

Assessment of Carotid Intima-Media Thickness and Infra-Renal Abdominal Aorta Diameter in Women with and Without Gestational Diabetes Mellitus-A case Control Study

Reza Nafisi-Moghadam¹, Nasim Namiaranian², Maryam Karbasi, Hashem Hojat⁴,
Hassan Haghani-Nejad³, Abbas Aflatounian⁵, Sied Kazem Razavi Ratki^{1*}

1. MD, Department of Radiology, Faculty of Medicine, Shahid Sadoughi University of Medical Sciences Yazd, Iran
2. MD, Community Medicine Specialist Yazd Diabetes Research Center, Shahid Sadooghi University of Medical Sciences ,Yazd, Iran
3. MD, Department of Cardiology, Afshar Hospital, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
4. MD, Department of Radiology, Faculty of Medicine, Shahid Sadoughi University of Medical Sciences Yazd, Iran
5. MD, Department of pediatrics, Faculty of Medicine, Shahid Sadoughi University of Medical Sciences Yazd, Iran

*Correspondence:

Sied Kazem Razavi Ratki Department of Radiology, Faculty of Medicine, Shahid Sadoughi University of Medical Sciences Yazd, Iran.

Email: razavi822@gmail.com

Tel: (98) 353 822 4000

Received: 12 November 2015

Accepted: 01 January 2016

Published in March 2016

Abstract

Objective: Gestational diabetes mellitus occurs during pregnancy is associated with increased cardiovascular risk. Carotid intima media thickness (CIMT) is a surrogate maker of subclinical atherosclerosis. The aim of this study is assessment of relationship between CIMT and infra-renal abdominal aorta diameter in women with and without Gestational Diabetes Mellitus.

Materials and Methods: The current case-control study was conducted in department of radiology of Shahid Sadoghi hospital in Yazd medical science university 2012 to 2013. Forty women between 20-40 years old with at least 6 months after pregnancy were enrolled, 20 participants with GDM in last pregnancy and 20 participants without history of GDM. All participants underwent physical exam and laboratory findings. Finally Carotid intima-media thickness and infra abdominal aorta diameter were obtained.

Results: over all comparison between GDM and non GDM groups revealed no significant difference in mean CIMT and infra-renal abdominal aorta diameter. FBS between two groups reveal significant statistically difference (P -value<0.05). Also Pearson correlation analysis shows association between infera-renal abdominal aorta diameter and cholesterol and LDL in non GDM participate.

Conclusion: Our study suggested GDM may not relate to CIMT and infera-renal abdominal aorta diameter. Also current study revealed women with history of GDM are prone to having impaired fasting glucose.

Keywords: Carotid intima-media thickness, Gestational diabetes mellitus, Infra-renal abdominal aorta diameter

Introduction

Gestational diabetes mellitus (GDM) is a sub type of diabetes mellitus which occurred during pregnancy {Ku, 2011 #1}. GDM is carbohydrate intolerance with

incidence rate approximately 1-14%. Woman with GDM are prone to type2 diabetes mellitus hypertension, dyslipidemia, metabolic syndrome and cardiovascular disease.

{Harreiter, 2014 #2; Krzyzanowska, 2008 #3; Kautzky-Willer, 2008 #4; Maple-Brown, 2009 #5; de CB Giuliano, 2008 #6} Carotid intima media thickness (CIMT) is a maker of subclinical atherosclerosis. {Bonora, 2000 #7} Associated between increased CIMT and type2 diabetes mellitus and cardiovascular disease is approved. Ultrasonographic CIMT is non-invasive and not expensive test for assessment sub clinical atherosclerosis. {Bauer, 2012 #8} GDM is a predictor of cardiovascular atherosclerosis. {Rademaker, 2013 #9} Some studies suggest relationship between abdominal aorta aneurysm and atherosclerosis. Although it may be confounded by other atherosclerotic risk factors. {Wilmink, 1999 #10; Wong, 2007 #11; Wanhainen, 2005 #12; Cornuz, 2004 #13; Iribarren, 2007 #14; Pleumeekers, 1995 #15; Singh, 2001 #16; Forsdahl, 2009 #17}

Across-sectional study revealed no significant correlative between carotid plaque and infera-renal abdominal aorta diameter less than 27mm but diameter more than 27mm was associated with increased Carotid plaque burden and coronary atherosclerosis. {Johnsen, 2010 #18}

The aim of this study is assessment of relationship between CIMT and infra-renal abdominal aorta diameter with GDM.

Materials and Methods

The study was conducted in department of radiology of Shahid Sadoghi hospital 2012 to 2013. Current case-control study included 40 participant. Including criteria were: women 20-40 years old with at least 6 months after pregnancy were enrolled 20 participants with GDM in last pregnancy and 20 participants without history of GDM. The exclusion criteria were diabetes mellitus, hyperlipidemia, hypotension, familial history of coronary artery disease, chronic disease (Hepatic, liver or history of cancer), FBS>126, smoking and BMI>35. GDM is defined as American diabetes association (ADA criteria).

Laboratory measurements

Fasting blood glucose, triglyceride, total cholesterol, low density lipoprotein cholesterol and high density lipoprotein cholesterol and high density lipoprotein were measured in same day which ultrasonography examination was done.

Ultrasonography

Carotid intima-media thickness and infra abdominal aorta diameter were assessment by a Bi-mode ultrasound (simens G40) scanner with linear high frequency transducer (7.5 MHZ). CIMT examination was done in supine position according the American echocardiography recommendation. {Stein, 2008 #19} Three segment were selected; proximal internal carotid 1cm lower the flow driver, 1cm upper the follow driver as bifurcation and 2cm or more in common carotid above the flow driver and measurements was done bilaterally. At the end CIMT was considered as average of the mean CIMT of the 3left and 3 right segments. For assessment of infera-renal abdominal aorta minimum and maximal transverse as well as anterior-posterior diameters were measured in supine position. The ultrasonography study was done by an expert radiologist blinded to the clinical data.

Results

The clinical characteristics, Laboratory test findings of the study groups were reveled in table 1.

Mean participant age BMI, systolic blood pressure, diastolic blood pressure, TG, cholesterol, LDL and HDL are not shown significant statistically difference. FBS between tow group reveal significant statistically difference (P -value <0.05). In comparison with control group GDM group revealed no significant difference in mean CIMT and infra-renal abdominal aorta diameter.

Control group had a lower infera-renal abdominal aorta than the GDM group significantly also Pearson correlation analysis shows association between infera-renal abdominal aorta diameter and cholesterol and

Table 1. Clinical characteristics, Laboratory test findings of The GDM and non GDM participant

Characteristics	GDM group (N=20)	Non GDM group (N=20)	P-value
Age (Y)	26.35± 3.10	25.6± 3.113	0.452
Body mass index(kg/m 2)	25.53± 2.37	26.61± 4.58	0.429
Systolic BP (mm Hg)	115.35±10.4	114.50±6.37	0.751
Diastolic BP (mm Hg)	78.75±7.20	74.35±6.99	0.57
Serum HDL (mg/dL)	54.90±8.22	65.15±7.45	0.618
Serum LDL(mg/dl)	83.05±13.86	89.45±15.42	0.176
Serum triglyceride (mg/dl)	113.45±67.23	94.85±26.65	0.261
Serum cholesterol (mg/dl)	161.05±21.48	161.8±18.72	0.907
Fasting blood sugar(mg/dl)	98.15±12.10	86/70±4.15	0.001

Table 2. CIMT and infra-renal abdominal aorta diameter (IAAD) in GDM and non GDM participant

	GDM	Non GDM	P-Value
CIMT (cm)	0.63±0.06	0.64±0.06	0.816
IAAD (mm)	12.43 ± 2.57	12.21±1.37	0.738

LDL in non GDM participate but other factors (HDL, TG, FBS) is not associated with IAAD.

Discussion

Pregnancy is related to increase insulin resistance. GDM patients are prone to type 2 diabetes mellitus that leads to coronary atherosclerosis. {Sullivan, 2012 #20} Although most of the studies reveal association between ITM and GDM {Akinci, 2014 #21; Atay, 2014 #22; Bo, 2007 #23; Caliskan, 2014 #24; Freire, 2012 #26; Gunderson, 2012 #27}, in current study no significant difference was detected. Corresponding to the results of Yun Hyiki (1) study which may be resulting from study in Asian population compared to the western study.

Obesity is a major factor affecting CIMT. Although BMI in current study is not

significantly difference between two groups. Women with lower BMI in control group had lower infra-renal abdominal aorta diameter. Also criteria used for diagnosis GDM may affected the influence of GDM on CIMT. (27,28)

The infra-renal abdominal aorta diameter is associated with cholesterol and LDL in non GDM participant. The major limitation of this study was not enough sample size.

Conclusion

Our study suggested GDM may not relate to CIMT and infra-renal abdominal aorta diameter. Also current study revealed Women with history of GDM are prone to having impaired fasting glucose.

References

1. Ku YH, Choi SH, Lim S, Cho YM, Park YJ, Park KS, et al. Carotid intimal-medial thickness is not increased in women with previous gestational diabetes mellitus. *Diabetes & metabolism journal*. 2011;35(5):497-503.
2. Harreiter J, Dovjak G, Kautzky-Willer A. Gestational diabetes mellitus and cardiovascular risk after pregnancy. *Women's Health*. 2014;10(1):91-108.
3. Krzyzanowska K, Zemany L, Krugluger W, Schernthaner G, Mittermayer F, Schnack C, et al. Serum concentrations of retinol-binding protein 4 in women with and without gestational diabetes. *Diabetologia*. 2008;51(7):1115-22.
4. Kautzky-Willer A, Bancher-Todesca D, Weitgasser R, Prikoszovich T, Steiner H, Shnawa N, et al. The impact of risk factors and more stringent diagnostic criteria of gestational diabetes on outcomes in central European women. *The Journal of Clinical Endocrinology & Metabolism*. 2008;93(5):1689-95.
5. Maple-Brown L, Hodge A, Cunningham J, Celermajer D, O'Dea K. Risk factors for cardiovascular disease do not fully explain

- differences in carotid intima-media thickness between Indigenous and European Australians without diabetes. *Clinical endocrinology*. 2009;71(2):189-94.
6. de CB Giuliano I, de Freitas SF, de Souza M, Caramelli B. Subclinic atherosclerosis and cardiovascular risk factors in HIV-infected children: PERI study. *Coronary artery disease*. 2008;19(3):167-72.
 7. Bonora E, Kiechl S, Oberhollenzer F, Egger G, Bonadonna R, Muggeo M, et al. Impaired glucose tolerance, type II diabetes mellitus and carotid atherosclerosis: prospective results from the Bruneck Study. *Diabetologia*. 2000;43(2):156-64.
 8. Bauer M, Caviezel S, Teynor A, Erbel R, Mahabadi AA, Schmidt-Trucksäss A. Carotid intima-media thickness as a biomarker of subclinical atherosclerosis. *Swiss Med Wkly*. 2012;142:1-9.
 9. Rademaker AA, Danad I, Groothuis JG, Heymans MW, Marcu CB, Knaapen P, et al. Comparison of different cardiac risk scores for coronary artery disease in symptomatic women: do female-specific risk factors matter? *European journal of preventive cardiology*. 2013;2047487313494571.
 10. Wilmlink TB, Quick CR, Day NE. The association between cigarette smoking and abdominal aortic aneurysms. *Journal of vascular surgery*. 1999;30(6):1099-105.
 11. Wong DR, Willett WC, Rimm EB. Smoking, hypertension, alcohol consumption, and risk of abdominal aortic aneurysm in men. *American journal of epidemiology*. 2007;165(7):838-45.
 12. Wanhainen A, Bergqvist D, Boman K, Nilsson TK, Rutegård J, Björck M. Risk factors associated with abdominal aortic aneurysm: a population-based study with historical and current data. *Journal of Vascular surgery*. 2005;41(3):390-6.
 13. Cornuz J, Pinto CS, Tevaearai H, Egger M. Risk factors for asymptomatic abdominal aortic aneurysm. *The European Journal of Public Health*. 2004;14(4):343-9.
 14. Iribarren C, Darbinian JA, Go AS, Fireman BH, Lee CD, Grey DP. Traditional and novel risk factors for clinically diagnosed abdominal aortic aneurysm: the Kaiser multiphasic health checkup cohort study. *Annals of epidemiology*. 2007;17(9):669-78.
 15. Pleumeekers H, Hoes A, Van Der Does E, Van Urk H, Hofman A, De Jong P, et al. Aneurysms of the abdominal aorta in older adults The Rotterdam Study. *American journal of epidemiology*. 1995;142(12):1291-9.
 16. Singh K, Bønnaa K, Jacobsen B, Björk L, Solberg S. Prevalence of and Risk Factors for Abdominal Aortic Aneurysms in a Population-based Study The Tromsø Study. *American journal of epidemiology*. 2001;154(3):236-44.
 17. Forsdahl SH, Singh K, Solberg S, Jacobsen BK. Risk Factors for Abdominal Aortic Aneurysms A 7-Year Prospective Study: The Tromsø Study, 1994–2001. *Circulation*. 2009;119(16):2202-8.
 18. Johnsen SH, Forsdahl SH, Singh K, Jacobsen BK. Atherosclerosis in abdominal aortic aneurysms: a causal event or a process running in parallel? The Tromsø study. *Arteriosclerosis, thrombosis, and vascular biology*. 2010;30(6):1263-8.
 19. Stein JH, Korcarz CE, Hurst RT, Lonn E, Kendall CB, Mohler ER, et al. Use of carotid ultrasound to identify subclinical vascular disease and evaluate cardiovascular disease risk: a consensus statement from the American Society of Echocardiography Carotid Intima-Media Thickness Task Force endorsed by the Society for Vascular Medicine. *Journal of the American Society of Echocardiography*. 2008;21(2):93-111.
 20. Sullivan SD, Umans JG, Ratner R. Gestational diabetes: implications for cardiovascular health. *Current diabetes reports*. 2012;12(1):43-52.
 21. Akinci B, Celtik A, Tunali S, Genc S, Yuksel F, Secil M, et al. Circulating apelin levels are associated with cardiometabolic risk factors in women with previous gestational diabetes. *Archives of gynecology and obstetrics*. 2014;289(4):787-93.
 22. Atay A, Simsek H, Demir B, Sakar M, Kaya M, Pasa S, et al. Noninvasive assessment of subclinical atherosclerosis in normotensive gravidæ with gestational diabetes. *Herz*. 2014;39(5):627-32.
 23. Bo S, Valpreda S, Menato G, Bardelli C, Botto C, Gambino R, et al. Should we consider gestational diabetes a vascular risk factor? *Atherosclerosis*. 2007;194(2):72-9.
 24. Caliskan M, Caklili OT, Caliskan Z, Duran C, Çiftçi FC, Avci E, et al. Does gestational diabetes history increase epicardial fat and carotid intima media thickness? *Echocardiography*. 2014;31(10):1182-7.
 25. Freire C, Barbosa F, De Almeida M, Miranda P, Barbosa MM, Nogueira AI, et al. Previous gestational diabetes is independently associated with increased carotid intima-media thickness, similarly to metabolic syndrome—a case control study. *Cardiovasc Diabetol*. 2012;11(59):10.1186.
 26. Gunderson EP, Hedderson MM, Chiang V, Crites Y, Walton D, Azevedo RA, et al. Lactation Intensity and Postpartum Maternal Glucose Tolerance and Insulin Resistance in Women With Recent GDM The SWIFT cohort. *Diabetes Care*. 2012;35(1):50-6.
 27. Berggren EK, Boggess KA, Stuebe AM, Funk MJ. National Diabetes Data Group vs Carpenter-Coustan criteria to diagnose gestational diabetes. *American journal of obstetrics and gynecology*. 2011;205(3):253.1-7.

28. Simmons D, McElduff A, McIntyre HD, Elrishi M. Gestational diabetes mellitus: NICE for the US? A comparison of the American Diabetes Association and the American College of Obstetricians and Gynecologists guidelines with the UK National Institute for Health and Clinical Excellence guidelines. *Diabetes Care*. 2010;33(1):34-7.