Original Article

Changes in Carotid Intimal Medial Thickness (CIMT) With Glycaemic Control in Patients of T2DM

Dr. Sanjay Sud [*]

Visiting Consultant in Medicine, Konnagar Matri Sadan Municipal Hospital, Hooghly,
India Director of Doctor Sud's Clinic, Serampore, India

*Corresponding author: Dr. Sanjay Sud, Email: doctorsud70@gmail.com

Abstract

A real world long term (10 years) prospective randomized observational study to monitor changes in CIMT of T2DM patients who achieved the target glycaemic goal of HbA1c $\leq$ 7%, with those who did not achieve it. CIMT is a marker of subclinical atherosclerosis associated with CVD risk factors. Hence any progression or regression of CIMT could be considered as increased or decreased risk of CVD as the case might be. This study was to ascertain if (keeping all other risk factors under control and at par in each group) a good glycaemic control could lead to a lower CIMT – leading to a lowering of CVD risk

The inclusion criteria was

- Non – pregnant Adults (Age >18 years)
- T2DM with HbA1c $\geq$ 8% at recruitment
- Those who remained normotensive (B.P. $\leq$130/80 mm of Hg)
- Those who maintained a normal Lipid profile
- Those who had eGFR $\geq$ 60mL /min/1.73m^2(CKD-EPI)
- CIMT measurements done at recruitment and then once every year

Exclusions

- Any requirement for hospitalization throughout the entire 10 year duration

The total number of patients who completed the follow up for the full ten years was 62.
CIMT of the CCAs were scanned with 7-10 MHz linear probe transducer under real time B mode imaging. The patients included in the study were divided into (Group A n = 32 and Group B n = 30)
Group A were those who could achieve the glycaemic target of HbA1c $\leq$ 7% by the end of the first year and were able to maintain the target for the major duration of the study.
Group B were those who did not achieve the glycaemic target of HbA1c $\leq$ 7% by the end of the first year of the study and had an average HbA1c of $\geq$ 7.5% for the major duration of the study

Results: The data at the end of ten year follow up showed that patients from

Group A had a mean CIMT of 0.79 mm at baseline and at the end of the study it was 0.75 mm

Group B had a mean CIMT of 0.81 mm at baseline at baseline and at the end of study period was 1.17 mm. (p<0.05)

A good glycaemic control can reduce the burden of CVD as an independent entity.

Keywords: **CIMT (Carotid Intimal Medial Thickness), CCAs (Common Carotid Arteries), CVD (Cardio Vascular Disease), T2DM (Type 2 Diabetes Mellitus), Glycaemic control**

Introduction

A real world long term (10 years) prospective randomized observational study to monitor changes in CIMT of T2DM patients who achieved the target glycaemic goal of HbA1c $\leq$ 7%, with those who did not achieve the target. The targets of B.P. $\leq$130/80 mm of Hg, a normal Lipid profile and eGFR $\geq$ 60 mL/ min/1.73m^2, with a comprehensive management for T2DM achieved by

standard up-titration of anti-hyperglycaemic, anti-hypertensive medications and statins was common for both the groups of patients.

CIMT is a marker of subclinical atherosclerosis associated with conventional cardiovascular disease (CVD) risk factors. Using CIMT to predict CVD, a number of longitudinal studies have examined the relationship between CIMT and future events, most frequently the incidence of cardiac events (myocardial infarction, and angina pectoris) and cerebrovascular events (stroke or transient ischemic attacks). Hence any progression or regression of CIMT could be considered as increased or decreased risk of CVD as the case might be. This study was to ascertain if (keeping all other risk factors under control and at par in each group) a good glycaemic control could lead to a lower CIMT – leading to a lowering of CVD risk.

Materials and methods

The inclusion criteria for the study was

- Non – pregnant Adults (Age >18 years)
- T2DM with HbA1c ≥ 8% at recruitment
- Those who remained normotensive (B.P. ≤130/80 mm of Hg) throughout the study
- Those who maintained a normal Lipid profile (as per ADA criteria) throughout the study
- Those who had eGFR ≥ 60mL /min/1.73m^2(CKD-EPI) throughout the study
- CIMT measurements were done at recruitment and then once every year

Exclusions

- Any requirement for hospitalization during the entire 10 year duration

All the above parameters were monitored at regular intervals - (HbA1c every 3 months, B.P. every 3months, Lipids, CIMT and eGFR annually) throughout the entire duration of the study which was for 10 years (Feb 2010 - Jan 2019).

The number of patients who came back for regular follow-ups for complete 10 years was 62.

Informed consent from all the patients was obtained and all the records were maintained in the digital database of the clinic. (The study was conducted by the author in his clinic – Doctor Sud's Clinic, having the facilities for Doppler and ultrasound imaging). CIMT was measured in all the cases by the author himself (So the chances of inter-observer variability was minimized).

CIMT of the Common Carotid Arteries (CCAs) were scanned using Sonosite Titan Ultrasound machine with 7-10 MHz linear probe transducer under real time B – mode imaging. After explanation of the procedure, the subjects were positioned supine with the desired neck extension achieved by pillow support under the neck. The neck was rotated 45˚ away from the side being examined to give appropriate neck exposure to visualize the common carotid artery and the internal carotid artery. The air interface between the probe and the skin was minimized by the application of acoustic gel. The scan of the common carotid artery began just above the clavicle and the transducer was rotated cephalad through the bifurcation and parallel to the internal carotid artery. The presence of atherosclerotic plaque was scanned for in the near and far walls of the common carotid artery, the carotid bulb and the internal carotid artery to avoid measurement of the thickness at the site of plaque (if present) giving erroneously increased values. The intimal -media thickness of the far wall of the carotid vessels was measured as the distance between the leading edge of the lumen-intima interface and the leading edge of the media-adventitia interface. The mean of both sides (left and right) was recorded as the CIMT for that patient.

The patients included in the study were divided into two groups – A (Table 1) and B (Table 2).

(Group A n = 32 and Group B n = 30). Total number n = 62.

Patients in group A were those who could achieve the glycaemic target of HbA1c ≤ 7% by the end of the first year and were able to maintain the target for the major duration of the study.

Patients in group B were those who did not achieve the glycaemic target of HbA1c ≤ 7% by the end of the first year of the study and had an average HbA1c of ≥ 7.5% for the major duration of the study.

In both the above groups the other risk factors for co-morbidity like, hypertension, dyslipidaemia and microalbuminuria were kept under strict control as per the recommendations in the guidelines with titration of medications for their management. Hence ruling out any advantage / disadvantage modifying the progression / regression of CVD marker (CIMT).

Figure 1: Measurement of carotid intimal medial thickness: The distance between the white + and blue + (marked with arrow), indicates the CIMT at the lower (distal) end of the Right Common Carotid Artery (CCA)

The annual CIMT values in mm for each patient in both the groups was serially recorded as shown in the tables below

Table 1: Group A

Pt. Serial No.	CIMT in mm										
	YEAR 2010	YEAR 2011	YEAR 2012	YEAR 2012	YEAR 2013	YEAR 2014	YEAR 2015	YEAR 2016	YEAR 2017	YEAR 2018	YEAR 2019
1	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7
2	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
3	0.6	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.6
4	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8
5	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
6	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7
7	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7
9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7
10	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0
11	0.8	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7
12	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.6
13	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7
14	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7
15	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
16	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
17	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9
18	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6
19	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
20	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
21	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7
22	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
23	0.8	0.8	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8

24	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7
25	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
26	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0
27	0.9	0.9	0.9	1.0	1.0	1.0	0.9	0.9	0.9	0.9	1.0
28	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8
29	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2	1.2
30	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.6
31	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8
32	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Table 2: Group B

Pt. Serial No.	CIMT in mm										
	YEAR 2010	YEAR 2011	YEAR 2012	YEAR 2012	YEAR 2013	YEAR 2014	YEAR 2015	YEAR 2016	YEAR 2017	YEAR 2018	YEAR 2019
1	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.2	1.2
2	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1
3	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.2
4	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9
5	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0
6	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.9	0.9	0.9
7	0.8	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.8	0.8	0.8
8	0.7	0.7	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
9	0.9	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.2
10	0.8	0.8	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.2
11	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.1	1.2	1.2	1.3
12	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.1
13	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0
14	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0
15	0.8	0.8	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1
16	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.2	1.3	1.3
17	0.9	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.3
18	0.8	0.8	0.9	0.9	1.0	1.0	1.2	1.2	1.2	1.2	1.2
19	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.2	1.2	1.2
20	0.9	0.9	0.8	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.3
21	0.9	0.9	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2
22	0.7	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.3	1.4
23	0.8	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.2	1.2
24	0.8	0.8	0.9	0.9	1.0	1.0	1.2	1.2	1.3	1.3	1.3
25	0.9	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3
26	0.6	0.7	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0
27	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2
28	0.8	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.2	1.2	1.3
29	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.4
30	0.9	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.4

Comments and Discussion:

The data from both the groups was analyzed at the end of ten year follow up.

The patients in Group A had a mean CIMT of 0.79 mm at baseline and at the end of the study it was 0.75 mm.

The patients in Group B had a mean CIMT of 0.81 mm at baseline and at the end of the study period was 1.17 mm.

The results were statistically significant ($p<0.05$)

Conclusion

So it can be concluded from the ten year prospective observational follow up that a good glycaemic control helps to reduce the CIMT in patients of T2DM over and above a good control of other risk factors like lipid and hypertension as an independent entity, and so can help to reduce the burden of CVD / macrovasular disease progression in these patients.

Conflicts of interest

None

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