

# Rehabilitation in osteoporotic vertebral fractures

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## Summary

**Vertebral fractures occur particularly in osteoporotic patients due to an increased bone fragility. Vertebral fractures influence the quality of life, mobility and mortality. Preventive training exercises and proprioception reeducation can be utilised for improving posture, balance and level of daily function and for decreasing pain. Quality of life is improved even beyond the active training period. This mini review provides information based on the literature for the rehabilitation of osteoporotic vertebral fractures after conservative or surgical treatment.**

*KEY WORDS: vertebral fractures, osteoporosis, rehabilitation.*

Osteoporosis is defined as an increase of bone fragility due to alterations in bone quality and quantity factors. As stated by OMS, osteoporosis is shown with a bone mass decrease of more than 2.5 SD compared with the mean value obtained by the youth population reference, T-score  $\leq$  2.5 SD.

The EVOS study (European Vertebral Osteoporosis Study) and the EPOS study (European Prospective Osteoporosis Study) (1), as indicated by European levels, show a prevalence in osteoporotic vertebral fractures of 12.2% in men as well as in women; and an incidence of 10.7% in women and of 5.7% in men on patients over 50 years old.

As indicated by these analysis it can be expected that in patients over 50 years old there will be circa 1.4 million vertebral fractures per year in Europe.

Moreover, since only 40%-60% of vertebral fractures are diagnosed (2-4), a remarkable percentage of events will go unnoticed.

Osteoporotic vertebral fracture consequences are various: organic, psychological, social and public health issues, either short or long term (5).

The presence of vertebral fractures is associated with a decrease in the quality of life and with an higher risk of further vertebral and

extra-vertebral fractures (6). Once the first vertebral fracture has occurred there is a higher risk equal to 20% of further vertebral fractures in the first year ("vertebral fracture cascade") (7).

In the development of the "vertebral fracture cascade" phenomenon, besides the bone mineral density, other factors such as bone intrinsic properties, local and global spine properties, neurophysiologic properties are indicative of the risk. The above mentioned factors contribute to increase the risk of new vertebral fractures in patients with a comparable T-score value (8-10).

The presence of previous vertebral fractures also makes the prognosis worse in terms of disability, autonomy in the ADL, and life quality (11).

A well-timed diagnosis and treatment is necessary in preventing further vertebral fracture consequences.

The most frequent levels of vertebral fractures are located between D6-D8 and the dorso-lumbar passage D12-L1.

In order to diagnose vertebral fractures the instrumental exam for reference is the spinal x-ray in two projections.

Through the morphometry, the type and the gravity of the fractures can be established (12). In order to evaluate completely a vertebral fracture case the Spinal Deformity Index (SDI) can be utilised (13, 14). The SDI is a summary measure for a total semi-quantitative evaluation of vertebral deformities on the spine. For each vertebra, a visual semiquantitative grade of 1, 2 or 3 is assigned if there is a decrease in vertebral height: mild (1-height decrease 20%-25%), moderate (2-height decrease 26%-40%) or severe (3-more than 41%) fracture; the SDI is calculated by summing the fracture grades of all vertebrae. The initial severity of the vertebral deformity is a negative prognostic index for persistent pain and disability (15).

The treatment of vertebral fractures related to fragility can be conservative or surgical and aims to heal the fracture, pain control and the prevention of further deformities. While pharmacological treatment shows strong scientific evidences, the conservative treatment in vertebral fractures including rehabilitation is nowadays not well-documented.

Conservative treatment comprises management of acute vertebral fracture, the post-acute phase, the rehabilitation phase, the treatment of a possible background disease and the education of the patient aiming for the prevention of further fractures.

In the acute and post-acute stage the most important factors of the treatment are pain control with pharmacological treatment and physical treatment, the prevention of complications, the use of orthopaedic corsets, frequent check-up concerning the spine and specific physiotherapeutic training.

The acute phase when the patient is bed-ridden, should be as short as possible. Scientific literature recommends having the patient stay in bed as brief as possible (16-19) in order to avoid the complications (National Osteoporosis Foundation). A protracted bed stay would cause muscle hypotrophy and weakness and joint rigidity even at extra-vertebral level; moreover it can lead to development of bed sores, deep-vein thrombosis, respiratory diseases, disorientation and depression.

During the stage in-bed it is advisable to begin educating the patient on the correct positions to maintain in bed and in posture passages. Moreover, patients can begin doing neuromuscular stabilization exercises of the toraco-lumbar spine that don't require any mobilization. Patients can also begin passive and active exercis-

es with mobilization of upper and lower limbs and of the cervical spine to avoid rigidity and to reduce the muscular hypotrophy. The placement of an orthosis with specific characteristics which depends on the level and severity of the vertebral fracture is necessary to enable the patient to stand up. Corsets used in clinical practice are the thoracic-lumbar-sacral orthosis (TLSO), the rigid corset with a tree-point pressure system, and for special events is used a less restrictive corset to provides support to the lumbar region (20). The vertebral orthosis treatment has to last 8-12 weeks approximately to encourage the fracture's complete stabilization. During the two months after the acute vertebral fracture physiotherapeutic exercises should avoid the intensive muscular strengthening (16) focusing on relaxing exercises, maintaining joint mobility of the major joints, and breathing exercises. The most intensive rehabilitation phase can start during the corset wearing and has to proceed after the orthopaedic corset is removed, generally in 8-12 weeks from the acute event depending on a radiographic control and the pain symptomatics. The rehabilitation program basically includes back-extensor muscle strengthening exercises, postural retraining exercises, ergonomic and balance increasing exercises. The back-extensor muscle strengthening decrease the kyphotic posture (21) which predisposes to back pain and to a higher risk of falls and secondary fractures (22). Proprioceptive postural retraining improve balance (23-25) decreasing falls risk.

Vertebral stabilization exercises, balance training, stretching and relaxing techniques are operative reducing chronic pain and disability of vertebral fractures patients (26-28). The way exercises are performed, the frequency, the length of time and the setting of sessions have to be adapted to the clinical state based on an individual rehabilitative project. Generally sessions are scheduled two or three times a week, lasting 45-50 minutes to patient's house or in suitable structures. Moreover, there are evidences that muscle strengthening exercise helps to maintain appropriate measurements (in bone mineral density, obtained from DXA) in postmenopausal woman (29). In the re-conditioning phase that starts with removal of vertebral orthosis, in addition to physiotherapeutic exercises is basic the recovering of the psychic-gesture abilities, and the restarting of normal activities of sport and work; all for a complete patient' social reinsertion.

The surgical treatment of vertebral fragility fractures is based on vertebroplasty and kyphoplasty, which are both mini-invasive interventions. The surgery treatment indications are basically a lean pain control by conservative treatment, the vertebral deformity progression and the choice of a fully informed patient. Both techniques are very useful in pain control, with an improvement in the 60%-100% of cases (30, 31). Kyphoplasty seems to give better results on disability reduction, and about the quality of life (31). Complications of both methods are basically due to the medical treatment and to the happening of new vertebral fractures. Vertebroplasty seems to have a statistically significant increased rate of procedure-related complications and cement extravasation (32). Even after vertebroplasty or kyphoplasty, physiotherapeutic back-extensor muscle strengthening exercises with a proprioceptive postural retraining decrease radically the incidence of a further vertebral fracture increasing the time between the two events (33).

In conclusion we can say that physical rehabilitative measures play a key role after vertebral fractures and beyond for preventing further fracture, but there is a dearth of controlled trials in this area, perhaps of the lack of founding for non-pharmacologic research. In particular there is a lack of an encoded training program after vertebral fracture. Muscle reeducation, resistance exercises for strengthening, and reduction of kyphosis are fundamental elements for reducing the risk of falls and further fractures, to improve quality of life and decrease the pain. Further studies about physical rehabilitative measures will help support the conviction that non-pharmacologic rehabilitative management of osteoporosis, when properly used, is beneficial and cost-effective.

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