Instrumentation of osteoporotic spine with expanding pedicle screws:
- Osteoporotic vertebral fractures
- Osteoporotic adult deformities
Vertebral osteoporotic fractures represent a continuously increasing pathology, with high complications rate and elevated health costs.

Possible treatment options of common osteoporotic vertebral fractures are represented by:

- Bed rest
- Percutaneous vertebroplasty or kyphoplasty
- Segmental instrumentation (open or minimally-invasive)
Disadvantages of conservative treatment

- Bedsore
- Infections
- Deep venous thrombosis
- Muscle weakness
- High mortality rate

Possible complications of vertebroplasty or kyphoplasty

- Leakage
- Adjacent vertebral fractures
- Fracture healing by non-biological procedure
Segmental screw fixation

- Offers immediate stability, in order to achieve early mobilization and faster rehabilitation

Major complication: screw pull-out and instrumentation failure due to reduced bone density
Biomechanical studies are carried out on cadaveric vertebra in order to improve pedicle screws anchorage in severe osteoporosis. There is still limited evidence regarding patients’ series.

... Expansive pedicle screw can markedly enhance screw stability with a similar effect to the traditional method of screw augmentation with PMMA in primary surgery in osteoporotic vertebrae.

... Expansive pedicle screw can overcome pedicle fracture, leakage and compression caused by larger screw and augmentation with PMMA.

Biomechanical comparison of different techniques in primary spinal surgery in osteoporotic cadaveric lumbar vertebrae: expansive pedicle screw versus polymethylmethacrylate-augmented pedicle screw.
Da Liu, Zi-xiang W, Xian-ming Pan, Suo-chao Fu, Ming-xuan Gao, Lei Shi, Wei Lei
... Evaluation of 36 consecutive patients with single level osteoporotic fracture received posterior instrumentation with cemented conventional screws (16 cases) and cemented expandable screws (20 cases).

- 4 screws loosened in the cemented conventional screws (4.2%)
- no screw loosening in the cement expandable screws (0%)
... expandable system inserted by a minimally-invasive approach into the vertebral body permits to obtain a double mechanical support for the vertebral plate, to partially reduce the fracture, to mobilize the patient immediately, reducing disability and costs related to the vertebral osteoporotic fractures.
Pull out tests:
- Conventional screw
- Conventional cemented screw
- Expandable screw
- Cemented expandable screw

...The augmentation with calcium cement can offer improved initial fixation strength of the pedicle screws. However, none of the four screw placement protocols examined in this study is efficacious in the severely osteoporotic bone.
We present our preliminary results with expandable screws in the treatment of osteoporotic fractures. Our objective is to reduce major complication:

- Screw pull-out and instrumentation failure due to reduced bone density

We applied expandable screws with:

- A 4 wing expansion mechanism
- 100% expansion ratio

- Instrumentation easy to apply
- Surgery of short duration
- Limited use of x-ray
- Avoid cement augmentation
Female, 62 years old
Severe osteoporosis: Wrist and femoral neck fractures in the past.
Lumbar spine T-score: -3.4

Acute L4 osteoporotic fracture

Classified as A.2.3
Pincer fracture
L3-L5 instrumented arthrodesis with expandable screws

Surgical time: 75 min
Blood loss: 400 ml
Postoperative drainage: 200 ml
Ambulation: 2nd postoperative day
Hospital stay: 6 days
At 6 months follow up, instrumentation is stable, with signs of bone healing.

No signs of screw loosening.
Female, 66 years old
Severe osteoporosis, in treatment with corticosteroids for chronic connective tissue disease for the last 10 years.
Obese patient: BMI 31

Acute L1 fracture after accidental fall

Classified as A.2.3
Pincer fracture with partial dislocation of posterior wall
T11-L2 posterior instrumented arthrodesis with expandable screws

Surgical time: 80 min
Blood loss: 600 ml
Postoperative drainage: 300 ml
Ambulation: 3d postoperative day
Hospital stay: 8 days
The patient referred acute thoracic pain, 1 day after operation. CT scan showed acute fracture of the mid portion of the sternum, that most probably occurred during positioning on operating table, due to severe osteoporosis from chronic corticosteroid therapy.

Interestingly, despite 10 years of continuous corticosteroid therapy, the patient was not aware of her severe bone density loss and was not receiving any medical treatment for osteoporosis.
At 4 months follow up instrumentation is stable, although there are poor signs of bone healing.
Female 69 years old
Acute L3 osteoporotic fracture
No neurologic impairment

Classified as A.3.1.3
Inferior endplate incomplete burst fracture
L2 – L4 posterior instrumented arthrodesis with expandable screws

Surgical time: 60 min
Blood loss: 400 ml
Postoperative drainage: 200 ml
Ambulation: 2d postoperative day
Hospital stay: 6 days

No F-Up available
... use of expandable screws in the treatment of adult osteoporotic deformities
Female, 23 years old
Severe osteoporosis, gastric bypass surgery at 18 years for severe obesity (130 kg). Osteoporotic fractures of L1, L2 and L3, L1 kyphoplasty at the age of 23

Thoracic hyperkyphosis 100°
Rigid deformity, partial correction in cast orthosis
T1 – L3 posterior instrumented arthrodesis with expandable screws in L1, T12 and T11

Surgical time: 4 hours
Blood loss: 1200 ml
Postoperative drainage: 700 ml
Intensive care: 3 days
Ambulation: 5\textsuperscript{th} day
Hospital stay: 12 days
Male 65 years old
Osteoporosis, poliomyelitis, progressive neurological impairment in the last few months
Osteoporotic fractures of L1, L2 and L3, L3 vertebroplasty

Thoracolumbar kyphosis
Severe bilateral paraparesis
Difficulty during ambulation
T9 – L4 stenosis
T3 – L4 posterior instrumented arthrodesis with expandable screws in L2 and L4

T7 – L4 wide laminectomy

Surgical time: 4.5 hours
Blood loss: 1500 ml
Postoperative drainage: 800 ml
Intensive care: 3 days
Ambulation: 5th day
Hospital stay: 12 days
Thank You!