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RESEARCH ARTICLE

CARDIOVASCULAR RESPONSES TO LUMBAR CORE MUSCLE STABILITY EXERCISE IN YOUNG ADULTS HAVING POSTURAL LOW BACK PAIN

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Core Stability Exercise; Blood Pressure; Heart Rate; Respiratory Rate; Postural Low Back Pain

Background: Postural low back pain is a significant public health problem worldwide, due to the changing lifestyle. Many interventions are used in the treatment of postural low back pain, among them core stability exercise is one of the treatment plans. After exercise, cardiovascular system produces significant changes in parameters such as blood pressure (BP), heart rate, and respiratory rate.
Aims and Objectives: The aim of this study was to evaluate cardiovascular response to lumbar core muscle stability exercise in healthy young adults having postural low back pain.
Materials and Method: In the study, 40 patients with postural low back pain were considered. First, baseline parameters such as BP, heart rate, and respiratory rate were measured and recorded as L1, then all the patients were taught to perform lumbar core stability exercise (drawing in maneuver) and asked to hold for 10 s and 10 repetitions were performed. A pressure biofeedback was used at 40 mm Hg pressure and placed at the lower lumbar region; then patient was asked to perform exercise. After the exercise parameter were again recorded as L2.
Results: Paired *t*-test was used to compare L1 and L2 parameters, and GraphPad software was used for the analysis. For systolic BP, *t*-value and *p*-value were 7.89 and <0.001; for diastolic BP, 5.84 and <0.001; for heart rate, 7.52 and <0.001; and for respiratory rate, 6.53 and <0.001, respectively. The result of the study shows a significant difference in all cardiovascular parameters.
Conclusion: A significant difference was observed in the cardiovascular parameters after lumbar core stability exercise.

INTRODUCTION

The ability of cardiovascular system is impressive in responding immediately to the body's many and ever -changing needs. Numerous cardiovascular changes occur during exercise, all share a common goal—they allow system to meet the increased demand placed on it and carry out its function with maximal efficiency.[1] Cardiovascular response to exercise depends on muscle mass involved and the intensity of the exercise.[2] Lifestyle changes have made low back pain one of the very common musculoskeletal disorders affecting 80% of people at some point in their lives. Low back pain is the most common site for pain in younger and middle-aged adults. Repetitive or static awkward body postures resulting from excessive bending and twisting increase spinal stress and disproportionate loading to spinal structures[3]; usually in profession where prolonged sitting is required such as computer/visual display unit users, bank clerks, accountants, stock exchange workers, industrial workers, and architects.[4]

Postural low back pain is common in young adults. It is a condition in which patient complain of pain because they are mechanically deforming their spinal soft tissue due to sustaining end-range posture and position. Abnormal position of spine leads to pain; it is usually localized, has gradual onset, gets worse in static position, and lacks deformity and deviation.[5]

Physical therapist treat low back pain by posture correction exercises, stretching exercise, strengthening exercise, lumber stabilization exercise, heating modality, and dynamic abdominal and core stability exercises.

Deep core muscles provide dynamic support to individual segments in the spine, they are transversus abdominis, multifidus, and quadratus lumborum. So the purpose of the study was to evaluate cardiovascular response to lumbar core

muscle stability exercise in young adults having postural low back pain.

MATERIALS AND METHODS

An experimental study was conducted at Physiotherapy OPD of SBB College of Physiotherapy, VS General Hospital, Ahmadabad, from May to October 2010. A total of 40 patients (24 men and 16 women, age 20–30 years) with postural low back pain were included in the study. Informed written consent was taken from each patient. Patients with postural low back pain were evaluated and baseline parameters such as blood pressure, heart rate, respiratory rate were recorded as L1. Patients with degenerative spine, internal fixation of spine, cardio respiratory disease, and neurological involvement were excluded. The outcome measures used were blood pressure, heart rate, and respiratory rate. The patients were asked to maintain hook-lying position (with knees 70°–90° and feet resting on an exercise mat). A pressure bio-feedback unit (Stabilizer; Encore Medical) was placed horizontally under the lower back and was inflated to 40 mm Hg.[6] The patients were instructed to breathe in, breathe out, and gently draw the belly button in toward the spine to hollow out the abdominal region. They were asked to hold it for 10 s and 10 repetitions were performed. After exercise, parameters (blood pressure, pulse rate, respiratory rate) were again measured and recorded as L2. The difference between L1 and L2 was noted.

RESULTS

SPSS software was used for analysis. Paired t-test was performed to compare L1 and L2 (pre- and post-exercise) parameters (Table 1). There were 40 patients and mean age was 25.37 years, SD was 3.43.

Table 1: Pre- and post-exercise parameters

Parameters	L1 (pre)	L2 (post)	*t*-Value	*p*-Value
Systolic blood pressure	113.9 ± 6.46	117.3 ± 7.16	7.89	<0.001
Diastolic blood pressure	73.55 ± 6.75	74.95 ± 6.80	5.84	<0.001
Heart rate	78.52 ± 6.12	80.25 ± 6.37	7.52	<0.001
Respiratory rate	16.77 ± 3.38	18.55 ± 3.28	6.53	<0.001

DISCUSSION

The purpose of this study was to evaluate cardiovascular response to lumbar core muscle stability exercise in healthy young adults having postural low back pain. The results of the study show a significant difference in all cardiovascular parameters.

Increase in arterial pressure can be caused by skeletal muscle contraction during exercise, because when the skeletal muscles contract, they compresses blood vessels throughout the body. Even anticipation of exercise tightens the muscle, thereby compressing the vessels. The resulting effect is to translocate large quantities of blood from the peripheral vessels into the heart and lungs and, therefore, to increase the cardiac output, leading to increase in the arterial pressure during exercise.[7]

Elkayam *et al*.[8] studied the hemodynamic effects of isometric exercise in patients with chronic advance heart failure .[2] In the study, 53 patients with congestive heart failure and 10 normal subjects were included. In both groups, isometric exercise resulted in increased heart rate and blood pressure, presumably caused by increase in left ventricular contractility.[9]

Efferent sympathetic fibers increase heart rate and myocardial contractility and dilate coronary arteries. Silva *et al*.[10] studied heart rate responses to isometric exercise and the role played by muscular mass and type. The subjects were asked to perform knee flexion and extension. The heart rate responses induced by isometric exercise performed by knee extension were significantly higher than knee flexion, which could be dependent on qualitative and quantitative differences in the fiber type composition found in each muscle group. This mechanism seems to demand a higher activation of motor units with a corresponding increase in central command to the cardiovascular centers that modulate heart rate control.

For the respiratory rate, the brain is believed to transmit collateral impulses into the brain stem to excite the respiratory center.[7] Some experiments suggest that hypoxia developing in muscles during exercise elicits efferent nerve signals to the respiratory centers to excite respiration. Also because exercising muscles produce a substantial amount of carbon dioxide and use tremendous amount of oxygen, the pCO_2 and pO_2 change markedly between the inspiratory cycle of respiration and the expiratory cycle.[7]

Lad and Bellare[11] have Studied cardiovascular

response to lumbar core stability exercise and shown that increase in respiratory rate was highest after exercise.

Some factors that affect the cardiovascular system are the following:

- *Age group*: During exercise, younger individual showed grater variability in heart rate responses to exercise, and more rapid heart rate acceleration at the start of the exercise. Their heart rate returned to baseline more rapidly than older subjects.[12]
- *Intensity*: Researcher have stated that the magnitude of change in blood pressure and heart rate was unrelated to the size of active muscle but closely related to the relative intensity of contraction.[13] The more the intensity of exercise, the greater the cardiovascular changes.
- *Different body parts*: In our body, upper limb and lower limb experience different blood pressure changes due to exercise. Exercise with arms produce considerably higher systolic and diastolic blood pressures than that with the leg. This is because of the smaller arm muscle mass and vasculature offer grater resistance to blood flow than the larger leg mass and blood supply.

The present study shows significant difference in the cardiovascular parameters such as blood pressure, heart rate, respiratory rate after the ("drawing-in" maneuver) lumbar core stability exercise.

Limitations of the study include lack of follow up, younger age group, and different duration of the postural low back pain in each patient. Intervention could also be given in the prone position. Future study should include core muscle stability exercise on subjects with nonspecific low back pain and long-term effect of core stability exercise on cardiovascular vascular parameters should also be evaluated.

CONCLUSION

The study concludes that lumbar core muscle stability exercise exerts significant effects on cardiovascular response in young adults having postural low back pain.

Clinical Implication

Lumbar core stability exercise produces significant change in the cardiovascular parameters, so it should be administered with the caution in the patients with cardiac problems.

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