

Scope and Impact of Physiotherapy in Organophosphorus Poisoning in Delayed Polyneuropathy: A Scoping Review

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Abstract: Organophosphorus (OP) poisoning can lead to delayed neuropathy, manifesting as a range of debilitating symptoms. This scoping review explores the role of physiotherapy in managing delayed polyneuropathy resulting from OP poisoning. We systematically examined existing literature to assess the scope and impact of physiotherapeutic interventions on functional recovery and quality of life in affected individuals. Findings suggest that physiotherapy, including targeted exercise programs and neurorehabilitation strategies, may enhance motor function and reduce disability. However, evidence is limited and often inconclusive, highlighting the need for further research to establish comprehensive guidelines and optimize therapeutic approaches. This review underscores the potential benefits of integrating physiotherapy into the multidisciplinary treatment of OP - induced delayed neuropathy.

Keywords: organophosphate poisoning, physiotherapy, delayed polyneuropathy, respiratory management, rehabilitation

1. Introduction

The increasing global use of pesticides has led to organophosphate (OP) poisoning becoming a leading cause of mortality and morbidity in developing countries.¹

Organophosphorus compounds produce clinical manifestations by depression of the enzyme cholinesterase resulting in the accumulation of acetylcholine at various receptors which has three types of effects. (1) Muscarinic (2) Nicotinic and (3) Central.

- Muscarinic effects are due to actions on bronchi, salivary, lacrimal, sweat glands, etc. and give rise to pulmonary oedema, sweating and bradycardia.
- Nicotinic effects are motor and sympathetic and lead to fasciculation, muscular weakness and tachycardia.
- The central effects lead to giddiness, anxiety, emotional lability, ataxia, confusion, and apathy.²

It can present as acute cholinergic crisis, intermediate syndrome and organophosphate - induced delayed neuropathy (OPIDN).³

Signs and symptoms of OPP are classified into acute (minutes to 24 hours), delayed (24 hours to two weeks), and late (beyond two weeks) onset.⁴

Symptoms include increased salivation and tear production, diarrhoea, vomiting, small pupils, sweating, muscle tremors, and confusion. Poisoning with OPs is linked to several conditions including intermediate syndrome (IMS) and organophosphate - induced postponed neuropathy (OPIP) ⁴

Organophosphate induced delayed neuropathy (OPIDN) is a sensory - motor distal axonopathy which usually occurs after the ingestion of large doses of certain organophosphate

insecticides. Most of the patients developed a mixed polyneuropathy, mainly motor.⁵

Proper medical treatment follows an initial diagnosis, which in turn requires a high index of suspicion. If required, OP exposure can be confirmed by quantifying the blood or plasma cholinesterase activity. Standard resuscitation and supportive care are essential in the management of the exposed patient. This is accompanied by rapid administration and dose titration of antagonists of muscarinic cholinergic receptors (anti - muscarinics, notably atropine).⁶

Physiotherapy can play a supportive role in the management of patients with poisoning, particularly in cases of organophosphate (OP) poisoning, which affects the nervous system and can lead to respiratory muscle weakness, paralysis, and respiratory failure. Here are some ways in which physiotherapy can be beneficial:

Respiratory Management: Patients with OP poisoning may experience respiratory muscle weakness or paralysis, leading to difficulty in breathing or respiratory failure. Physiotherapists can assist in maintaining and improving respiratory function through techniques such as chest physiotherapy, breathing exercises, and respiratory muscle training. This may include deep breathing exercises, incentive spirometry, and chest percussion to help clear secretions and improve lung function.

Mobility and Rehabilitation: OP poisoning can cause muscle weakness and paralysis, affecting the patient's ability to move and perform daily activities. Physiotherapists can design individualized exercise programs to help improve muscle strength, range of motion, and mobility. This may involve passive range of motion exercises, gentle stretching, and gradual progression to active exercises as the patient's condition improves.

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Positioning and Prevention of Complications: Physiotherapists can assist in positioning the patient to prevent complications such as pressure ulcers, contractures, and respiratory complications. Proper positioning can help optimize lung expansion, prevent muscle stiffness, and improve circulation.

Pain Management: Patients with OP poisoning may experience pain and discomfort, particularly due to muscle weakness, respiratory difficulties, and immobility. Physiotherapists can provide pain relief through techniques such as manual therapy, massage, heat therapy, and TENS (transcutaneous electrical nerve stimulation).

Functional Training and Activities of Daily Living (ADL): Physiotherapists can help patients regain independence in performing activities of daily living (ADL) such as dressing, grooming, and bathing. They can provide guidance on adaptive techniques and assistive devices to facilitate independence and improve quality of life.

Education and Support: Physiotherapists can educate patients and their caregivers about the importance of mobility, positioning, breathing exercises, and other rehabilitation strategies. They can also provide emotional support and encouragement throughout the recovery process.

Overall, physiotherapy plays a crucial role in the multidisciplinary management of patients with OP poisoning, aiming to optimize respiratory function, mobility, and quality of life while preventing complications and promoting recovery.

2. Methodology

Information sources:

Published Case Studies, randomized controlled trials examining Scope and Impact of Physiotherapy in Organophosphorus Poisoning in Delayed Polyneuropathy. Using a predetermined search strategy, PubMed, Pedro, Google Scholar, and the Physiotherapy Evidence Database (PEDro) were all searched from their inception through the years 2014–2024

Eligibility criteria:

Randomized controlled, Case Studies, clinical trials, fulfilling the PICO format, studies including Physiotherapy related Exercises and Outcome Measure for Organophosphorus Poisoning delayed polyneuropathy were included. Also, duplicate articles and Articles including study protocols were Excluded, Also Animals trial were Excluded.

	Inclusion	Exclusion
Participants	<ul style="list-style-type: none"> Age=18 to 65 years Organophosphorus Poisoning delayed polyneuropathy 	<ul style="list-style-type: none"> Age = Above 65 years Animal Studies
Type of Study	<ul style="list-style-type: none"> Case study, Clinical trials, RCT 	<ul style="list-style-type: none"> Study Protocols

3. Results

A total 53 articles met the initial search criteria.48 were excluded for not meeting the inclusion criteria. Hence, a total of 5 studies were included in this review. A total of 5 persons with Organophosphorus delayed polyneuropathy were participant sample in these re Search Items.

PubMed, Pedro, Google scholar and physiotherapy evidence database PEDro.

Search limits English only, inception through 2014 - 2024

Excluded: duplicate articles

Potential publications N= 10

Total publications included in the review N= 5

Outcomes of Articles selected.

First Author	Year	Type of Study	Outcome
1) Alfiza Khan	2024	Case Report	<ol style="list-style-type: none"> Glasgow Coma Scale Tone grading scale Functional independence scale ICU mobility score
2) Pallavi R. Bhakaney	2023	Case Report	<ol style="list-style-type: none"> Glasgow Coma Scale ICU Mobility Scale Functional Independence Measure Scale Hospital Anxiety Depression Scale
3) Sandesh P. Londhe	2020	Experimental study	<ol style="list-style-type: none"> Lung Compliance Minute Ventilation Oxygen Saturation Respiratory Rate Heart Rate Blood Pressure
4) Dr. Ankita P Ashtankar	2019	Experimental (Interventional) Comparative Study	<ol style="list-style-type: none"> Compliance (mL/cmH₂O) <ol style="list-style-type: none"> Static compliance: Dynamic lung compliance Respiratory Rate (RR) (breaths/min) Saturation of oxygen (Spo₂) % 4. Heart rate (HR) (beats/min)
5) Jaimala Vijay Shetye	2014	Case Report	Nerve conduction studies

Intervention given for selected Articles

First Author	Intervention	Conclusion
1) Alfiza Khan	<p>1) Patient education</p> <p>2) To improve ROM of the upper and lower limbs Active - assisted ROM exercises to the right upper limb and lower limb. Passive ROM exercises to the left upper and lower limbs.</p> <p>3) To normalize muscle tone: PNF rhythmic initiation D1 flexion - extension and Joint approximation to the left upper limb and lower limbs.</p> <p>4) To ensure good ventilation: Deep breathing exercises and pursed lip breathing Exercises.</p> <p>5) Improve airway clearance: Positioning, manual chest techniques (percussion and vibrations), and suctioning</p> <p>6) Bed mobility: Supine, side lying, bed side sitting with maximal Assistance</p> <p>7) To avoid pressure sores Manual positioning and air bed provided.</p> <p>8) Difficulty in walking: Maintain standing balance. Gait training</p> <p>9) Getting out of bed with a wheelchair: To encourage the patient's mobility and raise their level of attentiveness.</p>	<p>Physical treatment was given avoid neuro - musculoskeletal comorbidity. The paralyzed muscles of the upper and lower extremities were stimulated electrically using intermittent galvanic current in order to restore their characteristics and stop further muscle loss. Further abnormalities were averted with hand flexor and gastro - soleus stretching, proprioceptive neuromuscular facilitation for weak muscles, and orthotic devices. The negative effects of extended bed rest and postural hypotension were mitigated with the use of tilt table - aided standing. It has a big impact on improving patients' quality of life and helping them restore their physical abilities</p>
2) Pallavi R. Bhakaney	<p>1) Physiotherapist begin the process of weaning through bronchial hygiene and a spontaneous breathing trial by body positioning, percussion, and vibration techniques for ten minutes, four hourly followed by suctioning.</p> <p>2) Positioning in side - lying position every two hours.</p> <p>3) Manual hyperinflation, manual chest percussion and compression, rib springing, postural drainage, chest vibrations, and suctioning for respiratory mechanics in VAP patients.</p> <p>4) Passive limb mobility exercises to the shoulder, elbow, wrist, hip, knee, and ankle joints to maintain joint Integrity with mobility exercises, joint compressions to improve the proprioceptive input.</p> <p>5) Progression of the patient from bedside sitting to standing to spot walking, Spot marching to walking with maximal support to minimal support.</p> <p>6) Strengthening was started for the major muscle groups with 0.5 kg dumbbells in week It was performed once a day,</p> <p>7) Aerobic training included walking on high knees with minimal assistance, sit - to - stand, step - up and step down, and walking around the hallway.</p>	<p>Physiotherapy management showed decrease the risk of tightness or fatigue of the respective part of the body, remove secretions, and reduce the risk of bedsore. In lung function of static and dynamic compliance there was significant difference, which implies that physiotherapy treatment is effective in improving lung function</p>
3) Sandesh P. Londhe	<p>IN GROUP A On 1st DAY Chest Manipulation was given, this treatment lasted for 15 minutes. On 2nd DAY Neurophysiological Facilitation technique was given, this treatment lasted for 15 minutes.</p> <p>IN GROUP B On 1st DAY Neurophysiological Facilitation technique was given, this treatment lasted for 15 minutes. On 2nd DAY Chest Manipulation was given, this treatment lasted for 15 minutes.</p>	<p>Chest Manipulations helps to improve haemodynamic parameters as well as as compared to Neurophysiological Facilitation in organophosphorus poisoning patients. Hence Chest Manipulations can be used as an early intervention in organophosphorus poisoning patients.</p>
4) Dr. Ankita P Ashtankar	<p>Control group Conventional Chest Physiotherapy which included Vibration, Percussion, postural drainage and suctioning if indicated. The intervention was given twice in a day for 5 days for 25 - 30 min per session</p> <p>Experimental group PNF technique of Intercostal Stretch and Anterior Basal Lift along with conventional Chest Physiotherapy.</p>	<p>Improvement in Static, Dynamic compliance, Heart Rate, Respiratory Rate, Oxygen Saturation parameters after giving PNF along with Chest Physiotherapy than Chest Physiotherapy alone. In mechanically ventilated patient study concludes that there was significant difference in both the groups A (experimental) & groups B (control).</p>

	Each technique was repeated 10 - 12 times with 2 - 3 sets in supine lying position with 10 seconds of stimulus pressure and 10 seconds of rest for 3 days.	
5) Jaimala Vijay Shetye	Electrical stimulation with intermittent galvanic current was given to paralyzed distal muscles of upper and lower extremities to restore their properties and hence prevent further muscle wasting. Strengthening and proprioceptive neuromuscular facilitation for weak muscles, stretching of hand flexors and gastrosoleus and orthotic devices prevented further deformities. Tilt table supported standing helped to overcome the effects of prolonged bed rest and postural hypotension.	Physiotherapy plays a substantial role in making patient functionally independent and enabling integration into the community.

4. Discussion

According to study done by Alfiza Khan it suggest that the treatment approach demonstrates the importance of addressing neuro - musculoskeletal comorbidities comprehensively in individuals with paralysis. By combining electrical stimulation, stretching, orthotic devices, and tilt table therapy, patients can experience significant improvements in physical function, independence, and quality of life, highlighting the transformative impact of rehabilitation interventions in this population.

According to study done by Pallavi R. Bhakaney it suggests that physiotherapy interventions have shown remarkable efficacy in improving respiratory function and quality of life in patients with OPP and IMS. Physiotherapy techniques such as breathing exercises, chest physiotherapy, and mobilization techniques can help optimize respiratory function, alleviate symptoms of orthopnea, and improve overall functional capacity.

According to study done by Sandesh P. Londhe study's findings suggest that the chest manipulations offer promise as an effective early intervention strategy for improving hemodynamic parameters in organophosphorus poisoning patients. This highlights the importance of considering physical interventions alongside traditional medical approaches in the management of poisoning cases and underscores the need for further research in this area.

According to study done by Dr. Ankita P Ashtankar Study's suggest that the efficacy of PNF in conjunction with chest physiotherapy for improving respiratory parameters in mechanically ventilated patients. This highlights the potential of incorporating PNF techniques into respiratory care protocols to enhance ventilator management and optimize patient outcomes.

According to study done by Jaimala Vijay Shetye it emphasizes the integral role of physiotherapy in promoting functional independence and community integration during rehabilitation. Effective treatment requires ongoing evaluation, personalized planning, and collaboration between healthcare providers and patients throughout the rehabilitation process. By adopting a holistic and patient - centered approach, physiotherapists can optimize outcomes and support patients in achieving their goals for recovery and participation in society.

5. Conclusion

The study concludes challenges and uncertainties surrounding the management of organophosphorus poisoning - induced delayed polyneuropathy, physiotherapy emerges as a valuable therapeutic modality with the potential to improve outcomes and enhance the quality of life for affected individuals. By continuing to explore new avenues for research, practice, and collaboration, we can further advance our understanding and management of this debilitating condition.

6. Scope

Future studies may explore more advanced therapeutic techniques within physiotherapy, such as virtual reality - assisted rehabilitation, robotics - assisted therapy, or neuromodulation techniques like transcranial magnetic stimulation (TMS) or transcranial direct current stimulation (tDCS). These innovative approaches could offer new avenues for improving outcomes and enhancing recovery in individuals with delayed polyneuropathy.

There may be a shift towards personalized rehabilitation programs tailored to the specific needs and characteristics of individuals affected by delayed polyneuropathy. This could involve incorporating patient - specific factors such as severity of symptoms, comorbidities, functional limitations, and psychosocial factors into the design and implementation of physiotherapy interventions.

Future research may increasingly emphasize the importance of multidisciplinary collaboration in managing delayed polyneuropathy. Physiotherapists may work closely with other healthcare professionals such as neurologists, occupational therapists, psychologists, and nutritionists to provide comprehensive care addressing the diverse needs of patients with organophosphorus poisoning - induced neuropathy.

There might be a greater focus on long - term follow - up studies to assess the sustained effects of physiotherapy interventions on functional outcomes, quality of life, and prevention of secondary complications in individuals with delayed polyneuropathy.

The future scope of physiotherapy in organophosphorus poisoning - induced delayed polyneuropathy is likely to encompass a broader range of interventions, personalized approaches, interdisciplinary collaboration, long - term outcome assessment, and preventive strategies aimed at optimizing patient care and improving clinical outcomes.

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