ORIGINAL RESEARCH PAPER

Radiodiagnosis

RENAL ARTERY COLOUR DOPPLER ASSESSMENT OF DIABETIC PATIENTS AND ITS CORRELATION WITH BIOCHEMICAL PARAMETERS

KEY WORDS:

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ABSTRACT

The present observational cross sectional study entitled "To assess the role of renal artery colour doppler in diabetic patients and its correlation with biochemical parameters " was carried out in department of Radiodiagnosis ,GR medical College and J A Group of Hospitals, Gwalior from September 2015 to august 2017.

After obtaining the approval from the Institutional Ethical Committee, the study was carried out on 50 patients of either sex with age >30 years of age.

Renal duplex doppler USG is non invasive modality to examine the intrarenal haemodynamic changes in patients of diabetic patients. We demonstrated the presence of intrarenal haemodynamic abnormality with nephropathy, defined by the presence of increased albuminuria and renal insufficiency.

1. In the present study,the patients ranges from 35 yrs to 75 yrs and mean age is 54.7±9.46 yrs. Maximum number of patients were in the group 60-69 yrs of age, that is 34%.
2. In our study, female prevalence is slightly higher than male 52%Vs 48 %.
3. Resistive index increases in both among controls and diabetes patients with increasing age and also in diabetes patient in comparison to control when standardised with age and sex matched control. RI also increases with increasing the duration of diabetes.

INTRODUCTION

By Definition, Diabetes, a disease in which the body's ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in the blood and urine.(WHO definition).[1]

Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced.[2]There are three main types of diabetes mellitus: Type 1 DM results from the pancreas's failure to produce enough insulin. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes". The cause is unknown.[3]

Type 2 DM begins with insulin resistance, a condition in which cells fail to respond to insulin properly.[3]As the disease progresses a lack of insulin may also develop.[4]This form was previously referred to as "non insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes". The most common cause is excessive body weight and not enough exercise.[3]

Gestational diabetes is the third main form and occurs when pregnant women without a previous history of diabetes develop high blood sugar levels.[3]

Complication of diabetes can divided into microvascular and macrovascular,and frequently associated with preeminent and irreversible functional and structural change in the cells of the body,which is characteristically affect the eye (retinopathy),the kidneys (nephropathy) and the nervous system (neuropathy). (Frier et al 1999 and American Diabetes association,1996)

Macrovascularcomplication of diabetes includeartherosclerosis and arteriosclerosis. Myocardial infarction, renal vascular insufficiency, and cerebrovascular accidents are the most common causes of mortality in long-standing diabetes.

Another important complication of diabetes includes impairment functions of polymorphic leukocytes and lymphocytes.Defences against bacterial infections and tissue reparative processes are further retarded by the poor tissue perfusion secondary to vascular disease.

Why should we worried !

- The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014 (1a).[5]
- The global prevalence of diabetes* among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 (1a)[5].
- Diabetes prevalence has been rising more rapidly in middle- and low-income countries.
- In 2015, an estimated 1.6 million deaths were directly caused by diabetes. Another 2.2 million deaths were attributable to high blood glucose in 2012.
- Almost half of all deaths attributable to high blood glucose occur before the age of 70 years. WHO projects that diabetes will be the seventh leading cause of death in 2030 (1a)[5].
- Diabetes has emerged as one of the major health care problems in India. According to the Diabetes atlas published by the International Diabetes Federation (IDF), there are estimated 40.7 million persons with diabetes in India in 2007 and this number is predicted to rise to almost 60.9 million by 2025. It is also known that almost 50% of the people with diabetes remain undetected and some may even present with microvascular and macrovascular complications at the time of diagnosis. In the CURES study the prevalence of overt nephropathy was 2.2% while that of microalbuminuria was 26.9%.
- Assuming that 40 million people in India have Diabetes, this translates to 0.8 million with nephropathy. Thus the burden due nephropathy is very high in India due to sheer number of people with diabetes.
- Diabetic nephropathy is the single most common cause of end-stage renal disease (ESRD) accounting for 25-45% of all ESRD.It is estimated that death due to renal disease is 17 times more common in diabetic than in non-diabetic patient. Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation.

Diagnostic ultrasound is recognised as an important adjunct to clinical examination in the care of patients with many common illnesses (P.E.S Palmer 1995)[6] and it is easily available, non-invasive,informative and cost effective tool.

Grey scale ultrasound has greatly increased the morphological

details that displayed within kidney.The addition of colour doppler and spectral wave form allowed perfusion to be assessed both qualitatively and quantitatively.(Satish,2003)[7]

Importance of the study-
Early detection of the haemodynamic changes and grey scale finding in bilateral kidneys help in management and prevention of complications of diabetes because prevention is the best treatment for complications.

AIMS AND OBJECTIVES
1. To evaluate spectrum of renal artery colour Doppler findings in diabetic patients and its correlation with biochemical parameters.
2. To study flow metric changes in diabetes patients.
3. To evaluate the gray scale finding of renal parenchyma in diabetic patients.
4. Predict the risk of developing diabetic nephropathy by correlating with resistive index.

MATERIALS AND METHODS
This study was observational study involving 50 clinically diagnosed diabetic patients according to WHO criteria[1]coming to Department of Radiodiagnosis,J.A. Group of Hospitals,Gwalior for Ultrasound and colour doppler in between September 2015 to August 2017.

The study was approved by Ethical Committee and Written informed consent from patients or legal guardians was taken.
- **Study Design:** Observationalstudy involving **50 patients.**
- **Study Period:** Two years (September 2015 to august 2017).
- **Work Place:** Department of Radio-diagnosis G.R. Medical College &J A Group of Hospital, Gwalior.
- **Study Group :** All patients referred to the Department of Radio-diagnosis with the clinicallydiagnosed cases of diabetes.

As a control group, we have taken 16 healthy patients(8 male and 8 female) 2 in each age group i.e30-39,40-49,50-59,60-69yrs. For better comparison and minimizes the variation. None of the control subjects has proteinuria, renal insufficiency, hypertension, diabetes, cardiovascular diseases, cerebrovascular disease or peripheral vascular diseases.

- **Inclusion criteria-**Patient between 30 to 75 yrs age having diabetes more than 2 yrs of duration.
- **Exclusion criteria-**Patient having prior renal disorder and renal artery stenosis. To exclude patients with nondiabetic or obstructive kidney diseases,the patients with microscopic or macroscopic hematuria, or an abnormal urinary sediments, a past history of glomerulonephritis or nephro-ureterolithiasis, or dilated renalpelvis on real-time ultrasonography, were excluded from thisstudy. The patients who had severely atrophied kidney(s), eitherunilateral or bilateral, were also excluded from this study because of poor imaging of blood flow with real time/colour coded sonography and difficulty in detecting a waveform. Patients having analgesic abuse excluded from study.

- **OBSERVATION AND RESULTS**
- The study was observational cross sectional study carried out in J A Group of Hospital ,Gwalior between September 2015 to august 2017. The study was approved by Ethical Committee and written informed consents from patients or legal guardians was taken.
- 50 diagnosed cases of diabetes patients was taken.
- 16 healthy person with age and sex matched taken as control group.
- In the present study,the patients ranges from 35 yrs to 75 yrs and mean age is 54.7 ±9.46 yrs.
- Maximum number of patients were in the group 60-69 yrs of age, that is 34%.
- There is increased of renal resistive index with increased age group of diabetes patients with correlation coefficient, r=0.4023 and p value =0.0033 suggest a positive correlation although a weak correlation. Exceptionally there is decreased

in RI in age group >70 Yrs of age,may be possibility due to small sample size just 1 patient in this group.
- There is increased in RI in patients with relation to control in each group and on increasing age, there is increase in RI in both controls and patients.(in control r =0.9202 ,in patients r=0.4023).
- In present case study, there is slightly female predominance compare to male.
- The mean RI of female is also slightly higher than male.(52% Vs 48%.)
- In The present study, there is increase in RI with increase in duration of diabetes. Pearson correlation coefficient r= 0.917 suggest a strong positive correlation in between RI and duration of diabetes.
- In the present study, there is increasing of RI with increasing serum urea. Pearson correlation coefficient r= 0.7332 , a moderately positive correlation with p value < 0.01, statistically significant.
- However in the present study, there is decrease in RI value in the urea level 80-99 mg/dl, may be possibility due to small sample size, n =3.
- The present study shows there is a positive correlation between renal resistive index (RI) and serum creatinine in diabetic patients.It is consistently increases with increasing Serum creatinine. A significant positive correlation exist between the two measurements. *r = 0.798* ; p value = 0.00001.
- The present study shows a positive correlation between urine albumin excretion and RI value. RI increases with increasing urine albumin.(*r =0.7563 with p value <0.01*).
- The present study shows a positive correlation between Fasting Blood Sugar (FBS) and RI of diabetes patients with correlation coefficient r = 0.8714, p value <0.01.
- The present study shows there is positive correlation between glycated haemoglobin and renal arterial resistive index with correlation coefficient r = 0.9286, p value <0.01.
- In the present study,when diabetic patients divided into two group on the basis of duration , one is less than 8 yrs and other is more or equal to 8 yrs,there is significant difference in RI value in between two group with t value=11.04, and p value <0.01.
- In the present study,when diabetic patients divided into two group on the basis of blood urea level , one is <80 mg/dl and other is ≥80 mg/dl ,there is significant difference in RI value in between two group with t value=4.07, and p value <0.01.
- There is not much difference in RI value between control and patients with blood urea <80 mg/dl suggestive of blood urea rises only when there is significantly alteration in haemodynamic of kidneys or late stages of diabetic nephropathy.
- In the present study, when diabetic patients divided into two group on the basis of serum creatinine level , one is < 1.80 mg/dl and other is ≥ 1.80 mg/dl ,there is significant difference in RI value in between two group with t value=7.24, and p value <0.01.
- There is not much difference in RI value between control and patients with of serum creatinine level<1.80 mg/dl suggestive of creatinine rises only when there is significantly alteration in haemodynamic of kidneys or late stages of diabetic nephropathy.
- In the present study, when diabetic patients divided into two group on the basis of fasting blood sugar level , one is <225 mg/dl and other is ≥225 mg/dl, there is significant difference in RI value in between two group with t value=7.89 and p value <0.01.
- In the present study, when diabetic patients divided into two group on the basis of glycated haemoglobin level, one is HbA1C <7.5 %and other is HbA1C≥ 7.5 %, there is significant difference in RI value in between two group with t value=8.10 and p value <0.01.
- In the present study, when diabetic patients divided into three group on the basis of albumin level there is continuous increase in RI value and a significant difference of RI exist between < 30 mg and ≤30 to < 300 mg and ≥ 300 mg with p value <0.001.
- The present study shows there is significant difference in mean of covariables in between two groups i.e.duration of diabetes,

serum urea, blood urea , fasting blood sugar, glycated haemoglobin and urine albumin level in diabetes patients.
- In the present study, RI increases with decreasing kidney sizes showing a negative correlation in between two variables.
- In the present study, there is increase in RI when there is increase in echotexture of kidney showing positive correlation between two variable.
- In the present study, there is increase in RI in diabetic patients in with hypertension as comorbid condition in comparison to diabetic patients without hypertension.
- In the present study,the patients ranges from 30 yrs to 70 yrs and mean age is 49.7 ± 8.46 yrs.
- There is increased in RI with increase in age with coefficient of correlation (r) $=0.9202$ and PI <0.01.
- There is also mildly increased RI in female comparison to male in each age group except in 40-49 yrs of age which is almost equal.

CONCLUSION

1. Ultrasound is an informative, cost effective, accurate and noninvasive investigation to diagnose diabetic nephropathy and also to exclude other non diabetic renal abnormality like stone, cyst ,malignancy.
2. The duplex sonography is useful in the non invasive assessment of intra renal haemodynamic abnormalities present in diabetic nephropathy.
3. RI values are significantly affected / increased by advanced age, duration of diabetes, urine albumin level and decreased glomerular function.
4. RI might be very useful for early detection, evaluating the renal damage and predicting the prognosis and risk of developing diabetic nephropathy.
5. RI increased with the CKD stage and showed correlations with renal function as evaluated by serum creatinine and blood urea in our study. RI is better predictor of renal damage than gray scale finding such as size, echotexture and CM differentiation.
6. RI might be useful to identify the cohort of microalbuminuric patients withmore severe renal lesions and those prone to develop a rapid decay of GFR without performing routinely the invasive procedure of renal biopsy.