POLIO AND BONE HEALTH

By Frances Quinn - BPF Expert Panel Member

1. Introduction

As polio survivors, we are very aware of the damage to our motor neurons and the impact that had on our muscles. What may be less well understood is the impact of this on our bones. Due to reduced mobility and weight bearing activity, we have an increased likelihood of lower than average bone mineral density (osteopenia). If the bone mineral density (BMD) is very low, it can lead to very fragile bones which are at risk of fractures, a condition called osteoporosis.

Living our lives with weakened or atrophied muscles also increases the risk of falls. For those with osteoporosis, falls are more likely to result in life-changing fractures.

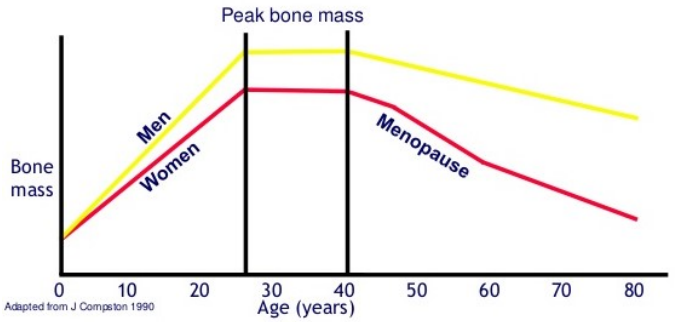
Best management of these issues is helped by understanding a bit more about the risks, what treatment is available and what changes in our lifestyle can help. These can be simple like looking for and removing trip hazards in our home. Improving the food we eat can support our bone health.

2. Bone growth

Bones are complex systems made up of compact bone, spongy honeycomb-like bone and are filled with bone marrow. They are living tissue and interact with the rest of the body by a network of blood vessels and nerves, metabolically active and constantly changing. Cells called osteoblasts build new bone and older bone is reabsorbed with the help of cells called osteoclasts. When we are growing, more bone is made than is reabsorbed. Typically, bone mass reaches a peak in the twenties and then reduces from about the forties. Women have lower bone mass than men, and following menopause, this reduces more quickly than for men (see the graph opposite). Weight bearing physical activity stimulates bone formation as does the push and pull of muscle activity.

Bone mass or density that is too low leads to osteoporosis and a risk of 'fragility fractures'. These are defined as fractures following a fall from standing height or less - when normally no damage would be done. In the spine, they may occur as a result of ordinary activities such as bending or lifting.

Changes in bone Mass by Age



There are an estimated 3 million people in the UK with osteoporosis, and 300,000 fragility fractures each year. The risk of 'osteoporotic' fractures in the wrist, spine and hip increases strongly after the age of 70 but can occur much younger.

Many things besides low physical activity can affect the health of bones and increase risk. Older age, being female and post menopause, family history, some medicines and some health conditions. Poor nutrition, smoking and alcohol also increase the risk of weakening bones.

3. Polio and bone health

People who contracted polio will have had decades of reduced mobility and less weight bearing activity and are thus likely to have lower bone mass than average. The exact effect on bone strength will depend on the degree and location in the body of the motor neuron and muscle loss. It is also possible that areas of the body that are compensating for weaker areas may even have higher bone mass.

A recent study in Ireland looking at bone health in 50 post-polio patients attending outpatient clinics found that 28 (56%) had osteoporosis. This is five times higher than the estimated rate of 10% for the general population of a similar age range. Like other studies in Canada, Turkey and Israel, these show that polio survivors are at increased risk of osteoporosis.

The risk of falls and fractures is also higher than average in polio survivors, and more likely on weaker limbs. Eight out of nine recorded hip fractures in the Irish study were on the weaker leg and resulting from falls from a standing height - fragility fractures. The impact of a fall on daily activities is likely to be greater -it is less likely that another limb can compensate while the injury heals.

The British Polio Fellowship Health Survey carried out in 2013/14 found that 86 (25%) out of 378 members responded that they had either osteoporosis or osteopenia, 70 of whom were women and 16 were men. This number is only those who know they have a low BMD. The published studies suggest many more may be undiagnosed and therefore untreated.

4. Assessment and diagnosis

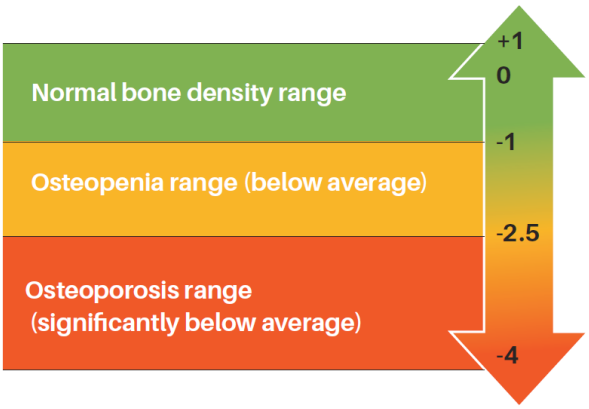
There are rarely any early signs of a problem, or any pain until a fracture occurs. This makes assessment of fracture risk very important. Many factors such as those mentioned earlier will be included in assessing a person's risk.

If you feel you would benefit from a fracture risk assessment, this may be carried out by your GP, or they might refer you to a fracture clinic or a fracture liaison service (FLS: these services are aimed at reducing further fractures in people who have had a fragility fracture). They will ask a series of questions to look at your personal risk of a fracture in the next 1 0 years. They may use a computer 'tool' to do help with the calculation of risk, such as FRAX or Qfracture. Qfracture includes falls history in its calculation, but FRAX does not, so make sure you tell the health care professional about your falls history and your balance. As polio survivors have a high risk of falls, a falls risk assessment would also be useful if you haven't already had one.

Following this, you may be referred for a measurement of bone density using DXA (sometimes called DEXA: dual-energy X-ray absorptiometry). This uses low energy X-rays to measure the density of bone - most often in the hip and spine and usually only on one side. People who have had polio should have both sides measured (both hips) as there can be large differences Z scores are used for young people who are still growing and is the difference between your measurement and someone of the same age. Above -1 SD is considered normal, below -2.5 SD is defined as osteoporosis.

This score only measures bone density, which is related to bone strength, it does not measure the 'quality' of the bone and is only one aspect of assessing risk. The results will be sent to your doctor who will then advise on any recommended treatments.

Measuring Bone Density



5. Non-medical management

Depending on your risk assessment and your preference, you may not be offered a drug treatment. You may be recommended to do a combination of things to reduce your falls risk and/or improve your bone health.

Reducing falls risk

As we know well, and many studies have proved, falls are very common among polio survivors. A recent Swedish survey of people who had polio, average age 69, found that three-quarters had fallen at least once in the previous year, and one quarter had fallen five times or more. Two thirds had been injured as a result. 10% who fell had fractures, twice as high as in the general population. They also found that most were afraid of falling, and nearly half had decreased their walking as a result.

Reducing the risk of falls is clearly very important for those with neuromuscular weakness caused by polio. The challenge is to also reduce the fear of falling and to maintain mobility.

A falls prevention assessment and course may help by looking at your home environment, handrails, ensuring well-fitting supportive shoes, and checking your eyesight and hearing. Balance training may also be possible for those who are still mobile and can involve very simple exercises like standing with your eyes closed for short periods.

An occupational therapist may be very helpful, especially if they are experienced in supporting people with neurological conditions. Independent Age has a good falls prevention checklist on their website.

Other aspects of post-polio management may help to reduce falls. Managing fatigue by pacing or adapting activities can preserve energy. Addressing any problems that affect sleep such as breathing issues or sleep apnea can improve alertness during the day. Pain management may help ease of mobility. Keeping muscles warm can help them function at their best.

Improving bone health
Look to reduce activities that weaken bones, for example, limiting alcohol consumption and stopping smoking. In the Irish polio study, six out of the seven men who had osteopenia had a history of smoking. Good nutrition can also help.

Physical activity is very important for strong bones. For polio survivors, exercise and physical activity can present great challenges. However, it is important to preserve what activity is possible and reviewing mobility aids and orthotics may help. Any physical activity or exercise programme must be non-fatiguing and pain-free.

Recent studies have investigated whole body vibration therapy to see if it can improve bone health. However, a major US review found very little scientific evidence for benefits or harms. A small three-month study in Texas (2018) looked at the possibility of using it as a form of weight bearing exercise in polio survivors. While some improvements in walking speed and pain were seen, and no adverse events occurred, this is only a starting point for future study. At present, these machines are not approved for medical use in the US and are unregulated and with wide variation in design and unclear risks. It may be that after more research, that these might be helpful for polio survivors in the future.

6. Medical Treatment

A wide range of drugs have been shown to increase bone density and reduce fracture risk. These mostly work by reducing the rate of absorption of bone, sometimes called anti-resorptive drugs, or by stimulating the growth of bone, called anabolic drugs. Some can do both. The range of drugs and how effective they are is changing all the time - to get the most up to date information it is best to talk to your GP, fracture service or consultant. The Royal Osteoporosis Society has a helpline run by specialist osteoporosis nurses who can provide information.

Bisphosphonates, such as alendronic acid or risedronate, are the generally prescribed drugs for treatment of osteoporosis These slow the rate that bone is broken down. Some are tablets and some have to be injected. The selective oestrogen receptor modulator Raloxifene has a similar effect on bone to oestrogen and helps to maintain BMD. Hormone replacement therapy (HRT) has been shown to keep bones strong but is rarely used for osteoporosis. Testosterone treatment can be used if bone loss is caused by low levels of male hormones.

All medications have side effects. These can be quite minor, like irritation of the throat, or more serious. Some have a very rare side effect of causing an atypical fracture of the thigh bone (AFF), or delayed healing of the jaw. These very rare side effects are more common with intravenous drugs and longer-term use (greater than 2 to 5 years).

The offered treatment will be based on which one is most appropriate for you, depending on the main cause of the osteoporosis, sex, individual fracture risk assessment without treatment, and previous history. Any drug treatment should be reviewed regularly.

7. Key points

- Polio survivors are at increased risk of osteopenia and osteoporosis
- Polio survivors have a high incidence of falling
- Consider talking to your GP about your bone health and fracture risk; include your polio history, your mobility and falls
- A falls risk assessment could be useful
- If referred for a DXA scan, both sides should be measured
- Look at the simple things you can do to reduce falls risk - use a falls checklist
- Good nutrition can improve bone health
- Regular review of any recommended management or drug treatment is essential

8. Further information

- NHS – Osteoporosis Treatment
- NHS - Bone density scan (DEXA scan)
- Royal Osteoporosis Society – Factsheets and Booklets (Helpline 0808 800 0035)
- The International Osteoporosis Foundation - No More Broken Bones
- Independent Age - Falls Prevention Checklist

Key Polio and PPS research

Mohammad, A.F.; Khan, K.A.; Galvin, L.; Hardiman, O.; O'Connell, P.G. High incidence of osteoporosis and fractures in an aging post-polio population. Eur. Neural. 2009, 62, 369-374.
Sherf, R. M., Cantrell, D., Or, K., Marcus, E., Shapira, A., Benbassat, C., Koren, R. (2020).
The Risk of Bone Fractures in Post-Poliomyelitis Patients Transitioning to Middle Adulthood. Endocrine Practice, 26(11), 1277-1285.
Skough Vreede, K., Broman, L., & Borg, K. (2020). Is Intervention to Prevent Falls Necessary in Prior Polio Patients? J Rehabil Med Clin Commun, 3, 1000023.
Agency for Healthcare Research and Quality (US). (2020). Whole-Body Vibration Therapy for Osteoporosis. Technical Brief 10.