The Late Effects of Polio The Role of Physiotherapy and Allied Health

February 20th 2014

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Overview of Presentation

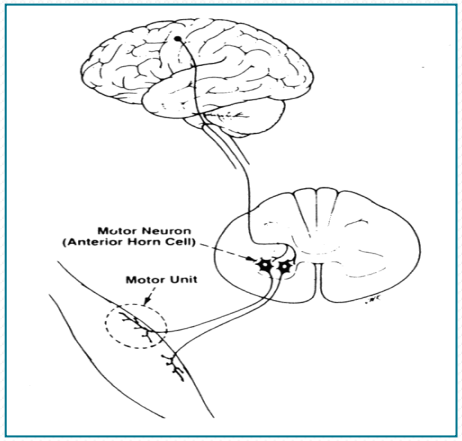
- Is Polio still an issue in Australia
- As an allied health practitioner what am I likely to encounter:
  - Signs and Symptoms
    - Polio
    - Late Effects of Polio
    - Post Polio Syndrome
  - Assessment considerations
  - Treatment options

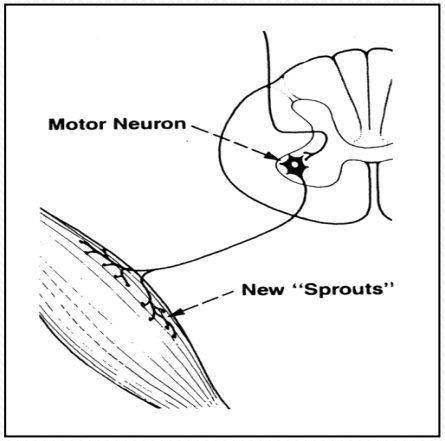
Is polio still a problem in Australia?

- Australia had two polio epidemics: in the early 1930s and early 1950s.
  - The last know case in Victoria was in 1979
  - The last known case in Australia was in 1986.
- A global effort to eradicate polio began in 1988 and was led by the WHO, UNICEF and The Rotary Foundation. These efforts have reduced 99% of annual diagnosed cases from an estimated 350,000 cases in 1988 to fewer than 2,000 cases in 2006.
- In 2000, polio was officially eradicated in 36 Western Pacific countries, including China and Australia. Europe was declared polio-free in 2002.
- According to the WHO in 2013, polio remains endemic in three countries: Nigeria, Pakistan and Afganistan

Polio Symptoms After Recovery Neurological

- Muscle paresis (LMN)
  - Skeletal deformities
  - Joint contractures
  - Movement disability



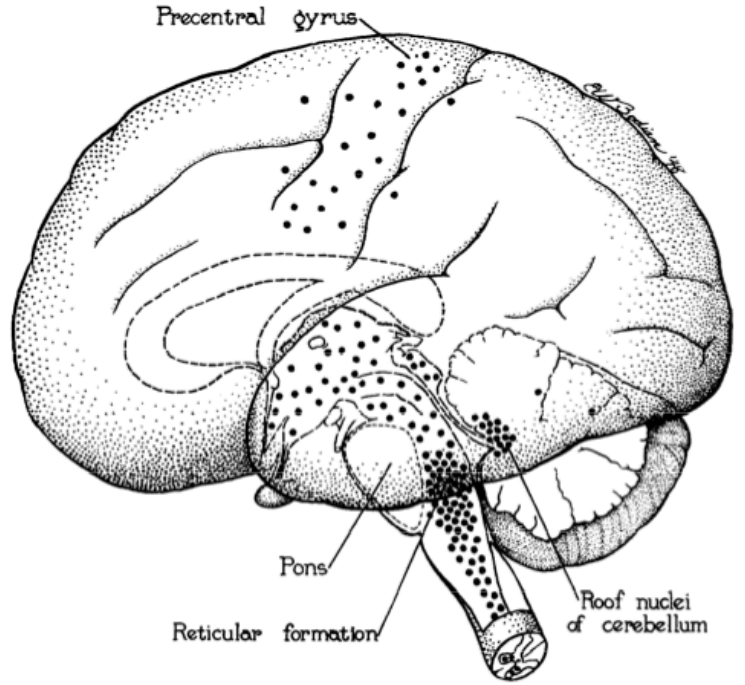


Sensory changes are not associated with polio.

Any sensory disturbance should be "red flag" screened and assessed as you would for any neuromusculoskeletal examination.

Common Presenting Problems Neurological

- **Central lesions -** Bodian (1949) discussed histopathologic findings in polio:
  - Reticular formation
    - Central fatigue
  - Deep nuclei of the cerebellum (aka Roof Nuclei)
    - Proprioceptive deficits
  - Vestibular nuclei
    - ?Balance deficits
  - Hypothalamus
    - ?Disorders of autonomic control systems



Polio Symptoms After Recovery Cardiorespiratory

- **Deconditioning is a major problem**
  - Decreased exercise tolerance←→ decreasing ability to mobilise
- **Compromised ventilatory pump**
  - (Kypho)scoliosis → decreased lung capacity
  - Weakness in diaphragm ± intercostals
  - Poor cough
- **Lung function tests** may appear normal (except scoliotic pts) → it may be a muscle endurance issue
- **Sleep disordered breathing**
  - History of bulbar polio in particular
    - Ventilated acutely; need for NG feeding
  - Screen for sleep apnoea (e.g. Epworth Sleepiness Scale / Berlin Questionnaire)

Polio Symptoms After Recovery Biomechanical/Musculoskeletal

Musculoskeletal related complaints by far the most common

- **Pain of vertebral origin** (all regions) – radiculopathies, associated neural dynamic problems, especially prevalent in scoliosis and limb length discrepancies

- **Upper limb**
  - Shoulder – OA, impingement syndromes and subsequent tendinopathies, overuse syndromes (crutch walkers, manual wheelchair users)
  - Wrist / hand – OA, overuse syndromes (eg. CTS due to crutch walking)

- **Lower limb**
  - Hip – OA, instability, muscle overuse syndromes
  - Knee – OA, ligamentous laxity, genu recurvatum
  - Ankle & Foot – OA, contractures, previous corrective surgery

Common Presenting Problems Other Issues

- **High falls risk**
- **Bulbar polio** – other presenting problems
  - Dysphagia & dysphonia
- **Persistent** (chronic) **pain**
  - "overdoers" rather than "underdoers"
- **Weight gain / obesity**
  - Metabolic syndrome / diabetes
- **Poor abdominal control / strength & pelvic floor dysfunction**
  - Implications for continence, LBP & compromised cough

- **Psychosocial considerations**
  - Previous experiences of healthcare
    - Calipers and splints, orthopaedic footwear
  - The 'stigma' of disability
    - Era in which they were raised

Terminology:
Symptoms of the Late Effects of Polio

Includes:

- secondary conditions related to the residual polio damage
  - Musculoskeletal imbalance
  - Effects of growth retardation
  - Osteoporosis
  - Respiratory insufficiency

- secondary trauma
  - Degenerative arthritis
  - Compression neuropathies
  - Overuse syndromes

- May also suffer ADDITIONAL symptoms

Post Polio Syndrome

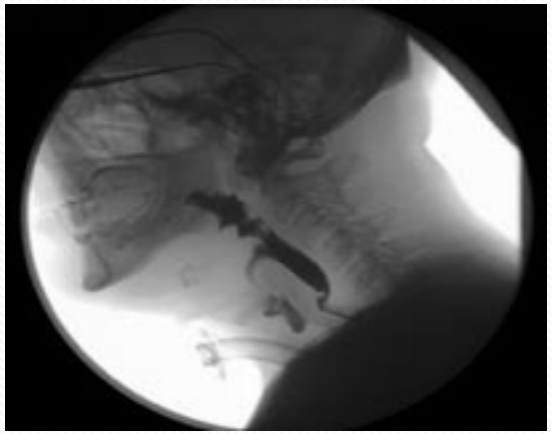
- History of Polio
- Partial to full recovery, a period of stability and then a reduction in function which cannot be fully explained by secondary complications
- New muscle weakness
- Fatigue
- Pain

Summary of the Common Issues

- The common issues as an allied health professional that you will encounter with someone who has had polio are:
  - Weakness
  - Fatigue
  - Pain
  - Functional Change
    - Walking
    - Falls

Assessment

- Multidisciplinary
- History of Polio
  - Severity of initial illness
  - Age of onset
  - Amount of recovery
  - Physical activity and function in intervening years
- Strength testing
- Swallowing/speech assessment
  - Videofluoroscopy
- Gait analysis
  - 10m walk
  - Gait rite
  - Walking cast
  - Falls history
  - Weight
- Home/work place assessment
- Psychosocial assessment

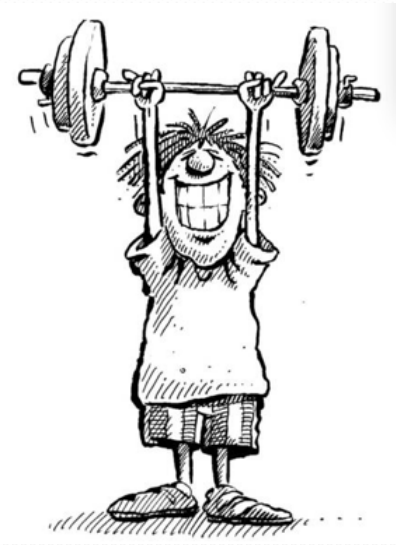


Approaches to Treatment

- Therapy for people who have had polio
  - Same approach as for many common presentations
- EXCEPT
  - Analyse holistically
  - Re-evaluate frequently
  - Try to predict the likely consequences of treatment choices – or your chosen treatment may not be successful

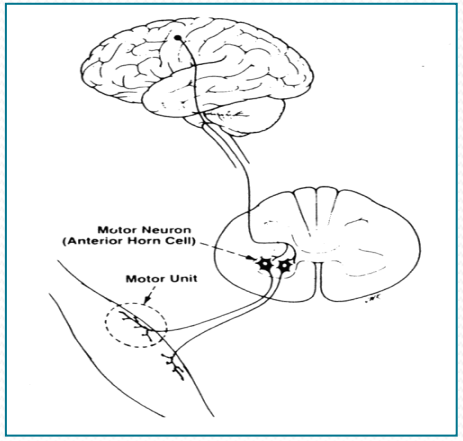
Weakness

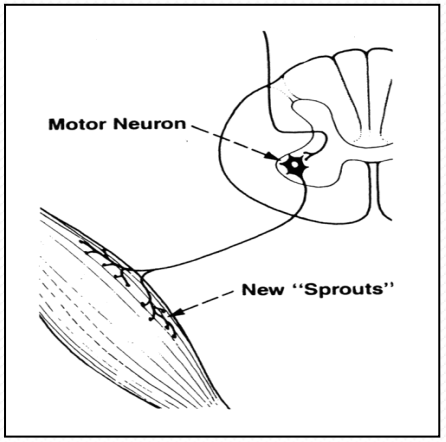
- Exercise – Concerns in a Polio Population
- Normal muscular strength improves by:
  - Hypertrophy
    - Increase myofibrils, capillary density, fibre size
    - Increased metabolic demands at motor unit level
  - CNS adaptations
    - Increased number motor units activated
    - Increase rate of activation
    - Increase synchronisation



Exercise – Concerns in a Polio Population

- Theoretical pathophysiology for polio-affected muscles:
  - Axonal sprouting has already put the motor unit under increased demands
  - Already performing at an "enhanced" level, therefore less reserve
  - Further demand results in axonal death → reduction in muscle cell innervation





- The Evidence Base
- Limited Quality!
  - Small sample size
  - Inconsistent use of randomisation or controls
  - Often not looking at long-term outcomes

Exercise Considerations

- "Non-fatiguing muscle training, in conjunction with rest, has a role in the management of individuals with PPS. Indications and exercise prescription parameters are based on detailed history and assessment of the client"
- Polio patients require closer monitoring than the normal population because of the risk of worsening muscle weakness and fatigue with excessive exercise

Dean E & Dallimore M (2005): Muscle function and training of individuals with chronic effects of poliomyelitis with and without postpolio syndrome. Physiotherapy Canada 57:19-32
Agre JC (1995): The role of exercise in the patient with post-polio

Weakness and Exercise

Why should patients with Polio Exercise?

- Improve and maintain strength
- Decrease fatigue
- Improve endurance
- Maintain muscle length
- Improve sleep patterns
- Improved mood
- Reduce risk of osteoporosis
- Help manage co-morbidities eg type 2 diabetes, hypertension, obesity….

Principles of Safe Exercise

- Make sure you know why you are prescribing the exercise
  - Addressing new weakness – is it overuse related
  - Deconditioning due to immobility
  - Targeted strengthening eg going into new orthotic, specific functional goal
- Appreciate the potential benefits vs the side effects of exercise
- Acknowledge the joint condition of polio and non-polio limbs
- Start the program gradually
- Include short rest periods during training and rest days in between
- Keep resistance or weight low-moderate
- Monitor response to the exercise
- Be particularly aware of pain and fatigue
- Regularly update the program

How do I monitor exercise

- Exercise needs to be performed without increasing overall fatigue levels or overusing muscles
- Signs that the program is too hard:
  - Limbs are reported to feel heavy
  - Reduction in the quality of movement
  - Quivering or flickering of muscles being exercised
  - Other parts of the body start to work harder (compensation for tired muscles)
  - Facial grimacing, jaw clenching or tensing of other body parts

Strength Training

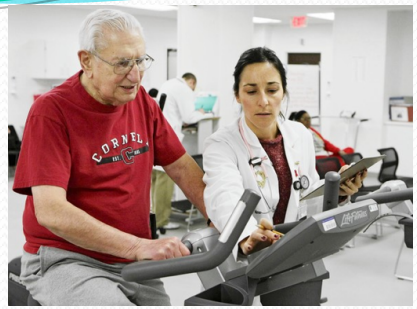
- Low resistance
- High repetitions
- Frequent rest

Example:

3 low resistance sets, of 8 repetitions (with 5 minute rests between sets), 3 times a week with a rest day between exercise days produces an increase in muscle strength without damage to the motor unit

Chan K et al (2003): Randomised Controlled Trail of Strength Training in Post-Polio Patients. *Muscle and Nerve* 27:332-338

Cardiovascular Training



- No high quality evidence providing guidelines for prescribing aerobic exercise
- Excessive CV training can exacerbate fatigue
- Principles of gaining fitness without worsening fatigue:
  - Moderate (rather than maximal) intensity
  - Short sessions with frequent rest
  - Adequate recovery time between session days
- Use Borg RPE/dyspnoea scales

Example: 20 minute sessions with frequent short rests as needed, 3 times a week with at least one day off in between sessions

Kriz J, Jones D and Speier J et al (1992): Cardiorespiratory Responses to Upper Extremity Aerobic Training by Postpolio Subjects. *Archives of Physical Medicine and Rehabilitation* 73:49-54

Hydrotherapy

- Benefits:
  - Buoyancy
  - Turbulence
  - Hydrostatic pressure
  - Resistance
  - Pain relief
  - Good for cold intolerance
  - Enables assisted task practice
    - Walking
    - Up/down stairs
  - Good medium in which to improve cardiovasular fitness
  - Enjoyable!
- Precautions:
  - Temperature
  - Adequate hydration

Example: 40 minute sessions, twice a week show reduction in exercising HR, less reported pain and positive subjective experience

Willen C, Sunnerhagen K and Grimby G (2001): Dynamic Water Exercise in Individuals with late Poliomyelitis. *Archives of Physical Medicine and Rehabiliation* 82:66-72.

Approaches to Treatment: Fatigue

- A sense of weariness that can be experienced in varying degrees. Different to normal tiredness
- Disproportionate or unrelated to physical activity
- Two types
  - Brain Fatigue (attention, cognition and alertness)
  - Physical Fatigue (muscle weakness and reduced endurance)

Stuifbergen AK, Rogers S (1997): The experience of fatigue and strategies of self-care among persons with multiple sclerosis. *Applied Nursing Research 10*(1);2-10

Bruno RL et al (1996) Polioencephalitis and the brain fatigue generator model of post-viral fatigue syndromes. *Journal of Chronic Fatigue Syndrome*, 2:5-27

Fatigue

- Fatigue is often the most debilitating symptom of PPS
- The cause of fatigue is multi-factorial, and can be influenced by:
  - Physical exertion
  - Sleep disturbance
  - Medication
  - Depression
  - Inadequate diet
  - Stress
  - Chronic pain
  - Co morbidity

- It is important that symptoms of fatigue are thoroughly investigated

Halstead, LS, Grimby G. eds. *Post Polio Syndrome*. Philadelphia: Hanley and Belfus, 1995

Fatigue

- Study at St Vincent's in 2001
  - 50% participants experienced fatigue daily over the last month
  - 32% wake feeling fatigued
  - 29% state that fatigue begins by late morning
  - 16% state that fatigue begins in the evening
  - 50% of people reported feeling fatigued all day
  - 39% of people reported their fatigue lasted 6-12 hours
  - Of all those who reported fatigue, 85% had been experiencing it for more than 12 months

Fatigue and Energy Conservation

- Study at St Vincent's in 2001
  - 95% of those who reported fatigue had implemented coping strategies
    - Napping
    - Reduction of activities
    - Receiving help from others
    - Using aids and equipment

Approaches to Treatment: Energy Conservation Techniques

Patient Education:

- Be aware of the time of day and duration of fatigue and plan activity and rest around that
- Plan the day around rest breaks, and ensure there is enough time for task completion
- Prioritise activities
- Delegate tasks where possible
- Self pace tasks when energy is available
- Respect signs of fatigue and respond accordingly

Approaches to Treatment: Functional Change

- Residual deficits of polio, such as muscle paralysis and joint deformity can cause major issues with pain and loss of function
- Functional change may be seen in alterations to walking pattern or more seriously with falls.
- This necessitates a gait assessment with a physiotherapist and an orthotist.

Falls

- Falls are the leading cause of injury related deaths in Australia in people over the age of 65.
- People with pre-existing conditions, such as polio, that causes muscle weakening and associated joint pathology are predisposed to falls.
- Injury following a fall is likely to lead to a loss of mobility and independence
- It is vital to prevent falls where possible.

Most falls occur within or around the home

- Environmental Factors
  - Floors
  - Lighting
  - Furniture
  - Electrical appliances
  - Stairs and steps
  - Outside the home
- Behavioral Factors
  - Avoid risk taking
  - Wear well fitting shoes
  - Use gait aids
  - Maintain your gait aids
  - Avoid hurrying
  - Have regular health check ups (BP, eyes, medication)
  - Hip Protectors

Approaches to Treatment: Orthotics

What if there is major joint instability of weakness which is not responding to treatment?

What if there is longstanding joint deformity?

- Orthoses may be indicated
- Orthotics are used to:
  - Assist with control of movement
  - Correct or prevent joint deformity
  - Compensate for muscle weakness
  - Improve energy efficiency
- Fitting of an orthosis with follow up gait training by a physiotherapist can make huge improvements to function.