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Prevalence of poor core muscle strength in subjects having type -2 diabetes mellitus along with hypertension

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Abstract
Introduction: Many activites require complex co-ordination between the upper and lower extremities. The core functions as a certral link between the upper and lower extremities and stability of this region is proposed to be a requisite[25]. Measurement of core muscular strength is therefore essential, so my study is to find out prevalence of poor core strength in subjects with type2 diabetes mellitus along with hypertension[1].
Aim and objective: To find out and to assess the prevalence of poor core strength in subjects having diabetes along with hypertension via pressure measurement using aneroid sphygmomanometer.
Material and Methods: Primary data collection was done from tertiary health care centres in miraj using non-randomised sampling. 50 type 2 diabetic and hypertensive subjects between the age group of 40-65 years were screened based on the selection criteria. Demographic data were recorded along with general assessment and investigations including blood glucose level and blood pressure. The scores of the core strength using aneroid sphygmomanometer were recorded and data were anlysed.
Results: The result of the study showed a statistical significance in the core strength (p=0.05) using aneroid sphygmomanometer in subjects with type 2 diabetes mellitus along with hypertension.
Conclusion: The study concludes that there is a good prevalence of poor core muscle strength in subjects with type 2 diabetes along with hypertension.

Keywords: type 2 diabetes mellitus, hypertension, aneroid sphygmomanometer, core strength

Introduction

Diabetes mellitus is defined as a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. Type 2 diabetes, formerly called adult onset diabetes, is the most common form (80% to 90% of all diabetes). The overall crude prevalence of diabetes by WHO criteria was 15.5% [16].

Hypertension is defined as a blood pressure greater than 140/90mmhg according to British hypertension society [6]. Prevalence of hypertension was varying from 17% to 21% [6]. It appears that 70% of hypertension in men and 60% in women could be attributed to abdominal obesity [18].

Obesity is defined as a chronic and increasingly common disease characterized by excess body fat [18]. Health risks associated with obesity are increased mortality, coronary artery disease, type 2 diabetes mellitus, hypertension, stroke, dyslipidemia, respiratory disease, cancer, osteoarthritis, infertility, venous circulatory disease etc [18].

The association between obesity and hypertension was found to be strong [14] and also there is a high prevalence of obesity in adults with diabetes [15] so obesity has a significant negative impact on back and core muscular endurance [17].

The muscular system is an organ system consisting of skeletal, smooth and cardiac muscle [1]. Tt permits movement of the body, maintains posture and circulates blood throughout the body [1]. The main core muscles are rectus abdominis, externaloblique, erectorspinae, latissimusdorsi, hamstrings, hip abductors and adductors. Based on various journal reports and research articles it states that the core muscles tone is important in maintaining the physiological functions of body [1]. The abdominal muscles resting length and contractile function is affected in obesity[1].According to a surveys conducted obesity is one of the predisposing factor in diabetes and hypertension [1]. It is reported that the quality of life is highly affected due to diabetes and hypertension [1]. Measurement of muscular strength is therefore essential to guide clinical decision– making regarding rehabilitation interventions and is usually employed within clinical and research settings [1].

There are various common methods for clinical assessment of strength. And one the method for clinical assessment of strength is the modified sphygmomanometer test (MST). MST provides objective measures and involves the use of Aneroid sphygmomanometer, a low cost, portable device widely used by health professionals [13].

One of the study evaluated that strength – hypertension association with and without CRF &that concludes that middle and high levels of muscular strength were associated with a reduced risk of hypertension in pre-hypertensive male only [26].

Research have revealed the prevalence rates of hypertension and obesity in patients with T2DM are high throughout the world [9]. These results highlight the need for specific evidence-based guidelines for physiotherapeutic management of T2DM with HTN related in poor abdominal strength in primary practice [8]. Based on various journal reports and research articles it states that the core muscles

tone is important in maintaining the physiological functions of body [1]. Hence prevention in practices and education about good lifestyle can reduce the probability of hypertension and diabetes as well as strengthening of core muscles [1].

Many activites require complex co-ordination between the upper and lower extremities. The core functions as a central link between the upper and lower extremities and stability of this region is proposed to be a requisite [25].

The " core" is described as a box with the abdominals in the front, paraspinal and gluteal muscles in the back, the diaphragm as the roof and the pelvic floor and hip girdle musculature as the bottom [22]. Within this box there are 29 pairs of muscles that help to stabilize the spine, pelvis, and kinetic chain during functional movements [23]. When the system works efficiently, there is appropriate distribution of forces, optimal control and efficiency of movement, adequate absorption of ground impact forces and an absence of excessive sharing forces on the joints of the kinetic chain [24].

Weakness of the trunk and lower limb muscles is related to decreased performance in some functional activities such as gait and sit to stand tasks [13]. Measurement of strength is therefore essential to guide clinical decision-making regarding rehabilitation interventions and is usually employed within clinical and research settings [13].

Also, there is a dearth in literature identifying the prevalence of poor core strength in type-2 diabetes mellitus along with hypertension so my study is to find out prevalence of poor core strength in subjects with type2 diabetes mellitus along with hypertension [1].

Material and Methodology

Material

1. Aneroid sphygmomanometer
2. Plinth

Methodology

1. Type of study-observational study
2. Study sample-50
3. Study duration-6 months
4. Type of sampling-non-randomized sampling
5. Study setting-Tertiary health care centre

Inclusion Criteria

1. Both male and female
2. Age group 40-65years
3. Subjects with both TYPE II diabetes mellitus and hypertension
4. Subjects on anti- hypertensive drugs
5. Subjects on diabetic drugs /on insulin injections.

Exclusion Criteria

1. Recent abdominal surgery
2. Subjects with type-1 diabetes mellitus
3. Subjects with stage 2&3 hypertension
4. recent cardiac\pulmonary surgery
5. Age <40 and >65 years
6. Congenital abnormalities of pelvis
7. low back pain
8. musculoskeletal disorders
9. spine deformity

Procedure

- Ethical approval will be obtained from the institutional ethical committee.
- Informed consent for participation of subjects in the study will be obtained.
- Demographic data will be taken and complete assessment will be done.
- One time assessment will made of their pressure measurement using aneroid sphygmomanometer.
- Patient will be taken in a supine position.
- The cuff of the aneroid sphygmomanometer inflated till 180mmhg and kept under patients low back and ask patient to tuck in the abdomen and press back on the cuff of aneroid sphygmomanometer.
- Then pressure should be noted and similarly next 2 trials will be taken.so total three readings should be noted and finally best of three measurement will be considered.
- Data collection will be tested statistically.

Results

Data was collected from 50 subjects consisting of 19 females and 31 males.

Table 1: Age group wise distribution of type-2 diabetes mellitus along with hypertension

Age groups	Frequency	Percent
41-50 years	9	18
51-60 years	27	54
61-65 years	14	28
Total	50	100

Table 1 shows that, there were 9(18%) between 41-50 years, 27 (54%) patients between 51-60 years and 14(28%) patients 61-65 years of age with type-2 diabetes mellitus along with hypertension.

Table 2: Gender distribution of patients with type-2 diabetes mellitus along with hypertension

Gender	Frequency	Percent
Females	19	38
Males	31	62
Total	50	100

Table 2 shows that, there were 19(38%) female patients and 31(62%) male patients with **t**ype-2 diabetes mellitus along with hypertension.

Table 3: BMI distribution of patients with type-2 diabetes mellitus along with hypertension

BMI	Frequency	Percent
Underweight	1	2
Normal	37	74
Overweight	10	20
Obese	2	4
Total	50	100

Table 3 shows that, there was 1(2%) underweight patient, 37(74%) patients having normal BMI. there were 10(20%) patients were overweight and 2(4%) obese patients.

Table 4: BP category wise distribution of patients with type-2 diabetes mellitus along with hypertension

BP category	Frequency	Percent
Elevated	3	6
High BP stage I	6	12

High BP stage II	41	82
Total	50	100

Table 4 shows that, there were 3(6%) elevated BP patients, 6(12%) patients having high BP stage I. There were 41(82%) patients were having high BP stage II.

Table 5: Correlation between variables of patients with type-2 diabetes mellitus along with hypertension

Sr. No.	Pearson Correlation	p value
1	Age	Diastolic BP (mm Hg)
	-0.28	0.04
2	Age	Diabetes history (years)
	0.33	0.01
3	Age	Hypertension history (years)
	0.39	0.005
4	Average pressure (mm Hg)	BMI
	-0.27	0.05
5	Average pressure (mm Hg)	Random blood glucose level (mg/dl)
	-0.31	0.03
6	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
	0.29	0.03
7	Diabetes history (in years)	Hypertension history (in years)
	0.95	<0.01

- Correlation analyses revealed a weak negative relationship between age and diastolic BP (r=-0.28, p=0.04), weak positive relationship between age and diabetic history in years (r=0.33, p=0.01) and age, hypertension history in years (r=0.39, p=0.005) So, it indicates that as age of patient increases, diastolic BP of patient decreases.

And as age of patient increases, diabetic history in years and hypertension history in years of patient increases.

- There was weak negative relationship between average pressure (mm Hg) and BMI (r=-0.27, p=0.05), average pressure (mm Hg) and random blood glucose level(mg/dl) (r=-0.31, p=0.03), So, it indicates that as BMI and glucose level of patients increases, average pressure (mm Hg)given to patient decreases.
- A weak positive relationship between systolic and diastolic BP of patients (r=0.29, p=0.03) So, it indicates that as systolic BP of patient' s increases, diastolic BP also increases.
- There was very strong positive relationship between diabetes history (in years) and hypertension history (in years) (r=0.95, p<0.01), so that indicates both histories (in years) increases simultaneously.

There was no correlation between rests of the variables of patients

Table 6: Descriptive statistics of parameters of type-2 diabetes mellitus along with hypertension

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	50	42	65	57.06	6.29
Height (cms)	50	145	180	162.54	6.44
Weight (kg)	50	45	130	64.02	11.55
BMI	50	17.6	55.5	24.47	4.94
Diabetes history (years)	50	1	30	8.60	7.07
Random blood glucose level (mg/dl)	50	130	180	154.30	10.79
Hypertension history (years)	50	1	30	8.50	6.48
Systolic BP (mm Hg)	50	100	160	130.10	11.00
Diastolic BP (mm Hg)	50	60	100	85.90	9.62
Average pressure (mm Hg)	50	220	280	248.60	12.12

It was found that mean age of patients was 57.06 years, mean height was 162.54 cms, mean weight was 64.02 kgs, and mean BMI was 24.47 (normal).
Mean diabetic history was 8.6 years and mean random blood glucose level was 154.3 (mg/dl)
Mean hypertension history was 8.5 years and mean systolic was 130.1 (mm Hg), mean diastolic was 85.9 (mm Hg)
Average pressure given to patient was 248.60 (mm Hg).
Finally, all 50 (100%) patients were having below average pressure (mm Hg) <285.5 (mm Hg) So the prevalence of poor core strength in type-2 diabetes mellitus along with hypertension was 100% which indicates that

Alternative hypothesis is accepted that is
There is a ssignificant correlation between core muscle weakness and diabetes as well as hypertension.

Discussion
The purpose of this study was to find out Prevalence of poor core muscle strength in subjects with type 2 diabetes mellitus along with hypertension. The core strength of subjects having type 2 DM along with hypertension was analysed in the form of pressure obtained in aneroid sphygmomanometer. Mainly, Diabetes is associated with excessive loss of skeletal muscle [19]. Muscle is the important insulin dependent glucose sink in the body [21] as well as hypertension co-morbidity with DM. Hence study was done to analyze the predisposition of core muscle weakness in such patients.
The muscular system is an organ system consisting of skeletal, smooth and cardiac muscle [1]. Tt permits movement of the body, maintains posture and circulates blood throughout the body [1]. The main core muscles are rectus abdominis, externaloblique, erectorspinae, latissimusdorsi, hamstrings, hip abductors and adductors. Based on various journal reports and research articles it states that the core muscles tone is important in maintaining the physiological functions of body [1]. The abdominal muscles resting length and contractile function is affected in obesity [1]. According to a surveys conducted obesity is one of the predisposing factor in diabetes and hypertension [1]. It is reported that the quality of life is highly affected due to diabetes and hypertension [1]. Measurement of muscular strength is therefore essential to guide clinical decision– making regarding rehabilitation interventions and is usually employed within clinical and research settings [1].
Many activites require complex co-ordination between the upper and lower extremities. The core functions as a central link between the upper and lower extremities and stability of this region is proposed to be a requisite [25]. The " core" is

described as a box with the abdominals in the front, paraspinal and gluteal muscles in the back, the diaphragm as the roof and the pelvic floor and hip girdle musculature as the bottom [22]. Within this box there are 29 pairs of muscles that help to stabilize the spine, pelvis, and kinetic chain during functional movements [23]. When the system works efficiently, there is appropriate distribution of forces, optimal control and efficiency of movement, adequate absorption of ground impact forces and an absence of excessive sharing forces on the joints of the kinetic chain [24].

Jay gupta, nanda bodalia, satish pimpale and priyanka honkalas performed Prevalence study on hypertensive and diabetic subjects with poor abdominal strength between the age group of 45-55 years on 100 subjects. The results, population recruited in the study suffered abdominal weakness [1].

Arch G. Mainous, Rebecca J. Tanner, Stephen D. Anton and Ara Jo performed study, Grip strength as a marker of hypertension and diabetes in healthy weight adults aged 20 years. The results, lower grip strength is associated with diabetes and hypertension [29].

Henning Andersen, Soren Nielsen, Carl E. Mongensen, and Johannes Jakobsen performed study on muscle strength in type 2 diabetic patients aged <70 years. The results, type 2 diabetes patients have weakness of extensors and flexors of the ankle and of knee flexors [28].

Lucas Araújo Castroe Souza, PT, MSc, Júlia Caetano Martins, PT, MSc, Luci Fuscaldi Teixeira-Salmela, PT, PhD, Eliza Maria Lara, PT, Juliana Braga Moura, PT, Larissa Tavares Aguiar, PT and Christina Danielli Coelho de Morais Faria, PT, PhD performed study on validity and reliability of the modified sphygmomanometer test to assess strength of the lower limbs and trunk muscles of patients aged >=20 years after stroke. The results MST is a promising method to be used within clinical settings worldwide for the assessment of the strength [13].

Finally, in all these subjects showed reduced core muscle strength So there is a good prevalence of poor core strength in type-2 diabetes mellitus along with hypertension which indicates that There is a significant correlation within core muscle weakness, diabetes and hypertension.

Limitations

Before attempting further research on this subject the researchers would make several suggestions on how to improve such study as, sample would be more representative of a clinical population by attempting to obtain a more even age distribution, gender distribution and by increasing the representation of sedentary subjects in the subjects that is always except Athelet as well as women with past H/O LSCS.

Conclusion

The purpose of this study was to find out Prevalence of poor core muscle strength in subjects with type 2 diabetes mellitus along with hypertension. Results of the study concludes that there is a good prevalence of poor core muscle strength in subjects with type 2 diabetes along with hypertension which indicates that alternative hypothesis is proved that There is a significant correlation between core muscle weakness and diabetes as well as hypertension. p-value =0.05.

Ethical clearance

Taken from Institutional ethical committee.

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