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Prevalence of Gall Bladder Disorders in Diabetic & Non-Diabetic Patients.

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Abstract:
Introduction: Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels. Individuals with type-2 diabetes mellitus are reported to have a 2 to 3-fold increase in the incidence of cholesterol gallstones. Hence the study is undertaken to determine prevalence of gall bladder disorders in diabetic patients and association of different parameters which affect them.
Material & Methods: This was a hospital based case-control study carried out during the period of October 2010 to October 2012. Institutional ethics committee approved the study.The study comprised of known or newly diagnosed 101 patients of type-2 diabetes mellitus and 101 age and sex matched controls.
Observation & Results: In this study out of 101 cases gallbladder disorders were found in 36 (35.64%) cases. Out of these 26 (25.74%) had gallstones, 9(8.91%) had biliary sludge, 1(0.99%) had cholecystitis. Out of 101 controls gallbladder disorder was found in 9 controls. Out of these 6 (5.94%) had gallstones and 3 (2.97%) had biliary sludge. The mean fasting gallbladder volume in cases was 24.20±2.73 cc and in controls it was 18.96±1.98 cc. The difference in mean fasting gallbladder volume in cases and controls was statistically significant ($p<0.05$). The mean postmeal gallbladder volume in cases was 12.50±2.2 cc and in controls it was 7.68±1.70 cc, the difference was statistically significant ($p<0.05$). Also the mean gallbladder motility in cases was 48.53±5.66% and in controls it was 59.73±6.41%, the difference was statistically significant ($p<0.05$).
Conclusion: Present study concluded that gall bladder disease is significantly more prevalent among type-2 diabetics compared to controls. Large, poorly contracting gall bladders are frequent among the type-2 diabetics, regardless of the presence or absence of symptoms of gall-bladder disease. Type-2 diabetic patients with gallbladder disorders are significantly older. Prevalence of gallbladder disorders is significantly more in type-2 diabetic females than in type-2 diabetic males.
Keywords: Gallbladder Disorders, Type-2 diabetic.

Introduction:

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels [1]. Various studies point towards the increased prevalence of gall bladder diseases like gall stones in diabetics. This has been attributed to cholecystomegaly & impaired gall bladder contraction, mainly due to autonomic neuropathy seen in diabetics [2].

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Ultrasonography is simple to use and does not require any radiation. Important advantages of the sonographic method over scintigraphy are that sonography (1) accurately discriminates the presence or absence of gallstones and (2) determines fasting and residual postprandial gallbladder volume as well as fractional gallbladder emptying. Although scintigraphy yields superb curves for gallbladder emptying, this method does not provide any information about gallbladder volume [3]. Therefore ultrasonography was chosen as the modality to assess gall bladder volume, as it is safe, inexpensive, less time consuming, and accurate [4].

In the Western world, the prevalence of cholelithiasis is increases with aging and approximates 30% at 70 years of age [2]. Duration of diabetes mellitus is positively correlated to prevalence of gallbladder disease, the type of therapy has no association and the fasting plasma glucose concentration is inversely associated with gallbladder disease [5].

Since the asymptomatic period of hyperglycemia, is on an average of 5 to 7 years, many individuals tend to have complications of diabetes microvascular or macrovascular at the time of diagnosis itself. Among various microvascular complications like retinopathy, nephropathy and neuropathy, autonomic neuropathy although a well recognized complication, has been given less attention. In autonomic neuropathy involvement of both parasympathetic and sympathetic chains leads to various manifestations involving various organs in the body, autonomic manifestations in the gastrointestinal tract includes gastropathies, nocturnal diarrhea, esophageal dysmotility, constipation and gallbladder dysfunction, being consequence of vagal neuropathy leading to reduced gastrointestinal motility.

Individuals with type-2 diabetes mellitus are reported to have a 2 to 3-fold increase in the incidence of cholesterol gallstones. Studies have shown a higher prevalence of gallstone disease in patients with type-2 diabetes mellitus and that type-2 diabetes mellitus is an independent predictor for increased gallbladder volume.

Hence the study is undertaken to determine prevalence of gall bladder disorders in diabetic patients and association of different parameters which affect them.

Aims and Objectives:

- To study prevalence of clinical features of gall-bladder disorders in type-2 diabetes mellitus.
- To study the prevalence of gall-bladder disorders in type-2 diabetes mellitus with ultrasonography.
- To study the association of patient factors such as age, sex, weight, presence of metabolic syndrome and duration of diabetes with gall-bladder disorders in type-2 diabetic patients.

Materials and Methods:

This was a hospital based case-control study carried out during the period of October 2010 to October 2012. Institutional ethics committee approved the study.

The study comprised of known or newly diagnosed 101 patients of type-2 diabetes mellitus, above age of 12 years, attending Medicine OPD or admitted in medicine wards at our hospital and 101 age and sex matched controls, taken from patients coming to Medicine OPD for minor complaints, who were unrelated to diabetic patients and without history/diagnosis of diabetes.

A detailed clinical history was recorded regarding symptoms related to diabetes and symptoms related to gallbladder disorder and autonomic neuropathy (biliary colic, fever, jaundice, flatulence, postmeal epigastric fullness, postural dizziness, constipation, nocturnal diarrhea and gustatory sweating).

Past history of jaundice, fever, abdominal pain, duration of diabetes was recorded. Treatment history of diabetes and family history of diabetes was recorded. Complete clinical examination was done for all consenting subjects including detailed general examination,

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abdominal examination, respiratory system, cardiovascular system, central nervous system. . Body weight, height, body mass index, waist circumference and hip circumference were recorded. Waist- hip ratio was calculated. Cardiovascular autonomic function tests were performed and findings were recorded.

Hematological investigations were carried out including complete blood count, peripheral smear. Biochemical investigations including ,fasting and 2 hour postprandial plasma glucose levels, glycated hemoglobin (HbA_{1C}), liver function test, lipid profile, serum creatinine, urine albumin were performed.

All the findings were recorded in prescribed proforma. Once basic examination and blood tests were over subjects were taken for ultrasound of abdomen.

Study design: Case Control Study at a Tertiary Care Teaching Institute.

Study Setting – Medicine OPD and Medicine wards Under Department of Medicine.

Inclusion criteria for cases:

Known and newly diagnosed cases of type-2 diabetes mellitus (ADA criteria) more than 12 years of age.

Diabetic patients giving informed consent.

Exclusion criteria for cases:.

- Sickle cell disease and other chronic hemolytic disorders.
- Patients having complications of diabetes like diabetic ketoacidosis, hyperglycemic hyperosmolar state.
- Patients having acute myocardial infarction, unstable angina & acute cerebrovascular accidents.
- Previously or recently diagnosed congenital and anatomical anomalies and abnormalities of biliary system.
- Refusal to give informed consent.

Inclusion Criteria For Controls:

Age group (± 5yrs) and sex matched healthy controls randomly selected from:-

Healthy attendants and other healthy staff of hospital.

Healthy subjects who visit the medicine OPD for minor complaints.

Exclusion Criteria for Controls:

- Any evidence of diabetes mellitus.
- Previously or recently diagnosed congenital and anatomical anomalies and abnormalities of biliary system.
- Subjects with hemolytic disorders.
- Those who do not give informed consent.

Cases of type-2 diabetes mellitus attending medicine OPD and/or admitted in medicine wards who meet the above eligibility criteria were enrolled in the study. Written and informed consents of subjects were taken.

Detailed history about general health, symptoms of gallbladder disorders and autonomic neuropathy was obtained through an interviewer administered questionnaire. Past history about biliary colic, fever, jaundice, duration of diabetes, treatment history of diabetes and family history was recorded. Personal history regarding smoking, alcohol consumption, bowel and bladder habits and drug intake was recorded.

Detailed general and systemic examination including per abdominal respiratory, cardiovascular examination was done. Anthropometric measurements and cardiovascular autonomic function test findings were recorded.

Investigations like fasting and postmeal blood sugar, glycated hemoglobin, Complete Blood Count, Liver function test, lipid profile, urine albumin were done. All the selected subjects underwent ultrasonography of abdomen with special interest for gallbladder.

Statistical Analysis:

Results on continuous measurements were presented as mean ± S.D. and results on categorical measurements were presented in Number (%). For categorical data, Chi square was used and Fischer exact test for small numbers. For continuously distributed variables, students T test and Z test was used. Comparison between multiple groups was done by generalized linear model. 'p' value of 0.05 or less was considered to be statistically significant.

Observations and Results:

Table 1: Comparison of Clinical Characteristics Of Cases Of Diabetes With Controls

Clinical Characteristics	Cases (n = 101) Mean +/- S.D.		Controls (n = 101) Mean +/- S.D.		z-value	'p' value
Age	59.61±6.87 years		59.51±6.85 years		0.24	0.96
Gender wise age distribution	Males 59.78±7.15 years	Females 59.46±6.67 years	Males 59.38±6.47 years	Females 59.65±7.33 years		
Male:Female Ratio	1:1.15		1:1.15		0.000	1.00
Systolic Blood Pressure	136.93±15.01 mm of hg		122.15±9.01 mm of hg		8.47	0.000*
Diastolic Blood Pressure	83.86±7.61 mm of hg		77.78±5.13 mm of hg		6.65	0.000*
Body Mass Index	24.35±2.67 kg/m^2		21.16±1.08 kg/m^2		11.12	0.000*
Waist Hip Ratio	0.93±0.065		0.86±0.01		10.26	0.000*

(*indicates statistically significant at 5% level of significance)

In our study, the mean age of cases of type-2 diabetes mellitus was 59.61±6.87 years and mean age of controls was 59.51±6.85 years. Out of 101 cases 47 were males who had mean age 59.78±7.15 and 54 were females who had mean age 59.46±6.67 Out of 101 controls 47 were males who had mean age of 59.38±6.47 and 54 were female who had mean age of 59.65±7.33. the male:female ratio was 1:1.15 in both cases and controls. The mean systolic blood pressure in cases was 136.93±15.01 and the mean systolic blood pressure in controls was 122.15±9.01. Mean systolic blood pressure in cases was significantly more than in controls ('p' value <0.05). The mean diastolic blood pressure in cases was 83.86±7.61 and in controls it was 77.78±5.13. Mean diastolic blood pressure in cases was significantly more than in controls ('p' value <0.05). The mean BMI of cases of type-2 diabetes mellitus was 24.35±2.67kg/m^2 and mean BMI of controls was 21.16±1.08 kg/m^2. Mean BMI in cases was significantly more than in controls ('p' value<0.05). The mean waist- hip ratio in cases was 0.93±0.065 and in controls it was 0.86±0.01. Waist- hip ratio was significantly higher in cases than in controls ('p' value<0.05).

Table 2: Comparison of Biochemical Parameters in Cases and Controls

Biochemical parameters	Cases (n = 101)	Controls (n = 101)	z-value	'p' -value
Fasting plasma Glucose Level (mg %)	125.05±36.32	92.73±4.47	8.877	0.000*
Postmeal plasma Glucose Level (mg %)	176.76±60.64	117.25±4.37	9.835	0.000*
Cholesterol (mg %)	161.15±31.27	129.56±7.66	9.860	0.000*
TG (mg %)	160.20±36.18	122.94±10.62	9.931	0.000*
LDL (mg %)	69.44±24.58	43.00±4.56	10.590	0.000*
HDL (mg %)	47.83±8.07	55.39±2.82	8.877	0.000*

AST (IU/L)	21.21±7.31	15.29±2.85	7.133	0.000*
ALT (IU/L)	22.16±7.59	15.48±3.80	7.798	0.000*
ALP (IU/L)	121.84±53.74	81.66±7.19	7.136	0.000*
Serum total Bilirubin (mg%)	0.90±2.8	0.73±0.20	4.266	0.000*
Serum Creatinine (mg%)	1.00±0.42	0.68±0.17	7.146	0.000*
HbA1C (%)	7.90±1.11%	4.97±0.20%	25.894	0.000*

(*indicates statistically significant at 5% level of significance, ALT: Alanin transaminase, AST: Aspartate transaminase, ALP: Alkaline phosphatase, TG: Triglycerides, HDL: High density lipoproteins, LDL: Low density lipoproteins, HbA_{1C} (%): glycated hemoglobin)

All the biochemical parameters in the cases such as mean fasting (125.05±36.32) and post meal (176.76±60.64) plasma glucose levels, mean serum cholesterol (161.15±31.27), mean serum triglycerides (160.20±36.18), Low density lipoproteins (69.44±24.58), mean serum Aspartate transaminase (21.21±7.31), mean serum Alanin transaminase (22.16±7.59), mean serum Alkaline phosphatase (121.84±53.74), mean serum billirubin (0.90±2.8), mean serum creatinine (1.00±0.42), mean HBA_1C level(7.90±1.11%) were significantly more than in controls such as mean fasting (92.73±4.47) and post meal (117.25±4.37) plasma glucose levels, mean serum cholesterol (129.56±7.66), mean serum triglycerides (122.94±10.62), mean serum Low density lipoproteins (43.00±4.56), mean serum Aspartate transaminase (15.29±2.85), mean serum Alanin transaminase (15.48±3.80), mean serum Alkaline phosphatase (81.66±7.19), mean serum billirubin (0.73±0.20), mean serum creatinine (0.68±0.17), mean HBA_1C level(4.97±0.20%) ; ('p' value< 0.05). While mean serum High density lipoproteins level in cases (47.83±8.07) was significantly lower than in controls (55.39±2.82); ('p' value<0.05).

Table 3: Frequency of Clinical Features of Gallbladder Disoders in Cases and Controls

Clinical Features Of Gallbladder Disorders	Cases (N= 101)	Controls (N=101)
Biliary Colic	4(3.96%)	0(0.00%)
Fever	1(0.99%)	0(0.00%)
Postmeal Epigastric Fullness and Flatulence	25(24.75%)	4 (3.96%)
Icterus	4(3.96%)	0(0.00%)

In present study, we studied the prevalence of clinical features of gallbladder disorders in cases and controls. We found that out of 101 cases, 4 (3.96%) gave history of biliary colic, 25 (24.75%) had complaint of postmeal epigastric fullness and flatulence, 1(0.99) case had fever, 4(3.96%) cases had icterus. Out of 101 controls 4 (3.96%) had complaint of postmeal epigastric fullness and flatulence.

Table 4: Frequency of Clinical Features Of Autonomic Neuropathy In Cases And Controls

Clinical Features Of Autonomic Neuropathy	Cases(N= 101)	Controls (N =101)
Postural Dizziness	20(19.80%)	5 (4.95%)
Constipation	10(9.9%)	0(0.00%)
Nocturnal Diarrhea	2(1.98%)	0(0.00%)
Gustatory Sweating	0(0.00%)	0(0.00%)

Out of 101 cases, 20(19.80%) gave history of postural dizziness, 10(9.9%) gave history of constipation, 2(1.98%) gave history of nocturnal diarrhea. None had history of gustatory sweating. Out of 101 controls, 5 (4.95%) gave history of postural dizziness.

Table 5: Comparison of Gallbladder Volumes and Motility in Cases of Diabetes and Controls

	Cases (N = 101) Mean ± S.D.	Controls(N = 101) Mean ± S.D.	z-value	p-value
Fasting Gallbladder Volume	24.20±2.73cc	18.96±1.98cc	15.59	0.0001*
Post meal Gallbladder Volume	12.50±2.2cc	7.68±1.70cc	17.38	0.0001*
Gallbladder Motility (% contraction)	48.53±5.66%	59.73±6.41%	13.15	0.0001*

(* indicates statistically significant at 5% level of significance)

In present study mean fasting gallbladder volume in cases was 24.20±2.73 cc and in controls it was 18.96±1.98 cc. The difference in mean fasting gallbladder volume in cases and controls was statistically significant ($p<0.05$). The mean postmeal gallbladder volume in cases was 12.50±2.2 cc and in controls it was 7.68±1.70 cc, the difference was statistically significant ($p<0.05$). Also the mean gallbladder motility in cases was 48.53±5.66% and in controls it was 59.73±6.41%, the difference was statistically significant ($p<0.05$).

Table 6 : Distribution of Gallbladder Disorders in Cases of Diabetes and Controls

Gallbladder Disorders	Cases (N = 101)	Controls (N = 101)
Gallstones	26(25.74%)	6 (5.94%)
Biliary Sludge	9(8.91%)	3 (2.97%)
Cholecystitis	1(0.99%))	0(0.00%)
Total	36(35.64%)	9(8.91%)

In this study out of 101 cases gallbladder disorders were found in 36 (35.64%) cases. Out of these 26 (25.74%) had gallstones, 9(8.91%) had biliary sludge, 1(0.99%) had cholecystitis. Out of 101 controls gallbladder disorder was found in 9 controls. Out of these 6 (5.94%) had gallstones and 3 (2.97%) had biliary sludge.

Table 7 : Age Distribution of Gallbladder Disorders in Cases

Age	Cases With Gallstones	Cases With Billiary Sludge	Cases With Cholecystitis	Total
40 TO 49 Yrs (N=9)	2(22.22%)	0(0.00%)	0(0.00%)	2 (22.22%)
50 TO 59 Yrs (N=42)	6(14.28%)	3(7.14%)	0(0.00%)	9 (21.42%)
60 TO 69 Yrs (N=42)	13(30.95%)	6(14.28%)	1(2.38%)	20 (47.61%)
70 TO 80 Yrs (N=8)	5(62.5%)	0(0.00%)	0(0.00%)	5 (62.5%)
Total (N=101)	26(25.74%)	9 (8.91%)	1(0.99%)	36 (35.64%)

In this study we found that out of 9 cases in age group 40 to 49 years 2(22.22%) had gallstones. Out of 42 cases in age group 50 to 59 years, 6(14.28%) showed gallstone and 3(7.14%) cases showed sludge. Out of 42 cases in age group 60 to 69 years, 13(30.95%) had gallstones, 6(14.28%) had sludge and 1(2.38%) had cholecystitis. Percentage of cases with gallstone was highest in age group 70 to 80 years, in which out of 8 cases, 5(62.5%) cases showed gallstone.

Table 8: Correlation of Gallbladder Volumes and Motility in Cases with Age.

AGE	40- 49Years (n = 9) Mean ± S.D.	50 - 59Years (n= 42) Mean ± S.D.	60-69Years (n = 42) Mean ± S.D.	70-79 Years (n = 8) Mean ± S.D.	F-value	'p' value
Fasting Gallbladder Volume	24.44±2.07cc	23.61±2.25cc	24.75± 3.20cc	24.74± 3.19cc	1.23	0.30
Postmeal Gallbladder Volume	12.22 ±1.56cc	12.01±2.19cc	12.95± 2.26cc	13.11± 2.36cc	1.52	0.21
Gallbladder Motility (% contraction)	50.11± 2.64%	49.32±6.65%	47.90±4.9%	46.01±5.63%	1.23	0.30

(* indicates statistically significant at 5% level of significance)

The difference of gallbladder volumes and motility in between age groups was found to be non-significant. ('p' value>0.05)

Table 9: Gender Distribution of Gallbladder Disorders in Cases

Gender	Gallstones	Billiary Sludge	Cholecystitis	Total
Males (N=47)	11 (23.4%)	3 (6.38%)	0(0.00%)	14 (29.79%)
Females (N=54)	15 (27.78%)	6 (11.11%)	1 (1.85%)	22 (40.74%)
Total(101)	26 (25.74%)	9 (8.91%)	1 (0.99%)	36 (35.64%)

In present study out of 101 cases 47(46.53%) were males and 54 (53.46%) were females. Out of 47 male cases studied 11 (23.4%) cases showed gallstone and 3 (6.38%) showed sludge. Similarly out of 54 female cases studied 15 (27.78%) showed gallstone, 6 (11.11%) showed sludge, 1 (1.85%) had cholecystitis.

Table 10: Correlation of Gallbladder Volumes and Motility in Cases With Gender.

Gender	Males (N = 47) Mean ± S.D.	Females (N = 54) Mean ± S.D.	Z-Value	P-Value
Fasting Gallbladder Volume	23.93±2.54cc	24.51±2.92cc	1.05	0.296
Postmeal Gallbladder Volume	12.47±2.07cc	12.54±2.37cc	0.16	0.868
Gallbladder Motility (% contraction)	48.09± 5.71%	49.05± 5.59%	0.85	0.396

In 47 male cases studied the gallbladder volumes and motility were as following: mean fasting gallbladder volume was 23.93±2.54 cc, mean postmeal gallbladder volume was

12.47±2.07 cc and mean gallbladder motility was 48.09 ± 5.71 %. In 54 female cases studied the gallbladder volumes and motility were as following: mean Fasting gallbladder volume was 24.51±2.92 cc, mean postmeal gallbladder volume was 12.54±2.37cc and mean gallbladder motility was 49.05 ± 5.59%. The difference of gallbladder volumes and motility in males and females was found to be non-significant. ('p' value>0.05)

Table 11: Distribution of Gallbladder Disorders According to Duration of Diabetes

Duration Of Diabetes	Cases With Gallstones (N=26)	Cases With Biliary Sludge (N=9)	Cases With Cholecystitis (N=1)	Total
<5 Years (N=45)	4(8.89%)	2(4.44%)	1(2.22%)	7(15.55%)
5 TO 10 Years (N=50)	20 (40%)	5 (10%)	0(0.00%)	25(50%)
11 TO 15 Years (N=4)	1 (25%)	2 (50%)	0(0.00%)	3(75%)
>15 Years (N=2)	1 (50%)	0(0.00%)	0(0.00%)	1(50%)

In present study, out of 45 cases who had duration of diabetes< 5 years, 4(8.89%) had gallstones, 2(4.44%) had sludge, 1(2.22%) had cholecystitis. Out of 50 cases who had duration of diabetes 5 to 10 years, 20 (40%) cases had gallstones, 5 (10%) cases had sludge. Most of cases were in the two groups of <5 years duration (n=45) and of 5 to 10 years (n=50) of duration of diabetes. Out of 4 cases who had duration of diabetes 11 to 15 years, 1 (25%) had gallstones and 2 (50%) had sludge. Out of 2 cases who had duration of diabetes >15 years 1 (50%) had gallstones.

Table 12: Correlation of Gallbladder Volumes and Motility in Cases With Duration of Diabetes.

Duration Of Diabetes	<5 Years (n=45) Mean ± S.D.	5 TO 10 Years (n=50) Mean ± S.D.	11 TO 15 Years (n=4) Mean ± S.D.	>15 Years (n=2) Mean ± S.D.	F-value	p-value
Fasting Gallbladder Volume	23.31 ± 2.46	24.85 ± 2.63	25.25 ± 4.92	26 ± 0	3.215	0.026*
Postmeal Gallbladder Volume	11.31 ±2.09	13.44±1.62	13.52± 4.03	14± 0	10.17	0.000 *
Gallbladder Motility (% contraction)	51.71±5.41 %	45.88 ± 4.44%	47.20 ± 6.08%	46.15% ± 0	11.25	0.000 *

(* indicates statistically significant at 5% level of significance)

In the 45 cases with duration of diabetes<5 years the mean fasting gallbladder volume was 23.31 ± 2.46cc, mean Post meal Gallbladder Volume was 11.31 ±2.09 and mean gallbladder contraction was 51.71±5.41%. In the 50 cases with duration of diabetes 5 to 10 years the mean fasting gallbladder volume was 24.85 ± 2.63 cc, mean Post meal Gallbladder Volume was 13.44±1.62 and mean gallbladder contraction was 45.88 ± 4.44%. In the 4 cases with duration of diabetes 11 to 15 years the mean fasting gallbladder volume was 25.25 ± 4.92cc, mean Post meal Gallbladder Volume was 13.52± 4.03 and mean gallbladder contraction was 47.20 ± 6.08%. In the 2 cases with duration of diabetes >15 years the mean fasting gallbladder volume was 26 ± 0 cc, mean Post meal Gallbladder Volume was 14±0 and mean gallbladder contraction was 46.15% ± 0. The difference in gallbladder volumes and motility among cases with different duration of diabetes was significant ('p' value<0.05). Comparison

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was mainly done in two groups of <5 years of duration and of 5 to 10 years of duration as in the other two groups due to less number of cases statistical correlation could not be done.

Discussion:

In the present study studied 101 cases of type-2 diabetes, their mean age was (59.61±6.86 years) and age range was 40-75 years. Out of 101 cases 47(46.53%) were male and 54(53.46%) were female. Where as study conducted by S Singh et al [6] there were 50 type-2 diabetic patients of which 25 were with autonomic neuropathy whose mean age was 64 years and 25 were without autonomic neuropathy whose mean age was 54.56 years. Out of 50 cases 26(52%) were males and 24 (48%) were females. AK Agarwal et al [4] there were 91 diabetics of which 19 were type-1 diabetics having mean age of 29.7 years and 72 were type-2 diabetics whose mean age was 50.9 years. Out of 91 cases 45(49.45%) were males and 46(50.54%) were females. Also PG Raman et al [7] studied 50 cases of type-2 diabetes of which 21 (42%) were males and 29 (58%) were females. The mean age of cases was 53±8.2 years. Sefa Guliter, et al [8] studied 88 cases of type-2 diabetes of which 41 (46.59%) were males and 47 (53.40%) were females. The mean age of cases was 59.61±6.86 years.

In the present study prevalence of gallbladder disorders found in cases (35.64%) was significantly more than in controls (8.91%). Similar results were found in the study conducted by Jorgenson et al [9] in which prevalence of gallbladder disorders found in the cases was 32.8% and in controls it was 17.3%. Also in the study conducted by Chapman et al [10] prevalence of gallbladder disorders found in the cases was 21.4% and in controls it was 14.0%. P G Raman et al [7]reported prevalence of gallbladder disorders found in the cases was 32.0% and in controls it was 6.70%. S Singh et al [6] prevalence of gallbladder disorders found in the cases was 26.0% and in controls it was 10.0%. Various studies conducted in the past have shown a positive correlation between gall bladder disease and diabetes [4,5,7]. The present study too showed the positive correlation between the two. It has been confirmed that there is increased prevalence of gall bladder dysfunction among diabetics and diabetics tends to have larger gallbladder and reduced responsiveness to meals which might lead to development of stasis of bile and development of complications like sludge, cholelithiasis and cholecystitis. Although exact pathophysiologic basis is not clear, motor abnormalities of gall bladder function is one of the proposed mechanism. These motor abnormalities could be due to larger size of gall bladder, impaired contractility due to vagal visceral neuropathy because of autonomic system involvement [6].

In the present study mean fasting gall bladder volume in control group was 18.96 ± 1.98 ml as compared to 24.20 ± 2.73 ml in study group (P<0.001). Present study has shown significantly larger fasting gallbladder volumes in diabetic patients as compared to controls. All the studies cited show increase in fasting gallbladder volume both in fasting state & post meal state, compared with controls. Simillar findings were noted by AK Agarwal et al [4] , PG Raman, et al [7] and Rupali Saxena et al [11]. Whereas Chapman et al revealed increased fasting gallbladder volume in only type-2 diabetic patients but not in type-1 diabetic patients and controls. They proposed that type-2 diabetes is an independent predictor for increased fasting gallbladder volume [10].

In the present study the mean gallbladder motility was significantly decreased in cases (45.29±12.21%) as compared to controls (53.07±16.31%). Similar results were found in the studies conducted by PG Raman et al [7] and Sefa Guliter et al [8]. Increased fasting gallbladder volume and reduction in gallbladder motility can be due to vagal neuropathy or due to reduced cholecystokinin release or resistance to its action in diabetics [7].

In the present study the difference of gallbladder volumes and motility in between different age groups was found to be non-significant. (‘p’ value>0.05) Similar results were found in the study conducted by Sefa Gu¨liter et al [8], they found that in the study group, there was no significant correlation between the fasting gallbladder volume and age. AK Agarwal et a

[4], A.B. Olokoba et al [12] showed positive correlation of gallbladder volume with age and similar results were observed by Chapman BA et al [10] i.e. higher age group was associated with larger gallbladder volume.

The difference in gallbladder volumes among cases with different duration of diabetes was found to be significant ('p' value<0.05) i.e. larger fasting gallbladder volumes were found in cases with longer duration of diabetes. Similar findings were observed in the study conducted by Sefa Guliter et al [8] in which fasting gallbladder volume and duration of diabetes mellitus showed significant correlation ($r = 0.212$; $P < 0.05$).

Conclusion:

Present study concluded that gall bladder disease is significantly more prevalent among type-2 diabetics compared to controls. Large, poorly contracting gall bladders are frequent among the type-2 diabetics, regardless of the presence or absence of symptoms of gall-bladder disease. Type-2 diabetic patients with gallbladder disorders are significantly older. Prevalence of gallbladder disorders is significantly more in type-2 diabetic females than in type-2 diabetic males. Duration of diabetes is longer in type-2 diabetic patients with gallbladder disorders. Gallbladder disorders are significantly associated with metabolic syndrome in type-2 diabetics. Thus clinical implication of present study is that all type-2 diabetics should also be evaluated for the presence of increased fasting gallbladder volumes, impaired postprandial gallbladder emptying, and gallbladder sludging; all markers of risk of progression to overt gall stone disease.

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