terms

had been earlier proposed for this syndrome including tropical calcific pancreatitis, tropical chronic pancreatitis, tropical pancreatic diabetes, nutritional pancreatitis, endemic pancreatic syndrome, and so on. The term "fibrocalculous pancreatic diabetes" was introduced by the World Health Organization Report.[1] The term "tropical chronic (calcific) pancreatitis (TCP)" is used to describe the patients with this condition before the onset of diabetes.[2] The cardinal triad of FCPD is abdominal pain, pancreatic calculi, and diabetes. Patients with FCPD present with several distinct clinical features. Patients were invariably poor and presented with extreme emaciation, protein energy malnutrition, bilateral parotid enlargement, distension of the abdomen, and rarely, a cyanotic hue of the lips. Recently, there appeared to be a change in the clinical features of patients with FCPD because of improved nutritional status. Although the etiology of FCPD is still unclear, the role of micronutrient deficiency merits further study. The first report of pancreatic pathology leading to diabetes was published more than 200 years ago by Cawley[3] who described the presence of pancreatic calcification in a patient with diabetes. After that various reports from Indonesia (Zuidema),[4] tropical Africa (Nigeria, Uganda, Zambia),[5,6] South America (Brazil),[7] and Asia (Bangladesh and Sri Lanka, India)[8–11] have suggested that certain type of diabetes may originated from generalized damage to both exocrine portion of pancreas and islets of Langerhans, moreover that this may be a unique form of secondary or pancreatic diabetes in these tropical zone. Our present knowledge suggested that there is not only wide variation in incidence and presentation between European, North American, USA, and South African countries but also a difference in the incidence and presentation between South and North Indian states, which may be due to nutritional and environmental factors. Madhya Pradesh, being the central state of our country, had a variation in environmental and nutritional factors along with inhabitants of different race, cast, and religions. It was thus thought worthwhile to elucidate the incidence and clinical profile of FCPD.

Materials and Methods

This study was conducted in Department of Medicine, Sukh-Sagar Medical College and Hospital (SSMCH), Mukanwara Jabalpur (Madhya Pradesh, India). A total of 891 cases of diabetes mellitus who were from in and around Jabalpur and who attended the OPD of Department of Medicine, SSMCH between December 2014 and April 2016 took part in the study with informed consent. Subjects were put to detailed history, clinical, and laboratory workup including base metabolic index, blood sugar level (fasting, postprandial), HbA1c, USG abdomen, and plain X-ray Abdomen. The cases which were lost during follow-up or could not be fully investigated were excluded from the study. The standard criteria were used for diagnosis of FCPD.[12]

Exocrine ("Tubeless" tests) and endocrine (measurement of c-peptide) pancreatic function could not be assessed because of unavailability and high cost of tests.

Statistical Analysis

Statistical analysis was carried out using SPSS software, version 20.0 (SPSS, Inc., USA). The chi-squared test and independent sample *t*-test were used to compare categorical and continuous variables, respectively. Data were presented as mean ± standard deviation or proportion as appropriate. The *p*-value less than 0.05 was considered to be significant.

Result

The total number of patients with diabetes enrolled in the study was 891, of these 838 cases were of type 2 DM of which 478 were men and 360 were women, 50 cases were of type 1 DM of which 28 were men and 22 were women, and only 3 cases were of FCPD of which 2 were men and 1 a woman.

Table 2 shows increase in FCPD in the third and fourth decade of life ($p < 0.001$). Two cases whose plain X-ray abdomen revealed pancreatic calcification were due to chronic alcoholism and whether calcification of pancreas was a result of chronic alcoholism or was due to some other factor could not be proved conclusively.

Social and economic class of the subjects studied revealed that 100% of the patients with FCPD belonged to low social and economic status (total family income = Rs.1,001 to 2,000 per month), and 33.3% of the subjects with FCPD consumed 1,500 calories/day whereas 66.6% used to take 1,501–2,000

Table 1: Total diabetic patients attended OPD of Sukh-Sagar Medical College and Hospital Jabalpur

Type of diabetes	Male patients	Female patients	Total patients	% of patients
T2DM	478	360	838	94.05
T1DM	28	22	50	5.61
FCPD	2	1	3	0.34
Total	508	383	891	100

FCPD, fibrocalculous pancreatic diabetes; OPD; T1DM; T2DM.

Table 2: The age of onset of diabetes mellitus (years) and prevalence of alcoholism in different groups

Age (years)	T2DM	T1DM	FCPD
Less than 15	0	06	0
16–25	16	37	0
26–35	122	07	0
36–45	266	0	03
46 and above	434	0	0
History of alcoholism			
Moderate drinker	190	0	1
Abstainers	210	0	1
No information	438	50	1

FCPD, fibrocalculous pancreatic diabetes; T1DM; T2DM.

calories/day. Most of the subjects with FCPD consumed high percentage of carbohydrates and moderate to low quantities of fat and proteins as a source of caloric intake per day. $p < 0.001$ and *p*-values preferable suggest significance.

In this study, we found that FCPD had the highest basal and postprandial blood glucose levels. Most of our series cases fell in uncontrolled group. In both the subjects with FCPD, HbA1c was found to be >7%.

$p < 0.001$ and p-values preferable suggest significance. Two of the FCPD cases were insulin dependent, although only one case responded to oral therapy.

Discussion

T2DM and T1DM are the two major entities of the diabetic syndrome. There are certain types of diabetes, which do not fit into either of these categories. In tropical countries, diabetes associated with malnutrition, such as J type diabetes and tropical pancreatic diabetes and FCPD have been described, and by this study, we were trying to know the prevalence and clinical presentation of FCPD in and around Jabalpur, Central India.Total enrolled cases were 891, of these 94.05% of the cases were of T2DM, 5.61% of the cases were of T1DM, and only 0.34% of the cases were of FCPD. All (100%) cases of FCPD belonged to 35–45 years of age group, low socioeconomical status, and consumed high percentage of carbohydrates as a main source of diet. Abdominal pain was one of the main complaints found in all three patients with FCPD. Although two (66.6%) cases whose plain X-ray abdomen revealed pancreatic calcification were chronic alcoholic, when we investigated further, we found that all the three cases of FCPD had the highest basal, postprandial blood glucose levels, as well as poor glycemic control (HbA1c>7), and mainly 66.6% of them responded to insulin therapy.

Age and Sex

This study was conducted on the entire group with diabetes irrespective of age and sex and it was noticed that FCPD was found in the age group of 35–45 years and calcification was present in men whereas the solitary case of pseudopancreatic cyst was a woman, but no valid conclusion could be drawn. It is likely that condition is more common in men than in women as noted in some previous studies also.[4–6]

Table 3: Economical status and caloric intake per day of patients of different groups

Income in rupees (PM)	T2DM	T1DM	FCPD
Less than Rs.1,000	414	42	—
Rs.1,001–Rs.2,000	288	06	03
Rs.2,001–Rs.3,000	34	02	—
Rs.3,001 to above	42	—	—
Calories/day			
1500	298	12	01
1501–2000	500	38	02
2001–2500	38	—	—
2500 and above	2	—	—
Carbohydrates			
0–50%	78	08	—
51%–60%	740	39	—
60%–75%	20	03	03
Fat			
0–20%	120	—	02
21%–30%	704	33	01
More than 30%	12	11	—
Proteins			
0–10%	178	13	02
10–20%	636	37	01
More than 20%	24	—	—

FCPD, fibrocalculous pancreatic diabetes; PM; T1DM; T2DM.

Table 4: Blood sugar level, glycemic control, and mode of therapy in patients of different groups

Fasting blood sugar	T2DM	T1DM	FCPD
Less than 120 mg%	312	—	—
120–140 mg%	168	12	—
141–160 mg%	76	08	01
161–180 mg%	60	24	—
181–200 mg%	64	02	—
Above 200 mg%	158	04	02
Blood sugar (PP)			
Less than 150 mg%	86	—	—
151–200 mg%	230	—	—
201–240 mg%	194	26	01
241–280 mg%	108	—	—
281–320 mg%	92	14	—
231 mg% and above	128	10	02
HbA1C%			
Less than 7%	202	04	01
7% and above	636	46	02
Mode of therapy in patients of different groups			
Diet	296	—	01
OHA + Diet	480	—	—
Insulin	40	50	02
OHA + Insulin	22	—	—

FCPD, fibrocalculous pancreatic diabetes; HbA1C%; OHA; PP; T1DM; T2DM.

Nutritional Factors

The mean body mass index (BMI) was found to be normal in both men and women but the female cases of FCPD had low BMI when compared with same age and sex. So like other studies by Mohan et al.[12] and Sathiaraj et al.,[14] our study also found that malnutrition is not the primary cause of FCPD, although it may well be a promoting factor.

Prevalence of Alcoholism in Different Group of Diabetes Mellitus

In our series of FCPD, two cases whose plain X-ray abdomen revealed pancreatic calculi were the ones who had chronic alcoholism and whether the calcification of pancreas was as result of chronic alcoholism or some other factor could not be proved conclusively. Howard[15] stated that pancreatic calculi were sequelae of alcoholic pancreatis. Alcoholism is also an important cause of chronic calcific pancreatitis in USA, South Africa, France, Australia, and some part of Europe.

Geographic Variations

In India, FCPD disease is most prevalent in the states of Kerala, Tamil Nadu, Telangana, Karnataka, and Orissa. Some correlation has been shown between the consumption of Cassava (Tapioca) and the occurrence of FCPD in Kerala (South India).[16] Although in our study, the disease is relatively rare (0.34%), and all patients were from central India where they do not eat Cassava; thus, the causative factor whether environmental or dietary cannot be ruled out.

Blood Sugar Level

In our study, we found that all the cases of FCPD had the highest basal, postprandial blood glucose levels, as well as poor glycemic control (HbA1c>7).but the reason behind this cannot be found.

Clinical Features

Clinical features of the patients with FCPD in Kerala, Tamil Nadu, Western Countries, and present study have shown subtle differences in several ways. All of these differences are summarized in the form of Table 5.

Mode of Management and Ketone Resistance

It was our observation that patients with FCPD required large dose of insulin for stabilization of the diabetes. One of our patients was still on diet and oral hypoglycemic drug; however, none of them developed ketosis. Earlier studies to explain the ketosis resistance in MRDM has suggested a number of mechanisms such as low adipose tissue mass and delayed mobilization of free fatty acids from adipose tissue.[18,19] Recent studies have offered other explanations. In one study, it was shown that although the plasma glucagon levels in patients with IDDM rose after administration of oral glucose, in patients with malnutrition diabetes (PDDM variety) there was a paradoxical fall in the glucagon levels.[20] Thus, low glucagon levels were suggested as one of the mechanisms for the resistance to ketosis.

Conclusion

FCPD is a rare form of secondary diabetes that remains confined to tropical parts of Asia, Africa, and South America. The prevalence rate of FCPD was 0.34% in and around Jabalpur (Central India), which was lower than the prevalence rate found in Southern India, probably on account of economic development, difference in dietary habits, and better levels of malnutrition, even though the etiology remains unknown. Also, the management of diabetes in these patients remains challenging, in spite of the vast strides made in the treatment

Table 5: Clinical presentations of FCPD in different studies

Criteria	Western countries[4–6]	Kerala[10]	Madras[17]	Present study
Age of cases >30 years	Most of >30	90%	100%	100%
Sex–M:F	03:1	02:1	03:1	02:1
Nutritional status	Good	90% Undernourished	80 % Undernourished	66% Undernourished
Socioeconomical status	Good	Poor	Poor	Poor
Abdominal pain	93%	70%–95%	90%	100%
Steatorrhea	30%	Not recorded	Not recorded	Not recorded
Alcoholism	70%–90%	20%	Not recorded	66%
Pancreatic calcification	25%–35%	60%–95%	13%	66%
Diabetes mellitus	11.8%–50%	90%	90%	100%
Insulin requirement	10–50 unit/day	40–60 unit/day	60–100 unit/day	>60 unit/day

FCPD, fibrocalculous pancreatic diabetes.

of hyperglycemia over the past few years. More studies need to be conducted to understand the exact nature of the pancreatic pathology in FCPD, what triggers it and if, and how, the process can be arrested, before the development of diabetes.

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