Parkinson’s disease (PD) is a chronic progressive neurodegenerative disorder affecting 5% and 8% of the population in residential aged care. People with Parkinson’s in aged care facilities suffer a high disease burden due to functional impairment, drug complications (such as hallucinations) and comorbidities associated with PD (such as dementia and incontinence). They also have a high falls rate, contributing to increased hospital admission rates.

People with Parkinson’s disease are at a higher risk of both osteoporosis and osteopenia compared to healthy people of the same age, with a lower bone mineral density (BMD) and an increased risk of falls and fractures. Females are at a greater risk than males.

**Definitions**

Parkinson’s disease is a movement disorder, first described by James Parkinson in 1817 as an “involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported, with propensity to bend the trunk forward and to pass from a walking to a running pace, the sense and intellects being uninjured.” The cardinal symptoms of PD are postural instability, akinesia or bradykinesia, cogwheel rigidity and resting tremor. PD is not simply a motor disease and its non-motor symptoms can impact significantly on quality of life. These include gastrointestinal dysfunction, foot dystonia, falls and hip fractures, and neuropsychiatric problems (eg depression, dementia, memory loss, anxiety, and confusion).

Osteoporosis and osteopenia describe a reduction in BMD and places older people at a higher risk of fractures, particularly in the spine, hip and wrist. According to the WHO criteria, osteoporosis is defined as a BMD that lies 2.5 standard deviations or more below the average value for young healthy women (T-score); and osteopenia is T-score between –1 and –2.5.

Half of all women and approximately one third of all men over 60 will be affected in their lifetime by osteoporosis.

Multiple factors contribute to the risk of osteoporosis:

- Age
- Gender (females > males)
- Family history
- Low body weight
- Smoking status
- Vitamin D status
- Poor dietary calcium intake

Numerous medications predispose people to osteoporosis, including glucocorticoids (eg prednisone, prednisolone), aromatase inhibitors for breast cancer (eg anastrazole, letrozole), thyroxine, glitazones (eg rosiglitazone, pioglitazone), SSRI antidepressants and anticonvulsants (eg phenytoin, carbamazepine). Regular use of higher dose PPI is associated with increased risk of hip fracture among postmenopausal women, with the strongest risk observed in individuals with the longest duration of use or with a history of smoking.

**Parkinson’s disease and osteoporosis**

Studies have shown that over 90% of females with Parkinson’s disease report osteoporosis or osteopenia, and over 60% of males. BMD of patients with PD is lower compared to healthy people, thus worsening the fracture risk.

Low body weight and low physical activity, often seen with patients with PD, are risk factors for low BMD. Patients with PD are at risk for poor nutrition for several reasons, such as impaired hand-mouth co-ordination, dysphagia, intestinal hypomotility, depression, cognitive deficits and side effects of medications. At the same time, there is an increased energy requirement due to muscular rigidity and involuntary movements.

**Fracture risk**

PD has been shown to be the strongest single contributor to fracture risk.

The most common fracture is in the hip (neck of femur), accounting for half of all fractures in people with PD. This is in contrast to the fracture type in people without PD, where the most common fragility fracture is a fracture of the spine.
fracture is in the spine. This predisposition to hip fractures may reflect that falls are often in a sideways or backward direction.

Postural instability, orthostatic hypotension, reduced muscle strength, motor fluctuations, cognitive impairment and physical deconditioning associated with PD contribute to an increased risk of fractures from falls. Physical inactivity which worsens as the disease progresses can contribute to bone loss in PD.

Other factors contribute to fracture risk:
- Gait impairment
- Polypharmacy
- Sedentary lifestyle
- Reduced sunlight exposure
- Vitamin D deficiency (secondary hyperparathyroidism)

Vitamin D deficiency and decreased mobility reduce muscle strength. Vitamin D deficiency is highly prevalent in Australian aged care facilities. Australian guidelines recommend vitamin D supplementation is recommended for all patients in residential aged care facilities. Dietary calcium intake should be optimised and supplementation offered to those with inadequate intake. The total dietary and supplement intake should be 1200–1500 mg per day. Vitamin D is required for calcium absorption and plays a crucial role in bone metabolism.

People with PD often experience depressed mood and concomitant use of SSRI antidepressants are associated with a 3 to 5-fold increased risk of hip fractures. High-dose antipsychotics are also associated with an increased hip fracture risk. Tricyclic antidepressants (TCAs) are not associated with an increased risk of osteoporotic fracture.

Levodopa
Levodopa is central to treatment of PD. However, it has been implicated as an independent risk factor for fracture, reduced BMD and reduced bone strength. This risk may be dose-dependent.

Levodopa commonly causes orthostatic hypotension and slowed reflexes during falling. Levodopa improves some motor deficits but tends not to improve postural instability. Patients are potentially more mobile with less rigidity and freezing, but at an increased risk of falls.

Management
Treatment and prevention of osteoporosis in patients with Parkinson’s disease involves:

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Smoking cessation and reduction in alcohol intake should be encouraged for all people with PD. Physical activity programs within individual capacity should be offered and encouraged. Supplementation with calcium, vitamin D, folic acid and vitamin B12 are recommended when dietary intake is insufficient.

Bisphosphonates (eg alendronate, risedronate) are first-line recommendations for the prevention and treatment of osteoporosis. No drug interactions occur with levodopa, dopamine agonists or other medications used to treat PD. Patients with swallowing problems can be prescribed once yearly intravenous zoledronic acid or six-monthly subcutaneous denosumab.

Summary
There is a significant association between Parkinson’s disease, reduced BMD and the risk of osteoporosis. It is essential to monitor multiple risk factors to assess the risk of osteoporosis and reduce the risk of fractures. Falls risk programs are essential to prevent fractures in residents with Parkinson’s disease. Ensuring adequate dietary calcium and sunlight exposure or supplements is critical to maintain good bone strength.

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