



ULTRASONOGRAPHY EVALUATION OF GALL-BLADDER VOLUME IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Dr. Neelam Chittora

Assistant Professor Dept. of Radio-Diagnosis RKDF Medical College Hospital and Research Centre Bhopal.

Conflicts of Interest: Nil

Corresponding author: Dr. Neelam Chittora

ABSTRACT

Background: The most common endocrine disorder is type 2 diabetes mellitus (T2DM). Gall-bladder disease has been consistently identified in patients with type 2 diabetes mellitus.

Aims & objectives: The aim of our research was to use Ultrasonography to determine the gall-bladder volume in T2DM patients and healthy controls.

Materials and methods: This three-year research included 200 cases and 200 healthy controls in the Department of Radio-diagnosis at a tertiary healthcare center in Central India. USG screened all T2DM cases with symptoms that were indicative of gall-bladder disease. All of the research participants were given a thorough physical and clinical review. Gray scale real-time ultrasound examinations were performed using 3.5 to 10 MHz curvilinear and linear array transducers on the GE VOLUSON P8 and Samsung U50 Ultrasound scan machines in this research. Patients with T2DM who were taking antihypertensive medications, those with cardiovascular disease, pregnant women, and those with cancer were all removed from the research. 3 ml of fasting blood samples were obtained from all research participants under aseptic conditions, allowed to stand for 30 minutes, and then centrifuged to obtain serum. Fasting blood glucose, postprandial blood glucose, total cholesterol, triglycerides, high-density lipoprotein, and low-density lipoprotein were all measured using the serum research.

Results: The gall-bladder volume was measured using ultrasonography in 200 people with type 2 diabetes and 200 healthy controls in this research. In this analysis, systolic (139.6 ± 10.6 mmHg) and diastolic (91.2 ± 8.4 mmHg) blood pressure, fasting blood glucose (142.32 ± 13.4 mg/dl), post-prandial blood glucose (168.6 ± 14.3 mg/dl), total cholesterol (198.3 ± 20.2 mg/dl), triglycerides (176.4 ± 15.6 mg/dl), LDL (132.3 ± 4.4 mg/dl) and gall-bladder volume (24.4 ± 10.4 ml) were significantly raised in type 2 diabetes mellitus patients compared with healthy controls. However Age, BMI, and HDL, on the other hand, were not statistically important.

Conclusion: To assess the risk of gall stone disease progression, all T2DM patients should be tested for raised fasting gall-bladder volumes. As a result, using USG to calculate gall-bladder volume changes will help us to anticipate gall-bladder function abnormalities.

Keyword: Gall-bladder volume, Ultrasonography, Type 2 diabetes mellitus.

Introduction

Diabetes mellitus is a group of metabolic diseases marked by chronic hyperglycemia caused by insulin release, insulin action, or both. The importance of insulin as an anabolic hormone causes metabolic abnormalities in carbohydrates, lipids, and proteins^{1,2}. It's one of the chronic non-communicable diseases (CNCDs) that's become a major global health issue. It's also related to blindness, vascular brain disorders, renal failure and amputations of limbs. T2DM is the most common endocrine condition, characterized by abnormal

metabolism and long-term complications affecting the kidneys, skin, nerves, and gastrointestinal tract, resulting in morbidity and mortality^{3,4}. T2DM is the most common form of diabetes worldwide, accounting for about 90% of all cases, and is more common in men than in women. Diabetes mellitus affected 2.8 percent of the world's population in 2000, which is projected to raise to 4.4 percent by 2030⁵. By 2035, the overall number of people with diabetes is anticipated to grow from 382 million in 2013 to 592 million. Diabetic keto-acidosis, hyperglycemia, hypoglycemia, thrombosis, and

electrolyte imbalance are all acute complications of diabetes mellitus⁶. As a result, diabetes's premature morbidity, mortality, and financial burden are a public health concern, accounting for 10.7% of global all-cause mortality among people aged 20 to 70 years. A few studies have looked at the prevalence of gall-bladder disease in people with type 2 diabetes⁷⁻⁹. Cholecystomegaly and impaired gall-bladder contraction have been blamed for this. Age, female sex, family background and genetic factors, obesity, rapid weight loss, and physical inactivity are all risk factors¹⁰. Ultrasound is a straightforward technique with a high degree of precision in detecting gall-bladder diseases. Since it is safe, inexpensive, and reliable, ultrasonography is a useful imaging modality for assessing gall-bladder volume in T2DM patients and controls¹¹.

Aims & objectives: To determine the gall-bladder volume in T2DM patients and healthy controls using Ultrasonography.

Materials and methods:

This three-year research included 200 cases and 200 normal controls in the Department of Radio-diagnosis at a tertiary healthcare center in Central India. USG screened all of the research participants to determine gall-bladder volume. All of the research participants were given a thorough physical and clinical review. Gray scale real-time ultrasound examinations were performed using 3.5 to 10 MHz curvilinear and

linear array transducers on the GE VOLUSON P8 and Samsung U50 Ultrasound scan machines in this research. Patients with T2DM who were taking antihypertensive medications, those with cardiovascular disease, pregnant women, and those with cancer were all removed from the research. 3 ml of fasting blood samples were obtained from all research participants under aseptic conditions, allowed to stand for 30 minutes, and then centrifuged to obtain serum. Fasting blood glucose, post-prandial blood glucose, total cholesterol, triglycerides, high-density lipoprotein, and low-density lipoprotein were all measured using the serum research. Demographic information was gathered.

Results:

The gall-bladder volume was measured using ultrasonography in 200 people with type 2 diabetes and 200 healthy controls in this research. In this analysis, systolic (139.6 ± 10.6 mmHg) and diastolic (91.2 ± 8.4 mmHg) blood pressure, fasting blood glucose (142.32 ± 13.4 mg/dl), post-prandial blood glucose (168.6 ± 14.3 mg/dl), total cholesterol (198.3 ± 20.2 mg/dl), triglycerides (176.4 ± 15.6 mg/dl), LDL (132.3 ± 4.4 mg/dl) and gall-bladder volume (24.4 ± 10.4 ml) were significantly raised in type 2 diabetes mellitus patients as compared with healthy controls. However Age, BMI, and HDL on the other hand, were not statistically important. (Table 1).

Table 1: Comparison of Demographic, biochemical parameters and gall-bladder volume in type 2 diabetes mellitus patients and healthy controls

Parameters	T2DM (Mean \pm SD) (n=200)	Controls (Mean \pm SD) (n=200)	P value
Demographic characteristics			
Age (years)	45.4 \pm 8.4	44.4 \pm 3.4	0.07
BMI (kg/m ²)	24.6 \pm 1.4	22.6 \pm 1.2	0.07
Systolic BP (mmHg)	139.6 \pm 10.6	113.7 \pm 9.2	0.001
Diastolic BP (mmHg)	91.2 \pm 8.4	77.4 \pm 7.4	0.001
Biochemical parameters and Gall-bladder volume			
FBS (mg/dl)	142.32 \pm 13.4	92.23 \pm 10.4	0.001
PPBS (mg/dl)	168.6 \pm 14.3	131.3 \pm 9.2	0.001
Total cholesterol (mg/dl)	198.3 \pm 20.2	148.6 \pm 15.3	0.001
Triglycerides (mg/dl)	176.4 \pm 15.6	99.4 \pm 8.3	0.001
HDL (mg/dl)	43.6 \pm 3.3	44.2 \pm 5.8	0.07
LDL (mg/dl)	132.3 \pm 4.4	90.3 \pm 4.6	0.001
Gall-bladder volume (ml)	24.4 \pm 10.4	17.4 \pm 4.1	0.001

Discussion

Patients with chronic diabetes mellitus who have autonomic neuropathy have a higher fasting gall-bladder volume and a lower percentage of contraction. Bile stasis causes complications such as cholelithiasis, cholecystitis, and sludge accumulation as a late result. When a chronic diabetic presents in an emergency and requires surgery, hepatobiliary ultrasonography may be used as a screening technique to detect complications early and prevent severe consequences. Diabetes complications that occur later in life are a significant cause of morbidity and mortality. Gallstones are more common in diabetics, particularly those with type 2 diabetes. The prevalence of cholesterol gall stones is estimated to be two to three times higher in diabetics. Gall-bladder diseases are very common and have a wide range of symptoms as well as morbidity and mortality. Gallstones account for 95 percent of all gall-bladder disorders, while non-calculus disease accounts for around 5%. Gall-bladder inflammation, whether acute or chronic, was also observed. Reduced gall-bladder motility, reduced post-prandial cholecystokinin (CCK) release, reduced sensitivity of gall-bladder smooth muscle to CCK, reduced number of CCK receptors in the gall-bladder wall, supersaturation of bile, and the occurrence of gall stones themselves are the key reasons for the high prevalence of gall stone disease in diabetes mellitus. Gall-bladder volume was found to be significantly higher in T2DM patients than in safe controls in this research. These results were backed up by a research by AK Agarwal et al², who found that T2DM patients had substantially raised gall-bladder volume as compared to healthy controls. In a research conducted by Bruce A. Chapman et al¹¹, they found that T2DM patients had a larger gall-bladder volume than healthy controls. R Harikiran Reddy et al¹² reported in another research that gall-bladder functional defects are most common in diabetic neuropathy. T2DM patients with neuropathy had a substantially higher fasting gall-bladder volume than the control group^{13,14}. Although hyper-triglyceridaemia is a recognized risk factor for gallstones, there is no proof that hyper-cholesterolaemia causes gall-bladder hypomotility¹⁵. As a result, the current research

emphasizes the importance of diabetic cholecystopathy, which can contribute to gallstone formation in T2DM patients. As a result, there's a greater chance of complications from gallstone disease and its care, both surgical and medical.

Conclusion

Raised gall-bladder volume and dyslipidemia in patients with type 2 diabetes mellitus, according to the findings of this research. As a result, all T2DM patients should be tested for elevated fasting gall-bladder volumes to determine the likelihood of gallstone disease progression. As a result, using USG to calculate gall-bladder volume changes will help us anticipate gall-bladder function abnormalities. Incomplete gall-bladder emptying can lead to gallstone formation and complications in T2DM patients, so gall-bladder function should be tested on a regular basis. More research with a large sample size is recommended.

References

1. Nagaraj S, Sunitha S et al. Study of prevalence of non alcoholic fatty liver disease in type 2 diabetes mellitus patients and variations in liver function tests, lipid profile and mean platelet volume in patients with fatty liver in comparison with patients without fatty liver. *Int J Res Med Sci.* 2016;4(3):1-6.
2. Agarwal A, Miglani S, Singla S, Garg U, Dudeja R, Goel A. Ultrasonographic Assessment of Gall-bladder Volume in Diabetics. *JAPI.* 2004;52:962-965.
3. Bloom A, Stachenfeld R. Diabetic cholecystomegaly. *JAMA.* 1969;208:357-359.
4. Miquel J, Covarrubias C, Villaroel L, Mingrone G, Greco A, Puglielli L, Carvallo P, Marshall G, Del Pino G, Nervi F. Genetic epidemiology of cholesterol cholelithiasis among Chilean Hispanics, Amerindians, and Maoris. *Gastroenterol.* 1998;115(4):937-46.
5. Stinton L and Shaffer E. Epidemiology of Gall-bladder Disease: Cholelithiasis and Cancer. *Gut and Liver.* 2012;6(2):172-187.
6. Pinto A, Reginelli A, Cagini L, Coppolino F et al. Accuracy of ultrasonography in the diagnosis of

- acute calculous cholecystitis: review of the literature. *Critical Ultrasound Journal*. 2013;5(1):S11:1-4.
7. Smith E, Dillman J, Elsayes K, Menias C, Bude R. Cross-Sectional Imaging of Acute and Chronic Gall-bladder Inflammatory Disease. *American Roentgen Ray Society*. 2009;192:188–196.
 8. Jansen S, Stodolski M, Zirngibl H, Gösde D and Ambe P. Advanced gall-bladder inflammation is a risk factor for gall-bladder perforation in patients with acute cholecystitis. *World Journal of Emergency Surgery*. 2018;13(9):1-6.
 9. Kayacetin E, Kisakol G, Kaya A, Akpınar Z. Real time sonography for screening of gall-bladder motility in diabetic patients: relation to autonomic and peripheral neuropathy. *Neuroendocrinol Lett* 2003;14:73-76.
 10. Gaur C, Mathur A, Agarwal A. Diabetic autonomic neuropathy causing gall-bladder dysfunction. *J Assoc Physicians India* 2000;48:603-605.
 11. Chapman B, Chapman T et al. Gall-bladder Volume (Comparison of Diabetics and Controls). *Dig Dis Sci*.1998; 43: 344-348.
 12. Reddy R, Sagar S, Anusha B and Sajjan B. A Comparative Study of Gall Bladder Volume Among Type 2 Diabetes Mellitus Patients with Autonomic Neuropathy and Normal Healthy Individuals. *Int J Recent Sci Res*.2020; 11(10): 39909-39911.
 13. Chen C, Lin C, Hsu C, Kao C. Association Between Type I and II Diabetes With Gall-bladder Stone Disease. *Front. Endocrinol*.2018; 9:1-8.
 14. Wilson I, Hurrell M, Pattinson N, Chapman B. The effect of simvastatin and bezafibrate on bile acid composition and gall-bladder emptying in female noninsulin dependent diabetics. *J Gastroenterol Hepatol* 1994;9:447-51.
 15. Premkumar M, Sable T. Obesity, dyslipidemia and cholesterol gallstone disease during one year of Antarctic residence. *Rural Remote Health*. 2012; 12:2186.