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1. Introduction

This factsheet contains some general polio-related considerations that your doctors should understand when preparing you for anaesthesia.

So long as surgeons and anaesthetists have a basic understanding of polio, and in particular appreciate the widespread neurological damage that the virus caused, a general anaesthetic is no more dangerous for people who had polio than for anybody else.*i

Your doctors may not appreciate that the polio virus caused widespread neural destruction, not just damage to the spinal cord anterior horn (motor nerve) cell. We now know that these anatomic changes can have life-long implications that affect many aspects of anaesthesia care.

Some polio-disabled people may not know whether they ever had respiratory complications, because early respiratory failure might not have been diagnosed, but an assessment of lung health is especially important when assessing patients with a history of polio.*ii

Although no formal research studies have been done into this subject, some conclusions have been drawn from our understanding of polio, and from many decades of experience. The following review and practical advice is offered for you to share with your doctors. Your anaesthetist may have treated patients with “Long Covid”, so may already have a general understanding of the long-term implications of a systemic viral infection.

2. Post-Polio Symptoms

People who had polio years ago may now be experiencing new symptoms. These can include new or increased muscle weakness and fatigue with or without other symptoms like muscle and joint pain, muscle atrophy or wasting, breathing or swallowing difficulties or cold intolerance.

There is more information on PPS in other British Polio Fellowship leaflets.

3. Before Surgery

Your anaesthetist may suggest that you have some breathing tests done including a vital capacity (VC) help to predict risk. Some warning signs revealed in a pre-operative assessment may include:

- Initial need for an iron lung during the original polio infection: in this case full pulmonary function studies should be done.
- Vital Capacity (VC) less than 1.0 litre.
- Obstructive sleep apnoea (and use of CPAP at night).
- Worsening shortness of breath on exertion and heavier reliance on daytime oxygen

However, people who had mild or moderate polio with no respiratory complications can still develop respiratory problems years later, especially during anaesthesia.

Your anaesthetist should understand that all patients who have had polio, even those who seem to have recovered completely, have an increased risk of chronic hypoventilation, initially at night, or sleep apnoea, because muscle weakness often remains hidden, manifesting mainly as muscle fatigue. You should be asked about symptoms such as morning headache, frequent waking, and daytime sleepiness.

Your anaesthetist may decide that you need more lung function tests to check for respiratory muscle weakness and nocturnal hypoventilation, and possibly a sleep study as well.

4. During Surgery

- Post-polio patients are nearly always very sensitive to sedative medication, and emergence from a general anaesthetic can be prolonged. This is probably due to central neuronal changes, especially in the reticular activating system, from the original disease.
- Non-depolarizing muscle relaxants cause a greater degree of block for a longer period of time in post-polio patients. Patients have less muscle mass, and the polio virus destroyed neuromuscular junctions throughout the entire body, even in muscles that seem to

- have been spared, and this makes all muscles hypersensitive to muscle relaxants, risking overdose.
- Anaesthetists have learned to start with half the usual dose of whatever is being used, adding more as needed. This is because the poliovirus actually lived at the neuromuscular junctions during the original disease, and there are extensive anatomic changes there, even in seemingly normal muscles, which make for greater sensitivity to relaxants.
 - The autonomic nervous system is also damaged by the polio virus, probably because inflammation and scarring in the anterior horn "spills over" to the intermediolateral (sympathetic) column. Your anaesthetist should therefore watch for:
 - gastro-esophageal reflux ("acid reflux")
 - tachyarrhythmias (irregular heartbeats) and difficulty maintaining blood pressure
 - Removing the endotracheal tube at the end of the operation and re-establishing adequate spontaneous ventilation is often a problem, so the use of nasal or face mask ventilation can be helpful at least immediately after surgery, until the patient is able to return to normal ideally unassisted - breathing. The use of nasal or face mask ventilation after removing the endotracheal tube is especially recommended if individuals normally use this type of ventilation at night-time.
 - Positioning a polio patient can be difficult because of atrophy and scoliosis. Bones in affected limbs are osteopenic and can easily be fractured during positioning for surgery. There is a higher risk of peripheral nerve damage, including to the brachial plexus and ulnar and median nerves.
 - Severely weak polio survivors have a greatly reduced muscle mass. Because muscle normally contains a great deal of blood and requires a substantial blood supply to function, if much of that mass is lost, the total blood volume is reduced. This demands precise and complete replacement of blood lost during surgery.
 - Polio survivors' lost muscle is replaced with fat, and fat cells contain less water than do muscle cells, so electrolyte disturbances, particularly potassium loss, require careful and precise balance and replacement.

5. Epidural instead of General Anaesthetic

Epidural anaesthesia blocks conduction in sensory nerves but has less effect on motor nerves. The effect on all nerves is only transient and does not

cause any permanent damage. Epidurals are sometimes offered as an alternative to a general anaesthetic because patients recover more quickly. Epidurals have been given to many people who have had polio and only rarely have adverse effects on nerves, or the spinal cord been reported.

Nowadays epidurals are often given using a combination of a low dose of bupivacaine with a low dose of pain-killing drug of morphine type, the advantage of such a combination being that post-operative pain is reduced.

Epidurals are not without risk in PPS; there are case reports*ⁱⁱⁱ that higher doses of a local anaesthetic such as bupivacaine cause temporary muscle weakness of nearby muscles such as the lower intercostals (muscles which help breathing via the ribs). In polio people who already have significant breathing muscle involvement, epidurals for upper abdominal surgery can affect post-operative breathing, so assisted breathing using a machine may be needed for some hours after such surgery.

6. After Surgery

- Polio survivors should be kept under close observation following a general anaesthetic and should not be left unattended in the recovery room.
- This is primarily because breathing can be severely affected, especially in patients who rely on ventilators, and some patients who did not need mechanical ventilation go onto a ventilator (including long-term use) after a general anaesthetic.
- Regardless of how carefully drugs were titrated, polio survivors can take much longer to recover and resume independent breathing.
- Succinylcholine can cause severe muscle pain after surgery, and it is best avoided, if possible.
- More widespread pain can result from anatomic changes caused by the original disease; this is thought to be due to "spill-over" from the pain pathways in the inflammatory response. Proactive, specialist post-operative pain management helps, and this may include local anaesthesia at the incision plus patient-controlled analgesia.
- Intubation and anaesthesia can cause laryngeal and swallowing problems due to muscle weakness. Many patients have at least one paralysed vocal cord before surgery, and bilateral cord paralysis has been seen after surgery.

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*i Perioperative care in restrictive respiratory disease, JA Patrick, M Meyer-Witting, F Reynolds and GT Spencer, Anaesthesia, 1990, Vol 45, p390-395.

*ii Review "Postpolio Syndrome and Anesthesia" by David A. Lambert, MD; Elenis Giannouli, MD; & Brian J. Schmidt, MD, The University of Manitoba, Winnipeg, Canada, in the September 2005 issue of Anesthesiology (Vol. 103, No. 3, pp 638-644).

*iii Schwartz A, Bosch LM, Anesthetic implications of postpolio syndrome: new concerns for an old disease by. AANA J. 2012 Oct;80(5):356-61.