IMMEDIATE EFFECTS OF GLOSSOPHARYNGEAL BREATHING IN PATIENTS WITH SPINAL CORD INJURY

EFECTUL IMEDIAT AL RESPIRAȚIEI GLOSOFARINGEALE LA PACIENȚII CU TRAUMATISME ALE COLOANEI VERTEBRALE

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Keywords: glossopharyngeal breathing, spinal Cord injury, pulmonary function testing

Abstract

Background. Respiratory dysfunction is a major cause of morbidity and mortality in spinal cord injury (SCI), which causes impairment of respiratory muscles, reduced vital capacity, ineffective cough, reduction in lungs and chest wall compliance, and excess oxygen cost of breathing due to distortion of the respiratory system. Severely affected individuals may require assisted ventilation, which can cause problems with speech production. Appropriate candidates can sometimes be liberated from mechanical ventilation by phrenic-nerve pacing and pacing of the external intercostal muscles**.**

Objective. To see the immediate effects of glossopharyngealbreathing on pulmonary function in patients with SCI.

Intervention. Glossopharyngeal breathing, one breath consists of cycles of 6 to10 gulps of air followed by exhalation.6 repetition of exercise in one session for 2 weeks.

Outcome Measure. forced expiratory volume in one second, forced vital capacity, inspiratory capacity and vital capacity.

Methods and results. Study Design- experimental (pre-post) study with simple random sampling, study population- patient with lower cervical spinal cord injury, Sample size- 20 patients.Data were analyzed after the intervention of glossopharyngeal breathing with students paired t-test.After 2 weeks of intervention, there were significant improvement of FEV1 (p value-0.001), FVC (p value- 0.002), VC (p value-0.004) and IC (0.003) in all patient.

Conclusion. This study concluded that glossopharyngeal breathing improves lung volume and capacities in patient with spinal cord injury.

Cuvinte cheie: respirație glosofaringiană, traumatisme vertebro-medulare, testarea funcției pulmonare

Rezumat

Introducere. Disfuncția respiratorie este o cauză majoră de morbiditate și mortalitate la pacienții cu traumatisme vertebro-medulare (TVM), care afectează mușchii respiratori ducând la reducerea capacității vitale, tuse ineficientă, reducerea complianței plămânilor și cutiei toracice și un cost crescut de oxigen datorită dirtorsiunii sistemului respirator. Pacienții sever afectați pot necesita ventilație asistată, care poate determina probleme de vorbire. Unii pacienți pot fi uneori eliberați de ventilația mecanică prin stimularea nervului frenic și a mușchilor intercostali externi**.**

Obiective. Observarea efectelor imediate ale respirației glosofariniene asupra funcției pulmonare la pacienții cu TVM.

Intervenție. Respirația glosofaringiană constă dintr-o respirație alcătuită din cicluri de 6 -10 guri de aer, urmate de expir. 6 repetări/ședință, timp de 2 săptămâni.

Evaluare. Volumul expirator de rezervă într-o secundă, capacitatea vitală forțată, capacitatea inspiratorie și capacitatea vitală.

Metode și rezultate. Studiu experimental (pre-post), cu eșantionare simplă aleatorie, realizat pe 20 de pacienți cu traumatisme cervicale joase. Datele s-au analizat după efectuarea intervensiei prin respirației glosofaringiană, folosind testul T student pentru eșantioane pereche. După 2 săptămâni de tratament, s-au constatat îmbunătățiri semnificative ale FEV1 (p value-0.001), FVC (p value- 0.002), VC (p value-0.004) și IC (0.003) la toți pacienții.

Concluzii. Acest studiu concluzionează că respirația glosofaringiană îmbunătățește volumele pulmonare și capacitatea vitală la pacienții cu traumatisme vertebro-medulare.

Introduction

Spinal cord injury (SCI) is a low-incidence, high coast disability requiring tremendous changes in an individual's lifestyle [1]Spinal cord injury is damage to the spinal cord that causes loss of sensation and motor control.SCI refers to any injury to the spinal cord that is caused

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by trauma instead of disease. Depending on where the spinal cord and nerve roots are damaged, the symptoms can vary widely, from pain to paralysis to incontinence. Spinal cord injuries are described at various levels of "incomplete", which can vary from having no effect on the patient to a "complete" injury which means a total loss of function.[2,3,4]

It is estimated that in the United States each year there are about 11,000 new cases of spinal cord injury and that there are currently about 250,000 persons alive with SCI. Because of improvements in medical care and survival, the prevalence of people living with SCI hasincreased, and it is predicted that there will be greater and greater numbers of older patients with SCI. Currently the average age at injury is 37.6 years, and about 80% of thoseaffected are male. The American Spinal Injury Association has promulgated standards (revised in 2002) for the classificationof level of injury and extent of impairment in SCI. [2,6,7] Intetraplegia there is injury to one of the 8 cervical segments of the spinal cord, whereas with paraplegia the lesions involve thoracic, lumbar, or sacral regions of the cord. The most caudal segment of the spinal cord with normal motor function defines the motor level of injury.

In the thoracic region, where there are no key muscles to test, sensory level is used to estimate the extent of motor impairment. The higher and more complete the motor level of injury, the greater the respiratory muscle impairment.[8,9,10]

Respiratory dysfunction and related diseases, such aspneumonia, which can be complicated by septicemia orpulmonary emboli, are common causes of death in SCI.From the point of view of respiratory dysfunction, it isinstructive to consider SCI in two phases: initial phaseimmediately following the injury and the year thereafterand the later, chronic phase during the rest of the lifeof the affected individual.[11,12]

Injuries above the level of the phrenic motor neurons (C_3, C_4, and C_5) cause virtually complete paralysis of both muscles of inhalation and exhalation and dependence on mechanical ventilation or phrenic-nerve stimulation. At lower levels of injury, the prospect of breathing without mechanical assistance is improved. Scanlon et al observed that within a month of injury there appears to occur a reduction in lung compliance that does not change during the year there after. This observation casts doubt on the previously held notion that reduced lung compliance inSCI is due to chronic lung injury from repeated infections.[4,6,7,10]

The cause of the early reduction in lung compliance is unclear but has been ascribed partially to reduced lung volume and partially to changes in the mechanical properties of the lung from alterations in surfactant,which can occur rapidly with ventilation at low lung volume.[11,12,13] Chest-wall compliance is also probably reduced in tetraplegia. This issue is complex because the abdominal compartment of the chest wall is highly compliant in SCI, but the rib cage compartment may be stiff because of muscle spasticity or abnormalities that develop in rib articulations with the spine and sternum, due to poor inspiratory-muscle performance that prevents stretching to the predicted total lung capacity. [14,15,16,17]

Respiratory dysfunction is a major cause of morbidity and mortality in spinal cord injury (SCI), which causes impairment of respiratory muscles, reduced vital capacity, ineffective cough, reduction in lung and chest wall compliance, and excess oxygen cost of breathing due to distortion of the respiratory system. [12,13,17]Appropriate candidates can sometimes be liberated from mechanical ventilation by phrenic-nerve pacing and pacing of the external intercostal muscles. Also, respiratory-muscle training and abdominal binders improve performance of the respiratory muscles.[14,15,17].

Goals of physical therapy management consist of are to prevent respiratory complication, to improve and maintain pulmonary strength and endurance and to prevent musculoskeletal complication. Physiotherapy treatment consist of exercises of upper and lower limb, breathing exercises, deep breathing, incentive spirometry, balloon blowing exercises, PNF and neurological rehabilitation.

Two specific training modalities that have been clinically evaluated are exercise training and inspiratory muscle training (IMT). This review systematically assessed the efficacy of

exercise training and IMT for the improved respiratory function of patients with SCI to facilitate the identification of optimal clinical care for clinicians who treat patients with SCI. [15,16]
Glossopharyngeal breathing is a technique that becomes known to therapist during the 1950s through patients with severe ventilator impairment as the result of poliomyelitis. It is means of increasing the inspiratory capacity when there is severe weakness of the muscles of inspiration.Glossopharyngeal breathing (GPB) is a 'tri.ck' method of breathing to help you take bigger breaths than you can take usually. Gulping action in this breathing looks like frog breathing and so this breathing is known as frog breathing. Today it is used primarily by patient who are ventilator dependent because of absent of incomplete innervation of the diaphragm as the result of high cervical spinal cord lesion or other neuromuscular disorders. Glossopharyngeal breathing combined with the inspiratory action of the neck musculature can reduce ventilator dependence. [19,18]

The aim of this study was to see the immediate effects of glossopharyngeal breathing on pulmonary function in patients with spinal cord injury.

Participants and methods
We studied20 participants (12 male & 8 female) with spinal cord injury. Study design was pre-post (experimental study) conducted ~~at~~ in the department of cardio-respiratory physiotherapy, Pravara Institute of Medical Sciences,Loni.Inclusion criteria of this study were male and female participants,clinical diagnosis of lower cervical spinal cord injury, age group between 20-40 year and participants after 1week of spinal cord injury. Exclusion criteria were unconscious patient, upper cervical spinal cord injury, patient with mechanical ventilator, any other neurological disorders and patient with mandible fracture

Outcome measurement

1. **Forced expiratory volume in one second (FEV_1)**
   This component of spirometry was used to assess the measurement of volume of air exhaled in first second of FVC (normal is approximately 4.20 L). The highest recorded reliability for spirometry in participants with lung disease is 0.98. [20]
2. **Forced vital capacity (FVC)**
   This component of spirometry was used to assess the maximum volume of air of the patient can forcefully and as quickly as possible (normal is approximately 4.80 L) The highest recorded reliability for spirometry in participants with lung disease is 0.98 [20]
3. **Vital capacity (VC)**
   This component of spirometry was used to assess the maximum amount of air a person can expel from the lungs after a maximum inhalation. (normal is approximately 4.5 L)
4. **Inspiratory capacity (IC)**
   This component of spirometry was used to assess the maximum amount of air a person can breathe in after resting expiration (normal is approximately 3500 ml).The highest recorded reliability for spirometry in participants with lung disease is 0.98.[20]

Procedure and intervention
Written informed consent was obtained and as per the inclusion and exclusion criteria participants were requested to participate in the study. Participants were briefed about the study and procedure explained with demonstration. Baseline data (FEV1, FVC, VC&IC) were measure before the study. Then glossopharyngeal breathing was given to 20 participants 6 repetition per session, and one session per day for 2 weeks.

Procedure
Glossopharyngeal breathing involves taking several gulps of air, usually 6 to 10 gulps in series, to pull air into the lungs when action of of the inspiratory muscle is inadequate. After taking several gulps of air, the mouth is closed and the tongue pushes the air back and traps it in

the pharynx. The air is then forced in to the lungs when the glottis is opened. This increases the depth of inspiration and the patients inspiratory and vital capacities.

Data analysis and results

Data were analyzed after 2 weeks of intervention. Descriptive statistics were calculated for demographic variables and comparison of pre and post values were done with students paired t test.

Before intervention mean value of FEV_1 was 1.21±0.39 in liters and 44.9±13.61 in % predicted and after 2 weeks of intervention it was 1.56±0.46 in liters and 56.6±13.72 in % predicted. This values of FEV_1 was statistically significant. Before intervention mean value of FVC was 1.23±0.47 in liters and 39±12.07 in % predicted and after 2 weeks of intervention it was 1.69±0.48 in liters and 53±12.06 in % predicted. This value of FVC was statistically significant.

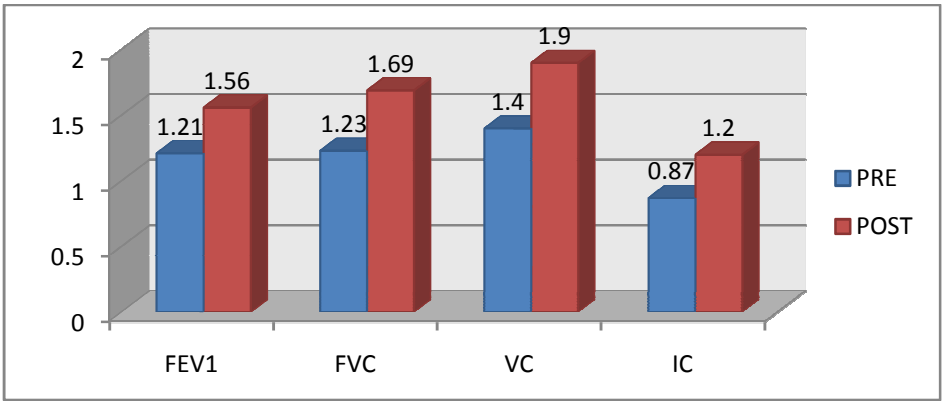
Pre intervention value of IC was 1.40±0.52 liters and after intervention it was 1.90±0.61 liters shown statistically significant. Pre intervention value of VC was 0.87±0.2 liters and after intervention it was1.20±0.32 liters shown statistically significant.

Table 1- gender wise distribution of participants'

Gender	Participants	Age (Mean)
Male	12 (60%)	29±7.3
Female	8 (40%)	31±5.3

Table 2 Pre-post value comparison of outcome measures

No	Parameters		Pre (MeanSd)	Post (Mean±Sd)	T-Value	P Value (P<0.05)
1	FEV_1	liters	1.21±0.39	1.56±0.46	6.93	0.001
		Pred %	44.9±13.61	56.6±13.72	7.02	0.001
2	FVC	Liters	1.23±0.47	1.69±0.48	7.80	0.002
		Pred%	39±12.07	53±12.06	8.70	0.001
3	VC	Liters	1.40±0.52	1.90±0.61	9.72	0.004
4	IC	Liters	0.87±0.25	1.20±0.32	5.94	0.003



Graph 1 Pre-post value comparison of outcome measures

Discussion

The present study immediate effects of glossopharyngeal breathing in patients with spinal cord injury was carried out to see the effect of glossopharyngeal breathing on pulmonary function on patient with spinal cord injury. Most of the studies have focused on respiratory dysfunction in patient with spinal cord injury but here is insufficient evidence of the studies which has seen the effect of glossopharyngeal exercises on pulmonary function in this patient.

By various studies it is seen that person having spinal cord injury have the low lung volumes and patient needs assistance to increase their lung volume values otherwise he may suffer various serious respiratory complications like pneumonia, atelectasis or respiratory failure which leads to death up to 80% of patients following spinal cord injury suffer from respiratory complications.

In this study we gave the glossopharyngeal breathing training to the20 participants who were having spinal cord injury and having difficulty in breathing .the values of pulmonary function test before and after glossopharyngeal breathing were compared . we found that initially before glossopharyngeal breathing their lung volume capacities were below the normal values and as participants used glossopharyngeal breathing technique we immediately took pulmonary function test and it showed significant improvement in lung volumes. In our study we saw the immediate effects of glossopharyngeal breathing in person with spinal cord injury and it is seen that there is significant changes in vital capacity, inspiratory capacity and forced expiratory volume and FEV1.

The mean value of FEV1 was improved by0.35 liter and 12 in % predicted after 2 weeks of intervention.Mean value of FVC was improved by 0.46 in liters and14 in % predicted after 2 weeks of intervention.The mean value of IC was improved by 0.50 liter and mean value of VC was improved with 0.33liter.

Another case report on spinal cord injury shows that people who are not dependent on ventilator as a result of spinal cord injury have been reported to learn glossopharyngeal breathing. Metcalf published the first study, which involved 23 adults with C4 to T1 complete tetraplegia. Using GPB, the subjects vital capacity increased to 81% of normal, they were able to perform an effective cough independently, and they maintained pulmonary compliance and thoracicmobility.

If you can only breathe with help from a ventilator, it can allow you to breathe for periods of time off the ventilator People with neuromuscular disease and weak or paralysed breathing muscles can find it difficult to cough properly and clear their sputum. If you can't clear your sputum it may make your breathing more difficult and can lead to a chest infection or pneumonia. Glossopharyngealbreathing is an alternative breathing technique that people who are dependent onventilators can use in emergencies and to promote respiratory health.

Conclusion

This study concluded that glossopharyngeal breathing has significant effect on lung volume and capacities in person with spinal cord injury and this exercises has improved pulmonary function in patient with spinal cord injury.

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