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Respiratory Physiotherapy in Patients with Spinal Cord Injury: A Systematic Review

Sakshi Patwa[1], Dr Sambhaji Gunjal[2]

[1](Intern), Dr APJ Abdul Kalam College of Physiotherapy, Loni Maharashtra, India
[2]Associate Professor, Dept. of cardiorespiratory Physiotherapy Dr APJ Abdul Kalam College of Physiotherapy, Loni Maharashtra, India.

ABSTRACT

Background: A spinal cord injury is a trauma or lesion to the spinal cord, which is made up of white matter (ascending and descending tracts) and grey matter (sensory neuron and motor neuron). It causes muscle paralysis and affects sensory abilities and other bodily processes below the level of the injury. Between 2,50,000 and 5,00,000 people worldwide experience spinal cord injuries each year, according to the WHO. In India, the prevalence of SCI is 0.15 million, with an average yearly incidence of 15,000 cases.

Objective- To study the effect of respiratory physiotherapy in spinal cord injury patients**.**

Method: A Systematic review according to PRISMA guidelines was conducted on 20 articles through different databases like PubMed, google scholar which were identified, sorted and screened according to the inclusion criteria and exclusion criteria post which the studies were assessed for quality.

Result: Data from the selected studies were extracted under the headings of title /author, type of study design, intervention /device /technique elaborated in the study, and key highlights of the study and was tabulated systematically

Conclusion: This study concludes that respiratory physiotherapy improves respiratory muscle strength and function in SCI Patients.

Key words: respiratory physiotherapy, spinal cord injury

INRODUCTION

A spinal cord injury is a trauma or lesion to the spinal cord, which is made up of white matter (ascending and descending tracts) and grey matter (sensory neuron and motor neuron). It causes muscle paralysis and affects sensory abilities and other bodily processes below the level of the injury[1]. Spinal segments T4–T11 supply the principal muscle of active expiration, the abdominals, while the phrenic nerve (spinal segments C3–C5) supplies the primary muscle of inspiration, the diaphragm.

Between 2,50,000 and 5,00,000 people worldwide experience spinal cord injuries each year, according to the WHO[2]. In India, the prevalence of SCI is 0.15 million, with an average yearly incidence of 15,000 cases[4]. Individuals with cervical cord lesions have mortality rates that are 9–18 times greater, respectively, than those in the general population for the same age.[15]

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When examining SCI from the perspective of respiratory dysfunction, it helps to think of the condition in two stages: (1) the acute phase that occurs right after the injury and lasts for a year, and (2) the chronic phase that lasts for the remainder of the affected person's life. Damage to the phrenic motor neurons (C3, 4, and 5) or above results in nearly total paralysis of the breathing muscles, necessitating phrenic nerve stimulation or artificial ventilation.[8]

People with long-term SCI frequently experience hypertension, and those who are paraplegic are more likely to experience it than those who are quadriplegic. Compared to individuals without spinal cord injuries, persons with SCI—particularly those who have paraplegia—had a higher prevalence of hypertension, according to earlier research. Following SCI, a sedentary lifestyle is linked to the development of hypertension. An increased risk of hypertension following SCI can also be caused by other risk factors, including age, smoking, diabetes, obesity, and high cholesterol.

The management techniques used in physiotherapy include postural drainage and secretion clearance procedure. Abdominal binders, positioning, deep breathing exercises, glossopharyngeal breathing, diaphragmatic breathing, thoracic expansion exercises, incentive spirometry, balloon blowing exercises, cough assisted techniques, and inspiratory muscle training are among the treatments used to improve ventilation[5]spirometry, balloon blowing exercises, cough assisted techniques, and inspiratory muscle training are among the treatments used to improve ventilation[5]

MATERIALS AND METHODS

Study design: Systematic review

Study Setting: DR. APJ Abdul Kalam College of Physiotherapy

Study Duration: August 2022 to January 2024

Sample Size and Method: Approximately 40.

Participants: Spinal cord injury patients.

Selection Criteria

The Inclusion criteria of the study were -full text articles, articles which are referred from last 13 years**,** cross sectional study and observational study, Systematic review, Case studies**,** Randomize control trial**,** Metaanalysis.

The exclusion Criteria of the study were -Duplicate articles, Articles with only abstracts**,** Articles in other languages

Procedure: Several articles from pubmed google scholar databases were reviewed the following keywords: pulmonary function in obese female, impact of obesity on pulmonary function, lung function in obese female were used studies that were completed and published in english focusing on respiratory physiotherapy in SCI patients were selected.

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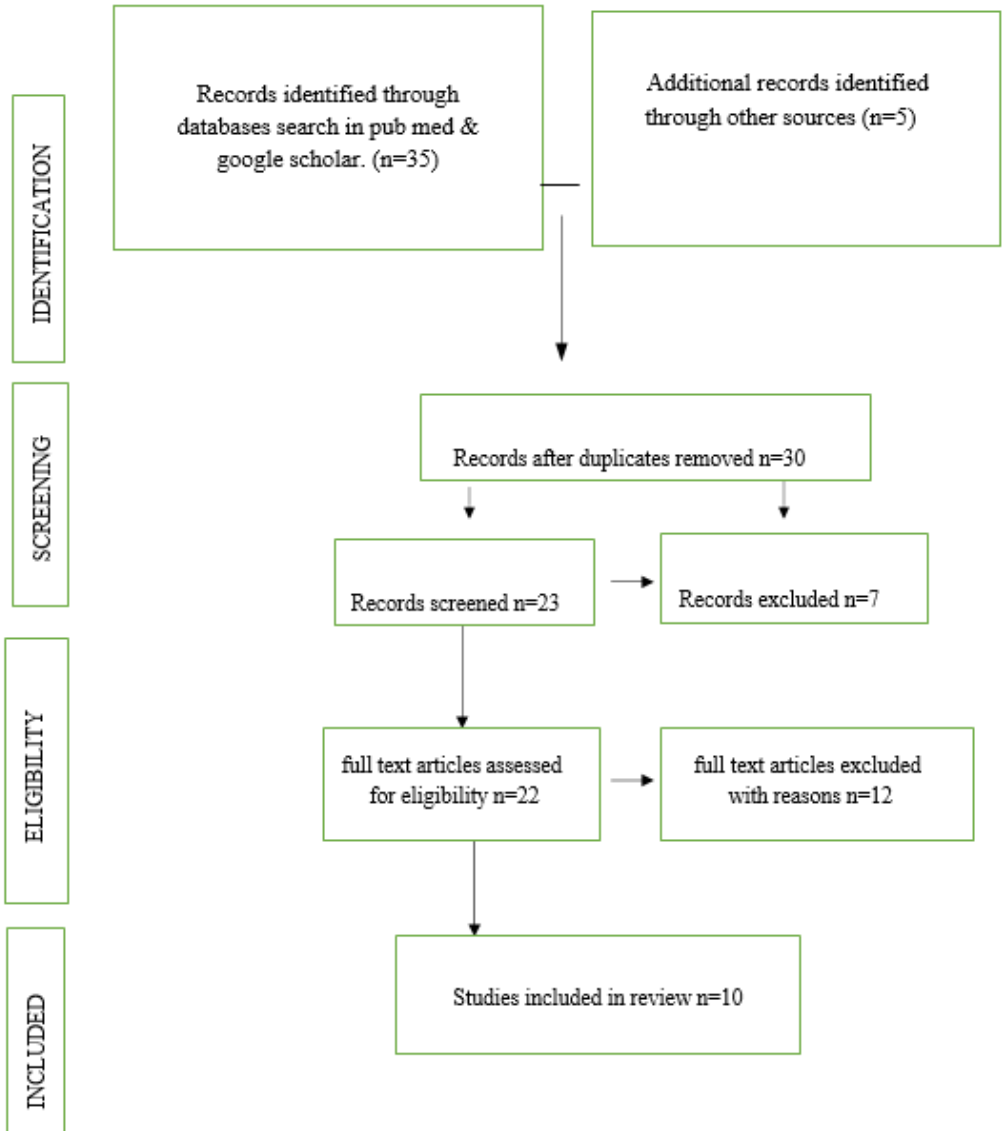

Data analysis and results-

REFERENCE	STUDY DESIGN	TREATMENT STRATEGIES	OUTCOME MEASURES	RESULTS
1. Xiao-Ying Zhang, Wei-Yong Yu et al.	Randomized controlled trial	Vocal respiratory training	Forced vital capacity, Peak expiratory flow, Respiratory neural plasticity, Dyspnea sores	This study indicated that VRT - MT can improve respiratory function and vocal function in patients with CSCI and that the neural regulation mechanisms of the respiratory center can be used as an effective basis for behavioral therapy.

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2. Kang D, Park J, Eun SD et al.	Feasibility study	Game based respiratory muscle training	Respiratory muscle strength, Feasibility(adherence), Quality of life, Game engagement	With the use of RMT in combination with a community exercise program for patients with CSCI. The participants demonstrated improvement in all the respiratory outcomes.
3. Kinjal parmar, Sambhaji Gunjal et al.	Interventional study	Manually assisted cough technique	**Baseline peak cough flow(PCF), Post-intervention PCF, Changes in PCF, Quality of life.**	This study indicated that manually Assisted Cough Technique improved the peak cough flow in patients with spinal cord injury.
4. Ramzi Alajam et al.	Systematic Review	Body Weight–Supported Treadmill Training	Vital capacity, Inspiratory capacity.	Use of BWSTT as an exercise in individuals with SCI has positive effects on cardiovascular and pulmonary health by improving resting and exercise HR and respiratory parameters.
5. A. William Sheel et al.	Systematic review	Exercise training, inspiratory muscle training	Respiratory function, Exercise capacity, Quality of life	IMT as an intervention that might decrease dyspnea and improve respiratory function in people with SCI.
6. Gee CM, Williams AM et al.	Interventional study	Respiratory muscle training	Cardiopulmonary function, Exercise capacity.	Found that 6 weeks of pressure threshold resulted in significant improvements in the ability to generate inspiratory and expiratory mouth pressure, as well as PEF.

7. Berlowitz DJ, Wadsworth B, Ross J et al.	Observational study	Respiratory muscle training	Forced vital capacity, peak expiratory flow, Respiratory quality of life, pre-treatment versus post treatment values.	This study stated that use of RMT can improve respiratory muscle strength
8. Daphne Balatsou, Ioannis S et al.	Observational study	Respiratory muscle training	Forced vital capacity, peak expiratory flow rate, respiratory muscle strength, quality of life.	This study shows that Respiratory muscle training is helpful in improving breathing and cough, preventing infections, and improving patients' overall quality of life.
9. Karin Postma, Janneke A. Haisma et al.	Randomized controlled trial	Resistive inspiratory muscle training	Primary outcome- maximal inspiratory pressure Secondary outcome- borg scale, Forced vital capacity, peak expiratory flow rate	Resistive inspiratory muscle training has a positive short-term effect on inspiratory muscle function in people with SCI who have impaired pulmonary function during inpatient rehabilitation
10. J Romero-Ganuza, A García-Forcada, E Vargas and C Gambarrutta et al.	Retrospective study	Respiratory muscle strengthening	Primary outcome - Vital capacity, peak flow Secondary outcome- incidence of respiratory complications	An intermediate respiratory care unit (IRCU) can manage a substantial number of severe SCI patients who need MV, and an important number of them can be weaned from the respirator.

DISCUSSIONS

This systematic review is primarily aimed to provide an overview of effect of respiratory physiotherapy in SCI patients.

The findings of this review has been drawn from the above summarized 10 articles, which had information on effect of respiratory physiotherapy in SCI patients.

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According to a study by S. Burney et al. examined the immediate respiratory management of cervical spinal cord injury and the efficacy of several treatment approaches for acute tetraplegia over the first six weeks following the injury. There were 21 studies found, totaling 1263 patients. Using a respiratory protocol resulted in a significant reduction in the frequency of respiratory problems and the need for a tracheostomy. It also decreased the length of stay in the ICU by 6-8 days, the duration of mechanical ventilation, and the cost of intubation.

According to a comparative study by Kyochul Seo et al examining the impact of balloon blowing exercise on the pulmonary function of twenty something female participants using a ball in the 90/90 bridge position. To improve lung function and respiratory system contractile activity, exercises such blowing balloons while in the bridge position with the knee and hip extended to ninety degrees and asking to hold a five-inch rubber ball between the knees are performed. The Controlled group remained in the same posture but underwent diaphragmatic exercises. The parameters were significantly changed for the experimental group. The controlled group's parameters remained unchanged.

Hyun Ji Jun et al carried out The study examined how breathing exercises and balloon-blowing training affected older smokers' lung function. After four weeks, the lung function of both groups greatly rose, and after six weeks, it significantly reduced. Ultimately, the benefits of FBT and BBT extend to pulmonary function.

A review of respiratory treatment for patients with spinal cord injuries was completed, according to Rita Galeiras Vázquez et al. In order to provide resistance during inspiration and permit expiration, it uses parts with spring-loaded valves. Based on expiratory muscle exercise, they concluded that early weaning and appropriate conservative treatment should be started.

An experimental study by Kinjal Parmar et al, the effectiveness of a manual coughing technique for maximum cough flow was examined in individuals with spinal cord injuries. The intervention involved two sessions every day for four weeks, with each subject doing three sets of three repetitions. The study concluded that the Manually Assisted Cough Method ought to be regarded as a baseline physiotherapy treatment regimen, given the noteworthy enhancement in peak cough flow that transpired after the intervention.

So we can say that inspiratory muscle training, expiratory muscle training, body weight supported treadmill training, vocal respiratory training, manually assisted cough technique, exercise training, abdominal bracing, abdominal muscle training, breathe training, electrical nerve stimulation, positioning, resistive inspiratory muscle training, respiratory muscle strengthening can be given to treat respiratory complications in spinal cord injury patients.

CONCLUSION

This study concluded that respiratory physiotherapy intervention improves the performance of respiratory, pulmonary and cough muscle function in individuals with SCI, which aids in removing excessive secretions from the lungs and improves muscle strength, henceforth respiratory physiotherapy can be added to routine physiotherapy intervention for spinal cord injury patients.

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REFERENCES

1. Susan B O'Sullivan, Thomas J. Schmiltz, George D. Fulk Physical Rehabilitation -Seventh edition 2019
2. Spinal cord injury [Internet]. Who.int. 2022 [cited 5 April 2022]. Available from: https://www.who.int/news-room/fact-sheets/detail/spinal-cord-injury
3. Galeiras Vázquez R, Rascado Sedes P, Mourelo Fariña M, Montoto Marqués A, Ferreiro Velasco ME. Respiratory management in the patient with spinal cord injury. BioMed research international. 2013 Jan 1;2013.
4. Singh G, Prakash R, Bhatti VK, Mahen A. Spinal cord injury in organizational setup-A hospital based descriptive study. Journal of Marine Medical Society. 2019 Jan 1;21(1):46-50.
5. Parmar K, Gunjal SB. Effectiveness of Manually Assisted Cough Technique on Peak Cough Flow in Patients with Spinal Cord Injury.
6. Kang D, Park J, Eun SD. A preliminary study on the feasibility of community game-based respiratory muscle training for individuals with high cervical spinal cord injury levels: a novel approach. BMC Sports Science, Medicine and Rehabilitation. 2022 Dec;14(1):1-9.
7. Xiao-Ying Zhang, Wei-Yong Yu. Effect of vocal respiratory training on respiratory function and respiratory neural plasticity in patients with cervical spinal cord injury: a randomized controlled trial – September 2021.
8. Brown R, DiMarco AF, Hoit JD, Garshick E. Respiratory dysfunction and management in spinal cord injury. Respiratory care. 2006 Aug 1;51(8):853-70.
9. Bach JR. Prevention of respiratory complications of spinal cord injury: a challenge to "model" spinal cord injury units. The journal of spinal cord medicine. 2006;29(1):3.
10. Alajam R, Alqahtani AS, Liu W. Effect of body weight–supported treadmill training on cardiovascular and pulmonary function in people with spinal cord injury: a systematic review. Topics in spinal cord injury rehabilitation. 2019 Sep 1;25(4):355-69.
11. Sheel W, Reid WD, Townson A, Ayas N, Konnyu K. Effects of exercise training and inspiratory muscle training in spinal cord injury: a systematic review. The journal of spinal cord medicine. 2008 Jan 1;31(5):500-8.
12. Gee CM, Williams AM, Sheel AW, Eves ND, West CR. Respiratory muscle training in athletes with cervical spinal cord injury: effects on cardiopulmonary function and exercise capacity. The Journal of physiology. 2019 Jul;597(14):3673-85.
13. Alvarez SE, Peterson M, Lunsford BR. Respiratory treatment of the adult patient with spinal cord injury. Physical Therapy. 1981 Dec 1;61(12):1737-45.
14. Brown R, DiMarco AF, Hoit JD, Garshick E. Respiratory dysfunction and management in spinal cord injury. Respiratory care. 2006 Aug 1;51(8):853-70.
15. Baydur A, Sassoon CS. Respiratory dysfunction in spinal cord injury: physiologic changes and clinically relevant therapeutic applications. J. Pulm. Respir. Med. 2018;8(2):453.
16. Berlowitz DJ, Wadsworth B, Ross J. Respiratory problems and management in people with spinal cord injury. Breathe. 2016 Dec 1;12(4):328-40.

17. Van Houtte, Yves Vanlandewijck, Rik Gosselink. Respiratory muscle training in persons with spinal cord injury: A systematic review. Nov 2006;22**.**
18. Balatsou D, Benetos IS, Vlamis I, Pneumaticos SG. Physiotherapy rehabilitation of respiratory system and the factors which facilitate its plasticity after Spinal Cord Injury. Acta Orthopaedica Et Traumatologica Hellenica. 2022 Mar 24;73(1):101-7.
19. Postma K, Haisma JA, Hopman MT, Bergen MP, Stam HJ, Bussmann JB. Resistive inspiratory muscle training in people with spinal cord injury during inpatient rehabilitation: a randomized controlled trial. Physical therapy. 2014 Dec 1;94(12):1709-19.
20. Romero-Ganuza J, Garcia-Forcada A, Vargas E, Gambarrutta C. An intermediate respiratory care unit for spinal cord-injured patients. A retrospective study. Spinal Cord. 2015 Jul;53(7):552-6.
21. Sezer N, Akkuş S, Uğurlu FG. Chronic complications of spinal cord injury. World journal of orthopedics. 2015 Jan 1;6(1):24.