Original Article

ISSN (O): 2663-8290; ISSN (P): 2663-8282

Laboratory Findings Associated with Pulmonary Tuberculosis in Diabetic Patients

P. V. R. Leelamohan[1], **Kiran N**[2]

[1]Assistant Professor, Department of General Medicine, , M. V. J. Medical College and Research Hospital, Bangalore, Karnataka, India, [2]Assistant Professor, Department of Pulmonary Medicine, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India.

Abstract

Background: An epidemic of diabetes is currently, both in developed and developing nations. The seriousness of the association of pulmonary tuberculosis and diabetes mellitus was first noted by the great Arab Physician Avicenna nearly 1000 years ago. The global figure of people with diabetes is projected to rise from the current estimate of 220 million to 300 million in 2025. **Subjects and Methods:** All type 2 diabetic patients reporting to MVJMC and RH will form the subjects for study. The study conducted over a period of 2 yrs. Adult patients with diabetes mellitus with pulmonary tuberculosis were included while Diabetic patients with extrapulmonary tuberculosis were excluded from the study. **Results:** LDL: 18% of the patients had an LDL value below 100. 40% of the patients had LDL value between 100 – 120. Only 42% of the patients had LDL values between 120-140. HDL: 22.0% of the patients had an HDL value below 30. 24% of the patients had HDL values between 30 – 40. Only 36.0% of the patients had HDL value between 40-50 and 18% of the patients had an HDL value between 50-60. Triglycerides: 56.0% of the patients had Triglycerides value below 150. 42% of the patients had Triglycerides value between 150 – 199. Only 2.0% of the patients had Triglycerides value between 200-499. **Conclusion:** Male preponderance of the disease was noted and Peak incidence of the disease was noted in the age groups of 31 – 40 and 41 – 50. The majority of our patients had poorly controlled blood sugars, suggesting that severe hyperglycemia is associated with the development of pulmonary tuberculosis and sputum positivity was more in patients aged ≤ 50 yrs. Early diagnosis and properly monitored treatment regimen is the only time tested answer to this problem.

Keywords: Triglycerides, Mantoux, HBA1C levels, Lowenstein –Jensen medium, Sputum AFB

Corresponding Author: Kiran N, Assistant Professor, Department of Pulmonary Medicine, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India.
E-mail: kiran.n@gmail.com

Received: 21 December 2019 **Revised: 27 January 2020** **Accepted: 11 February 2020** **Published: 25 June 2020**

Introduction

Tuberculosis can be traced back to the early history of mankind. In our country, it has been known since the Vedic ages, which is about 5000 years ago and it was called Rajalakshmi (meaning wasting disease). Despite all efforts to eliminate tuberculosis, it continues to be one of the most prevalent infections in the world. 90% of the infected persons do not develop the disease in their lifetime because of immunity that they develop against it or immunization with BCG vaccination. An epidemic of diabetes is on currently, both in developed and developing nations. The seriousness of the association of pulmonary tuberculosis and diabetes mellitus was first noted by the great Arab Physician Avicenna nearly 1000 years ago. The global figure of people with diabetes is projected to rise from the current estimate of 220 million to 300 million in 2025.[1] With the recognition of this explosive increase in the number of people diagnosed with diabetes mellitus all over the world, a whole new field of issues related to the interaction between diabetes and pulmonary tuberculosis has been laid open. Based on a compilation of studies from different parts of the globe, the WHO has projected that the maximum increase in diabetes would occur in India.[1] Studies conducted in India in the last decade have highlighted that not only is the prevalence of type 2 diabetes high, but also that it is increasing rapidly in the urban population.[2] In a study in Mumbai, tuberculosis was found to be the most common complicating illness (5.9%) in a large cohort of over 8000 patients with diabetes mellitus.[3] Various studies show that the incidence of tuberculosis in diabetic patients varies from 1.6 – 8.4%.[4] Early diagnosis of the combination is rare. At the time of diagnosis, a large majority of cases have severe diabetes and far advanced pulmonary tuberculosis. We aimed to conduct a study on laboratory findings associated with pulmonary tuberculosis in diabetic

patients.

Subjects and Methods

All type 2 diabetic patients reporting to MVJMC and RH will form the subjects for study. The study conducted over a period of 2 yrs. Adult patients with diabetes mellitus with pulmonary tuberculosis were included while Diabetic patients with extrapulmonary tuberculosis were excluded from the study. Diagnosis of diabetes was based on the National Diabetes Data Group and World Health Organization (WHO) which issued diagnostic criteria for diabetes mellitus based on the spectrum of fasting plasma glucose (FPG) and the response to an oral glucose load varying among normal individuals. Individuals with IFG or IGT are at substantial risk for developing type 2 diabetes mellitus (40% risk over the next 5 years) and cardiovascular disease. Oral glucose tolerance testing, although still a valid mechanism for diagnosing diabetes mellitus is not recommended as part of routine care. Diagnosis of Pulmonary Tuberculosis was made on the basis of sputum examination that was examined by direct smear using the Ziehl-Neilsen stain. The fluorescence method allows a large number of specimens to be examined rapidly. Sputum smear examination is usually positive in advanced disease but may be negative in less advanced disease, Sputum culture: Growth is visible on culture only after 3 – 8 weeks (Lowenstein –Jensen medium). Rapid diagnosis is now possible within 2 – 6 days using a radiometric culture system, the basic system. In any patient in whom the diagnosis is in doubt, repeated smear and culture examination should be carried out, Radiological appearances suggestive of tuberculosis: Following characteristics of a Chest radiograph favors the diagnosis of tuberculosis- Opacities mainly in the upper zone (s), Patchy or nodular opacities, Presence of cavity or cavities, Presence of calcification, Bilateral opacities especially if in upper zones, Opacities that persists after several weeks (and thus are less likely due to acute pneumonia).

Results

Figure 1 shows the age wise distribution of Patients. The maximum incidence of pulmonary tuberculosis was noted above the age of 30yrs were 13 (26.0%). The peak incidence was in the age group of 31 – 40 and 41 – 50 years. The mean age is 52.62. As shown in Table 1, the total numbers of males were 64% and females were 36%. The male to female ratio was 2.11:1. [Table 2] shows the investigations like hemoglobin, Fasting blood sugar, Postprandial blood sugar, Erythrocyte sedimentation rate and Total leukocyte count were done Anemia was observed in 54% of patients and 2% had severe Anemia. 46% of the patients had an erythrocyte sedimentation rate above 60 mm/hr. The average fasting and postprandial blood sugar values in the study group were 191.72 and 308.50 mg/dl, respectively. As shown in Table 3, LDL: 18% of the patients had an LDL value below 100. 40% of the patients had LDL value between 100 – 120. Only 42% of the patients had LDL values between 120-140. HDL: 22.0% of the patients had an HDL value below 30. 24% of the patients had HDL values between 30 – 40. Only 36.0% of the patients had HDL value between 40-50 and 18% of the patients had an HDL value between 50-60. Triglycerides: 56.0% of the patients had Triglycerides value below 150. 42% of the patients had Triglycerides value between 150 – 199. Only 2.0% of the patients had Triglycerides value between 200-499. As shown in Table 4, sputum AFB was demonstrated in 78% of 39 patients. The total sputum positive patients are 39 and negative are 11 among the 11 patients induced sputum was done which was showing negative for AFB. As shown in Table 5, Mantoux was demonstrated in 34% of 17 patients. As shown in Table 6, According to the distribution of HbA1c among 50 patients, the hba1c value between 6-8 is 18%, HbA1c value between 8-10 is 18.0%, HbA1c value between 10-12 is 14.0% and hba1c value above 12 is 50.0%.

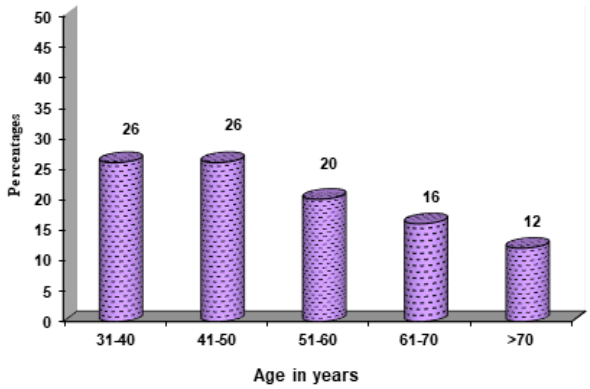

Figure 1: Age Distribution of Patients Studied

Table 1: Gender Distribution of Patients Studied

Gender	Number of patients	Percentage (%)
Male	32	64.0
Female	18	36.0
Total	50	100.0

Discussion

In the present study, the number of patients above the age of 30 years was 13 (26.0%) and the peak incidence was in the age groups of 31-40 and 41-50 (26.0%). 50% of the total cases were in this age group. Ezung et al. reported that the majority

Table 2: Distribution of Investigations of Patients Studied

Investigation	Number of patients (n=50)	Percentage (%)	Mean ±SD
Hemoglobin			
• <10	1	2.0	12.50±1.44
• 10-12	26	52.0	
• >12	23	46.0	
FBS mg/dl			
• <110	-	-	
• 110-140	5	10.0	
• >140	45	90.0	
PPBS mg/dl			
• <140	-	-	
• 140-200	-	-	
• >200	50	100.0	
ESR			
• <40	16	32.0	
• 40-60	11	22.0	
• >60	23	46.0	
Total count			
• <4000	-	-	
• 4000-11000	8	16.0	93.91
• >11000	42	84.0	

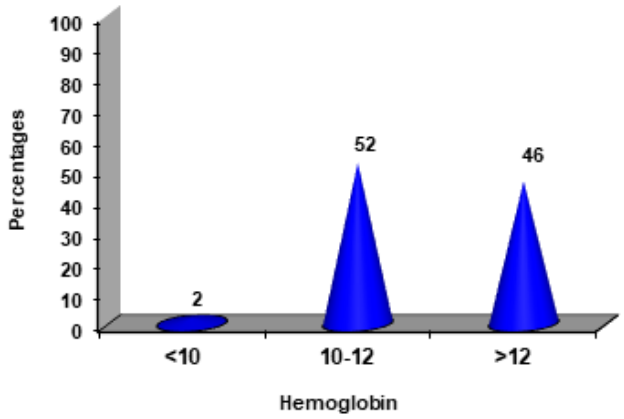

Figure 2: Hemoglobin level among study population

Table 3: Distribution of Lipid Profile of Patients Studied

Lipid profile	Number of patients (n=50)	Percentage (%)	Mean ±SD
LDL			
• <100	9	18.0	
• 100-120	20	40.0	
• 120-140	21	42.0	
• 140-160	0	0.0	
• 160-180	0	0.0	
HDL			
• <30	11	22.0	
• 30-40	12	24.0	
• 40-50	18	36.0	
• 50-60	9	18.0	
Triglycerides			
• <150	28	56.0	
• 150-199	21	42.0	
• 200-499	1	2.0	
• ≥500	0	0.0	

Table 4: Distribution of Sputum AFB of Patients Studied

Sputum AFB	Number of patients	Percentage (%)
Negative	11	22.0
Positive	39	78.0
Total	50	100.0
Total	50	100.0

Table 5: Distribution of Mantoux of Patients Studied

Mantoux	Number of patients	Percentage (%)
Negative	33	66.0
Positive	17	34.0
Total	50	100.0

Table 6: Distribution of HbA1c of Patients Studied

HbA1c	Number of patients	Percentage (%)
6-8	9	18.0
8-10	9	18.0
10-12	7	14.0
>12	25	50.0
Total	50	100.0

Mean ± SD: 11.30±3.45

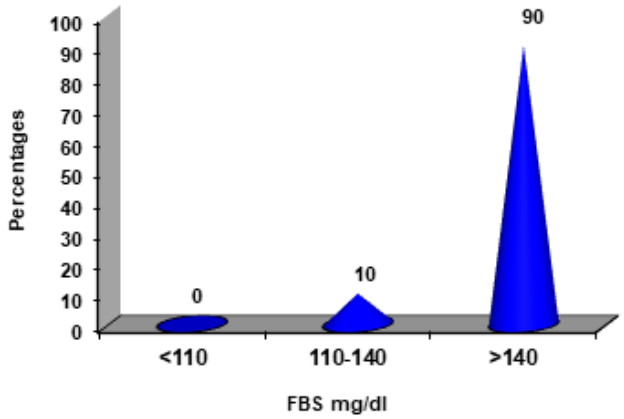

Figure 3: Fasting Blood Sugar level among study population

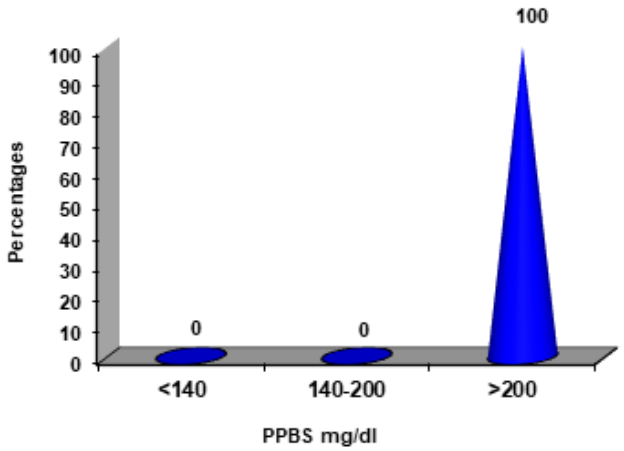

Figure 5: Post-Prandial Blood Sugar level among study population

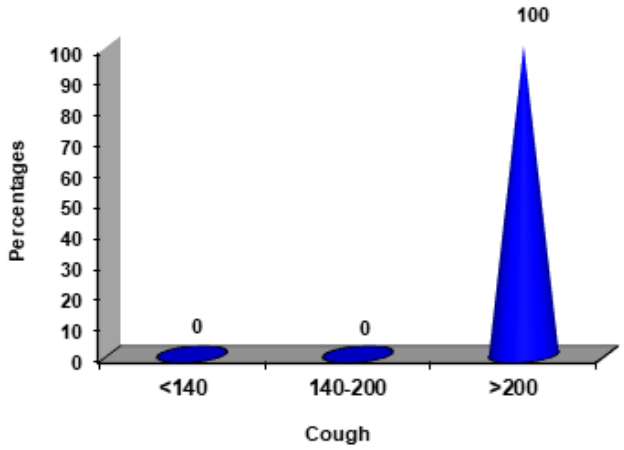

Figure 4: Cough among study population

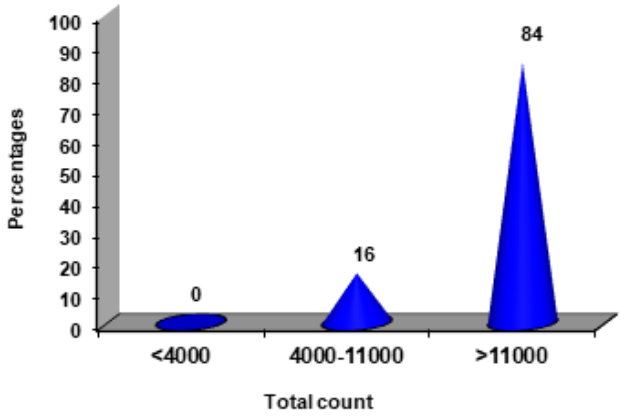

Figure 6: Total Leucocyte Count among study population

of cases of tuberculous diabetics belong to the age group of 45 yrs and above (82.6%).[5] Banerjee observed that 57.1% of the patients were above the age of 40 yrs. Philips noted that half of the active new cases of tuberculosis were observed in those who were at least 45 yrs and relative incidence was highest in those who had passed 65 yrs.[6] In our study the total number of males was 64% and females were 36%. The male to female ratio was 2.11:1. Other studies have shown that the prevalence as well as the incidence of tuberculosis, is higher among males than among females, the ratio varying from 3:1 to 5:1. In a study of 2434 cases of pulmonary tuberculosis by Deshmukh and others, it was reported that 62.9% were males and 37.1% were females. Among the 138 cases of diabetes with pulmonary tuberculosis, 72.4% were males and 27.53% were females. Patel JC showed a similar ratio of male: female. In the 179 cases he studied,76% were males and 24% were females.[7] The fasting blood sugar value of 110- 140 mg% was noted in 5 of the patients and values above 140mg% were noted in 90% of the cases, with a standard deviation of 191.72± 47.13. Postprandial blood sugar value at 2 hours was above 200 mg% in pts number 50,100% of patients. Mean PPBS was 308.50, with a standard deviation of 76.53. This showed that in most of the cases, blood sugar was not controlled. In a study done by Sachdeva AK and others, it was shown that a high incidence of pulmonary tuberculosis was associated with severe hyperglycemia.[8] Deshmukh PA also had made a similar observation. When HbA1C levels are studied in the fifty patients it is found that >7 41 patients (82%)

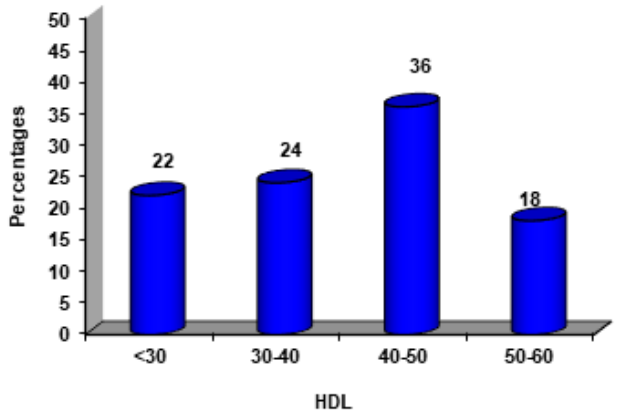

Figure 7: HDL levels among study population

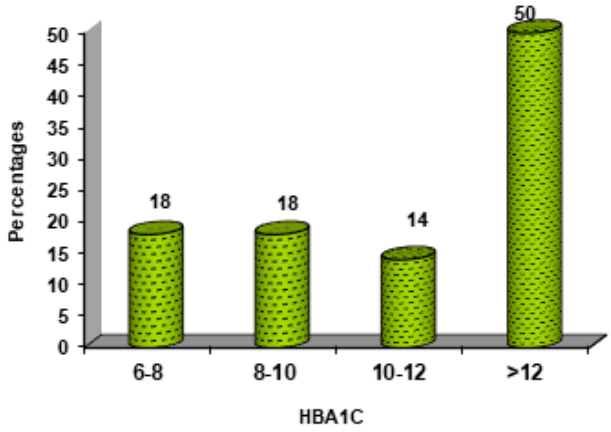

Figure 9: HbA1c among study population

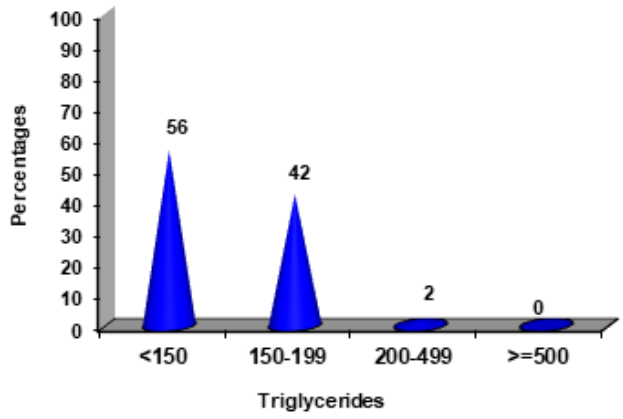

Figure 8: Triglyceride levels among study population

were observed and among them >12 were 25 patients (50%), Which infers that increased levels of HBA1C has more risk of developing pulmonary tuberculosis. This is mainly due to poor glycaemic control, which in turn increases the susceptibility for the infections and the patients are more prone to pulmonary tuberculosis because of its rapidity in India. In our study when lipid profile values are considered among the fifty patients the LDL values were normal among all the patients with Mean 115.09 and standard deviation 15.33 and the HDL values are also found to be normal with the Mean 41.28 and SD 11.83 and TG levels are increased in 22 patients (44%) with Mean 147.70 and SD 32.68. In other studies conducted by Gordonleitch and Barberis in 40 male patients found there is no effect on lipid profile in pulmonary tuberculosis, [9,10] same results were encountered by other workers in patients with pulmonary tuberculosis found serum cholesterol in PTB patients is lower than healthy controls so, [11] borderline Triglycerides which are increased in our study is mainly due to poor control of diabetes and insulin resistance. When sputum examination is done, 39(78.0) patients were sputum positive for acid-fast bacilli among them male where 24 (75%) and females where 15 (83.3%) and 11 (22.0)were negative for acid-fast bacilli among them Males where 8 (25%) and females where 3 (16.7%) and when age is considered <50 yrs 56% of the patients were sputum positive for acid-fast bacilli and P-value was 0.041 which is significant in that sputum positivity is more in patients aged <50 years and these levels are taken considering the young adults and elderly patients above the age of 50. Mantoux was positive in 17 patients and negative in 33 patients. It also depends on observational variations. In patients >50yrs, cavitation and fibrosis were more compared to <50yrs patients. Cavitary lesions, though maintain high bacterial population, less smear positivity is noted in diabetes. This may be related to muscle weakness due to uncontrolled hyperglycemia and less effective expectoration. In our study also in patients > 50 yrs, sputum positivity was less and the results are comparable to other studies. The highest incidence of sputum positivity was seen at the age of 40 yrs, which include in 37 patients -26 patients were sputum positive. But whereas in the age <40yrs 13 patients are studied and among all of the 13 are positive with the p-value -0.041with male preponderance and noted mainly in 18.6-24.9 range and the no of cases are 26(81.3%) – with p-value -0.175, Sputum positivity is seen mainly in patients with expectoration when symptoms are considered (44 patients) p-value -0.317. Sputum positivity is not increased with the duration of diabetes in our study, because the cases studied most of the patients where less than 10yrs with p-value -1.000. Sputum positivity was seen more at the borderline HBA1C levels in a total of 9 patients with the p-values -0.007 and also

Fasting blood sugar 162- 210 (26) patients with the p-value 0.382. Postprandial blood sugar -247 – 390 with p values - 0.584.

Conclusion

The male preponderance of the disease was noted and Peak incidence of the disease was noted in the age groups of 31 – 40 and 41 – 50. The majority of our patients had poorly controlled blood sugars, suggesting that severe hyperglycemia is associated with the development of pulmonary tuberculosis and sputum positivity was more in patients aged ≤ 50 yrs. Early diagnosis and properly monitored treatment regimen is the only time tested answer to this problem.

References

1. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. Diabetes Care. 1998;21(9):1414–31. Available from: https://dx.doi.org/10.2337/diacare.21.9.1414.
2. The current state of diabetes mellitus in India. Australas Med J. 2014;7(1):45–48. Available from: https://dx.doi.org/10.4066/AMJ.2013.1979.
3. Dooley KE, Chaisson RE. Tuberculosis and diabetes mellitus: convergence of two epidemics. Lancet Infect Dis. 2009;9(12):737–746. Available from: https://dx.doi.org/10.1016/S1473-3099(09)70282-8.
4. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res. 2007;125(3):217–230.
5. Ezung T, Devi NT, Singh NT, Singh TB. Pulmonary tuberculosis and diabetes mellitus–a study. J Indian Med Assoc. 2002;100(6):378–379.
6. Banerjee S, Banerjee M. Diabetes and tuberculosis interface. J Indian Med Assoc. 2005;103:318–322.
7. Patel JC. Complications in 8793 cases of diabetes mellitus, 14 years study in Bombay Hospital. Ind J Med Sci. 1989;43:177–183.
8. Sachdeva AK, Arora RC, Misra DN. Clinicoradiological study of pulmonary tuberculosis in diabetics. J Assoc Physicians India. 1984;32:30–34.
9. Gordonleitch A. Crofton and Douglas's respiratory diseases. vol. 1. Wiley; 2000. p. 515–521. Available from: https://dx.doi.org/10.1002/9780470695999.
10. Barberis I, Bragazzi NL, Galluzzo L, Martini M. The history of tuberculosis: from the first historical records to the isolation of Koch's bacillus. J Prev Med Hyg . 2017;58(1):E9–E12.
11. Bashar M, Alcabes P, Rom WN, Condos R. Increased incidence of multidrug-resistant tuberculosis in diabetic patients on the Bellevue chest service. Chest. 1987;120(5):1514–1533.

How to cite this article: Leelamohan PVR, Kiran N . Laboratory Findings Associated with Pulmonary Tuberculosis in Diabetic Patients. Acad. J Med. 2020;3(1):52-57.

DOI: dx.doi.org/10.47008/ajm.2020.3.1.11

Source of Support: Nil, **Conflict of Interest:** None declared.