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The Effect of Otago Exercise Program for Fall Prevention in Alcoholic Neuropathy Patients

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ABSTRACT

Introduction: Otago Exercise Program (OEP) consists of lower limb strengthening, balance and endurance exercises designed to prevent risk of fall. Alcoholic Neuropathy [AN] patients frequently complaints of muscle pain, difficult in gait, reduced muscle strength, falls and cramps thus they are at a high risk of fall. The aim of study is to find the effect of OEP for fall prevention in alcoholic neuropathy patients.
Method: Study consists of 34 male patients aged 45 to 64 years diagnosed with AN. Patients at moderate high and risk of fall on Tinetti Performance Oriented Mobility Assessment [TPOMA] was part of the study. The intervention comprises of 5 lower limb muscle strength training, 12 balance exercises and endurance training given for 1 hour for 5 days per week for 4 weeks along with warm-up and cool-down 5 mins each. Progression of exercises will be done by increasing the duration and then intensity. Pre-intervention and post intervention data was collected and compared.
Outcome measure: Tinetti Performance Oriented Mobility Assessment
Result: Data of total 34 patients was compared using paired t-test for TPOMA. The results of p-value for TPOMA are p=0.00 which is highly significant. Out of 34 patients 33 were at minimal and no risk of fall post-intervention.
Conclusion: Patients with alcoholic neuropathy have decreased muscle strength, lack of coordination of the feet or hands, and impaired balance on walking. OEP be taught for improving balance and gait which will help to reduce fall risk in alcoholic neuropathy patients. The Otago Exercise Program is effective in reducing risk of fall in patients with alcoholic neuropathy by strengthening leg muscles, balance exercise and gait training.

Keywords: OTAGO Exercise Programme, Tinetti Performance Mobility Assessment, Alcoholic Neuropathy, Risk of fall.

INTRODUCTION

Alcohol is a psychoactive substance with toxic and addiction generating properties. Consumption of alcohol varies extensively around the world; the health burden due to alcohol is enormous. The harmful effect of alcohol use is one of the leading risk factors for disease burden worldwide.[1] As per pharmacological definition, alcohol is a drug and may be classified as a sedative, tranquillizer, hypnotic and anaesthetic depending upon the quantity consumed. Alcohol is the only self-induced intoxication which is socially acceptable.[2] In India, alcohol consumption is extended across all the states and the union territories, and projected 160 million consume alcohol. 29.2 % men and 1.2% women consume alcohol according to National Family Health Survey-4 (NFHS-4).[3]

From the overall percentage of alcoholics 64% develops some or the other neurological disorder. The most common

neurological derangement was peripheral neuropathy present in 20% of cases. Peripheral neuropathy was the most common and earliest manifest in alcoholics. The amount, pattern, and chronicity of alcohol drinking describe the severity of this disease.[4] Alcoholic polyneuropathy is categorised under the disorders of peripheral nervous system (PNS). As, the central nervous system (CNS) has a special blood-brain barrier system, whereas PNS lacks any such protection.[5]

Alcohol is rapidly absorbed from stomach and small intestine and within 2-3 minutes of consumption is detected in blood with maximum concentration achieved about one hour after.[2] Alcohol is unhealthy to the nervous tissue in individuals with alcoholic pathology, where the peripheral nerves are broken by an excessive amount of alcohol use.[6] Long-term consumption as well as extreme alcohol consumption is the main cause of alcoholic peripheral neuropathy. It is worth mentioning that there is no reliable cure due to the poor understanding of its pathology of alcoholic peripheral neuropathy.[7] Symptoms usually develop slowly (extending over a period of months) and gradually worsen over time.[5]
Signs and symptoms comprise of any combination of the following:

Hyperalgesia, allodynia, and burning pain, decreased sensation of the feet, legs, fingers, toes, arms or hands, loss of vibration and position sense. Weakness, lack of coordination, loss of unsteadiness OR balance once walking, muscle weakness, cramps or aches, numbness, heat intolerance, impotency, urinating problems, Sub-perineurial oedema.
Other symptoms include:

Alcoholic redness, weight loss, constipation/diarrhoea, nausea/vomiting, swallowing difficulty, movement disorders.

Fall is an unexpected incident in which the individual comes to rest on the ground, or lower level. Fall may be the first indication of an undetected illness remaining undiagnosed due to looking at a bigger picture.[8] The dynamic balance and leg muscle strength have a co-relation to fall risk. Improving the factors affecting the patient helps to reduce frequency of falls as well as its costs both financially and physically.[9]

For walking, both static and dynamic balance is needed. Strengthening and balance exercises mainly lower limb is easy, cheap and gainful in the prevention of fall.[10] The Otago Exercise Program (OEP) is the most widespread fall prevention program. The OEP is strength and balance retraining programme designed to prevent falls. [11] As Otago intervention includes components for improving balance, strength and functional capacity and thus reduces risk of fall. [8]

METHODOLOGY

1. Type of study: Experimental Study
2. Type of sampling: Purposive Sampling
3. Study design: Pre and post experimental study
4. Sample size: 34
5. Study duration: 6 months
6. Study setting: De-addiction center, Miraj

Materials: Data collection Sheet, Consent form, Pen, Weight cuffs, Chair (with arm rest), Staircase

Procedure: Ethical clearance was obtained. Permission was taken from Deaddiction center, Miraj. Participants included according to inclusion criteria. Written consent was taken and procedure was explained about the study in their vernacular language. Pre and post intervention assessment was done using TPOMA. Intervention for 4 weeks was conducted. Pre-intervention and post-intervention results were compared using paired t-test. Statistical Analysis was done using SPSS 23 VERSION Software.

INTERVENTION: Otago exercise programme comprises of five lower limb muscles strengthening exercises, twelve static and dynamic balance training exercises, and gait training for endurance.

Progression of exercises will be done by increasing the duration and then intensity. It starts with warm up, consisting of flexibility exercises for 5 min each. Exercise session was conducted for 1hr/ 5days/ 4weeks.

EXERCISE PROTOCOL

Table No.1 Exercise Protocol

	Strengthening	Balance retraining	Walking
Activities	5 leg muscle strengthening exercises, with up to 4 levels of difficulty	12 balance retraining exercises, with up to 4 levels of Difficulty	Advice about walking
Assessment	The amount of weight in Ankle cuff should allow 8-10 repetitions before fatigue	Set each exercise at a level that the person can safely perform	Discuss the present walking activities
Intensity	Moderate	Moderate	At own pace
Progression	Increase to 2 sets of repetitions or Increase the weight of ankle cuff	From supported exercise to unsupported exercise	
Frequency	5 times a week	5 times a week	At least 2 times a week
Duration	Approximately 30mins for flexibility, strength and balance exercises		30mins, can be broken down to 3*10mins walk throughout the day

Table No. 2 Strengthening Exercises

STRENGTHENING EXERCISES		
Knee extensors (front knee strength) Knee flexors (back knee strength) Hip abductors (side hip strength)	All 4 levels Ankle cuff weights are used to provide resistance to muscles and 10 repetitions of each exercise are carried out	
Ankle plantarflexors (calf raises)	Level C 10 repetitions, hold support, repeat	Level D 10 repetitions, no support, repeat
Ankle dorsiflexors (toe raises)	10 repetitions, hold support, repeat	10 repetitions, no support, repeat

Table No.3 Balance Exercise

BALANCE RETRAINING EXERCISES				
	Level A	Level B	Level C	Level D
Knee bends	10 repetitions Hold support	1)10 repetitions, no support or 2)10 repetitions, hold support, repeat	10 repetitions, no support, repeat	3*10 repetitions No support
Backwards walking		10 steps, 4 times Hold support		10 steps, 4 times No support
Walking and turning around		Walk and turn around (make figure of 8) twice Use walking aid	Walk and turn around (make figure of 8) twice no support	
Sideways walking		10 steps, 4 times Use walking aid	10 steps, 4 times No support	
Tandem stance (heel toe stand)	10 sec, hold support	10 sec, no support		
Tandem walk (heel toe walk)			Walk 10 steps Hold support, repeat	Walk 10 steps No support, repeat
One leg stand		10 sec, hold support	10 sec, no hold	30 sec, no hold
Heel walking			10 steps, 4 times Hold support	10 steps, 4 times No support
Toe walk			10 steps, 4 times Hold support	10 steps, 4 times No support
Heel toe walking backwards				Walk 10 steps No support, repeat
Sit to stand	5 stands, 2 hands for support	1)5 stands, one hand support or 2)10 stands,2 hands for support	1)10 stands, no support or 2)10 stands,2 hands for support, repeat	10 stands, no support Repeat
Stair walking	As instructed	As instructed	As instructed	As instructed, repeat

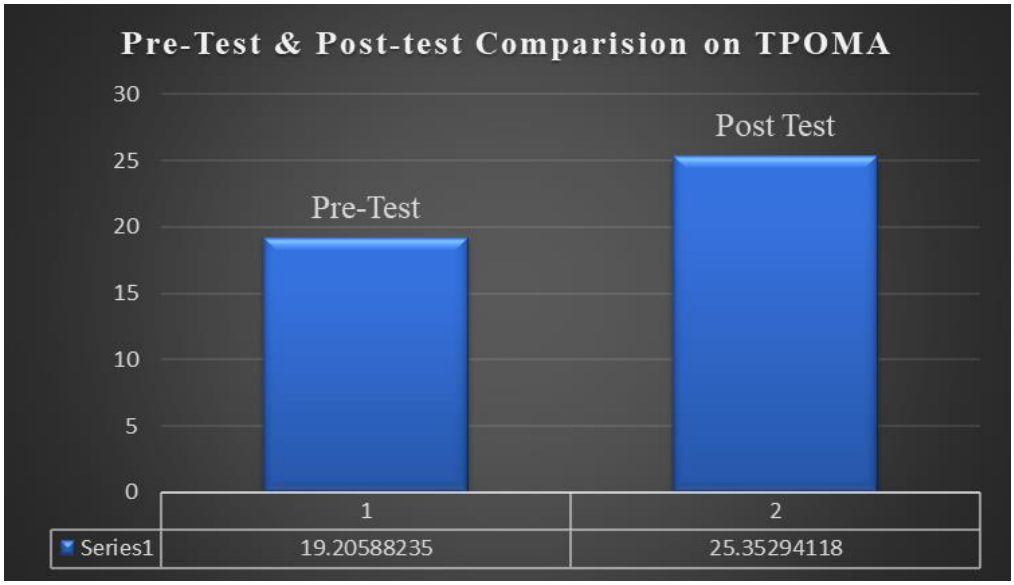
Statistical analysis

Statistical Analysis was done using SPSS 23 VERSION Software. The significance of pre and post-intervention for gait and balance using TPOMA Scale was calculated by paired t-test.

RESULTS

Table No.4 Paired Samples Statistics

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Intervention Score on Balance	9.9706	34	1.81718	.31164
	Post Intervention Score on Balance	14.0294	34	.96876	.16614
Pair 2	Pre-Intervention Score on Gait	9.2353	34	1.01679	.17438
	Post Intervention Score on Gait	11.2941	34	.71898	.12330
Pair 3	Pre-Intervention on TPOMA	19.2059	34	2.44676	.41962
	Post Intervention Score on TPOMA	25.3529	34	1.06976	.18346



Graph.1 Pre-Test & Post-Test Comparision on TPOMA

Table. 5 Pre-Intervention on TPOMA- Post Intervention Score on TPOMA

Mean	Std. Deviation	t	df	Sig. (2-tailed)
-6.14706	2.14804	-16.686	33	.000

Results from analysis: Data of total 34 patients diagnosed with alcohol neuropathy was compared using paired t-test for Tinetti Performance Mobility Assessment Scale. The results of p value for TPOMA p = 0.00 was found to be highly significant. Out of 34 participants 15 were at high risk of fall and 19 were at moderate risk of fall pre-intervention, of whom 33 were at minimal risk of fall post-intervention. Paired t-test was used for results of p value for Tinetti performance oriented mobility assessment and was found to be very significant.

DISCUSSION

The OEP was developed to prevent risk of fall in elderly people. It consists of 5 lower leg muscles strengthening, 12 balance retraining exercises and 30mins walk throughout the day which can be broken down to 10min thrice daily. Common clinical manifestation being Cramps, Weakness within the hands or feet, lack of coordination of the feet or hands, loss of balance once walking. This exercise can be prescribed institutional as well as a home exercise programme. These are simple, cost effective and can be performed with minimal supervision.

Lower limb muscle weakness is considered a fall predictor, so the OEP aims to improve the strength of leg muscles that usually reduces with alcohol consumption. OEP along with leg muscle strengthening it also comprises of static and dynamic balance exercises with gait training. Strength training was done by using weight cuff to strengthen Hip abductors, Knee flexors-extensors and ankle plantarflexors - dorsiflexors. Static balance exercises comprise of knee bends, tandem stance, heel raise, toe raise, sit to stand.

While dynamic balance exercises include backward walking, walking and

turning around, sideways walking, tandem walk, heel walk, toe walk, heel toe walking backwards, stair walking along with it 30min of walking.

Through these exercise individuals are trained in speed, distance, direction, rhythm and muscle tone, and strength while walking along with subjects practiced with a fixed foot support, acceleration, balance control, extension and contraction of the lower limb, and ankle dorsiflexion to move the centre of gravity to control the afferent - efferent, and contraction of the lower limb muscles. Coordination and weight shifting were learned through movement of the lower limbs and this improvement results in an overall improvement in gait and risk of fall.

Previous studies have demonstrated that patients at greatest risk of fall are more likely to be benefited but at the cost of it being challenging to participate them in the fall prevention program. Focusing on the leg muscles helps in improving ankle strategy and hip strategy. This is helpful in ambulation on different terrains, standing erect, and control of the body when it moves with a small BOS, and regaining balance when moving unintentionally.

According to a study conducted by Singh Baghel V, et al (2020) to measure the number of different neurological disorders in alcohol-dependent patients and to the established relationship between the frequency of these disorders with type, duration, amount, and frequency of alcohol intake concludes that highest percentage of neurological manifestation in alcoholics being peripheral neuropathy with 20%.

Some nerve harm being permanent with no reliable remedy due to less known about its pathology, preventive measures must be taken by working on its clinical features stated by Tapan Behl, et al (2013) such as balance issues, gait abnormalities, muscle weakness, lack of coordination, etc.

Another study conducted by Sebin Jose, et al (2013) aims at finding out the effectiveness of Otago Exercise to Improve Balance, Quality of Life and to Reduce Risk of Fall in Hemiplegic Patients. He concluded that falls are common in elderly people as well as hemiplegics due to decreased muscle strength, flexibility, balance and reaction time. Thus, repetitive training using the Otago exercise will leads a significant improvement in balance, quality of life and significant reduction in fall risk in hemiplegic patients.

CONCLUSION

Patients with alcoholic neuropathy have decreased muscle strength, lack of coordination of the feet or hands, and impaired balance on walking. OEP be taught for rehabilitation along with the other essential management. The present study concluded that there was a significant improvement in balance and gait which will help to reduce fall risk in alcoholic neuropathy patients. Thus, Otago exercise protocol can be used in clinical practice and also as well as a home exercise programme to improve the factors affecting fall in patients with alcoholic neuropathy.

Limitations

- Small sample size
- Short study duration
- Females not included

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