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RESEARCH ARTICLE

STUDY OF ANAEMIA IN TYPE 2 DIABETES MELLITUS, RISK FACTOR FOR THE PRESENCE AND SEVERITY OF MICRO VASCULAR COMPLICATION, DIABETIC RETINOPATHY

Dr. Srimaan S.¹, Dr. Ritesh Yadav², Dr. Ankit Jain³ and Dr. Ashish Gupta⁴

1. Senior Resident Dept. of Medicine, Govt. Netaji Subhash Chandra Bose Medical College Jabalpur (M.P.).
2. Asst. Professor Dept. of Medicine, Govt. SRVSMC, Shivpuri (M.P.).
3. Senior Resident, Dept. of Medicine, Govt. SRVSMC, Shivpuri (M.P.).
4. Asso. Professor Dept. of Medicine, Govt. Netaji Subhash Chandra Bose Medical College Jabalpur (M.P.).

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Abstract

Objectives: To estimate the prevalence of anemia in persons with type 2 diabetes mellitus and its role as a risk factor for the presence and the severity of diabetic retinopathy, in a population based study. Although chronic kidney disease-induced anemia is more prevalent in patients with diabetes mellitus (DM), anemia is a common finding prior to manifestation of kidney disease. In presence of some risk factors at the time of diagnosing DM, microvascular complications must be considered. The effect of anemia as a risk factor on progression of DM complications is still unclear. The aim of the study was to determine the prevalence of anemia and its association with microvascular complications in patients with type 2 DM. This cross-sectional study was performed in the present study is carrying out from Department of Medicine, Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur (M.P.) Results: The prevalence of anemia (Hb<12g/dl in women and <13g/dl in men) was 12.3%. Between 41 and 50 years of age, prevalence of anemia was higher in women than in men (78.6 % vs 56.3.3%). Men with anemia, and not women, had 2 times the risk of developing diabetic retinopathy. Multivariate analysis revealed independent predictors for anemia: age group more than 70 years (66.7% vs 100%) duration of diabetes of more than 5 years or 1.56 (1.09-2.69) and the presence of diabetic retinopathy or 1.82 (95% CI 1.22-2.69).

Conclusion: Diabetes mellitus is one of the serious diseases affecting the largest population worldwide. Diabetic retinopathy is a sight threatening preventable complication. Anemia is more common in diabetic population both men and women. Identifying and treating anemia would make a great impact in managing diabetic retinopathy. Anemia is a common complication of DM and is associated with duration of disease and microvascular complications.

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Corresponding Author:- Dr. Ashish Gupta

Address:- Asso. Prof. Dept. of Medicine, Govt. Netaji Subhash Chandra Bose Medical College Jabalpur (M.P.).

Introduction:-

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia, resulting from defects in insulin secretion, insulin action or both. It may be accompanied by the presence of progressive microvascular and macrovascular complications. The prevalence of type 2 diabetes is increasing all over the world. It has emerged as a major public health problem in India. The WHO estimated that there were 31.7 million persons with diabetes in India in the year 2000 and this number is likely to rise by 71.4 million in 2030.³ The chronic complications of diabetes includes micro vascular complication and macrovascular complication. The macrovascular complications includes the cardiovascular diseases, cerebrovascular diseases, peripheral vascular diseases. The microvascular complications includes diabetic retinopathy and diabetic nephropathy and diabetic neuropathy. Among the microvascular complication retinopathy is a dreadful sight threatening one. Retinopathy is considered to be a leading cause of blindness in diabetic population. Blindness is 25 times more common in diabetic patients than non diabetic. Diabetic retinopathy is ranked as the sixth common cause of blindness in India. While the type 2 diabetes mellitus patients may have retinopathy at the time of diagnosis. After two decades nearly 60% of the type 2 DM patients will have retinopathy. The scope of preventing, diagnosing and treating the devastating effects of retinopathy on vision is at present a major issue.² The incidence of the diabetic retinopathy increases as the age advances. The relative risk is greater between the age of 30-60 years. The incidence of vision loss increases with increase in age, severity of retinopathy, duration of diabetes, presence of proteinuria and hyperglycemia.

Anemia, a common complication is more prevalent in persons with diabetes than in person without diabetes. Anemia can occurs in 25% of people with diabetes mellitus. Anemia may develop earlier and more severe in patients with diabetes than in patients with renal impairment from other causes. The World Health Organisation WHO guidelines recommends investigation of anaemia where Hb is less than 12g /dl in women and less than 13g /dl in men.² By using this definition nearly 1 among 4, that is 25% patients with diabetes have anemia. People who have both anemia and diabetes are more likely to die earlier than those who have diabetes but not anemic.³ Anemia can lead to false low level of HbA1C which may result in under treatment of hyperglycemia which in turn will contribute to the progress of micro and macro vascular complications.⁴

Aims & Objectives:-**Primary objective:**

To estimate the prevalence of anemia in patients with type 2 diabetes mellitus.

Secondary objective:

Its role as a risk factor for the presence and the severity of diabetic retinopathy in N.S.C.B. Medical College and Hospital.

Background

Diabetes mellitus is now been established as one of the leading cause of morbidity and mortality throughout the world. Most of the ill effects on health can entirely be attributed to the long term complications of diabetes.

Chronic complication of Diabetes⁵:

The chronic complications of diabetes can be classified into microvascular complications and macrovascular complications traditionally.

Microvascular complication:

Diabetic retinopathy, Diabetic nephropathy, Diabetic neuropathy

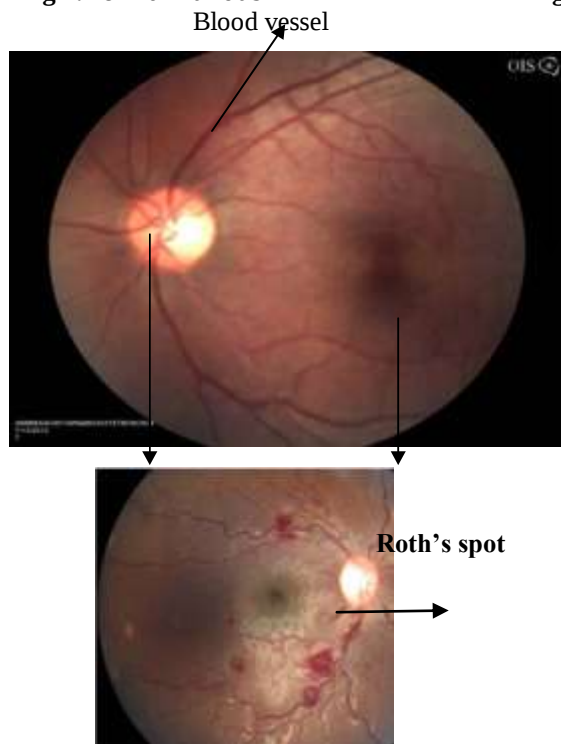
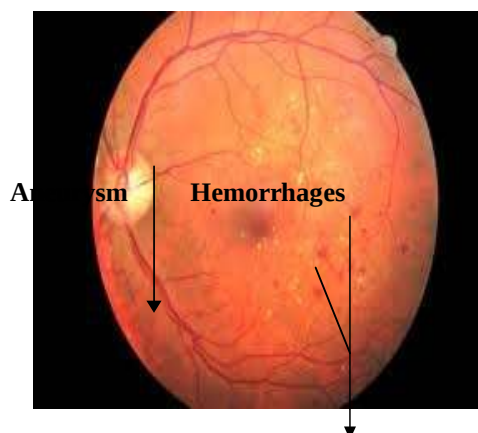
Macrovascular complication:

Cardiovascular disease, Peripheral vascular disease, Cerebro vascular disease.

Diabetic Retinopathy:

Diabetic retinopathy is the most common cause of blindness in diabetic population. Diabetic retinopathy is often asymptomatic in its most treatable stages; hence early detection through regularly scheduled ocular examination is critical. The prevalence of retinopathy at the time of diagnosis is much greater in type 2 (6.7- 30.2%) as compared to type 1(0-3%), as the former is more likely to remain undiagnosed for longer periods of time. Approximately 1 among 4 diabetics is unaware of their disease.

Prevalence of proliferative diabetic retinopathy is more in long standing type 1 diabetes mellitus. However, in type 2 diabetes mellitus patients on insulin, risk is equally high (25%) possibly owing to chronic hyperglycemia. Most of the diabetic retinopathy patients seen in the clinics will be suffering from type 2, rather than type 1 diabetes simply because type 2 is seen more commonly in the population than type 1, though type 1 are more prone to develop retinopathy.

Fig 1. Normal Fundus**Fig 2. Diabetic retinopathy**

Risk factors for the development of Diabetic Retinopathy⁶

Poor control of Diabetes- It is now proven that good diabetic control may slow the development and progression of diabetic retinopathy in both type 1 and type 2 diabetes. The United Kingdom Prospective Diabetes Study 1998 (UKPDS) followed 5,102 newly diagnosed type 2 diabetes prospectively since 1977. Those diabetics who were intensively treated and achieved tight control with either insulin or sulphonylurea had diabetic complications 12% lower than less well controlled diabetics. Overall there was a 25% reduction in microvascular complications in the group exhibiting good glycemic control.

Complications of diabetic retinopathy

All are essentially complications of neovascularization²

1. Vitreous hemorrhage: Patient presents with sudden loss of vision, usually precipitated by straining while lifting a heavy weight or at the toilet and often is the presenting feature of undetected PDR.
2. Tractional retinal detachment (TRD)
3. Rubeosis Iridis: Refers to growth of new vessels on the surface of iris. New vessels first appear at the papillary margin and then extend radially towards the angle.
4. Glaucoma: Neovascular glaucoma is a complication of rubeosis iridis, new vessels in angle of anterior chamber cause angle closure leading to mechanical obstruction to out flow of aqueous through channels in angle. This cause raised intra ocular pressure and becomes distorted as iris gets pulled over the angle. Eye becomes painful and red along with progressive loss of vision.
5. Blindness is due to non-clearing vitreous hemorrhage, neovascular glaucoma, TRD and macular ischemia.⁶

Prevalence and characteristic of anemia in diabetes⁷

Practical Diabetes, International Journal, Apr: 2008, Article: vol 25. Adetunji, FWACP, AO Ijuhungbe, MRCPJ. Ronand. This article states that there are an increasing number of patients with diabetes who have been found to be anaemic without underlying evidence of chronic renal disease.

Anemia in diabetes: An emerging complication of micro vascular diseases⁸

Gurre Diabetes Review S. Jan 2005, November Merlin Thomas, Richard Macsav, George Serums

According to this article: In diabetic patients, anemia is 2-3 times more prevalent than non-diabetic, may be due to diabetic nephropathy induced, reduced erythropoietin systemic inflammation, autonomic neuropathy and reduced red cell survival.

Recognizing anemia in people with diabetes³ National Anemia Action Council, NAAC Article Published, and March 11, 2009. In this article, they state that anemia is a common concern and can occur in up to 25% of people with diabetes. This is because having diabetes for a long time can affect kidneys and nerves.

Material And Methods:-**Study Area and target population:**

The present study is carrying out from Department of Medicine, Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur (M.P.).

Inclusion Criteria:

All the patients selected for the study were aged 40 years and above 40 years. All the patients selected for the study had type 2 diabetes. All the patients selected for the study were attending N.S.C.B. Medical College and Hospital in patients. Patients willing for and giving consent to participate in the study.

Exclusion Criteria:

Patients not willing to participate in the study. Patients having type 1 diabetes were excluded from the study. Patients with age below 40 years were excluded from the study.

Investigation:

Complete blood cell count (CBC). Reticulocyte count. Peripheral Blood Smear. Urine routine microscopy. Direct ophthalmoscopic examination.

Considering the best availability of the patients by reviewing the previous records of this health facility, to achieve the maximum sample size we will randomly screen all patients and select those who fulfil the inclusion and exclusion criteria and are ready to give the written informed consent. Informed and written consent would be obtained from each individual and the participation in the project would be on voluntary basis.

Result:-**Table 1:- Male and Female.**

Both Male/Female (Yrs)	Anemia				Total
	Anemic		Non anemic		
	No.of cases	Percentage	No. of cases	Percentage	
30-40	21	67.7%	10	32.3%	31
41-50	20	66.7%	10	33.3%	30
51-60	14	58.3%	10	41.7%	24
61-70	8	88.9%	1	11.1%	9
>70	5	83.33%	1	16.7%	6
TOTAL	68		32		54

The above table shows anemia present in most of the cases in young individuals and anemia present almost 88.9% in 61-70 age group followed by 83.33% in >70 age group

Male(yrs)					Total
	Anemic		Non anemic		
	No. of cases	Percentage	No. of cases	Percentage	
30-40	9	69.2%	4	30.8%	13
41-50	9	56.3%	7	43.8%	16
51-60	10	62.5%	6	37.5%	16
61-70	6	100%	0	0%	6
>70	3	100%	0	0%	3
Total	37		17		38

The above table shows anemia present in young male individuals most of cases and almost 100% are anemic among 61-70 and > 70 age group.

AGE Vs ANEMIA (n=46)

Female (Yrs)					Total
	Anemic		Non anemic		
	No.of cases	Percentage	No.of cases	Percentage	
30-40	12	66.7%	6	33.3%	18
41-50	11	78.6%	3	21.4%	14
51-60	4	50.0%	4	50.0%	8
61-70	2	66.7%	0	33.3%	2
>70	2	66.7%	1	33.3%	3
Total	31		10		45

Table shows anemia present in young individual most of the anemic present between 41-50 is 78.6% .Table-2

Anemia Vs Retinopathy (n=50)

Both Male /Female (Hb in grams %)	Retinopathy				Total
	Absent		Present		
	No.of cases	Percentage	No.of cases	Percentage	
Anemic	39	57.3%	29	42.64%	68
Non Anemic	32	100%	00	0.00%	32
TOTAL	71		29		100
Chi Square Tests					
		Value	df	P value	
Pearson chi square		19.22	1	<0.0001	

The above table shows in 42.64% of the cases in anemic group when comparing it to non anemic group is 0% p value <0.0001

In 100 cases of with diabetes, anemic was present in 68 cases, not an anemic in 32 cases. Among the anemic group retinopathy was present in 42.64% comparing with non anemic group it was 0%.the chi square test showed p value <0.0001.show in diabetics with anemic presence of retinopathy was statistically significant.

Table 3:- Anemia Vs Albuminuria (n=50).

Both Male/Female	Albuminuria				Total
	Absent		Present		
	No.of cases	Percentage	No.of cases	Percentage	
Anemia	48	70.6%	20	29.4%	68
Non Anemia	32	100%	0	100%	32
Total	80		20		100
Chi square tests					
		Value	df	P value	
Pearson chi square		11.76	1	0.001	

The above table shows that albuminuria is present in 29.4% of cases in anemic group when compare to non anemic group is 0%. P value is 0.001.

Among the 100 diabetics, albuminuria was present in 20 cases of anemic group whereas albuminuria was absent in non anemic patient. The chi square test showed the P value of 0.001 so in diabetics with anemia was statistically significant for the albuminuria.

Table 4:- Duration Vs Retinopathy.

Both Male/Female	Retinopathy				Total
	Absent		Present		
	No.of cases	Percentage	No.of cases	Percentage	
<5 YRS	63	100%	00	0.00%	63
>5 YRS	8	21.62%	29	78.37%	37
Total	71		29		100
Chi square tests					
		Value	df	P value	
Pearson chi square		69.55	1	<0.0001	

In diabetics more than 5 year group the retinopathy was present in 78.37% compare to duration of less than 5 years was only 0.00% The chi square test showed the Pvalue of <0.0001. So in diabetics duration more than 5 Years statistically significant for retinopathy.

Table 5:- Iron deficiency vs Vitamin B-12 / Folic Acid.

Gender	Albuminuria			
	Iron deficiency		Vitamin B-12 /	
	No.of cases	Deficient	No.of cases	Deficient
Male	54	24	54	6
Female	46	15	46	5
Total	100	39	100	11
Chi square tests				
Pearson chi square	5.28		0.024	
P value	0.022		0.877	

The above table shows iron deficiency is present in 39 cases and vit B12/folic acid is present in 11 cases among 100 cases. The P value of iron deficiency is 0.02 which is statistically significant where as P-value of Vit.B12/folic acid is 0.877 that is not significant statistically.

Discussion:-

In our study we analyzed the significance of anemia in type 2 diabetic patients with retinopathy and compared anemia with other risk factors like gender, albuminuria, duration of diabetes and hypertension both in males and females separately.

In our study results we observed that the percentage of anemia in type 2 diabetes was more than expected. Anemia is more common in diabetics, both men and women.

The study also shows that anemia is more in younger women than in men. In females aged 41-50 years, maximum percentage of anemia was noted (78.6%) and in men it was at its maximum between 61-70years (100%) and above 70years (100%).

After the fifth decade however there was no difference in the anemia noted both in women and men. The possible reasons would be the onset of menopausal period around this age in women as the literature shows.

In our study we observed that the diabetic patients with anemia are more likely to develop diabetic retinopathy than without anemia. In men the risk of developing diabetic retinopathy is increased as compared with women. This observation is supported by the study⁹. They reported the odds ratio of 2 for the presence of diabetic retinopathy and retinopathy increased with anemia, in a cross sectional study of more than 1600 individuals with type 2 diabetes mellitus.

Other observation of our study shows, albuminuria is present in 29.72% of men with anemia and it is 0% in men without anemia on the other hand the observation shows albuminuria is present in 29.03% in women with anemia and 0% in non anemic group. Even though the effect of anemia on albuminuria is statistically significant, p value in observation is probably not entirely due to anemia. Presence of anemia increases the likelihood of albuminuria.

In our study, we observed the duration of diabetes is definitely influencing with retinopathy and albuminuria (81.81% Vs 0%, 73.33% Vs 0%, 50% Vs 0%, 60% Vs 0%) in men and women respectively.

In our study iron deficiency is Present in most of the cases (39%) is more than vitamin B-12/ Folic Acid (11%). more over iron deficiency and deficiency about (69.23%) of female age group (41-50) may be due to menopause and It is noted that hypermethylcobalaminemia was present in 89.19% for diabetes >5 years.

Finally, detection of anemia and its treatment is important in the management of diabetic retinopathy. In those patients who had both anemia and diabetes mellitus, Friedman and associates¹⁰ reported that the treatment of anemia with erythropoietin was correlated with substantial resolution of macular hard exudate.

There by prevents the new vessel formation in retina and reduce the diabetic retinopathy. So these observations suggest that anemia evaluation should be considered in routine management of persons with diabetes and could be treated to minimize the risk of micro vascular complications like retinopathy.

Conclusion:-

Diabetes mellitus is one of the serious diseases affecting the largest population worldwide. Diabetic retinopathy is a sight threatening preventable complication. Anemia is more common in diabetic population both men and women. Anemia is one of the independent risk factor for the presence of diabetic retinopathy. Presence of anemia in men is a risk factor for severe form of diabetic retinopathy. Along with life style modification and strict glycemic control, early detection of anemia in diabetic patient and treating the anemia irrespective of the cause of anemia will prevent the micro vascular complications especially diabetic retinopathy. Every tenth individual in diabetic population could be anaemic⁴³. Identifying and treating anemia would make a great impact in managing diabetic retinopathy.

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