NUMBER OF RENAL ECHOGENIC FOCI IN PATIENTS OF FATTY LIVER IN RELATION WITH DIABETES

Javed Anwar, Muhamamd Tahir*

Combined Military Hospital Multan Pakistan, *Combined Military Hospital Rawalpindi Pakistan

ABSTRACT

Objective: To establish a relationship of numbers of renal echogenic foci and the grades of fatty liver with the time span of diabetes mellitus.

Study Design: Cross sectional study.

Place and Duration of Study: Radiology Department of Combined Military Hospital (CMH) Kohat from 1st January 2014 to 1st May 2014.

Material and Methods: Patients reporting for ultrasound abdomen in Radiology Department at CMH Kohat and showing renal echogenic foci i.e. bright foci without significant distal acoustic shadowing and fatty liver were selected and included in this study. Forty (40) patients were selected in the study by non probability purposive sampling and these were categorized into three groups according to the number of renal echogenic foci i.e. those with less than 5 were grouped as REF 1, those with 5-10 as group REF-2 and those with more than 10 foci as group REF-3. Patients having associated fatty liver that is those showing bright liver along with vascular blurring in liver parenchyma were grouped as mild, moderate and severe depending upon the ultrasound attributes of fatty liver (FL). The clinical and demographic variables were laid down. All of the patients were subsequently subjected to fasting blood sugar levels and glycated hemoglobin HBA1C with their consent. The patients having normal fasting blood sugar levels (3.3-5.6 mmol/L) were excluded from the study. These cases were grouped according to the HbA1C levels i.e. 5.6-6.8%, 6.8%-7.6% and >7.6% as good, fair or poor control patients respectively. Data was analyzed by SPSS version 20.

Results: Average age of patients included in the study was 48.62 years (SD=10.43) with 70% female patients. Twenty four (60%) patients had mild FL, 14 (35%) patients had moderate FL and 2 (5%) patients had severe FL. Thirteen (32.5%) patients were in REF-1 group, 9 (47.5%) were in group REF-2 and 8 (20%) were in group REF-3. Fifteen (37.5%) patients had good control of diabetes, 16 (40%) patients had fair control while 9 (22.5%) patients had poor control. Duration of diabetes varied from newly diagnosed (0 years) to 20 years with mean duration of 5.33 years (SD=4.73). Nine (22.5%) patients were recently diagnosed, 18 (45%) patients had disease span of 2 – 5 years while 13 (32.5%) patients had disease span of more than 5 years. Number of echogenic foci had significant and stronger association with disease span ($p<0.001$, Cramer's V= 0.660) than disease control ($p=0.002$, Cramer's V=0.466). Insignificant association was observed between severity of fatty liver with disease span ($p = 0.373$) and disease control ($p=0.581$).

Conclusion: In diabetics with fatty liver the number of the renal echogenic foci have a link to the time span of diabetes. The greater the number of renal echogenic foci in these cases, the longer is the time span of the disease.

Keywords: Diabetes mellitus, Fatty liver, Renal echogenic foci, Ultrasound abdomen.

INTRODUCTION

The ultrasound abdomen is a common investigation in our clinical practice. Hepatic fatty infiltration is commonly seen in diabetics and ultrasound is the investigation of choice[1].The frequency of fatty liver in diabetes mellitus is reported to be 42.1% to 75.2%[2]. The enlargement of liver is a common manifestation in diabetes, and most of these patients have abnormal liver function tests. Fatty change may be a manifestation of excessive fat transport to the liver or decrease in its removal from the liver. The degree of glycemic control does not correlate well with the presence or absence of fatty liver[3].

Diabetes has renal complications like renal papillary necrosis, urinary tract infections, acute pyelonephritis and chronic pyelonephritis that

Correspondence: Dr Javed Anwar, Classified Radiologist, CMH Multan, Pakistan (*Email: javenerz@hotmail.com*)

can be identified to some extent on ultrasound abdomen[3]. Renal echogenic foci may be one of the ultrasound manifestations of these conditions. Similarly, diabetes is the most common condition reported in approximately 30% of the cases of renal papillary necrosis, which can be due to sloughing of the tips of renal papillae and resultantly may be giving these echogenic foci on ultrasound abdomen[4].

The rationale of this study was to find out a relationship between the number of renal echogenic foci and grades of fatty liver and HbA1C with reference to control of diabetes mellitus.

MATERIAL AND METHODS

This cross sectional study was carried out in the radiology department of CMH Kohat from 1st January 2014 to 1st May 2014. After approval from ethical committee of the hospital all patients irrespective of their age and gender reporting for ultrasound abdomen and having fatty liver and renal echogenic foci (size range 1.2-5 mm) demonstrated on our ultrasound examination were included in this study. These renal echogenic foci were bright foci, which were not giving significant distal acoustic shadowing. They were usually located at tips of medullary papillae, adjacent to renal calyces and sometimes in renal pelvis of the kidneys. The patients having fatty liver showed bright liver with vascular blurring in parenchyma. All those who were having normal fasting blood sugar levels (3.3-5.6 mmol/L) were excluded from the study.

A sample of 40 patients was selected fulfilling the inclusion criteria through non-probability purposive sampling. Ultrasound of all the patients was done on Toshiba Nemio XG machine using 3.75 MHz curvilinear probe. All patients were subjected to examination in longitudinal, transverse and oblique planes in grey scale mode. The color doppler did not help in the evaluation of these foci and was not carried out as a routine for these patients. No further radiological tests were performed on these patients. A patient data proforma was made for all the patients that included demographic details, their REF group, fatty liver group and diabetic control group. The patients were categorized into three groups according to the number of renal echogenic foci i.e. those with less than 5 was grouped as REF-1, those with the renal echogenic foci between 5-10 as group REF-2 and those with innumerable (>10) foci as group REF-3.

Patients having fatty liver showed bright liver along with vascular blurring in liver parenchyma. These were grouped as mild, moderate and severe depending upon the ultrasound attributes of fatty liver. All those who were having fatty change liver and renal echogenic foci were subjected to fasting blood sugar levels and glycated hemoglobin HBA1c accordingly. The patients having normal fasting blood sugar levels (3.3-5.6 mmol/L) were excluded from the study. According to the HbA1C levels of 5.6-6.8%, 6.8%-7.6% and >7.6% the cases were grouped as good, fair or poor control patients respectively. Data was analyzed through SPSS version 20. Descriptive statistics were used to describe the variables i.e. mean and standard deviation (SD) for quantitative variables while frequency and percentages were used for qualitative variables. Chi-square test was applied to study the association between the variables and Cramer's V value was calculated to study the strength of association. A p-value < 0.05 was considered as significant.

RESULTS

Forty patients were included in the study. mean age of patients was 48.62 years (SD = 10.43) with age range of (26 – 70) years. Twenty-eight (70%) of the patients were females while 12 (30%) were males. All (100%) patients had fatty liver (FL) of various grades. Twenty four (60%) patients had mild FL, 14 (35%) patients had moderate FL and 2 (5%) patients had severe FL. Thirteen (32.5%) patients had less that 5 renal echogenic foci (REF) which placed them in REF-1 group, 19 (47.5%) patients had 5-10 renal echogenic foci and thus fell in group REF-2 while 8 (20%) had more than 10 renal echogenic foci and so were in group REF-3. Fifteen (37.5%) patients had good control of diabetes, 16 (40%) patients had fair control while 9 (22.5%) patients had poor control. Duration of diabetes varied from newly diagnosed to 20 years with

average duration of 5.33 years (SD=4.73). Nine (22.5%) patients were newly or recently diagnosed, 18 (45%) patients had disease span of 2–5 years while 13 (32.5%) patients had disease span of more than 5 years.

Association of Renal Echogenic Foci with disease span and disease control

The number of renal echogenic foci is significantly associated with disease span ($p<0.001$) and disease control ($p=0.002$). The association was stronger between disease span and renal echogenic foci as Cramer's V value was higher for these two variables as compared

a weak relationship with the grade of fatty liver. The probable reason of this observation could be prevalence of fatty liver in normoglycemic general population as well as in obesity. Although not included in our selected patients but it was observed that few of the patients having fatty liver and renal echogenic foci were found to be having hyperuricemia when their laboratory reports were checked.

It is an established fact that "the renal echogenic foci" is a very common finding seen by the radiologists, giving them different names like concretion, crystals, particles or renal

Table: Association of renal echogenic foci with disease span and disease control.

Disease span	Number of renal echogenic foci			p-value	Cramer's V
	<5	5-10	>10		
≤ 1 year	8 (20%)	1 (2.5%)	0 (0%)	< 0.001	0.660
2 – 5 years	5 (12.5%)	13 (32.5%)	0 (0%)		
> 5 years	0 (0%)	5 (12.5%)	8 (20%)		
Disease control					
Good control	9 (22.5%)	6 (15%)	0 (0%)	0.002	0.466
Fair control	2 (5%)	11 (27.5%)	3 (7.5%)		
Poor control	2 (5%)	2 (5%)	5 (12.5%)		

to association between renal echogenic foci and disease control i.e. 0.660 vs. 0.466. (Table).

Severity of fatty liver was also checked for possible association. But insignificant association was observed between severity of fatty liver with disease span ($p=0.373$) and disease control ($p =581$).

DISCUSSION

This study emphasizes on the relationship between number of renal echogenic foci and grades of fatty liver and control of diabetes mellitus. In our study the number of the renal echogenic foci in diabetics with fatty liver turned out to be almost synonymous with the time period of the diabetes. We observed that more number of renal echogenic foci was seen in cases of longstanding and uncontrolled diabetes. However the number of these foci had

echogenic foci because these actually don't fit into the sonographic attributes of renal calculi[5]. However. Diabetes is known for its renal complications and fatty liver, which can be observed on ultrasound abdomen[6]. Diabetes, is seen in approximately 50% of the cases of renal papillary necrosis[4] that can be one of the possible causes of renal echogenic foci on ultrasound. These foci of various sizes can also be due to mucosal sloughing and accumulation of proteinacious material adjacent to the tips of the renal papillae and calyceal cups which latter on undergo calcifications, as diabetes is known to cause calcifications at various locations. The long-term effects of diabetes on the genitourinary system include diabetic nephropathy, papillary necrosis, renal artery stenosis, diabetic cystopathy and vas deferens calcification[4,6] there has been a mention of

Randall plaques in literature that could be a cause of these echogenic foci. It is believed that Randall's plaques are soft tissue calcific lesions located in the deep renal medullae about the surface epithelium of the papillae, where they act as a nidus for renal calculi or stone formation. These plaques have been described as composed of carbapatite[7].

It is mentioned in the literature that one-fifth of the patients undergoing abdominal imaging have renal calcifications, which may be labeled as "renal stones"[5,8] but many of these calcifications are Randall plaques and not true renal stones because they are neither picked up on plain X ray KUBs nor on excretory urograms. On CT scans they may appear as mere high density foci[9] these plaques can erode into the collecting systems and become renal stones later on[10].

Randall plaques could result in obstruction of ducts of Bellini and cause pain[5] although the Randall plaques may be precursors for a renal stones, they are not equivalent to stones[11] and the factors that could distinguish the two remains unexplored[5]. Hepatic fat accumulation is a recognized complication of diabetes with a reported frequency of 42.1% to 75.2%[2].

This study has a limitation that renal echogenic foci and fatty liver can be present in non-diabetic patients also and the relationship between number of renal echogenic foci and grades of fatty liver in our study has only been assessed in diabetic patients. Another possible shortcoming is that ultrasonography is a lot, machine-dependent as well as operator dependent modality, so there can be difference of opinion in categorization of the patients with reference to the number of renal echogenic foci and the grades of fatty liver, however this can be catered for by utilizing multiple radiologists with fairly good experience.

Standardized HbA1C measurement has not been done worldwide 11 nor has there been any use of ultrasound in assessment of progression of diabetes. We recommend that all cases of any group of fatty liver with group 2 renal echogenic foci (REF-2) or above be advised fasting blood sugar to pick up new cases of diabetes and subsequently be advised Hb1Ac in the positive cases. This will also give an idea of the time span of their diabetes as the number of renal echogenic foci tends to be higher in longer time spans. This criterion may be named as Javed Anwar's Radiological index of diagnosing diabetes mellitus and assessing its time span.

CONCLUSION

In diabetics with fatty liver the number of the renal echogenic foci does have a link to the time span of diabetes mellitus. The number of renal echogenic foci may be regarded as synonymous to time-span snapshot in the assessment of diabetes mellitus.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

1. Cazzo E, Gallo FDF, Pareja JC, Chaim EA. Nonalcoholic fatty liver disease in morbidly obese subjects: correlation among histopathologic findings, biochemical features, and ultrasound evaluation. Obes Surg. 2014; 47-61.
2. Lv W-S, Sun R-X, Gao Y-Y, Wen J-P, Pan R-F, Li L, et al. Nonalcoholic fatty liver disease and microvascular complications in type 2 diabetes. World J Gastroenterol. 2013;19 (20):3134-42.
3. Gavin N, Levinthal MD, Anthony S, Tavill L. Liver Disease and Diabetes Mellitus. Clinical diabetes 1999 ; 17(2) : 48-52.
4. Rodriguez-de-Velasquez A, Yoder IC, Velasquez PA, Papanicolaou N. Imaging the effects of diabetes on the genitourinary system. Radiographics. 1995;15 (5):1051-68.
5. Chi T, Miller J, Stoller ML. Randall plaque versus renal stone? Transl Androl Urol 2012;1(1):66-70
6. Klouwens M, Blok W, Witmer A, Verouden C, Mura M. [Serious complications of urinary tract infection in diabetes: emphysematous pyelonephritis and endogenous endophthalmitis]. Nederlands tijdschrift voor geneeskunde. 2012; 157(7):A5243-A.
7. Carpentier X, Bazin D, Jungers P, Reguer S, Thiaudière D, Daudon M. The pathogenesis of Randall's plaque: a papilla cartography of Ca compounds through an ex vivo investigation based on XANES spectroscopy. J Synchrotron Rad. 2010; 17(3):374-9.
8. Ciftcioglu N, Vejdani K, Lee O, Mathew G, Aho KM, Kajander O, et al. Association between Randall's plaque and calcifying nanoparticles. Int J Nanomedicine 2008;3:105-15.
9. Brenner DJ, Hall EJ. Computed tomography--an increasing source of radiation exposure. N Engl J Med 2007;357(22):2277-84.
10. Evan AP, Coe FL, Lingeman JE, Worcester E. Insights on the pathology of kidney stone formation. Urol Res 2005;33(5):383-9.
11. González-González JG, Rodríguez-Gutiérrez R, Lavalle-González FJ, González-Cantú A, Taméz-Pérez HE, González-Saldívar G, et al. Hemoglobin A1c: a reliable and accurate test for diabetes care? A prospective study in Mexico. Salud pública de méxico. 2013; 55(5):462-8.