Parkinson’s disease (PD) is a progressively degenerative neurological disorder which affects the control of body movements. One in every 350 Australians lives with Parkinson’s disease. It is conservatively estimated that in 2011 over 64,000 Australians were living with PD, of which, 52% were male and 48% were female. In 2011, an estimated 6,600 people with Parkinson’s disease were residing in aged care facilities.

People with Parkinson’s disease have a high risk for osteoporosis and reduced bone mass. A recent study showed over 10% of people with Parkinson’s disease has osteoporosis, and nearly half are osteopenic. Males with Parkinson’s disease have a higher risk for osteoporosis than females.

**PD symptoms**
The cardinal motor symptoms of Parkinson’s disease are tremor, rigidity, bradykinesia (slowness of movement) and postural instability. Postural instability can lead to a stooped posture and is often accompanied by impaired balance and coordination.

Non-motor symptoms can also occur and are often under-recognised. These symptoms can occur at any stage of the disease, and may precede the motor symptoms by more than a decade. Non-motor symptoms can be neuropsychiatric, sleep disorders, and autonomic, gastrointestinal or sensory symptoms, and include:

- Depression, anxiety
- Hallucinations
- Dementia
- Panic attacks
- Restless legs
- Insomnia
- Bladder disturbances (nocturia, frequency, urgency)
- Erectile dysfunction
- Nausea, constipation, vomiting
- Incomplete bowel emptying
- Dysphagia
- Pain
- Fatigue
- Postural hypotension

**Postural instability and falls**
Postural instability and gait disturbances associated with Parkinson’s disease increase fracture risk.

Postural hypotension may be caused by the disease itself or the medications used to treat Parkinson’s disease. It is defined as a symptomatic drop of 20 mm Hg in systolic or 10 mm Hg in diastolic blood pressure when shifting from a lying or sitting position to standing. Residents may experience lightheadedness or syncope, or nonspecific complaints including fatigue, unsteadiness, headache, neck tightness, and cognitive slowing.

Levodopa (contained in *Madopar* and *Sinemet*) is the most common medicine used to treat Parkinson’s disease. It can however cause low blood pressure and postural hypotension, increasing the risk of falls. Anticholinergics such as benztrapine (*Cogentin*), biperiden (*Akineton*) or benzhexol (*Artane*) are used to treat tremor and can also cause postural hypotension.

**Bone loss**
Not all fractures in people with Parkinson’s disease are related to falls. People with Parkinson’s disease have lower bone mineral density (BMD) than those of the same age without the disease. This is probably due to a number of factors relating to Parkinson’s disease:

- Immobility
- Vitamin D deficiency
- Decreased muscle strength
- Low body weight
- High homocysteine levels

**Physical activity**
People with Parkinson’s disease are often less active due to motor symptoms and postural instability. Immobility is associated with bone loss in Parkinson’s disease.
Vitamin D
Vitamin D is necessary for absorption of calcium from the diet and plays a crucial role in bone metabolism. Inadequate serum 25-hydroxyvitamin D (25-OHD) levels are associated with muscle weakness and increased incidences of falls and fractures. A deficiency of vitamin D in people with Parkinson’s disease may be related to malnutrition, immobility and lack of exposure to sunlight.

Current Australian guidelines recommend a serum 25-OHD level of 50nmol/L or greater at the end of winter and 10–20nmol/L higher at the end of summer to allow for a seasonal decrease, for optimal musculoskeletal health.

Muscle strength
Both vitamin D deficiency and decreased mobility reduce muscle strength.

Low body weight
Low body weight is a risk factor for low BMD in PD. People with Parkinson’s disease are at a high risk of poor nutrition for a number of reasons, such as impaired coordination when eating, depression, dysphagia (swallowing problems), slowed gastrointestinal motility and side effects of medications. In addition, there is an increased energy requirement due to muscular rigidity and involuntary movements.

Homocysteine
High homocysteine levels are an independent risk factor for osteoporosis. This may be due to levodopa use for the treatment of Parkinson’s disease, as well as vitamin B12 and folic acid deficiency.

Management
Smoking and alcohol are well known risk factors for osteoporosis, so residents should be supported with smoking cessation strategies and medications, and should reduce alcohol consumption. Exercise within limits, and improving muscle strength and balance is important.

A few studies have shown that treatment with bisphosphonates, vitamin D and calcium supplements can increase BMD and reduce fractures in people with Parkinson’s disease.

Vitamin D supplementation is recommended for all residents in residential aged care facilities (RACFs). Vitamin D in the form of colecalciferol (Vitamin D3) should be administered in a dose of 800IU daily or higher. Vitamin D supplementation of up to 1,000-2,000 IU per day is considered safe and beneficial. Residents shown to be deficient require 3000-5000IU daily for 6 to 8 weeks, followed by the maintenance dose. Access to sunshine for nursing home residents improves vitamin D status.

Calcium intake from diet is usually around 500 to 900mg per day. Supplementation to reach a combined total of 1,300mg daily for women 50 years and older, and men 70 years and older is recommended. Recent evidence suggests that excessive supplementation may increase the risk of myocardial infarction.

Supplementation with folic acid and vitamin B12 may reduce homocysteine levels and prevent bone loss in people treated with levodopa.

Treatment with bisphosphonates can decrease bone loss in PD. Bisphosphonates include:

- Alendronate (Fosamax)
- Risedronate (Actonel)
- Zoledronic acid (Aclasta)
- Enteric coated risedronate (Actonel EC) may be taken with or without food, whereas alendronate must be taken at least 30 minutes before food or drink. Zoledronic acid is administered by intravenous infusion once per year.

Other anti-osteoporotic medications raloxifene (Evista), denosumab (Prolia) and strontium ranelate (Protos) are effective in treating osteoporosis, but have not been evaluated in people with Parkinson’s disease.

Summary
Parkinson’s disease and osteoporosis are two common conditions which affect a substantial proportion of the older population. A number of factors influence the risk of falls and fractures in people with Parkinson’s disease. These factors include use of levodopa, low body weight and malnutrition, vitamin D deficiency, decreased muscle strength and mobility. Lifestyle factors and exercise, dietary supplementation and anti-osteoporotic medications contribute to management and treatment.

References
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