International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 06, 2020
ISSN: 1475-7192

VISCERAL ADIPOSITY INDEX (VAI) IN TYPE II DIABETES MELLITUS (DM) AND ITS CORRELATION WITH MICROVASCULAR COMPLICATIONS

[1]*DR. VIDYASHREE S. HULKOTI, [2]DR. SOURYA ACHARYA, [3]DR. SUNIL KUMAR

ABSTRACT-- *Obesity like an iceberg phenomenon is causing a large amount of cardiovascular metabolic disorders, it is crucial to identify an ideal index to quantify the risk and prognosis associated with diabetes. Visceral Adiposity Index along with the simple anthropometric data and lipid profile can be a simple yet effective parameter to evaluate the relationship between obesity and diabetes and can also explain the magnitude of various microvascular complications of diabetes, thus navigating the management of morbidity and mortality associated with it. VAI will help in decreasing the burden of obesity and diabetes mellitus in the society.*

Keywords--*Visceral adiposity index, microvascular complications, diabetes*

I. INTRODUCTION

Background/rationale:

Diabetes is a metabolic disease which can occur by defect in secretion of insulin or in action of insulin or both resulting in hyperglycemia. Diabetes and obesity are chronic metabolic disorders that are rising worldwide and are closely related to each other.

Visceral Adiposity Index (VAI) is an ideal, gender-specific tool, related to various basic anthropometric (BMI and WC) and functional parameters (triglycerides (TG) and HDL cholesterol), and is an ideal marker of total fat distribution. Visceral adiposity index is the index that has been used as a pioneer for "adipose tissue dysfunction" (1-4).

VAI is independently related to the cardiovascular events. This was not establised with WC, BMI, and other classical cardiovascular risk factors analyzed. Therefore, VAI seems to be a crucial index of fat distribution and function. To conclude , despite the fact that VAI is not completely a diagnostic tool for the various cerebrovascular and cardiovascular events, the simplicity of the basic parameters like BMI and WC and TG and HDL assessment makes an index for evaluation of visceral fat dysfunction (5-9).

[1] **Junior Resident, Medicine Department, JNMC, DMIMS (Deemed University), Sawangi Meghe, Wardha, drvidyahulkoti@gmail.com, 9920914932.*

[2] *Professor, Medicine Department, JNMC DMIMS (Deemed University), Sawangi Meghe, Wardha, souryaacharya@gmail.com,*

[3] *HOD, Professor, Medicine Department, JNMC DMIMS (Deemed University), JNMC, DMIMS (Deemed University), Sawangi Meghe, Wardha.*

Received: 22 Feb 2020 | Revised: 13 Mar 2020 | Accepted: 05 Apr 2020

II. OBJECTIVES

- To estimate the Visceral adiposity index in diabetes patients and non-diabetic healthy controls
- To correlate Visceral adiposity index with various anthropometric parameters and lipid profile in patients of Type II DM
- To correlate Visceral adiposity index with microvascular complications in patients with diabetes

III. METHODS

The following methodology was standardized for the purpose of the study:-

1. Demographic data like age, sex, history of diabetes, hypertension, relevant family history, anthropometric measurements such as height, weight, waist circumference will be recorded on predesigned proforma.
2. Body mass index to be calculated with the anthropometric findings.
3. Investigations like fasting blood sugar, postprandial blood sugar, glycosylated hemoglobin, fasting lipid profile will be noted along with routine laboratory investigations such as complete blood counts, blood grouping, liver function test, kidney function test.
4. Visceral adiposity index will be calculated with the help of formula

$$\text{Males: VAI} = \left(\frac{\text{WC}}{39.68 + (1.88 \times \text{BMI})}\right) \times \left(\frac{\text{TG}}{1.03}\right) \times \left(\frac{1.31}{\text{HDL}}\right)$$

$$\text{Females: VAI} = \left(\frac{\text{WC}}{36.58 + (1.89 \times \text{BMI})}\right) \times \left(\frac{\text{TG}}{0.81}\right) \times \left(\frac{1.52}{\text{HDL}}\right)$$

TG- mmol/l HDL- mmol/l

VAI will be calculated using a VAI of 1 for healthy patients who are not obese along with ideal adipose tissue distribution and adequate TG and HDL-C levels. (4)

5. Fundoscopy will be done to rule out diabetic retinopathy (6)
6. In order to rule out diabetic nephropathy GFR, urinary albumin will be calculated. (8)
7. Sensory perception will be tested with the help of monofilament and all reflexes will be tested to rule out diabetic nephropathy. (7)

Study design: Cross- sectional

Setting: The study will be conducted in AVBRH, a tertiary care teaching hospital situated in the rural area of Wardha District. The aforementioned hospital, AVBRH, is a 1280 bedded teaching hospital providing healthcare to the rural people of central India

Participants:

Newly detected individuals with diabetes diagnosed as per World Health Organization (WHO) criteria or individuals already on treatment either Oral hypoglycaemic agents (OHAs) or parenteral insulin.

Inclusion criteria*:* ***Study Group:*** Newly detected individuals with diabetes diagnosed as per World Health Organization (WHO) criteria or individuals already on treatment either Oral hypoglycaemic agents (OHAs) or parenteral insulin.

Age*:* more than 18 years.

Gender*:* Both male and female subjects.

Consent: subjects capable of giving consent and voluntarily willing to participate in study.

Control Group*:* Equal number of age and gender matched non-diabetic subjects will be enrolled as controls. Age of control subject would be upto two years on the either side of diabetic individual of same gender.

Exclusion ***criteria****:* -

Chronic kidney disease patients

Any non diabetic nephropathy

Hypertension

Ocular disorders

Neuropathies of other etiologies like chronic liver disease, alcoholics, drugs

Variables: To estimate VAI in type 2 DM patients.

Visceral adiposity will be assessed by the following equations:

$$\text{Males: VAI} = \left(\frac{\text{WC}}{39.68 + (1.88 \times \text{BMI})}\right) \times \left(\frac{\text{TG}}{1.03}\right) \times \left(\frac{1.31}{\text{HDL}}\right)$$

$$\text{Females: VAI} = \left(\frac{\text{WC}}{36.58 + (1.89 \times \text{BMI})}\right) \times \left(\frac{\text{TG}}{0.81}\right) \times \left(\frac{1.52}{\text{HDL}}\right)$$

TG- mmol/l HDL- mmol/l

Study size:

Received: 22 Feb 2020 | Revised: 13 Mar 2020 | Accepted: 05 Apr 2020

A total of 250 individuals will be included in the study. This includes 125 subjects with type 2 diabetes mellitus and 125 age and gender matched non-diabetic controls.

IV. EXPECTED OUTCOMES/RESULTS

Outcome data: The main outcome variables will be the visceral adiposity index and presence of microvascular complications. The visceral adiposity index and microvascular complications in people in study group and control group will be evaluated and compared to test the association between altered visceral adiposity index and patients with diabetes with and without microvascular complications. Proportion of participants with diabetes and control will be estimated. Weighted analysis will be done by controlling the various cofounders like age, smoking, and alcoholism.

V. DISCUSSION

The present study will assess the VAI in patients of type II DM and will correlate it with various anthropometric parameters and microvascular complications in patents of DM. Many studies relevant to the associated factors, causation cascade and healthcare scenario in this region were accessed and reviewed (9-72).

REFERENCES

1. Acharya, Sourya, and Samarth Shukla. “Metabolic Healthy Obesity-A Paradoxical Fallacy?” JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH 12, no. 10 (October 2018): OE7–10. https://doi.org/10.7860/JCDR/2018/36809.12165.
2. Acharya, Sourya, Samarth Shukla, and Anil Wanjari. “Subclinical Risk Markers for Cardiovascular Disease (CVD) in Metabolically Healthy Obese (MHO) Subjects.” JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH 13, no. 6 (June 2019): OC1–6.
3. Rathi N, Taksande B, Kumar S. Nerve conduction studies of peripheral motor and sensory nerves in the subjects with prediabetes. J Endocrinol Metab 2019;9(5):147-150.
4. Dubey YK, Damke S. Baby monitoring system using image processing and IoT. Int J Eng Adv Technol 2019;8(6):4961-4964.
5. Jain S, Gaurkar S, Deshmukh PT, Khatri M, Kalambe S, Lakhotia P, et al. Applied anatomy of round window and adjacent structures of tympanum related to cochlear implantation. Brazilian J Otorhinolaryngol 2019;85(4):435-446.
6. Jagati A, Chaudhary R, Rathod S, Madke B, Baxi K, Kasundra D. Preparation of platelet-rich fibrin membrane over scaffold of collagen sheet, its advantages over compression method: A novel and simple technique. J Cutan Aesthet Surg 2019;12(3):174-178.
7. Kumar S, Jain S, Wanjari A, Mandal S. Development and validation of a modified frailty risk index as a predictor of mortality in rural elderly people. Asian J Gerontol Geriatr 2019;14(1):15-22.
8. Chaudhry P, Jaiswal A. Secondary live abdominal ectopic pregnancy: A case report. World J Laparoscopic Surg 2019;12(2):86-87.

Received: 22 Feb 2020 | Revised: 13 Mar 2020 | Accepted: 05 Apr 2020

9. Agrawal D, Bhake AS, Rastogi N, Laishram S, Wankhade A, Agarwal A. Role of Bethesda system for reporting thyroid lesion and its correlation with histopathological diagnosis. J Datta Meghe Inst Med Sci Univ 2019;14(2):74-81.
10. Sen B, Chaudhary A, Sen J. Hemodynamic changes with intravenous dexmedetomidine and intravenous esmolol for attenuation of sympathomimetic response to laryngoscopy and tracheal intubation in neurosurgical patients: A comparative study. J Datta Meghe Inst Med Sci Univ 2019;14(2):67-73.
11. Khanam N, Wagh V, Gaidhane AM, Quazi SZ. Knowledge, attitude and practice on uses of plastic products, their disposal and environmental pollution: A study among school-going adolescents. J Datta Meghe Inst Med Sci Univ 2019;14(2):57-60.
12. Chaudhary KS, Phatak SV. Choroidal melanoma in a young patient ultrasonography and magnetic resonance imaging. J Datta Meghe Inst Med Sci Univ 2019;14(2):106-108.
13. Phatak S, Shrivastav D, Marfani G, Daga S, Madurwar K, Samad S. Transvaginal sonography and elastography evaluation of ectopic pregnancy. J Datta Meghe Inst Med Sci Univ 2019;14(2):86-89.
14. Madurwar KA, Phatak SV. Benign fibrous histiocytoma of male breast: Ultrasonography, doppler, and elastography imaging with pathological correlation. J Datta Meghe Inst Med Sci Univ 2019;14(2):103-105.
15. Swarnkar M. Giant calcifying aponeurotic fibroma of web space: case report with review of literature. J Krishna Inst Med Sci Univ 2019;8(2):99-102.
16. Dhatrak AA, Chaudhary K, Singh BR, Gajbe U. Evaluation of intensive pulse polio immunization in Solapur District. J Datta Meghe Inst Med Sci Univ 2019;14(2):82-85.
17. Agrawal M, Acharya N, Joshi K, Shrivastava D. Effectiveness of isosorbide mononitrate in cervical ripening before induction of labor in full-term antenatal patients. J SAFOG 2019;11(2):96-99.
18. Walinjkar RS, Khadse S, Kumar S, Bawankule S, Acharya S. Platelet Indices as a Predictor of Microvascular Complications in Type 2 Diabetes. Indian J Endocrinol Metab 2019;23(2):206-210.
19. Sharma SK, Dheda K. What is new in the WHO consolidated guidelines on drug-resistant tuberculosis treatment? Indian J Med Res 2019;149(3):309-312.
20. Varyani UT, Shah NM, Shah PR, Kute VB, Balwani MR, Trivedi HL. C1q nephropathy in a patient of neurofibromatosis type 1: A rare case report. Indian J Nephrol 2019;29(2):125-127.
21. Dangore Khasbage S, Bhake AS. Cervical lymphadenopathy in a dental patient: An eye opener case report. Spec Care Dent 2019;39(1):59-64.
22. Henry D, Singh A, Madke B, Kedia P. A case of altered clinical picture of extensive tinea corporis (Tinea as a great mimicker). Iran J Dermatol 2019;22(3):107-109.
23. Patond S, Mohite P, Ninave S, Pande V. Knowledge about medicolegal aspect of documentation amongst residents and faculty-a cross-sectional study. J Indian Acad Forensic Med 2019;41(2):117-119.
24. Singh R, Singam A. Comparative evaluation of dexmedetomedine versus clonidine as an adjuvant in supraclavicular brachial plexus block. J Krishna Inst Med Sci Univ 2019;8(3):53-65.
25. Jain S, Deshmukh PT, Lakhotia P, Kalambe S, Chandravanshi D, Khatri M. Anatomical study of the facial recess with implications in round window visibility for cochlear implantation: Personal observations and review of the literature. Int Arch Otorhinolaryngol 2019;23(3):E281-E291.
26. Deshpande SS, Phatak SV. A rare case of bilateral multiple ovarian dermoids with uterine fibroid and ectopic kidney. J Datta Meghe Inst Med Sci Univ 2019;14(1):39-41.

27. Bajaj A, Kumar S, Inamdar AH, Agrawal L. Noninvasive ventilation in acute hypoxic respiratory failure in medical intensive care unit: A study in rural medical college. Intl J Crit Illn Inj Sci 2019;9(1):36-42.
28. Aglawe PB, Jha RK, Mishra V, Sakore KM, Chetan A, Shrivastava DS. Appraisal of core therapy, supportive therapy, and alternative therapy in a tertiary care rural hospital of vidarbha region in correlation to plethora of menopausal problems. J Mid-Life Health 2019;10(1):14-21.
29. Wankhade A, Vagha S, Shukla S, Bhake A, Laishram S, Agrawal D, et al. To correlate histopathological changes and transvaginal sonography findings in the endometrium of patients with abnormal uterine bleeding. J Datta Meghe Inst Med Sci Univ 2019;14(1):11-15.
30. Patond S, Nagrale N, Jain K. Correlation between stature and skull dimensions in the population of central india: A cross sectional study. J Forensic Med Toxicol 2019;36(1):56-58.
31. Nagrale N, Patond S, Jain K. Estimation of cephalic index of chhattisgarhi population: An anthropometric study from central India. J Forensic Med Toxicol 2019;36(1):9-12.
32. Shrivastava D, Master A. Fetal Growth Restriction. J Obstet Gynecol India 2019.
33. Khanam N, Wagh V, Gaidhane AM, Quazi SZ. Assessment of work-related musculoskeletal morbidity, perceived causes and preventive activities practiced to reduce morbidity among brick field workers. Ind J Community Health 2019;31(2):213-219.
34. Swarnkar M, Jindal R. Obstructed obturator hernia: A diagnostic dilemma. J Krishna Inst Med Sci Univ 2019;8(3):115-117.
35. Marfani G, Phatak SV, Madurwar KA, Samad S. Role of sonoelastography in diagnosing endometrial lesions: Our initial experience. J Datta Meghe Inst Med Sci Univ 2019;14(1):31-35.
36. Gulve SS, Phatak SV. Parathyroid adenoma: Ultrasonography, Doppler, and elastography imaging. J Datta Meghe Inst Med Sci Univ 2019;14(1):47-49.
37. Bhayani P, Rawekar R, Bawankule S, Kumar S, Acharya S, Gaidhane A, et al. Profile of urinary tract infection in a rural tertiary care hospital: Two-year cross-sectional study. J Datta Meghe Inst Med Sci Univ 2019;14(1):22-26.
38. Laishram S, Gupta V, Bhake A, Wankhede A, Agrawal D. To assess the utility of proliferative marker Ki-67 in surface epithelial ovarian tumor. J Datta Meghe Inst Med Sci Univ 2019;14(1):6-10.
39. Swarnkar K, Gaikwad S, Uke P, Vagha K, Dalal Y. Apert syndrome presenting with omphalocele. J Krishna Inst Med Sci Univ 2019;8(1):95-99.
40. Balwani MR, Pasari A, Tolani P. Widening spectrum of renal involvement in psoriasis: First reported case of C3 glomerulonephritis in a psoriatic patient. Saudi J Kidney Dis Transpl 2019;30(1):258-260.
41. Balwani MR, Bawankule CP, Pasari A, Tolani P, Vakil S, Yadav R. Minimal change disease and Kimura's disease responding to tacrolimus therapy. Saudi J Kidney Dis Transpl 2019;30(1):254-257.
42. Balwani MR, Bawankule CP, Khetan P, Pasari A. Awareness about kidney and its related function/dysfunction in school going children: A survey from the Central India. Saudi J Kidney Dis Transpl 2019;30(1):202-207.
43. Sharma SK, Mohan A, Singh AD, Mishra H, Jhanjee S, Pandey RM, et al. Impact of nicotine replacement therapy as an adjunct to anti-tuberculosis treatment and behaviour change counselling in newly diagnosed pulmonary tuberculosis patients: An open-label, randomised controlled trial. Sci Rep 2018;8(1).
44. Samad SA, Phatak SV. An unusual case of abdominoscrotal swelling in a young patient-hydrocele en bissac. J Clin Diagn Res 2018;12(11).

45. Widmer M, Piaggio G, Nguyen TMH, Osoti A, Owa OO, Misra S, et al. Heat-Stable Carbetocin Versus Oxytocin to Prevent Hemorrhage after Vaginal Birth. Obstet Gynecol Surv 2018;73(11):613-614.
46. Acharya S, Shukla S. Metabolic healthy obesity-a paradoxical fallacy? J Clin Diagn Res 2018;12(10):OE07-OE10.
47. Samad S, Phatak S. Bilateral axillary accessory breast with ductal ectasia: Ultrasonography and elastographic appearance. J Datta Meghe Inst Med Sci Univ 2018;13(4):206-208.
48. Modi S, Agrawal A, Bhake A, Agrawal V. Role of adenosine deaminase in pleural fluid in tubercular pleural effusion. J Datta Meghe Inst Med Sci Univ 2018;13(4):163-167.
49. Gotarkar S, Ingole A. Knowledge of Anganwadi worker with respect to early childhood development. J Datta Meghe Inst Med Sci Univ 2018;13(4):168-170.
50. Goje K, Phatak S. Testicular torsion causing infarction of testis, ultrasonography and color Doppler imaging. J Datta Meghe Inst Med Sci Univ 2018;13(4):215-216.
51. Sarode RD, Tendolkar VD. Psychological pain as predictor of impulse control among BAMS new entrants: A correlation study. J Datta Meghe Inst Med Sci Univ 2018;13(4):171-174.
52. Mishra KK, Kelkar P, Kumar K. An interesting case of trichotillomania in a pre-school child. J Indian Assoc Child Adolesc Ment Health 2018;14(4):131-135.
53. Sthapak E, Gajbe U, Singh BR. Study of communication between musculocutaneous and median nerves in man. J Anat Soc India 2018;67:S37-S44.
54. Tripathi A, Avasthi A, Grover S, Sharma E, Lakdawala BM, Thirunavukarasu M, et al. Gender differences in obsessive-compulsive disorder: Findings from a multicentric study from northern India. Asian J Psychiatry 2018;37:3-9.
55. Yeola ME, Gode D, Bora AK. Evaluation of abdominal malignancies by minimal access surgery: Our experience in a rural setup in central India. World J Laparoscopic Surg 2018;11(3):115-120.
56. Srivastava TK, Mishra V, Waghmare LS. Formative assessment classroom techniques (FACts) for better learning in pre-clinical medical education: A controlled trial. J Clin Diagn Res 2018;12(9):JC01-JC08.
57. Balwani M, Bawankule C, Ramteke V, Pasari A. Hepatitis C virus, directly acting antivirals and Guillain-Barré syndrome. Saudi J Kidney Dis Transpl 2018;29(5):1237-1239.
58. Balwani MR, Pasari A, Meshram A, Jawahirani A, Tolani P, Laharwani H, et al. An initial evaluation of hypokalemia turned out distal renal tubular acidosis secondary to parathyroid adenoma. Saudi J Kidney Dis Transpl 2018;29(5):1216-1219.
59. Goyal RC, Choudhari SG, Tankhiwale SR. Assessment of competency based medical internship training with 'cumulative grade points average system'-An innovative step towards meeting 'vision 2015' of medical council of india. Indian J Public Health Res Dev 2018;9(8):155-162.
60. Yeola ME, Gode D, Bora AK. Diagnostic laparoscopy as an effective tool in evaluation of intra-abdominal malignancies. World J Laparoscopic Surg 2018;11(2):68-75.
61. Sharma S, Singh AD, Sharma SK, Tripathi M, Das CJ, Kumar R. Gallium-68 DOTA-NOC PET/CT as an alternate predictor of disease activity in sarcoidosis. Nucl Med Commun 2018;39(8):768-778.
62. Daigavane S, Prasad M. To observe the proportion of amblyopia among children presenting in a rural hospital in Central India. J Datta Meghe Inst Med Sci Univ 2018;13(3):119-121.

63. Gadge A, Acharya N, Shukla S, Phatak S. Comparative study of transvaginal sonography and hysteroscopy for the detection of endometrial lesions in women with abnormal uterine bleeding in perimenopausal age group. J SAFOG 2018;10(3):155-160.
64. Anjankar SD. Urethral protrusion of the distal end of shunt. J Pediatr Neurosci 2018;13(3):371-372.
65. Swarnkar M, Pandey P. Heterotopic subserosal pancreatic tissue in jejunum. Formosan J Surg 2018;51(4):167-170.
66. Choudhari MS, Sonkusale MI, Deshpande RA. Sudden cardiac arrest on 5 th day after coronary artery bypass graft surgery: Diagnostic dilemma. Ann Card Anaesth 2018;21(3):341-342.
67. Kirnake V, Arora A, Sharma P, Goyal M, Chawlani R, Toshniwal J, et al. Non-invasive aspartate aminotransferase to platelet ratio index correlates well with invasive hepatic venous pressure gradient in cirrhosis. Indian J Gastroenterol 2018;37(4):335-341.
68. Kürhade G, Nayak BS, Kurhade A, Unakal C, Kurhade K. Effect of martial arts training on IL-6 and other immunological parameters among Trinidadian subjects. J Sports Med Phys Fitness 2018;58(7-8):1110-1115.
69. Balwani MR, Bawankule C, Khetan P, Ramteke V, Tolani P, Kute V. An uncommon cause of rapidly progressive renal failure in a lupus patient: Pauci-immune crescentic glomerulonephritis. Saudi J Kidney Dis Transpl 2018;29(4):989-992.
70. Mohite D, Hande A, Gupta R, Chaudhary M, Mohite P, Patil S, et al. Immunohistochemical evaluation of expression pattern of p53, p63, and p73 in epithelial dysplasia. J Datta Meghe Inst Med Sci Univ 2018;13(3):122-129.
71. Rathi N, Chandak M, Mude G. Comparative evaluation of dentinal caries in restored cavity prepared by galvanic and sintered burs. Contemp Clin Dent 2018;9(5):S23-S27.
72. Gupta V, Bhake A. Reactive Lymphoid Hyperplasia or Tubercular Lymphadenitis: Can Real-Time PCR on Fine-Needle Aspirates Help Physicians in Concluding the Diagnosis? Acta Cytol 2018;62(3):204-208.

Received: 22 Feb 2020 | Revised: 13 Mar 2020 | Accepted: 05 Apr 2020