Balloon kyphoplasty for treatment of osteoporotic vertebral compression fracture

Essay

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Abstract

Osteoporosis is the epidemic of this century in the western and Asian countries. Vertebral compression fractures are a common and often debilitating expression of this disease. Progressive loss of posture as a result of these fractures is one of the major problems related with an enormous impact on the quality of life **(Kado et al., 1999)**.

Deformities are the most frequent cause of osteoporotic vertebral compression fracture (OVCF) pain .The degree of kyphosis caused by the OVCF correlates well with the patient's physical function (independent of pain), mental well-being, pulmonary function, increased mortality and the risk of further fractures **(Pluijm et al., 2000).**

Key Words :

Vertebral body – Computed tomography – Standard devition .

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1. NOF (National Osteoporosis Foundation).
2. VB (vertebral body).
3. VCFs (vertebral compression fractures).
4. OVCFs (osteoporotic vertebral compression fractures).
5. C.T (Computed tomography).
6. Ha (anterior verebral height).
7. Han (normal anterior verebral height).
8. Haf (fractured anterior verebral height).
9. Hp,Hp' (posterior verebral height).
10. Hpn (normal posterior verebral height).
11. Hpf (fractured posterior verebral height).
12. Hm (middle vertebral height).
13. SD (standard deviation).
14. MRI (Magnetic Resonance Imaging).
15. BMD (Bone Mineral Densitometry).
16. Q.C.T (dual-energy quantitative computed tomography).
17. DEXA (dual-energy X-ray absorpiometry).
18. PMMA (polymethylmethacrylate).
19. IBT (infalatable bone tamp).
20. psi (pound per square inch).
21. ap (anteroposterior).
22. lat (lateral).
23. FDA (Food &Drug Association in USA).
24. Ha/TCP (hydroxyapatite/tricalcium phosphate).
25. BAER (Balloon assisted endplate reduction).
26. SF36 (short form 36).
27. VAS (visual analogue scale).
28. ANOVA (Analysis of variance).
29. C.V (coefficient of variation).
30. Ka (kyphotic angle).
31. SI (sagittal Index).
32. BKP (balloon kyphoplasty).

Chapter (1)

Osteoporotic vertebral compression fracture

The Consensus Development Conference (1991) defined osteoporosis as a disease that is characterized by low bone mass and micro architectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk**.** The National Osteoporosis Foundation (NOF) in the United States added to the definition in (2000) by incorporating the bone mineral density T-scores according to the WHO criteria for Osteoporosis to provide diagnostic criteria to classify the extent of the process (table 1-1) **(Denise et al., 2005).**

Table 1 -1 **World Health Organization Criteria for Osteoporosis (Denise et al., 2005).**

Normal:	T-score within 1 SD of young adult reference.
Osteopenia:	T-score 1 to <2.5 SD below the young adult reference.
Osteoporosis:	T-score ≥2.5 SD below the young adult reference.
Severe osteoporosis:	T-score ≥2.5 SD below the young adult reference with ≥ 1 fracture.

(SD i.e.; standard deviation)

The National Osteoporosis Foundation (NOF) estimates that 44 million (55%) Americans aged over 50 years have osteopenia / osteoporosis**.** Women account for most of the affected individuals; with 50% of women aged 80 having osteoporosis. Osteoporosis is considered a major public health concern, with an estimated 1.5 million osteoporotic

vertebral compression fractures in the United States with direct and indirect cost for the year 2002 was $17billion, with the projected cost for the year 2030 at greater than $60 billion (**NOF Prevalence Report, 2002**).

Increased morbidity and mortality in this population affected with vertebral compression fractures is related to progressive spinal deformity, compromised pulmonary function, pain and complications associated with immobility (deep vein thrombosis, infection, muscle atrophy, pressure sores) (**Kahn et al., 2004)**.

Primary osteoporosis is age-related bone loss (type II)and is generally seen in post-menopausal (type I) women, whereas secondary osteoporosis develops with long-term glucocorticoid use, long term thyroid replacement therapy, diseases (hyperthyroidism, hyperparathyroidism), post bilateral oopherectomy **(Old et al., 2004)**.

Additional variables that adversely influence osteoporosis include dietary factors (high protein, low calcium, high caffeine), sedentary lifestyle, malabsorption states, low body weight, moderate to heavy alcohol intake and cigarette smoking (Table 1-2) **(Kahn et al., 2004)**.

Table 1-2 **Risk Factors (Denise et al., 2005).**

Non modifiable risk factors:

Sex: female > male

Age: males, >70 years; females, 45–50 years (post menopause)

Modifiable risk factors:

Moderate to heavy alcohol intake

Dietary (high protein, low calcium, high caffeine intake)

Sedentary lifestyle

Low body weight

Disease-related risk factors:

Long-term steroid use

Long-term thyroid replacement therapy

Hyperthyroidism

Hyperparathyroidism

Malabsorptive states

Amenorrhea

Bilateral oophrectomy

Primary osteoporosis is subdivided into type I (postmenopausal) and type II (age related). Type I indicate women who demonstrate excessive bone loss within 15-20 years after menopause and is associated with the diminished estrogen level. The precise role of estrogen in maintaining bone density has not been fully determined, although it is felt to play a part in maintaining bone mass density (**Peacock et al., 2002)**.

After menopause, the primary source for estrogen is in the adipose tissue, so this account for the fact that it is uncommon for obese patients to contract osteoporosis. Type II is excessive bone loss that is seen after age 70 and is seen in both sexes (**Kahn et al., 2004)**.

A normal process of gradual bone loss (1% per year) occurs after approximately age 35 when the body bone remodeling shifts from osteoblastic activity (bone formation) to increased osteoclastic activity (bone reabsorption).Thus, as one's age increases, bone density decreases, placing one at risk for osteoporosis (**Compston et al., 2001)**.

The majority of the skeleton is composed of cortical bone (80%), with the remainder being composed of trabecular bone (20%) (**Compston et al., 2001**).

Within the vertebra, the cancellous bone provides an architectural supportive frame for the vertebral bodies. Ninety percent of the biomechanical load is borne by the cancellous bone, even though the outer cortical bone is ten times stronger (**Kayanja et al., 2004**).

Peak bone mass is reached in early adulthood (age 17–28). Many variables (dietary, physical activity, medications, and life habits) affect an individual's peak bone mass, although 60% – 80% is felt to be genetically determined (**Peacock et al., 2002)**.

Bone mass remains relatively stable in women until menopause, or roughly the age of 44 – 55; at this time, women can demonstrate a rapid bone loss (25% – 30%) over 5 –10 years compared to men, who have a gradual loss of 1% loss per year(**Compston et al., 2001**).