

11. Falls

Key messages

- Tailored exercise programs that include exercises to challenge balance should be implemented for polio survivors with LEO/PPS to reduce their high fall rate.
- Osteoporosis is common in the hips of polio survivors, especially those with polio-affected lower limbs, so bone mineral density of both hips should be determined in males and females in this population and treatment instituted, if indicated.
- The removal or modification of environmental hazards in the home and the avoidance of risky behaviour and external hazards can prevent falls.
- The use of braces and walking aids contributes to the prevention of falls.

Incidence and Impact

The latest Cochrane review of the medical literature on falls in people over 65 years of age and living in the community confirms that approximately 30% fall each year.⁵⁸

In contrast, the frequency of falls in polio survivors is significantly higher. A 2010 publication from The Netherlands reported that 74% of 305 polio survivors sustained at least one fall in the previous year with 60% reporting more than one fall.⁵⁹ An earlier report from the United States recorded a fall rate of 64% among 233 polio survivors in the previous year with 61% of the falls requiring medical attention, including 35% who had at least one bone fracture.⁶⁰ A report published on 50 post-polio patients in Ireland in 2009 recorded a fall rate of 64% over the previous six months; 19 of those 50 had fractured a bone as the result of a fall over the previous five years.⁶¹

Assessment

Osteoporosis is common in the hips of post-polio populations, especially in the hip that is associated with a polio-affected lower limb.⁶² Bone mineral density should be measured in both hips in males and females in such populations and appropriate treatment instituted, if indicated. Twenty eight of the 50 Irish post-polio patients were diagnosed with osteoporosis and 20 with osteopaenia, yet only eight of the 48 were receiving treatment for their low bone mineral density to reduce the risk of hip fractures.⁶¹

Reduced muscle strength, relatively rapid muscle fatigability and the impaired balance and gait associated with LEO/PPS are risk factors for falling. Other risk factors to be assessed in this population are visual impairment, dizziness on standing (eg, due to low blood pressure), and the taking of certain medications (eg, psychotropic drugs).⁵⁸

Environmental hazards in the home and risky behaviour by the occupants should be assessed, preferably by an occupational therapist, where frequent falls have occurred in the home.^{58, 63}

Intervention and Prevention

Reviews of the medical literature provide strong evidence that exercise programs can reduce fall rates in older populations but the exercises that are more likely to be effective are those that challenge balance.^{58, 64} Such exercises involve standing with feet close together or on one leg while practising controlled movements that strengthen the core trunk muscles.⁶⁴ The particular exercise program will need to be tailored to the capabilities of the individual polio survivor with LEO/PPS under the direction of a physiotherapist who has been trained or is experienced in devising appropriate exercise programs for polio survivors.

The removal or modification of environmental hazards in the home under the direction of an occupational therapist has been shown to prevent falls among older people who are at

increased risk of falling. In addition, the home visits may also lead to changes in behaviour that enable older people to move more safely in the home and in the external environment.⁶³ Rough terrain, sloped surfaces, wind and crowds in the external environment increase the risk of falling for those with LEO/PPS and are best avoided, if possible.

Bracing that prevents foot drop and stabilizes joints also contributes to the prevention of falls,

as does the use of a wheeled walker instead of a walking stick as muscles become weaker.

Polio survivors who live alone should be encouraged to wear personal alarms since they may not be able to get up from a fall, even in the absence of a bone fracture. A coded key safe box containing the house keys should be installed on the outside of the house near the front door to ensure prompt access when help arrives.

12. Psychological considerations

Key messages

- Psychological and emotional factors may be significant contributors to the severity of symptoms associated with the LEOp.
- Conversely the severity of symptoms may in itself have an impact on psychological and emotional well being.
- Psychological state is inextricably linked to physical wellbeing and recovery.

Incidence and impact

Psychological symptoms in polio survivors vary greatly along with the incidence and severity of the LEOp symptoms. The intertwined triad of LEOp (fatigue, pain and muscle weakness) often results in social isolation and strained interpersonal relationships which puts marriages and friendships at risk.^{11, 65} Central to the aetiology of psychological symptoms may be polio survivors reliving many of the realities, emotional and physical, of their acute paralytic poliomyelitis. Polio survivors frequently report that the onset of post-polio symptoms have forced them, often for the first time, to recall and examine their acute polio experience.⁶⁶

In surveys that have reviewed LEOp, depressed, anxious or stressed patients report a more severe physical deterioration, more pain with a higher rate of somatic complaints, poorer coping mechanisms, a lesser quality of life and more social exclusion.⁶⁶ Interestingly, most studies do not report an increased incidence of psychosocial or depressive events amongst LEOp patients.⁶⁷ This may in part be due to reports of the Type-A personalities (hard driving over-achievers) of some polio survivors, who frequently demand perfection of themselves in all aspects of their lives, and are confronted with new, progressive disability²³. These unique circumstances surrounding the development of an unexpected second disability are thought to result in particular psychosocial difficulties.¹¹

Clinical characteristics

As the physical causes and optimum treatment regimes for post-polio symptoms are being clarified, psychological symptoms including chronic stress, anxiety, depression, and compulsive behaviour are becoming evident in polio survivors.²³ It is important for clinicians to consider the psychological impact of a chronic illness like polio, as these symptoms are commonly missed.⁶⁵ Importantly, these symptoms are not only exacerbating the LEOp but often prevent patients from making the lifestyle changes necessary to achieve a benefit from treatment programs.^{15, 66}

Individuals who lose abilities which they previously re-gained through strenuous rehabilitation, may experience a deep feeling of bereavement resulting in social withdrawal, isolation, relationship hardships and a change in self perception. Polio survivors will often respond to these new symptoms with anger, fear and confusion.⁶⁶ Due to their experiences during the acute illness, many post-polio individuals fear hospitals and are wary of health professionals. As a result, faith in the medical profession has often been lost.^{11, 16, 67}

Assessment

It can often be difficult to separate the symptoms of the LEOp due to the interwoven connectivity of physical and emotional states. In order to provide the best therapeutic advice, it is essential to have a good knowledge of the symptoms but also take the time and listen to

patients in order to differentiate the underlying physical and psychological components.⁶⁷ The most appropriate method of providing a comprehensive and coordinated evaluation that addresses the polio survivor's medical, functional, psychosocial and vocational needs is through the use of an interdisciplinary team, including physician, physiotherapist, occupational therapist, psychologist and social worker.^{11, 16}

Management

The main aims of addressing the psychological needs of the post-polio patient should be to:^{11, 16}

- increase and expand the patient's personal and external resources;
- provide education and support (to both the patient and family); and
- reinforce the need for the patient to have control over their lives.

Psychologists can provide counselling, education and support with regards to emotional difficulties the individual and close family members may experience. Intimate relationships between partners may also be affected due to the symptoms of pain, fatigue and weakness which affect the individual's self image and their sexuality.^{11, 16} Psychological support can also assist the patient in their evaluation of therapeutic choices (rehabilitation, orthotics, mobility devices, medications, speech pathology or surgery), as well as the choice between treatment or an abstention of treatment.⁶⁷ In particular, the concept of relying on mobility devices such as walking sticks and wheelchairs can be extremely traumatic for polio survivors, so it is suggested that patients first test out these devices to help enhance their enjoyment of an activity (eg, visiting an art gallery or at an airport).

Importantly, previous approaches to polio treatment have been to ignore pain and fatigue and to exercise as much as possible; these therapeutic strategies are now being regarded as possible contributors to the post-polio

symptoms.^{11, 16} So post-polio patients and their families are now being challenged and are being told to dramatically change their approach to managing their symptoms. This is a major obstacle for many individuals and often results in higher levels of non-compliance in treatment programs.⁶⁶

Unfortunately, the support of family and friends is often not sought by polio survivors and, even when it is, may not prove to be adequate to the patient. Newly diagnosed patients frequently experience problems in communicating effectively about LEOp with their families and friends, and in obtaining help from them. It has been reported that only 39% of polio survivors requested help from their family and of these only 52% found it "very helpful" to do so. While 75% had talked with their family about LEOp only 40% rated this as a "very helpful" experience. In addition, this study also found that 74% had talked with friends about LEOp but only 23% of these found this "very helpful". Personal coping strategies (such as becoming more involved in interests they can still pursue, developing their philosophy of life, reading more about LEOp) were more frequently reported as being adopted than were interpersonal coping strategies and were more frequently rated as "very helpful". The length of time required to get a diagnosis results in many survivors' symptoms being discounted by their families and often health practitioners.^{30, 68} As with the patient's assessment, the most successful approach to managing the complex psychological components of the LEOp will involve a comprehensive interdisciplinary treatment program comprising physicians, physiotherapists, social workers and psychologists.^{11, 16, 66} Each team member brings with them specific skills and knowledge that could assist the patient to address some of the aspects of their condition. In addition, patients should be encouraged to connect with post-polio support groups to facilitate communication and awareness about their illness, and to allow access to an additional support network.¹⁶ Together they can address the LEOp as a whole.

13. Pharmacological considerations (summary of Cochrane Review)

In 2011 the Cochrane Collaboration undertook a review of the treatments for symptoms associated with the LEOp.^{15, 69} This section briefly summarises that review.

Key messages

- Due to the lack of both good quality data and randomised controlled studies, definite conclusions on the efficacy of various treatment options for the LEOp could not be drawn.
- Results showed that intravenous immunoglobulin, lamotrigine, muscle strength training and static magnetic fields may be beneficial for the management of the LEOp, however require further investigation.

Background and objective

The late effects of polio can affect 15% to 80% of those who survive paralytic poliomyelitis. The efficacy and optimum use of pharmacological and rehabilitation treatments to manage the LEOp is yet to be definitively established. The objective of the Cochrane review was to systematically review the efficacy of a range of potential LEOp treatments, both pharmacological and non-pharmacological, compared to placebo, usual care or no treatment.

Pharmacological treatments

The pharmacological treatments included in the Cochrane review were:

- Amantadine, bromocriptine and modafinil: these drugs act on various areas of the brain and are used in an attempt to address general fatigue.
- Insulin-like growth factor (IGF-I) and human growth hormone: these agents may improve muscle strength by promoting regeneration of peripheral nerves.
- High-dose prednisone and intravenous immunoglobulin (IVIG): muscle strength, fatigue and pain may be improved by the immunosuppressive and immunomodulating properties of these drugs.
- Pyridostigmine: inhibits the breakdown of acetylcholine in the neuromuscular

synapse and may have a positive effect on fatigue and other LEOp symptoms.

- Lamotrigine: its postulated neuroprotective effects may reduce fatigue and pain.
- Coenzyme Q10 and selegiline: may assist with general symptoms of the LEOp via their effects on muscle metabolism and muscle strength.

Rehabilitation (non-pharmacological) treatments

The three non-pharmacological treatments listed below were included in this review:

- Muscle strengthening: may improve functional capacities however literature suggests that muscle overuse and intensive training may worsen muscle weakness and fatigue resulting in further loss of muscle strength. Physically active LEOp patients, however, were found to have fewer symptoms and greater functional capacity.
- Rehabilitation in warm and cold climates: may have positive effects on physical, psychological and social aspects of health.
- Static magnetic fields.

Summary of main results

Commentary was provided for the following treatments:

- Amantadine: 200mg/day for six weeks did not reduce fatigue compared to placebo.

These results were based on a small population and therefore it was concluded that there is very low quality of evidence on the benefits or otherwise of amantidine.

- Modafinil: 400mg/day did not reduce activity limitations, fatigue or pain compared to placebo. The studies investigating the use of modafinil were considered to be of high quality and hence the authors concluded there are no beneficial effects of modafinil.
- IVG: two infusions of 90g or one of 2g/kg body weight did not show improvements in activity limitations or fatigue. The effects of IVG on muscle strength and pain were inconsistent. The evidence is considered of moderate quality and further investigation is required.
- Prednisone: 80mg/day for four weeks followed by a 20 week tapering scheme showed no beneficial effects on fatigue. The authors concluded that the evidence is of very low quality based on the sample size of the study.
- Pyridostigmine: there is moderate quality evidence that 180mg or 240mg/day showed no effect on activity limitations, muscle function, fatigue or pain. Daily doses of 540mg to 720mg are indicated for treatment of myasthenia gravis and plasma concentrations vary significantly between individuals. Based on this, the authors concluded further investigation is warranted.
- Lamotrigine: 50mg to 100mg/day for four weeks was shown to improve activity limitations and pain. However, the evidence is of very low quality and further investigation is required to establish the efficacy of lamotrigine.
- Muscle strengthening: progressive resistance training of thumb muscles affected by polio showed an improvement in muscle strength;

however the evidence is of low quality. The authors commented on the value in assessing the effects of strength training of larger muscle groups such as the lower limbs, which are more frequently affected by the LEOp.

- Rehabilitation in warm and cold climates: there is low quality evidence that rehabilitation in warm or cold climates is of no benefit three months after treatment.
- Static magnetic fields: a reduction in pain was observed immediately after application of static magnetic fields over pain trigger points. The evidence is of moderate quality. Long term effects and effects on activity limitation were not studied and require further investigation.

Authors' conclusion

It was concluded that it was impossible to draw definite conclusions on the efficacy of the various treatment options for the LEOp due to the lack of both good quality data and randomised controlled studies. Results showed that IVG, lamotrigine, muscle strength training and static magnetic fields may be beneficial however all require further investigation.

Addendum: Medical Alert

The following therapeutic drugs may worsen the symptoms of LEOp/PPS and should be avoided or used with caution. The decision whether or not to take any drug always has to weigh up the benefits and the possible side effects:

- Cholesterol-reducing drugs such as statins.
- Beta-blockers.
- Benzodiazepines.
- Central nervous system depressants.
- Muscle relaxants.
- Local anaesthetics.

14. Comorbidity considerations

This section provides a summary of a presentation given by Irene Tersteeg at the European Conference on Post polio Syndrome in 2011.^{66, 70}

Key messages

- A higher level of comorbidity has been shown to be associated with a lower level of physical functioning.
- Polio survivors have more cardiac disease, respiratory disease, endocrine and metabolic disease, and more bone disease than the non-polio-affected population.
- Screening tests are important and should be done for diabetes, hyperlipidemia, hypothyroidism, osteoporosis, and lung function.

Incidence and Impact

Polio survivors have paresis, are less able to lead an active lifestyle and are therefore more prone to certain types of comorbidity. A higher level of comorbidity has been shown to be associated with a lower level of physical functioning and a faster decline in physical functioning in polio survivors. Lifestyle-related factors, physical inactivity and excess weight are also associated with a lower level of functioning in polio survivors.

Clinical Characteristics

Compared with the non-polio-affected population, polio survivors have more disease of the heart and blood vessels, such as heart attacks, hypertension and cardiac arrhythmias.

They also have more respiratory disease such as chronic pulmonary disease and asthma. When polio survivors age they may encounter late onset respiratory failure due to weakening of respiratory muscles and deformities of the chest.

The incidence of endocrine and metabolic disease such as diabetes, hyperlipidaemia, and hypothyroidism are also higher in polio survivors.

Due to an imbalance in muscle load, polio survivors have more disease of the bones,

muscles and tendons such as arthrosis and osteoporosis. Increased muscle weakness can lead to reduced balance and combined with osteoporosis can increase the risk of fractures after a fall.

Assessment & Management

Many of the comorbidities associated with the LEOp are asymptomatic in their early stages, highlighting the importance of regular screening tests. While fatigue is a common symptom associated with the LEOp, it is important to rule out fatigue from other causes such as hypothyroidism. Screening should be done for diabetes, hyperlipidemia, hypothyroidism, osteoporosis, and lung function.

Walking aids may be needed in patients with increased muscle weakness in order to reduce the risk of falls and related bone fractures. Advice should also be offered regarding ways to manage diet and weight. Daily physical activity should be encouraged, with activities prioritised to lowering symptoms of fatigue and pain and to minimising the decline in physical functioning. Training in warm water is recommended, as it reduces the stress on joints and muscles and warm water may have an analgesic effect. Dynamic water exercises, not involving swimming, are a good alternative to weight-bearing exercises.

15. The Post-Polio Health Team

Due to the numerous and varied considerations for the diagnosis and management of patients suffering the LEOp, a broad team of healthcare professionals may be required to make up the “Post-polio Health Team”. A list of experts that could make up this team is provided below.

- **Rehabilitation specialist:** To support the management of pain and energy levels.
- **Neurologist:** To provide definitive diagnoses and comprehensive treatment plans for the neurological sequelae in polio survivors.
- **General Practitioner:** To develop a management program to address the post-polio patient's specific symptoms, ensure continuity of care, educate the patient and promote a healthy lifestyle.
- **Physiotherapist:** To support polio survivors in improving/maintaining mobility, function and provide relief from pain.
- **Occupational therapist:** To assist polio survivors to employ strategies to help maintain overall health and encourage the highest level of lifestyle independence.
- **Orthotist:** To fit appropriate and well-fitting orthoses for patients who require them.
- **Podiatrist:** for assessment and treatment of foot conditions (commonly present in patients with a history of polio).
- **Speech Pathologist:** To support the management of patients with speech or swallowing disorders.
- **Respiratory Specialist / Sleep Specialist:** For management of respiratory dysfunction in patients with LEOp including preventative measures, ventilator assistance and treatment of sleep apnoea.
- **Psychologist/Social worker:** To provide counselling, education and support.
- **Dietitian/Nutritionist:** To provide education and management strategies regarding weight management.
- **Massage Therapist:** Can assist in the management of cold intolerance and pain control.
- **Osteopath:** To provide support for the management of postural / biomechanical issues in patients with LEOp.

16. Summary

- The late effects of polio (LEoP) is a set of sequelae in polio survivors characterised by the chronic impairments caused by the original polio infection, the secondary traumatic effects of those impairments, and from Post-Polio Syndrome (PPS), a neurologic disorder characterized by increased weakness and/or abnormal muscle fatigability and pain occurring many years after the initial polio infection.
- New muscle weakness can involve previously affected muscles, as well as muscles that appeared to be originally unaffected. Management of this new muscle weakness requires appropriately paced physical activity.
- Frequent fatigue is one of the most common and disabling symptoms of the LEoP, and a balanced, active lifestyle is recommended to minimise this symptom.
- Muscle and joint pain is a major and common issue for people suffering from the LEoP. Successful management strategies focus on improving abnormal body mechanics and posture, supporting weakened muscles with bracing and mobility devices, targeted exercises, and promoting lifestyle changes such as weight loss.
- The most common presentation of respiratory complications is shortness of breath and other symptoms may be consistent with sleep disordered breathing. These complications should be evaluated by a respiratory physician.
- Swallowing and speech difficulties are caused by damage to the Bulbar nerves during the acute phase of polio and may not be detected by clinical history assessment alone. Referral to a speech pathologist for full evaluation and management is recommended.
- A common symptom associated with the LEoP is cold intolerance, which is managed by managing the symptoms of impaired thermoregulation, rather than the cause.
- Disturbance to sleep is common in patients suffering from the LEoP and may be due to chest and spinal deformities and weakened respiratory muscles following primary polio infection. Assessment should always involve a thorough clinical and physical examination.
- Bladder dysfunction, potentially caused by impaired detrusor muscles and nerves, leg oedema and restricted mobility, can have a significant impact on the sufferers quality of life. Treatments vary depending upon the underlying cause of symptoms.
- Special precautions are necessary when a polio survivor presents for surgery (including dental surgery) due to the higher risk of complications as a result of the LEoP, and a potentially longer recovery period. The choice and dose of anaesthesia requires special consideration and more intensive monitoring during the post operative period may be required.
- The modification of environmental hazards and tailored exercise programs to challenge balance should be implemented to help prevent falls. If necessary, the use of mobility aids can also be of help.
- Psychological and emotional factors may be significant contributors to the severity of symptoms associated with the LEoP. Physical wellbeing and management of symptoms can be linked to psychological state.
- The efficacy of pharmacological and rehabilitation treatments to manage the LEoP are yet to be firmly established. Definite conclusions cannot be drawn on the efficacy of various treatments due to the lack of good quality data and randomised controlled studies.

17. Useful resources for patients

The following is a list of useful resources that may be useful for post-polio patients:

Resources for Polio Survivors

Polio Australia / Resources / Resources for Polio Survivors

http://www.polioaustralia.org.au/?page_id=45

State Polio Networks

Polio Australia / About Us / State Polio Networks

http://www.polioaustralia.org.au/?page_id=22

Fact Sheets for Polio Survivors

Polio Services Victoria / Resources

<http://www.svhm.org.au/services/polioservicesvictoria/Pages/Resources.aspx>

Post-polio health care considerations for families and friends

Post-Polio Health International

<http://www.post-polio.org/edu/healthcare/index.html>

Save Our Shoulders

A Guide for Polio Survivors

<http://www.polioaustralia.org.au/wp-content/uploads/2010/09/Save-Our-Shoulders.pdf>

PolioPlace

A Service of Post-Polio International

<http://www.polioplace.org/>

Frequently Asked Questions

Post-Polio Health International

<http://post-polio.org/faq.html>

PolioToday

Salk Institute for Biological Studies

<http://poliotoday.org/>

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19. List of Abbreviations

BIPAP	Bi-Level Positive Airway Pressure
CSA	Central Sleep Apnoea
EMG	Electromyography
IPPV	Intermittent Positive Pressure Ventilation
LEoP	Late Effects of Polio
NHRMC	National Health and Medical Research Council
OSA	Obstructive Sleep Apnoea
PPS	Post-Polio Syndrome

20. Credits

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About Polio Australia

Polio Australia is a community based, not-for-profit, national peak consumer body committed to standardising quality polio information and service provision across Australia for polio survivors.

Polio Australia's vision is that all polio survivors in Australia have access to appropriate health care and the support required to maintain independence and make informed lifestyle choices.

For more information: www.polioaustralia.org.au

