Silent Epidemic of Non-communicable diseases- Trend of Diabetes, Coronary Artery Disease, Cerebrovascular Accident, Thyroid and Hypertension at a Tertiary Care Center in India

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Abstract

Introduction- In a developing country like India, non-communicable diseases are on a rise. Diabetes (DM), Coronary artery disease (CAD), Cerebrovascular accident (CVA), thyroid disorders and hypertension (HTN) are the leading communicable diseases and have become a common occurrence. In this study we aim to study the prevalence of these diseases over the span of five years as well as their association with each other.

Material Methods- In this retrospective study we aim to study trends of non-communicable diseases, in a cohort of 48,966 in-patients for 5 years from 2016-2020. Co-prevalence and association of these comorbidities with each other were also studied.

Result- Non-communicable diseases had an increasing trend from 2016-2020. Association of diabetes and hypertension (Chi-square 12268.54 , P<0.0001), diabetes and CVA (Chi-square 864.99, P<0.0001), diabetes and CAD (Chi-square 4999.73, P<0.0001) diabetes and thyroid (chi-square 583.60, P<0.0001), hypertension and CAD (Chi-square 8013.82, P<0.0001), hypertension and CVA (Chi-square 2135.881, P<0.0001), hypertension and thyroid (Chi-square 1097.278, P<0.0001), thyroid and CVA (Chi-square 18.81, P<0.0001), thyroid and CAD (Chi-square 1233.501, P<0.0001), CAD and CVA (Chi-square 704.662, P<0.0001) was found to be very highly significant statistically .

Conclusion- The increase in non-communicable diseases is imminent in developing countries like India and it emphasises the importance of timely clinical investigations and interventions. The increasing trend of non-communicable diseases in India may be attributed to sociological changes towards a more westernised lifestyle.

Keywords- *Diabetes, Hypertension, Coronary artery disease, Cerebrovascular accident, Thyroid, Non-communicable.*

Introduction

Non-communicable diseases account to 70% of deaths worldwide.(1) There is a notable increase in the number of cases of diabetes, hypertension, coronary artery disease, cerebrovascular accident and thyroid disorders in India.(2,3,4,5,6) Although there is a considerable decrease in the cases of CAD and CVA (7, 8) in the west, the increase in other comorbidities match

the increase in India.[9, 10, 11] India's rapid change in lifestyle tending more towards a western lifestyle can contribute to the rise. The risks of these diseases are well established, and their occurrence is now considered common. This epidemic of non-communicable diseases is a silent threat and calls for more attention to control and manage this spread.

In this study we aim to study the trends of Diabetes, Hypertension, CAD, CVA and Thyroid disorders in India and the degree of association of these diseases by analysing a cohort of 48,966 patients over the span of five years in a tertiary care hospital.

Materials and Method

Post approval from the ethics committee, patient data records were retrieved from the medical records department. Coded data as per International classification of diseases was analysed by the team of bio-statisticians. A total of 48,966 admitted patients from year 2016 - 2020 were analysed. Parameters such as age, gender, diabetes, hypertension, Coronary Artery Disease, Cerebrovascular accident and Thyroid were analysed using SPSS software. Senior consultants in internal medicine dept interpreted data for its clinical significance.

Results

Diabetes, CAD, hypertension, CVA and thyroid disorders are in a rising trend from the year 2016-2020. Percentages of hypertension (17.68%), cerebrovascular accident (2.52%), coronary artery disease (12%) and thyroid (2.46%) were found to be in an increasing order for the years 2016, 2017, 2018, 2019 and 2020. Mean age was found out to be 46.64 with a standard deviation of 19.31. Figure 1 shows the trend of diabetes, hypertension, coronary artery disease, cerebrovascular accident and thyroid from 2016-2020.

Association of diabetes and hypertension (Chi-square 12268.54 , P<0.0001), diabetes and CVA (Chi-square 864.99, P<0.0001), diabetes and CAD (Chi-square 4999.73, P<0.0001) diabetes and thyroid (Chi-square 583.60, P<0.0001), hypertension and CAD (Chi-square 8013.82, P<0.0001), hypertension and CVA (Chi-square 2135.881, P<0.0001), hypertension and thyroid (Chi-square 1097.278, P<0.0001), thyroid and CAD (Chi-square 1233.501, P<0.0001), thyroid and CVA (Chi-square 18.81, P<0.0001), CVA and CAD (Chi-square 704.662, P<0.0001) was found to be very highly significant statistically .

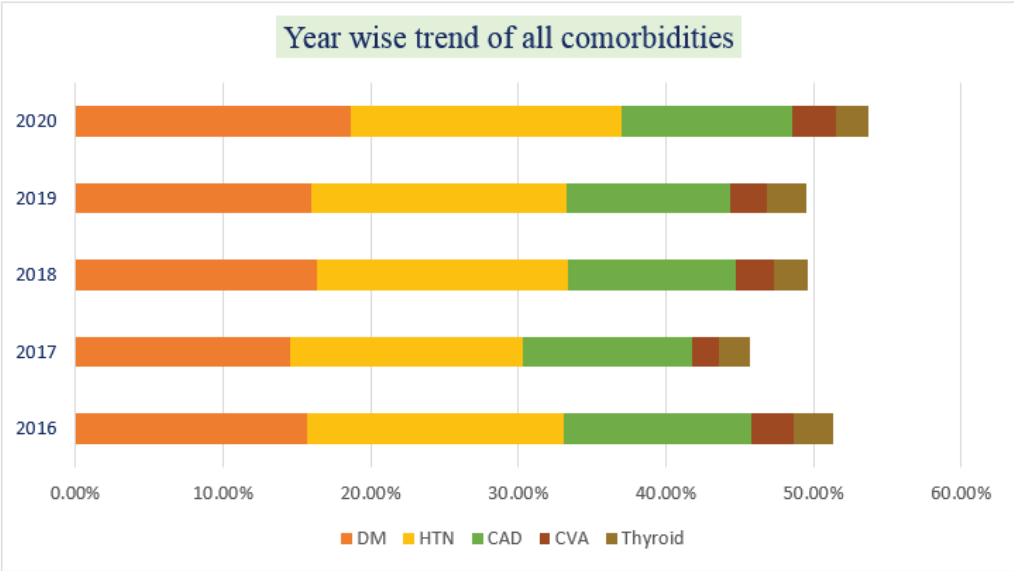

Figure 1: trend of diabetes, hypertension, coronary artery disease, cerebrovascular accident and thyroid from 2016-2020.

Discussion

1. Diabetes and Hypertension:

Type 2 Diabetes and Hypertension are two non-communicable diseases seen in the urban population of India, which can be prevented by leading a healthy lifestyle and thus reducing the risk of other cardiovascular events such as stroke. The association between diabetes mellitus and hypertension can be attributed to their common factors such as hyperinsulinemia, obesity, sedentary lifestyle etc. Both these diseases can either precede or succeed each other. The risk of cardiovascular death in diabetic patients is nearly doubled in the presence of hypertension.[12] Diabetes Mellitus and Hypertension was found to coexist in 50% of patients in a study conducted by Gupta A et al. [13] The association between diabetes and hypertension can be seen in figure 2a.

2. Diabetes mellitus with coronary artery disease:

There is an increase in mortality associated with coronary artery disease in urban populations due to epidemiological transition. [14] The prevalence varies from 2% to 4% in urban populations and 1% to 2% in rural populations. [15] It has been observed that for Type 2 Diabetes mellitus, CAD has been the main cause of death. [16] It has been stated that 2 out of 3 people with diabetes are prone to die from CAD related episodes like a stroke or a heart attack too. [17] In case of increased mortality risks from CAD or heart disease, diabetes mellitus is associated with it: twofold to fourfold. [18]The modifiable risk factors associated with type 2 diabetes and CAD are as follows: Hypertension, obesity, sedentary lifestyle, elevated LDL or low levels of HDL etc can be focussed on to reduce the several risks involved. [19]Here, 48.62% of the total patients were found to have to CAD. From our data, when a patient is suffering from diabetes the risk to develop CAD was found to be 7 times more than when a patient was not suffering from diabetes. Results for the same are documented in figure 2b.

3. Diabetes mellitus with Thyroid:

Thyroid disease and diabetes mellitus are two of the common endocrine disorders in the adult population as it is well known that thyroid hormones and insulin influence each other's actions [20]. For the same, thyroid disorders and diabetes have a propensity to coexist in patients. In a study conducted in 2017, Hypothyroidism was observed in 16% of the diabetic patients while least common was hyperthyroidism that was observed in only 1% diabetic patients. [21] Similarly, in our study the prevalence of hypothyroidism with diabetes was found out to be 11.8% and hyperthyroidism was found out to be only 0.5%. This indicates that it is prudent for clinicians to look for hypothyroidism when the patient presents with diabetes and should call for an HbA1C test and blood sugar fasting when they present with hypothyroidism. This relationship can be attributed to the fact that due to the low metabolic state created due to hypothyroidism can work adjacently with insulin resistance. In this five-year retrospective study, a total of 41.88% of patients were observed to have diabetes mellitus along with thyroid. Association is also highly statistically significant. ($P<0.0001$) as shown in figure 2c.

4. Diabetes mellitus with cerebrovascular accident:

Diabetes has been a prominent risk factor for CVA and is reported by some to be second only to hypertension. [22, 23] Additionally, higher mortality rates and post stroke outcomes are poorer in patients with diabetes and stroke. It has also been shown that the young population having diabetes has a higher risk of stroke. [24] The Framingham study conducted in 1997 had resulted in the inference that, among men and women aged 45 to 74 years; the incidence of atherothrombotic cerebral infarction was 2.5 to 3.5 - fold greater in diabetic than in non-diabetic patients. [25] 47% of patients who suffered a CVA have been noted to have Diabetes and there is a strong association between the two ($P<0.0001$) which is also shown in figure 2d.

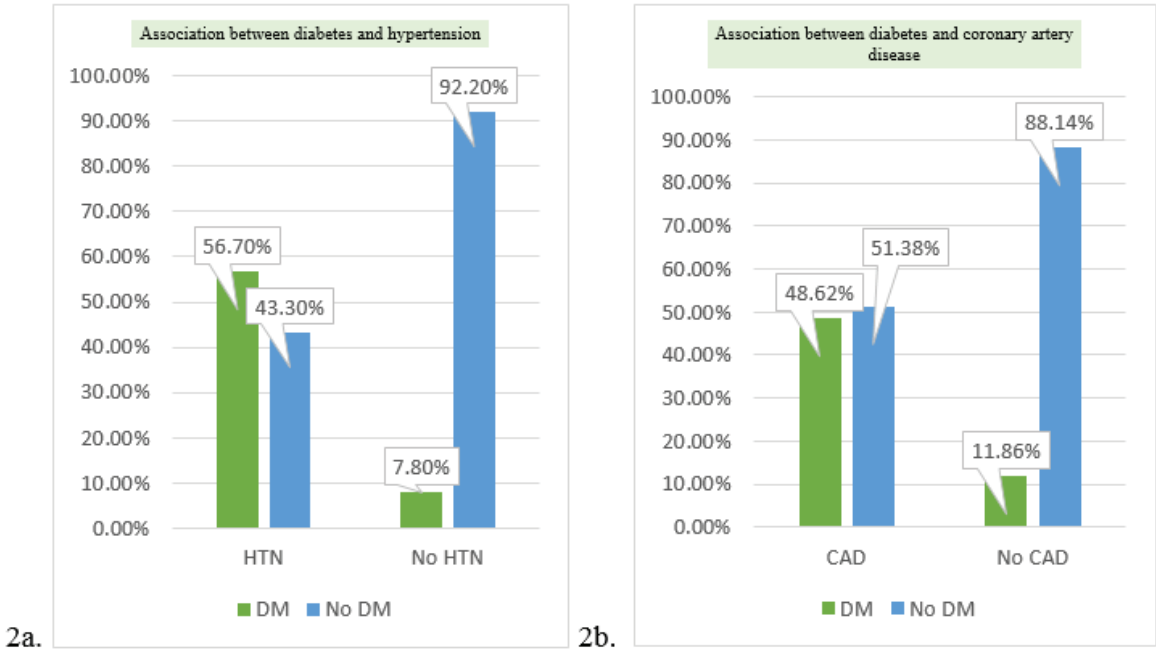

Figure 2: Association of Diabetes mellitus with other comorbidities.

5. Coronary artery disease with cerebrovascular accident:

In a study conducted at University Hospital in Lisbon on 248 patients for understanding the association between heart disease and acute cerebrovascular accident, it was learned that in stroke, heart disease is very frequent. [19] Both Coronary artery diseases (CAD) and cerebrovascular diseases (CVD) are caused by blockage of the blood supply to their respective end organs, thus they have a common pathology. [13] Heart disorders leads to stroke as plaque in the arteries leads to blockage of the flow of oxygen rich blood to the brain. The association between Coronary artery disease and cerebrovascular accident can be seen in figure 3a.

6. Coronary artery disease and Thyroid:

Hypothyroidism has profound effects on cardiac function as it decreases cardiac output due to impaired relaxation of vascular smooth muscle and decreased availability of endothelial nitric oxide which is very essential for relaxing vessels and keeping them flexible for boosting blood flow. [26] A study conducted in 2009 on 1047 patients for understanding the relation between thyroid dysfunction and coronary artery disease revealed that hypothyroid in particular may lead to CAD, and this may be due to presence of biologically active free triiodothyronine in the serum. [27] Our study has shown a strong association between these two diseases (figure 3b).

7. Coronary artery disease and Hypertension:

The association of hypertension and coronary heart disease is a frequent one and as seen in our study ($P<0.0001$) which is also documented in figure 3c. There are several pathophysiologic mechanisms which links Hypertension with coronary artery disease. Hypertension induces endothelial dysfunction that exacerbates the process of atherosclerosis and it contributes to making the atherosclerotic plaque more unstable. Treatment should always be aimed to achieve optimal values of blood pressure, and all the strategies to treat coronary heart disease should be considered on an individual basis [28].

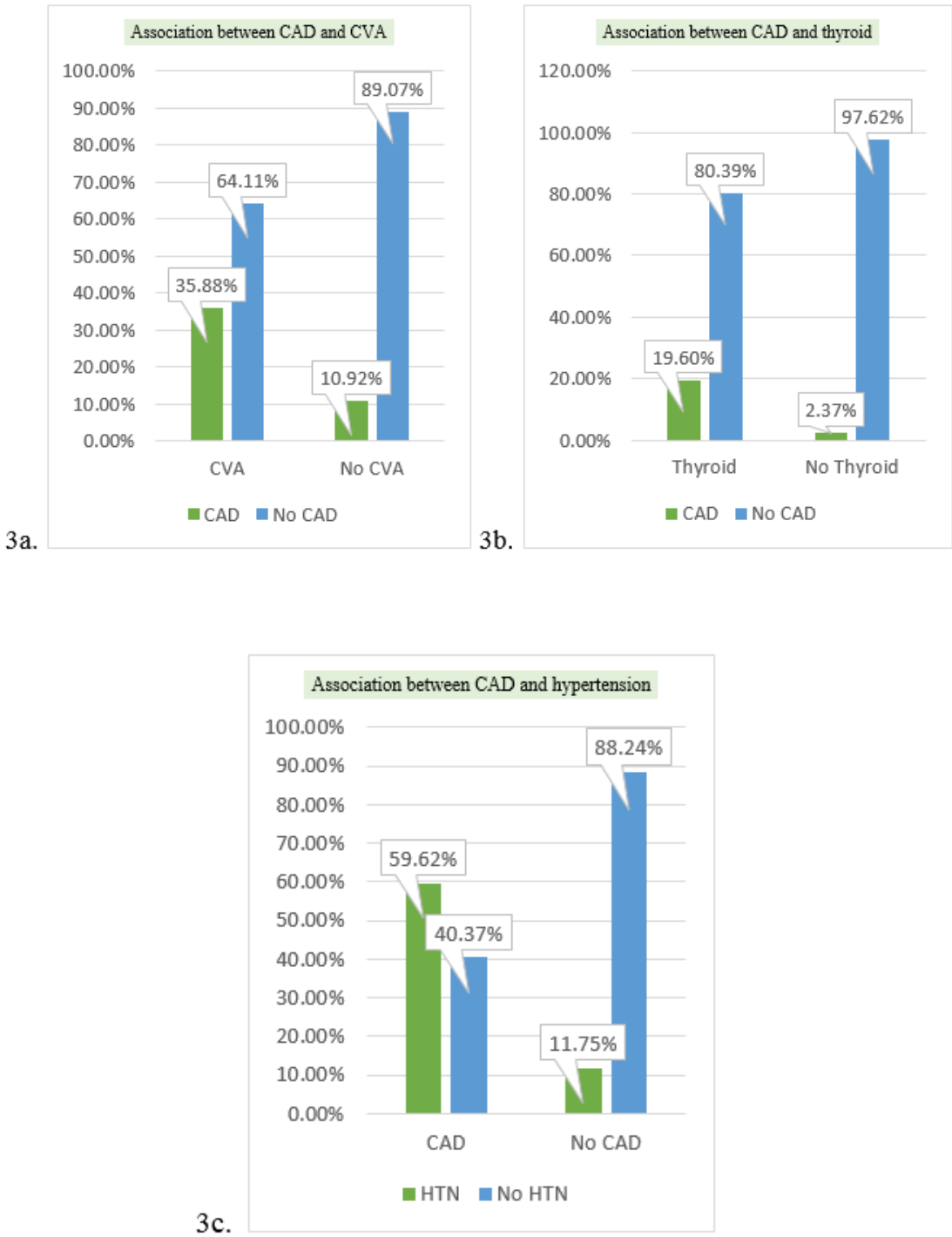

Figure 3: Association between Coronary artery disease with other comorbidities.

8. Hypertension with cerebrovascular accident:

Hypertension is the most prevalent risk factor for stroke. Stroke causes haemodynamic consequences which are heterogeneous in nature that makes the management of blood pressure in stroke patients complex, requiring an accurate diagnosis and precise definition of therapeutic goals.[29] It has been observed that patients having cerebrovascular accident also

have acute rise in blood pressure and this rise in blood pressure is associated with worst outcomes. [30] Significant association between these two comorbidities were observed in this study too, as shown in figure 4.

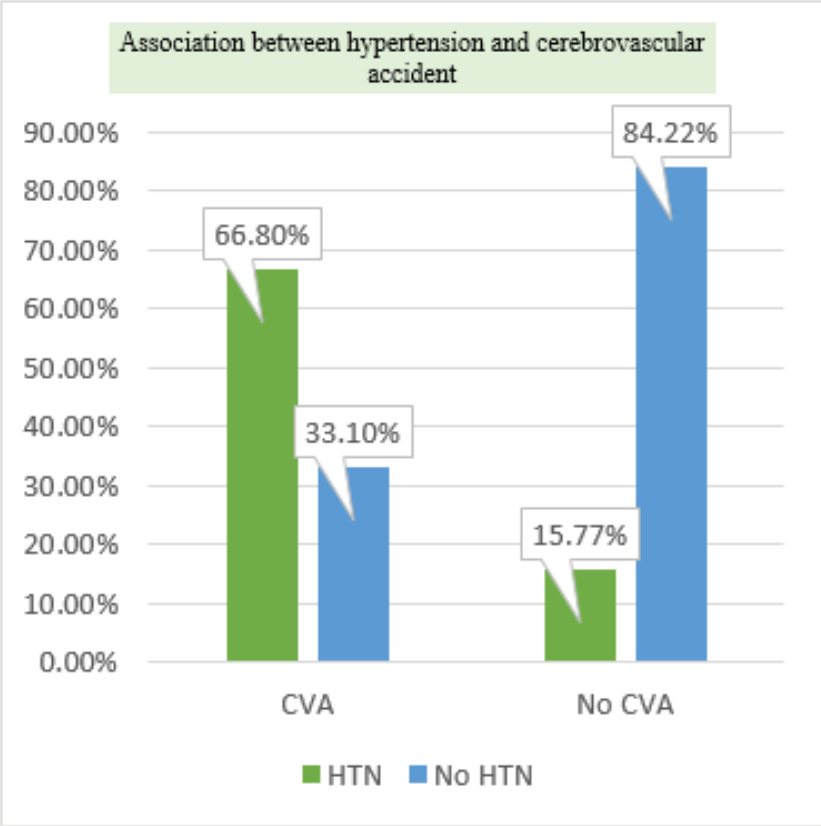

Figure 4: Association between hypertension and cerebrovascular accident

9. Hypertension with thyroid:

Endocrine disorders are common illnesses and some of them may lead to elevated blood pressure, among which thyroid diseases are of high prevalence and often overlooked, especially in mild cases. Overt and subclinical hyper and hypothyroidism can both lead to (mostly mild) hypertension; however, the underlying mechanisms are only partially understood. [31] From our study it is evident that hypothyroidism and hypertension have a strong association which is also observed in figure 5a.

10. Cerebrovascular accident with thyroid: In various thyroid disorders, the presence of acute cerebral ischaemia is observed. It is suggested that hyperthyroidism is more associated with acute cerebral venous thrombosis, but strong research evidence for the same is yet lacking suggesting the need for more study in this area. [32]A case report published in 2016 showed a Hispanic man having the condition of cerebrovascular accident due to thyroid storm. [33]This suggests that a patient with thyroid disorder could possibly be prone to having cerebrovascular accident. Figure 5b shows the correlation between Cerebrovascular accident and thyroid which is actually not much high.

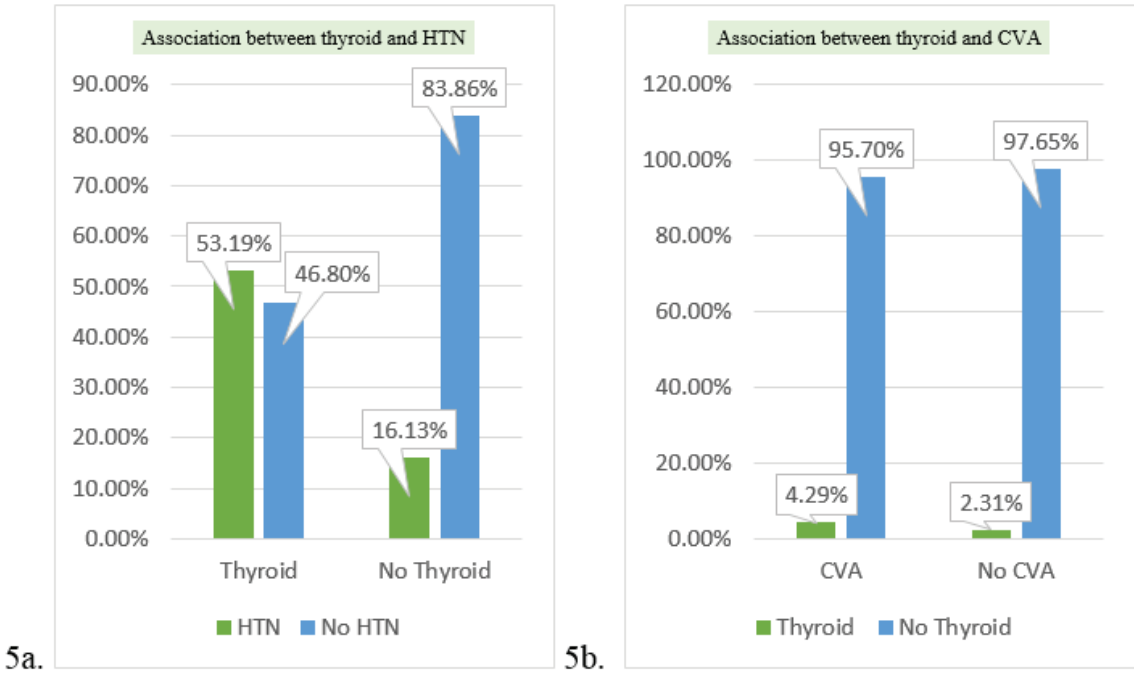

Figure 5: Association between Thyroid with other comorbidities.

Conclusion

The prevalence of non-communicable diseases is increasing worldwide and it is driven by a complicated and cumulative interrelation of multiple factors such as: genetic, lifestyle, environmental, demographic and socioeconomic factors. Of the above factors lifestyle modification probably is the only preventable modifiable variable which can impact disease outcome. As India, more importantly urban India is moving towards a westernized lifestyle it is raising the risks and concern of these preventable diseases. One can consider these diseases to be a silent epidemic as they are now becoming more socially acceptable for their occurrence and often receive patients' focus only when complications arise. The strong association between these diseases also point towards the predilection of developing a secondary disease when a patient is presented with a condition. This study also highlights that clinicians should look for hypothyroidism when the patient presents with diabetes and should call for an HbA1C test and blood sugar fasting when they present with hypothyroidism. It is the need of the hour to emphasize the risk prevalence of non-communicable diseases and spread awareness to prevent them.

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Ethical Clearance: Obtained

Conflicting Interest *(If present, give more details):* The authors do not have any conflict of interest.

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