

## Cochrane Corner



## What are the effects of exercise for improving outcomes after osteoporotic vertebral fracture? - A Cochrane Review summary with commentary

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The aim of this commentary is to discuss in a rehabilitation perspective the published Cochrane Review "Exercise for improving outcomes after osteoporotic vertebral fracture"<sup>1</sup> by Gibbs JC et al.<sup>3</sup>, under the direct supervision of Cochrane Musculoskeletal Group. This Cochrane Corner is produced in agreement with the Journal of Musculoskeletal and Neuronal Interactions by Cochrane Rehabilitation.

### Background

Osteoporosis is a skeletal condition characterized by decreased density (mass/volume) of normally mineralized bone, with a consequent increase in bone fragility and susceptibility to fracture. Fragility fractures result from low-energy trauma, most commonly in the spine (vertebrae), hip, distal forearm and proximal humerus, but also described for many other sites<sup>2</sup>. The lifetime incidence of any osteoporotic fracture is estimated to be 40% to 50% in women and 13% to 22% in men<sup>3</sup>. Fragility fractures, especially those of the hip and vertebra, are associated with increased mortality and

significant morbidity (pain, deformity, depression, impaired physical performance, reduced quality of life).

The absolute risk of a subsequent vertebral fracture among women with a prevalent vertebral fracture and osteoporosis has been reported to be 50%<sup>4</sup>. A person who sustains one fracture is at 50% to 100% higher risk of having another one<sup>3</sup>. That is why it is very important that such individuals are directed for fracture preventing strategies.

The management of osteoporosis is multimodal, including both pharmacological and non-pharmacological interventions. Exercise is recommended to slow the rate of bone loss<sup>5</sup>. There are specific exercise recommendations for individuals with osteoporotic vertebral fractures, that include resistance, balance and aerobic exercise training (postural corrections, balance training, trunk and lower extremities muscle training exercises and aerobic physical activity). The goals are to increase spine stability, improve functional performance, and decrease the risk of falls and fractures<sup>6,7</sup>.

A recent Cochrane review searched for evidence of the effects of exercise interventions directed to adults with a history of vertebral fractures<sup>1</sup>.

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## Exercise for improving outcomes after osteoporotic vertebral fracture

(Gibbs JC, MacItyre NJ, Ponzano M, Temleton JA, Papaioannou A, Giangregorio LM, 2019)

### What is the aim of this Cochrane review?

The aim of this Cochrane Review was to assess the effects (benefits and harms) of exercise intervention among adults with a history of vertebral fractures.

### What was studied in the Cochrane review?

The population addressed in this review was men and women over the age of 40 years with a history of non-traumatic or minimal trauma osteoporotic fracture of one or more vertebrae. The exclusion criteria were: contraindications to exercise (heart or pulmonary disease, inflammatory or joint disease, severe osteoarthritis, psychiatric condition, neuromuscular condition), secondary causes of osteoporosis, radicular signs or symptoms, back pain radiating into lower limb, physiotherapy in the last 6 months or previous participation in pain management program for back pain. The studies included exercise interventions provided to outpatients: home-based, clinical based and home exercise programmes and centre based interventions.

The exercise interventions studied were exercise: muscle strengthening or resistance training, aerobic exercise, balance training, Tai Chi, or individualized exercise alone or as part of a multi-modal physical therapy intervention of at least four weeks duration. The intervention was compared to: a) non-exercise/non-active physical therapy intervention; b) no intervention; c) placebo.

Data were pooled for Timed Up and Go test, self-reported physical function measured by the QUALEFFO-41 physical function subscale score (scale of zero to 100; lower scores indicate better self-reported physical function), and disease-specific quality of life measured by the QUALEFFO-41 total score (scale of zero to 100; lower scores indicate better quality of life).

The major outcomes studied were incident fragility fractures of the hip, vertebra or other sites; incident falls; pain; physical performance; health-related quality of life; adverse events (other than fragility fractures or falls). The minor outcomes studied were posture, muscle function, balance, bone mineral density of the lumbar spine or hip, fear of falling, patient global assessment of success.

### Search methodology and up-to-dateness of the Cochrane review?

Authors have updated the results of their previous Cochrane Review published in 2013<sup>8</sup> including studies until March 2019.

## What are the main results of the Cochrane review?

The review included nine randomized control trials and quasi randomized trials, involving 749 participants, among them 68 male participants.

There was considerable diversity in the frequency, intensity, and duration of interventions, as well as follow-up periods: the frequency varied from daily exercise interventions to twice per week; no specific intensity was mentioned; the duration of the intervention – from 4 to 52 weeks; assessment was made before and after the intervention period with a follow-up from 4 weeks to 52 weeks.

The limited number of studies, the diversity of outcomes reported, measurement tools and duration of follow-up prevented any meaningful pooling of data for most outcomes. The review shows that:

#### Major outcomes:

- **Incident fragility fractures (Very-Low Quality Evidence, 1 study):** no reported group difference on incident fragility fractures (risk ratio (RR) 0.54, 95% confidence interval (CI) 0.17 to 1.71; control: 184 per 1000 and exercise: 100 per 1000, 95% CI 31 to 315; absolute difference 8%, 95% CI 2 to 30).
- **Falls (Very-Low Quality Evidence, 1 study):** no reported group difference on incident falls (RR 1.06, 95% CI 0.53 to 2.10; control: 262 per 1000 and exercise: 277 per 1000; 95% CI 139 to 550; absolute difference: 2%, 95% CI -12 to 29).
- **Pain (Very-Low Quality Evidence, 5 studies):** uncertain results with no firm conclusion about the benefits of exercise for improving pain, because the trials were too diverse and certain studies showed no evidence of clinically important benefits for this outcome. The range of estimates (MD between change from baseline for exercise and control groups) for pain outcomes were: -0.52 points to -2.0 points (after 4 to 12 weeks); -0.45 points to -0.73 points (after 16-24 weeks); and -0.97 points to -1.28 points (after 52 weeks). Narrow 95% CIs indicate a possible effect of exercise on these pain outcomes. No between-group differences were found in two studies.
- **Physical Performance (From Moderate to Very-Low Quality Evidence, 5 studies):** a small between-group difference in favor of exercise on performance of the Timed Up and Go test, which did not change following a sensitivity analysis (MD -1.09 seconds, 95% CI -1.78 to -0.40; 3 studies; moderate-quality evidence). Exercise improved QUALEFFO-41 physical function without any clinically important differences (MD -2.84 points, 95% CI -5.57 to -0.11; 2 studies; very low-quality evidence).
- **Quality of Life (Very-Low Quality Evidence, 2 studies):** uncertain that exercise could improve quality of life, because certain studies showed no evidence of clinically important differences. QUALEFFO-41 total score (MD -3.24 points, 95% CI -6.05 to -0.43).
- **Adverse Events (Very-Low Quality Evidence, 3 studies):** trials reported four adverse events related to exercise

interventions (costal cartilage rib fracture, rib fracture, knee pain, irritation to tape).

#### Minor outcomes

- Posture (no between group differences), muscle function (uncertain), balance (uncertain), bone mineral density (uncertain), fear of falling (positive results in favor of the intervention group). Individual trials did report benefits for some minor outcome measures, including balance, back extensor muscle strength, trunk muscle endurance, bone mineral density and fear of falling.

#### How did the authors conclude?

The authors concluded that there was no sufficient evidence to determine the effects of exercise on incident fractures, falls or adverse events. There was moderate quality evidence that exercise probably improves physical performance, specifically Timed Up and Go test, in individuals with vertebral fracture (downgraded due to study limitations). Although individual trials reported benefits for pain and some disease specific quality of life outcomes, the findings do not represent clinically meaningful improvements and should be interpreted with caution, because of the very low-quality evidence. The ability to pool outcomes and make conclusions was limited, because of the small number of trials and the variability across them. Evidence regarding the effects of exercise after vertebral fracture in adults is scarce.

#### What are the implications of the Cochrane evidence for practice in rehabilitation?

Fragility fractures, especially those of the hip and vertebra, are associated with increased mortality and significant morbidity (pain, deformity, depression, impaired physical performance, reduced quality of life).

It may not be appropriate to generalize results of exercise studies conducted in older adults without vertebral fractures to those with vertebral fractures, because it may be necessary to tailor exercise to address the specific impairments. More adequately powered high-quality randomized control trials are needed to assess the safety and effectiveness of exercise to lower incidence of fracture

and falls and to improve patient-centered outcomes (pain, function) for adults with vertebral fractures.

#### Acknowledgements

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