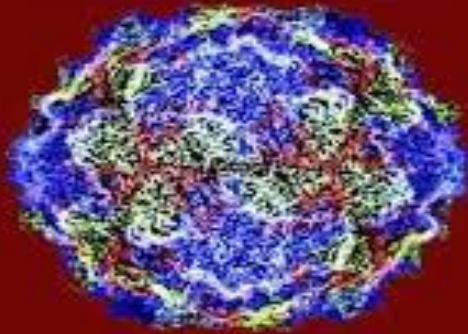


Polio virus



Poliomyelitis and the ageing polio survivor

Dr Nigel Quadros
Rehabilitation Medicine
Specialist

The Queen Elizabeth Hospital
and Hampstead Rehabilitation
Centre

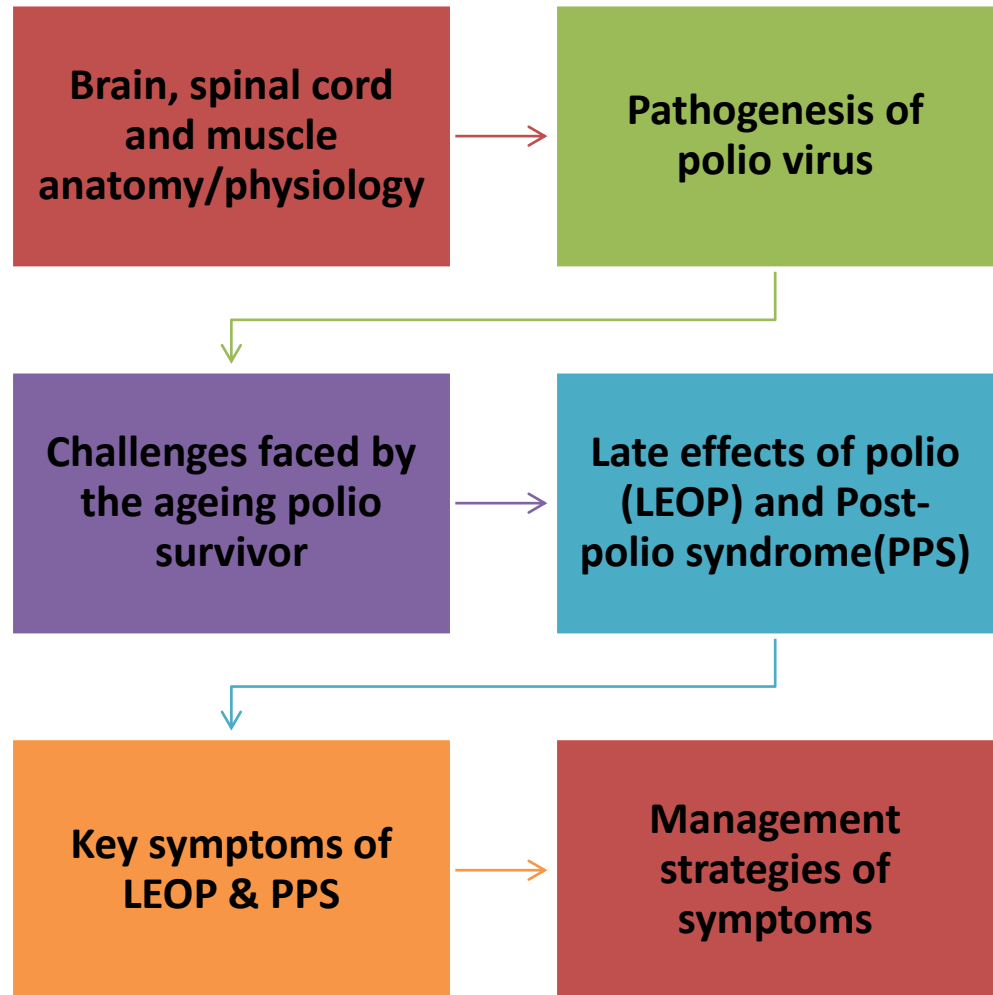


We would like to acknowledge this land that we meet on today is the traditional Lands for the Kurna people and that we respect their spiritual relationship with their country. We also acknowledge the Kurna people as the custodians of the greater Adelaide region and that their cultural and heritage beliefs are still as important to the living Kurna people today

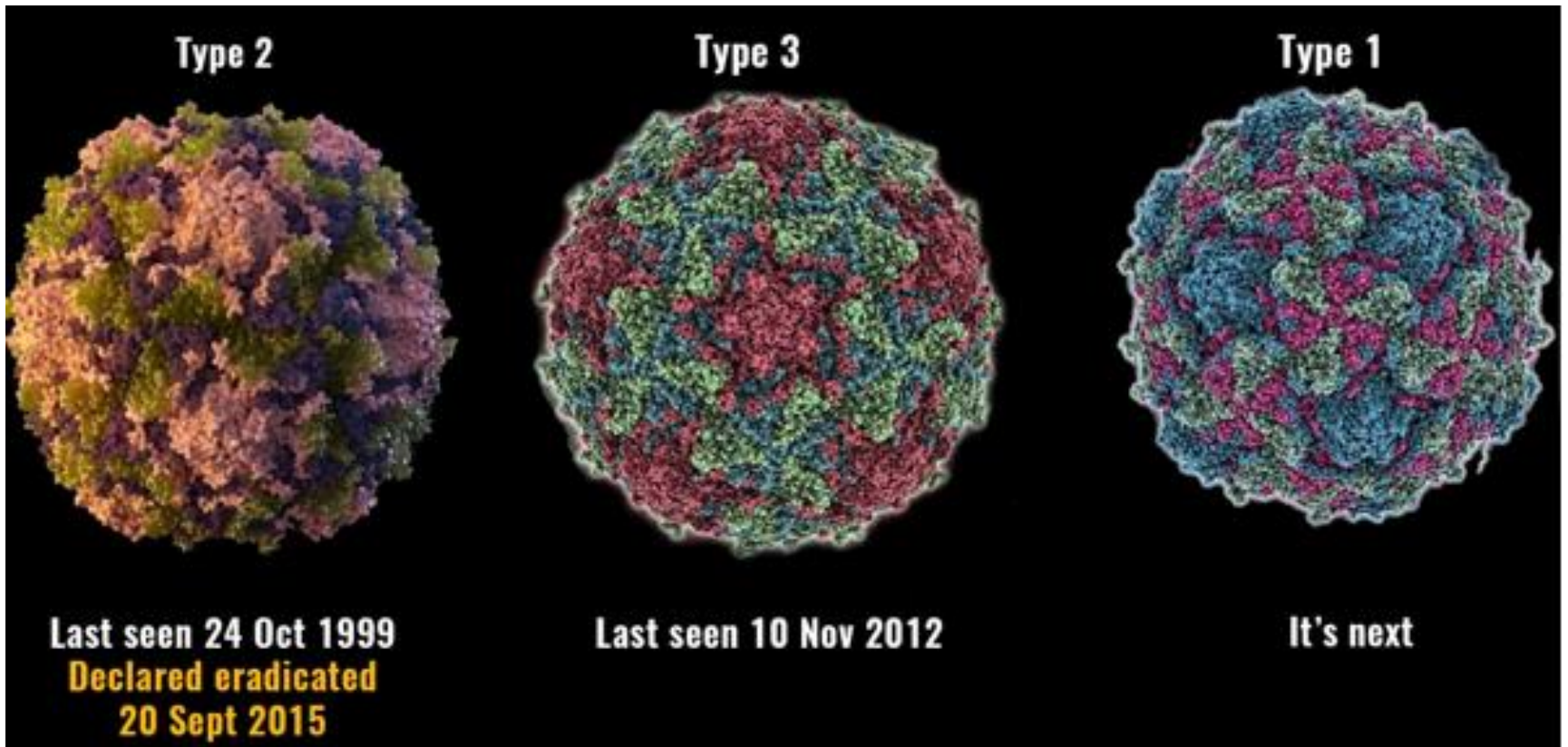
I HAVE NO



Outline of presentation

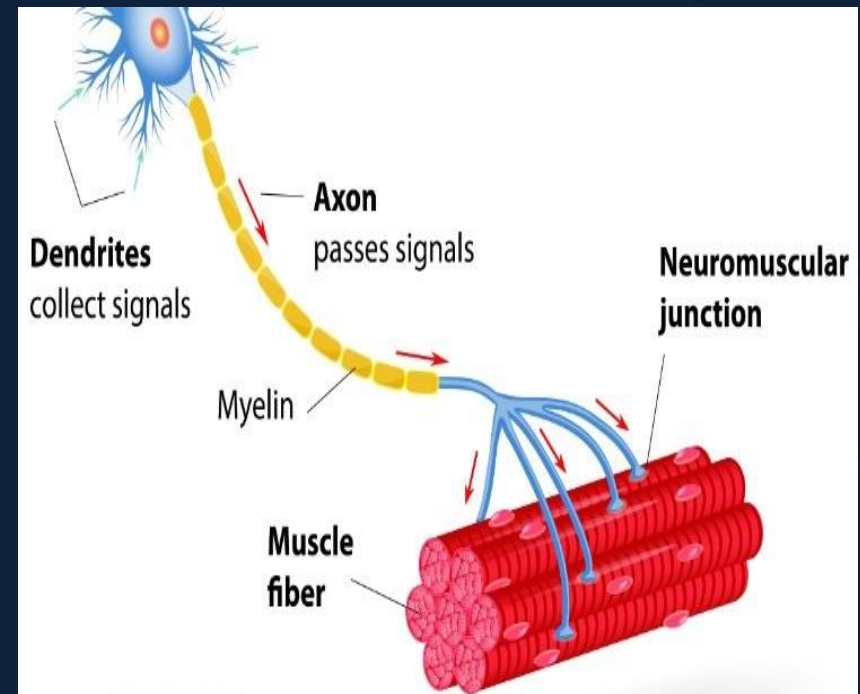
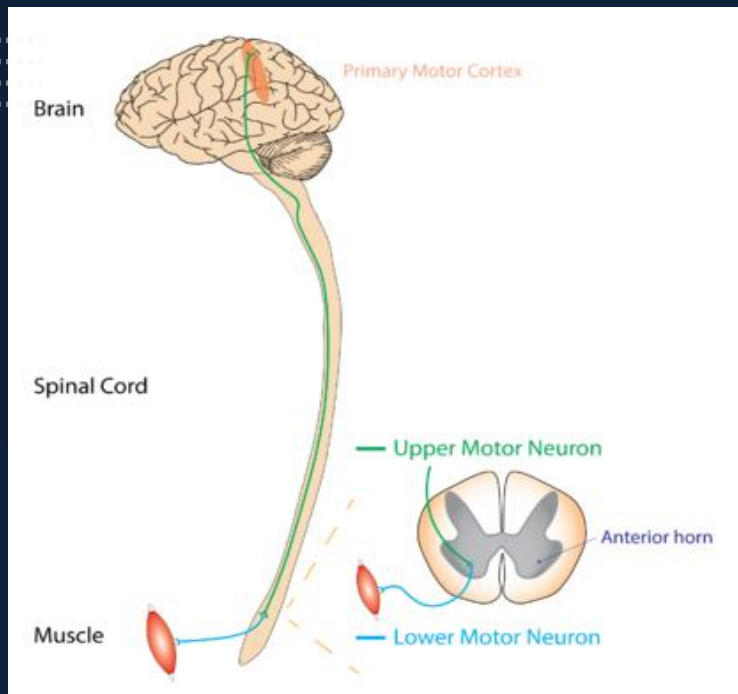


The polio virus

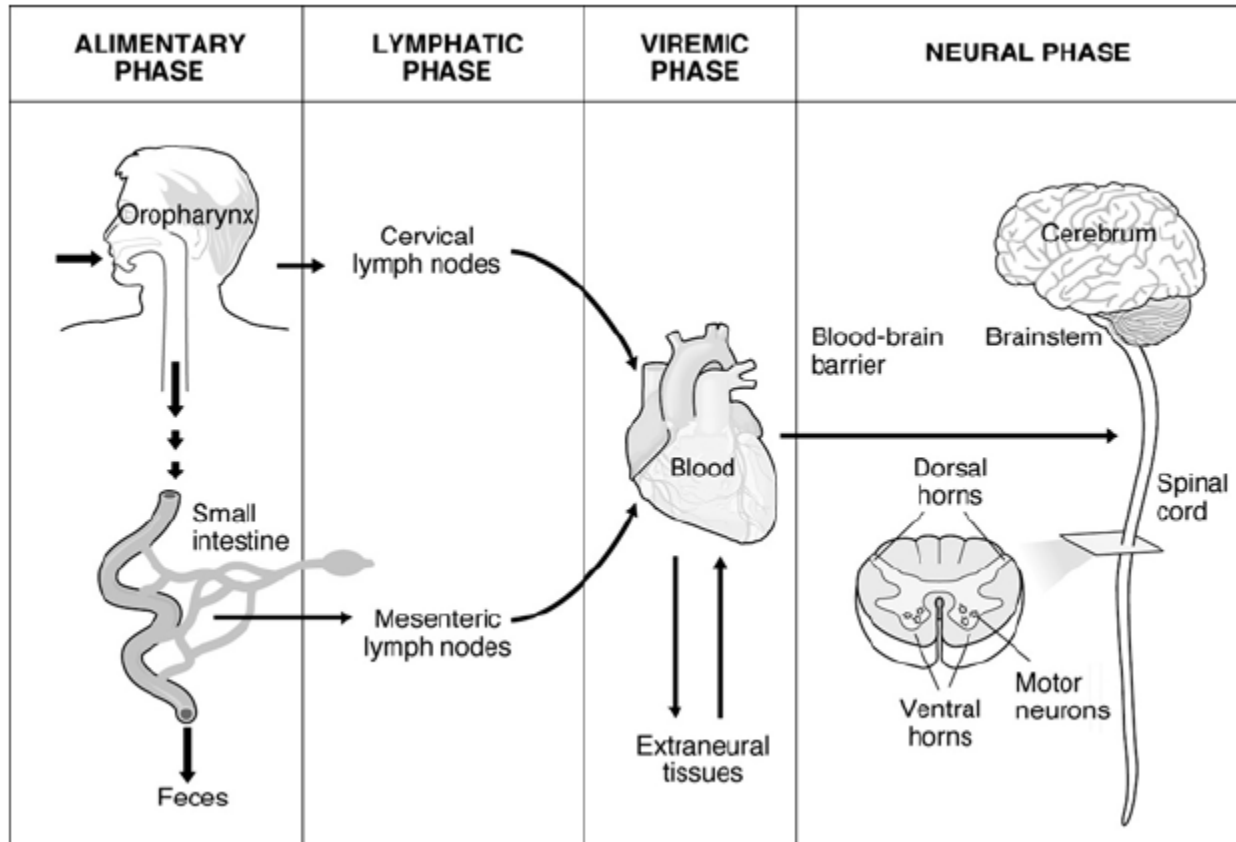


Brain spinal cord and muscle

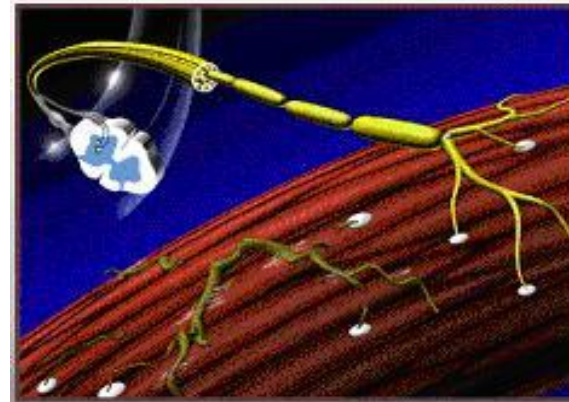
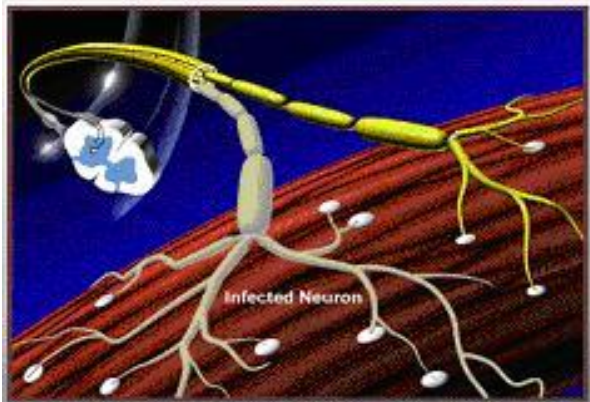
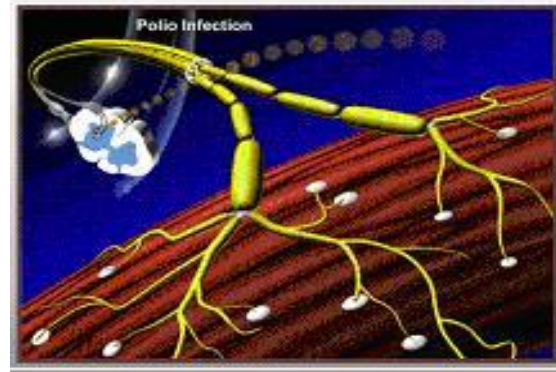
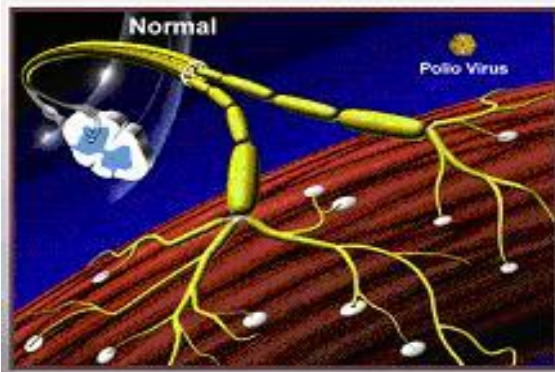
Motor unit



Transmission of the polio virus



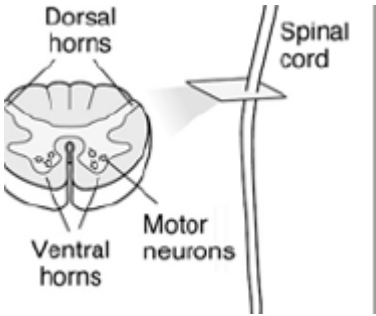
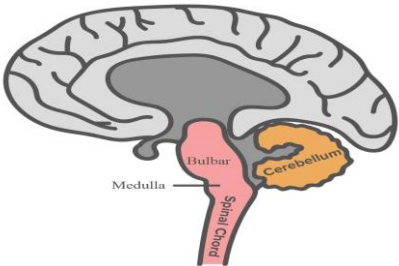
Nerve cell degeneration during acute polio



Outcomes of poliovirus infection

Outcome	Proportion of cases
No symptoms	72%
Minor illness	24%
Nonparalytic aseptic meningitis	1–5%
Paralytic poliomyelitis	0.1–0.5%
— Spinal polio	79% of paralytic cases
— Bulbospinal polio	19% of paralytic cases
— Bulbar polio	2% of paralytic cases

Pathogenesis of poliomyelitis



Bulbar Poliomyelitis

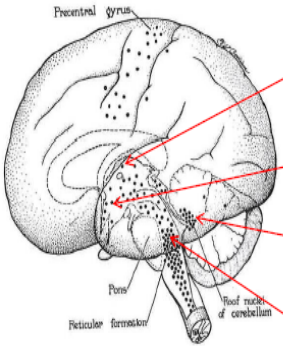
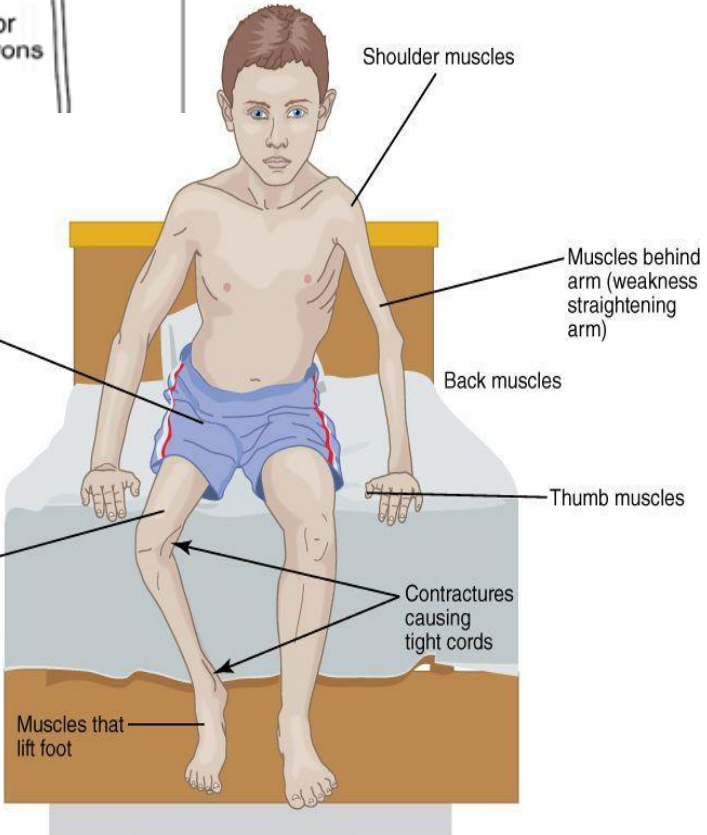


FIG. 1. Bodian's schematic view of the human brain which includes the upper portion of the spinal cord. The solid dots show the general distribution of lesions of poliomyelitis (from Bodian, n. 17). Reproduced by permission of the National Foundation for Infantile Paralysis.

- Thalamus and basal ganglia:**
adjustments in muscles tone and body position
- Hypothalamus:** temperature, thirst, heartbeat, blood pressure
- Cerebellum:** balance
- Brainstem and reticular formation:**
Breathing, sleep/awake, heartbeat, blood pressure, muscles of neck and face



Information from Werner, J. *Disabled Village Children: A Guide for Community Health Workers, Rehabilitation Workers, and Families*, Second Edition. The Hesperian Foundation, 1999.

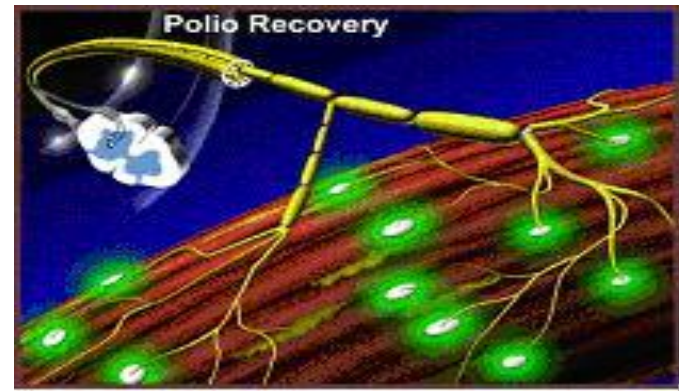
Recovery from acute paralytic polio

Surviving motor nerve cells in the brain stem and spinal cord extend new branches to re-connect the nerve cell to the muscle. These are called sprouts.

Muscle function partially or fully regained



Motor neuron ends up supplying several times the number of muscle fibers they would normally supply



Challenges faced by the aging polio survivor

General ageing process

- Cardiovascular disease
- Endocrine & metabolic disease
- Chronic pulmonary disease
- Hip & limb fractures due to falls
- Weight gain due to decreased mobility

Late effects of polio

'Late effects of polio' (LEOP) and 'post-polio syndrome' (PPS)

These terms are often used interchangeably; however, 'late effects of polio' has a broader definition that includes post-polio syndrome and a wider range of symptoms.

'Late effects of polio' includes three categories of symptoms:

- 1. Symptoms attributed directly to damage caused by the poliovirus.**
- 2. Post-polio syndrome (symptoms believed to relate to the body's failure to maintain the level of recovery achieved after poliovirus infection).**
- 3. Symptoms that result from secondary trauma.**

- Residual weakness.
- Musculoskeletal imbalance.
- Growth retardation.
- Skeletal deformities of affected limbs.
- Respiratory insufficiency.
- Cold intolerance due to circulatory disturbances.

- Specific diagnostic criteria

- Compression neuropathy e.g. carpal tunnel
Degenerative arthritis of joints that are over-stressed
Other repetitive motion problems such as tendonitis, bursitis

1. Polio Australia. The Late Effects of Polio: Introduction to Clinical Practice, 2012. Available at: <https://www.polioaustralia.org.au/wp-content/uploads/2010/09/The-Late-Effects-of-Polio-Introduction-Module-Online-Version.pdf>. Accessed January 2020.
2. Queensland Health. The Late Effects of Polio. Information for General Practitioners, March 2001. Available at: <https://www.polionsw.org.au/wp-content/uploads/2013/07/The-Late-Effects-of-Polio-Information-for-General-Practitioners.pdf>. Accessed January 2020.

Diagnostic criteria for PPS

There are no specific diagnostic criteria for the late effects of polio; however, criteria for post-polio syndrome include:

- 1 **Prior paralytic poliomyelitis with evidence of motor neuron loss**
- 2 **A period of partial or complete functional recovery after acute paralytic poliomyelitis, followed by an interval (usually ≥ 15 years) of stable neuromuscular function.**
- 3 **Gradual onset progressive and persistent new muscle weakness, abnormal muscle fatigability, muscle and joint pain. Onset may at times follow trauma, surgery, or a period of inactivity.**
- 4 **Symptoms that persist for ≥ 1 year.**
- 5 **Exclusion of alternative neuromuscular, medical and orthopaedic problems as causes of symptoms.**

1. March of Dimes Birth Defects Foundation. Post-polio syndrome: identifying best practices in diagnosis and care. Available at: <http://www.marchofdimes.com/mission/polio.aspx>. Accessed January 2020.

2. Farbu E. Update on current and emerging treatment options for post-polio syndrome. *Ther Clin Risk Manag* 2010;6:307–13.

Risk factors for PPS

Polio contracted over the age of 15

Permanent impairment after initial recovery

Female gender, although women in many studies had more severe and widespread polio

Longer period of time since acute disease

Presence of overuse symptoms during the stable period after initial polio (muscle fatigue, cramps and twitching)

Proposed mechanism of new weakness and loss of function in PPS

Axonal sprouts that supported muscle activity post infection degenerate as part of normal ageing process

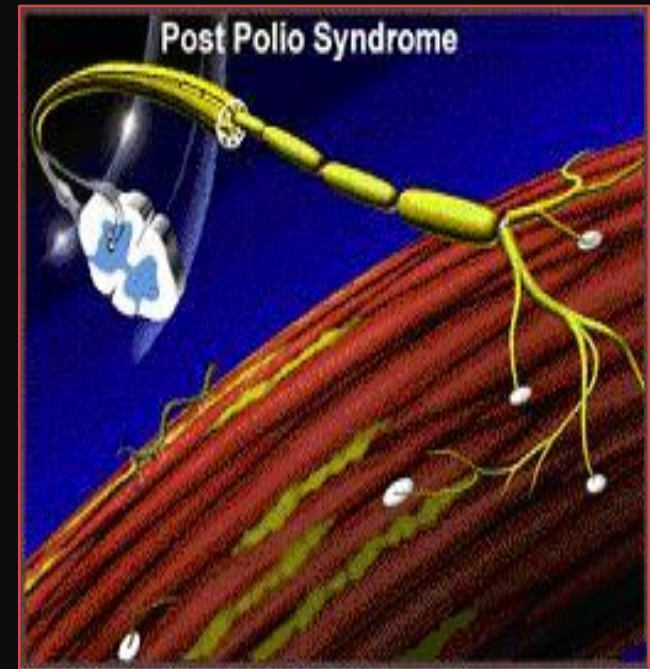
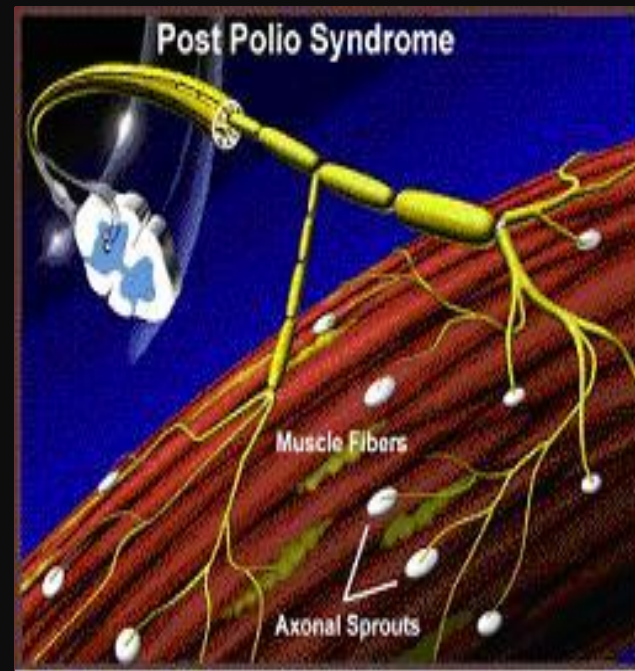
Wiechers and Hubbell (1981) proposed that sprouts degenerate over time also due to an "overexertion" phenomenon resulting once again in muscle fibers that no longer contract, which a survivor recognizes as new weakness and loss of function.

Non-paralytic polio survivors also have some degree of subclinical damage to their motor neurons

They may now begin to experience muscle weakness and atrophy and loss of function as well.

non-paralytic polio will have also suffered some degree of subclinical damage to their motor neur

non-paralytic polio will have also suffered some degree of subclinical damage to their motor neurons Axonal sprouts that supported muscle activity post infection degenerate as part of normal ageing process



Main symptoms of LEOP /PPS

Symptoms are non-specific, can be attributed to a number of other conditions and can be hard to fit together if the history of polio is unclear.

Muscle weakness	Further weakness in previously weak areas or new weakness in an unaffected muscle.
Pain	Patients can experience both nociceptive (damage to body tissue) and neurogenic (nerve damage) pain.
Fatigue	Physical fatigue with decreased muscle endurance. This is often localised to a muscle or muscle group. Mental fatigue can also occur.
Respiratory problems	Weakness of respiratory muscles and chest wall deformities lead to poor sleep, frequent awakening, difficulty in lying flat and sleep apnoea
Difficulty in swallowing	Weakness in oesophageal and laryngeal muscles. Leads to increased swallowing time and food catching in throat

1. March of Dimes Birth Defects Foundation. Post-polio syndrome: identifying best practices in diagnosis and care. Available at: <http://www.marchofdimes.com/mission/polio.aspx>. Accessed January 2020.
2. Farbu E. Update on current and emerging treatment options for post-polio syndrome. *Ther Clin Risk Manag* 2010;6:307–13.

Restless legs syndrome (RLS)

RLS is prevalent in patients with post-polio syndrome and is associated with decreased quality of life and fatigue



Common causes & Triggers of RLS

Causes:

Iron-deficiency

Peripheral neuropathy (damage to the nerves of the legs, by underlying conditions such as diabetes).

Parkinson's disease

Varicose veins

Triggers of RLS:

Smoking

Alcohol

Excess caffeine

Extreme exercise

Medications

- Melatonin
- Antihistamine (Benadryl)
- Some antidepressants (Zoloft)
- Tramadol
- Maxolon

Treatment of RLS

Identify & treat potential medical causes of RLS

Reduce trigger factors for RLS

Healthy sleep habits

Iron, vitamin C, D and E supplementation

Exercise improves sleep & reduce symptoms of RLS

Leg massage

Vibration pads

Medications

Anti-Parkinson (pramipexole, ropinirole)

Anti-seizure (Lyrica, Neurontin)

Benzodiazepines (Clonazepam)

Opioids (Targin)

Impact of LEOP on the ageing polio survivor

- Patients often surprised, frustrated and angry
- Polio they thought they had overcome during childhood is affecting their lives again.
- Confused about which symptoms were simply due to normal ageing rather than LEOP.
- The increased impairments makes it difficult to live the life they were used to, **they need to cut back on activities and social events.**

Muscle weakness and atrophy

Features

- May involve muscles previously affected by polio as well as those unaffected by the initial polio infection.
- First sign may be an increased time needed for recovery after muscle activity.

Patients experience:

- New physical limitations in walking, lifting and carrying, getting up from a chair, reduced mobility.
- Difficult managing activities of daily living.
- Joint pain
- Peripheral fatigue and pain due to overuse of compensating muscles

Conditions to exclude:

- Nerve entrapment, radiculopathies or spinal stenosis
- Degenerative conditions like multiple sclerosis or Parkinson's disease,
- Spinal disorders like infection, inflammation or ischaemia.

1. Polio Australia. The Late Effects of Polio: Introduction to Clinical Practice, 2012. Available at: <https://www.polioaustralia.org.au/wp-content/uploads/2010/09/The-Late-Effects-of-Polio-Introduction-Module-Online-Version.pdf>. Accessed January 2020.

2. Post Polio Syndrome guidelines from the British Polio Fellowship. Available at: <http://www.britishpolio.org.uk/wp-content/uploads/2016/02/PPS-Report-low-res.pdf>. Accessed January 2020.

Fatigue

Features

- Can be generalised or localised.
- Often with onset later in the day and with increasing severity toward the evening.

Patients may report:

- **General fatigue**, occurs with minimal exertion, and described as “an overwhelming exhaustion” with flu-like aching and can include hot and cold
- **Muscle fatigue**, occurs on exertion and often resolves after a period of rest. Described as “a heavy sensation in the muscles”, and an “increased loss of strength during exercise.”

Conditions to exclude:

- Anaemia
- Thyroid disorders
- Adrenal insufficiency
- Cardiovascular disease
- Diabetes
- **Sleep or breathing problems**
- Stress or depression

1. Polio Australia. The Late Effects of Polio: Introduction to Clinical Practice, 2012. Available at: <https://www.polioaustralia.org.au/wp-content/uploads/2010/09/The-Late-Effects-of-Polio-Introduction-Module-Online-Version.pdf>. Accessed January 2020.
2. Post Polio Syndrome guidelines from the British Polio Fellowship. Available at: <http://www.britishpolio.org.uk/wp-content/uploads/2016/02/PPS-Report-low-res.pdf>. Accessed January 2020.

Pain

Features

- Muscle pain and joint pain are common.
- Pain presents more frequently in younger people and those with an earlier initial polio age, especially women.

Some other conditions to exclude:

- Spinal orthopaedic conditions (e.g. myofascial pain syndromes)
- Fibromyalgia

Patients may report:

Biomechanical pain

- Most common form of pain.
- Presents as degenerative joint disease or pain from nerve compression syndromes.
- Shoulder pain and scoliosis are common.
- Weakness of polio affected muscles places excessive pressures on joints.

Overuse pain

- Occurs in muscles that are unaffected or only mildly affected by polio, and in tendons, bursa and ligaments.
- Occurs when these structures are overused to compensate for weakened polio muscles.

Post-polio muscle pain

- Described as burning, cramping or a deep ache
- Typically occurs at night and is associated with physical activity

1. Polio Australia. The Late Effects of Polio: Introduction to Clinical Practice, 2012. Available at: <https://www.polioaustralia.org.au/wp-content/uploads/2010/09/The-Late-Effects-of-Polio-Introduction-Module-Online-Version.pdf>. Accessed January 2020.
2. Post Polio Syndrome guidelines from the British Polio Fellowship. Available at: <http://www.britishpolio.org.uk/wp-content/uploads/2016/02/PPS-Report-low-res.pdf>. Accessed January 2020.
3. Queensland Health, 'The late effects of polio: information for general practitioners', 2001.

Main principles of managing the late effects of polio



There are no medications currently available that are proven to reverse muscular atrophy, improve neuromuscular strength or relieve the neuromuscular fatigue of late effects of polio



However, symptoms can be stabilised over long periods and quality of life enhanced by effective management



A multidisciplinary approach is strongly recommended involving GPs, allied health professionals and rehabilitation medicine physicians

1. Polio Australia. The Late Effects of Polio: Introduction to Clinical Practice, 2012. Available at: <https://www.polioaustralia.org.au/wp-content/uploads/2010/09/The-Late-Effects-of-Polio-Introduction-Module-Online-Version.pdf>. Accessed January 2020.
2. Post Polio Syndrome guidelines from the British Polio Fellowship. Available at: <http://www.britishpolio.org.uk/wp-content/uploads/2016/02/PPS-Report-low-res.pdf>. Accessed January 2020.
3. Lo JK, Robinson LR. Post-polio syndrome and the late effects of poliomyelitis: Part 2. treatment, management, and prognosis. *Muscle Nerve* 2018;58:760–9.
4. Farbu E. Update on current and emerging treatment options for post-polio syndrome. *Ther Clin Risk Manag* 2010; 6: 307–313.
5. Queensland Health. The Late Effects of Polio. Information for General Practitioners, March 2001. Available at: <https://www.polionsw.org.au/wp-content/uploads/2013/07/The-Late-Effects-of-Polio-Information-for-General-Practitioners.pdf>. Accessed January 2020.

Management strategies for Weakness and fatigue

Management of weakness

- Strengthening exercises
- Stretching exercises
- Avoidance of muscular overuse
- Energy conservation – pacing, rest, activity reduction
- Weight loss (if overweight)
- Orthoses and assistive devices

Management of fatigue

- Energy conservation – pacing, rest, activity reduction
- Lifestyle changes
- Weight loss (if overweight)
- Prescription of aids
- Aerobic exercise
- Medications

Management of pain

Biomechanical pain

Postural correction Strengthening
exercise Stretching exercise

Orthoses

Assistive devices

Biofeedback and muscle relaxation

Medications

- Non-steroidal anti-inflammatory medications, Opioids
- Steroid injections
- Surgery

Overuse pain

Medications

Moist heat, ice

Ultrasound

Energy conservation

Assistive devices

Orthoses

Muscular pain

Stretching exercise

Energy conservation

– pacing, activity reduction

Medications

Ensuring healthy aging of the polio survivor

Multidisciplinary approach (Health Professionals)

Encourage self management of symptoms

Optimal management of medical comorbidities

Optimal management of psychosocial issues

Reduce sedentary lifestyle

Reduce deconditioning

Prevent further bone and muscle loss

adequate nutrition

appropriate exercises to prevent injury to body

Thank you for listening

Questions??

