

# VERTEBRAL FRACTURE OCCURRENCE IN PATIENTS WITH OSTEOPENIA

## IMPORTANCE OF INDEPENDENT RISK FACTORS AND FRACTURE THRESHOLDS



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Ch. Muschitz<sup>1</sup>, J. Patsch<sup>1</sup>, Th. Woegerbauer<sup>1</sup>, E. Buchinger<sup>1</sup>, E. Edlmayr<sup>1</sup>, P. Pietschmann<sup>2</sup>, G. Nirnberger<sup>3</sup>, H. Resch<sup>1</sup>

1 St. Vincent Hospital, Medical Department II, Vienna, Austria

2 Institute of Pathophysiology, Medical University of Vienna, Austria

3 Bioconsult Ltd, Perchtoldsdorf, Austria

### Objectives:

Although it is well established that the fracture risk is highest in women with BMD levels that indicate osteoporosis, women with higher BMD levels such as those used for the diagnosis of osteopenia (i.e.  $-1 < T < -2.5$ , WHO definition) are also subject to an increased fracture risk. Furthermore, BMD measurements are highly specific, however, they may lack sensitivity and do not always reflect the true quality of the bone. Consequently clinical risk factors are integrated with BMD measurements to get a more accurate indication of fracture risk.

### Aim of the study:

We focused on the prevalence of vertebral and peripheral fractures in patients with osteopenic T-scores and various clinical risk factors to assess the individual fracture risk in patients with osteopenia. Furthermore, we calculated a fracture threshold within the osteopenic range as measured by DXA at spine and femur to obtain an estimate of patients at risk.

### Methods:

DXA-scans from lumbar spine, femoral neck and total hip (Lunar Prodigy Advanced) of 698 Caucasian pre- and postmenopausal women and men aged 20 to 92 years from patients with osteopenia (i.e.  $-1 < T < -2.5$ , WHO definition) were investigated at our bone unit over a period of 18 months.

Vertebral fractures were identified by lateral x-ray examinations of lumbar and thoracic spine. Previous peripheral fractures were patient self-reported.

### Statistical analysis:

Data are presented as mean  $\pm$  SD or frequency distributions. The occurrence of vertebral fractures (yes, no) was evaluated by a multivariate General Linear Model (fractures as fixed factors, age, BMI and T-Scores as dependent variables). In addition, frequency distributions were analyzed using Chi-square tests; for numerical data, Mann-Whitney-U-test or Kruskal-Wallis test was used.

### Results:

The whole group of patients consisted of 86% females and 14% males with a mean age of  $65.1 \pm 15.49$  years, 54% of the patients were in the sixth and seventh decade of life. Mean T-score was  $-1.28 \pm 0.93$  at lumbar spine,  $-1.64 \pm 0.55$  in the femoral neck and  $-1.48 \pm 0.57$  in the total hip [fig 1].

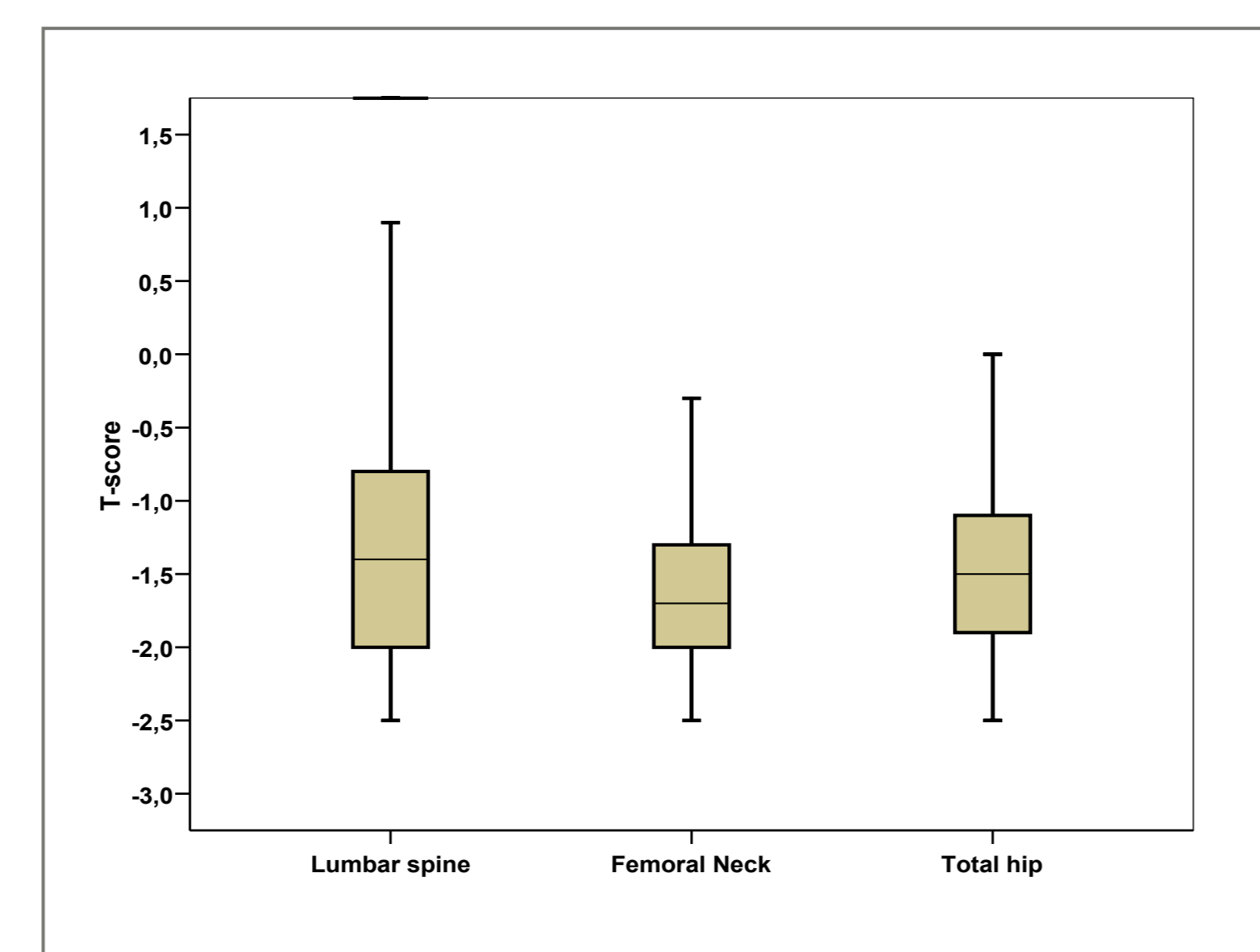


Fig 1. Mean T-score at lumbar spine, femoral neck and total hip, measured by DXA

By focussing on specific measuring sites 37.0% of the patients had lowest T-score at L1-L4, 24.8% in the total hip and 38.3% at femoral neck ( $p < 0.0001$ ) [fig 2].

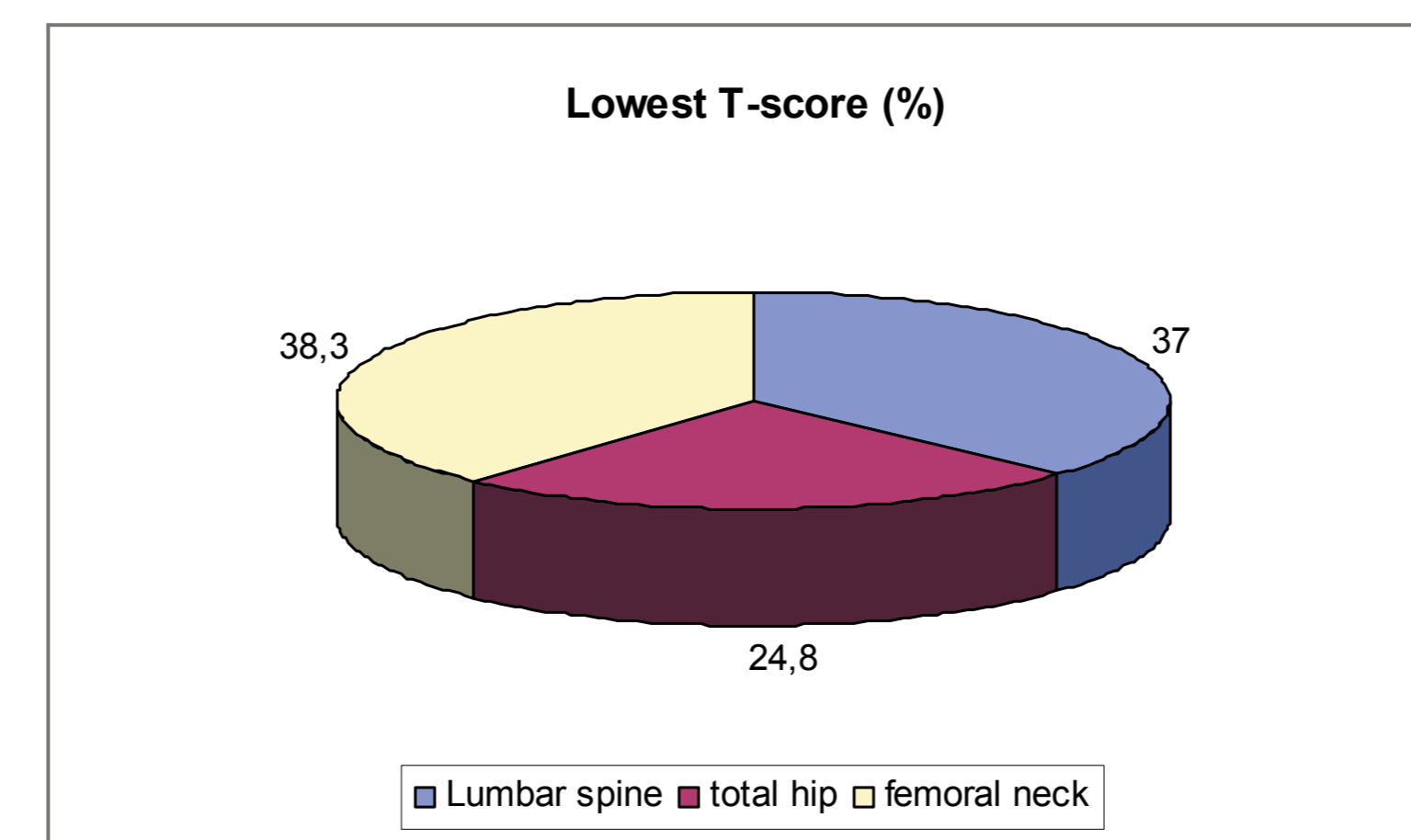


Fig 2. Comparison of lowest T-score on specific anatomical sites ( $p < 0.0001$ )

Fracture analysis revealed in 31.3% ( $p = 0.033$ ) of our patients ( $n = 218$ ) vertebral fractures (22.8% vertebral, 18.9% peripheral fractures, 8.5% fractures at both sites). 25% ( $n = 163$ ) of the fracture patients had between 1 (10.2%) and 3 (5.3%) vertebral fractures. 84.9% of all vertebral fractures occurred during sixth and eighth decade of life. Mean age of the patients with fractures was significantly higher than in patients without fractures ( $72.2 \pm 11.3$  vs  $61.3 \pm 16.3$  years;  $p < 0.0001$ ) [fig. 3].

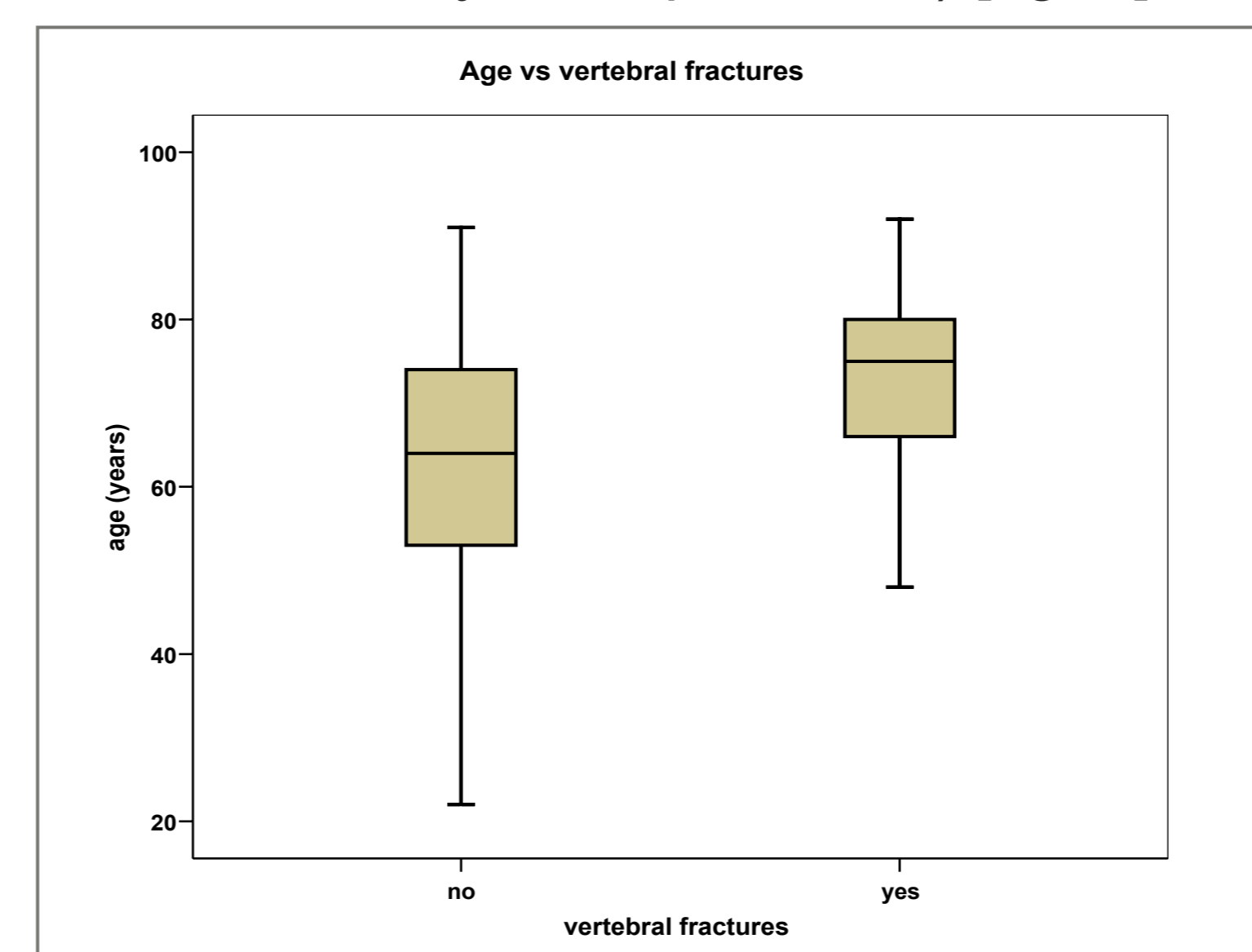


Fig 3. Comparison of age of osteopenic patients with/without vertebral fractures ( $p < 0.0001$ )

BMI was higher in the fracture patients showing no protective effect of body weight ( $26.1 \pm 4.3$  vs  $24.2 \pm 4.8$ ;  $p < 0.0001$ ) [fig 4].

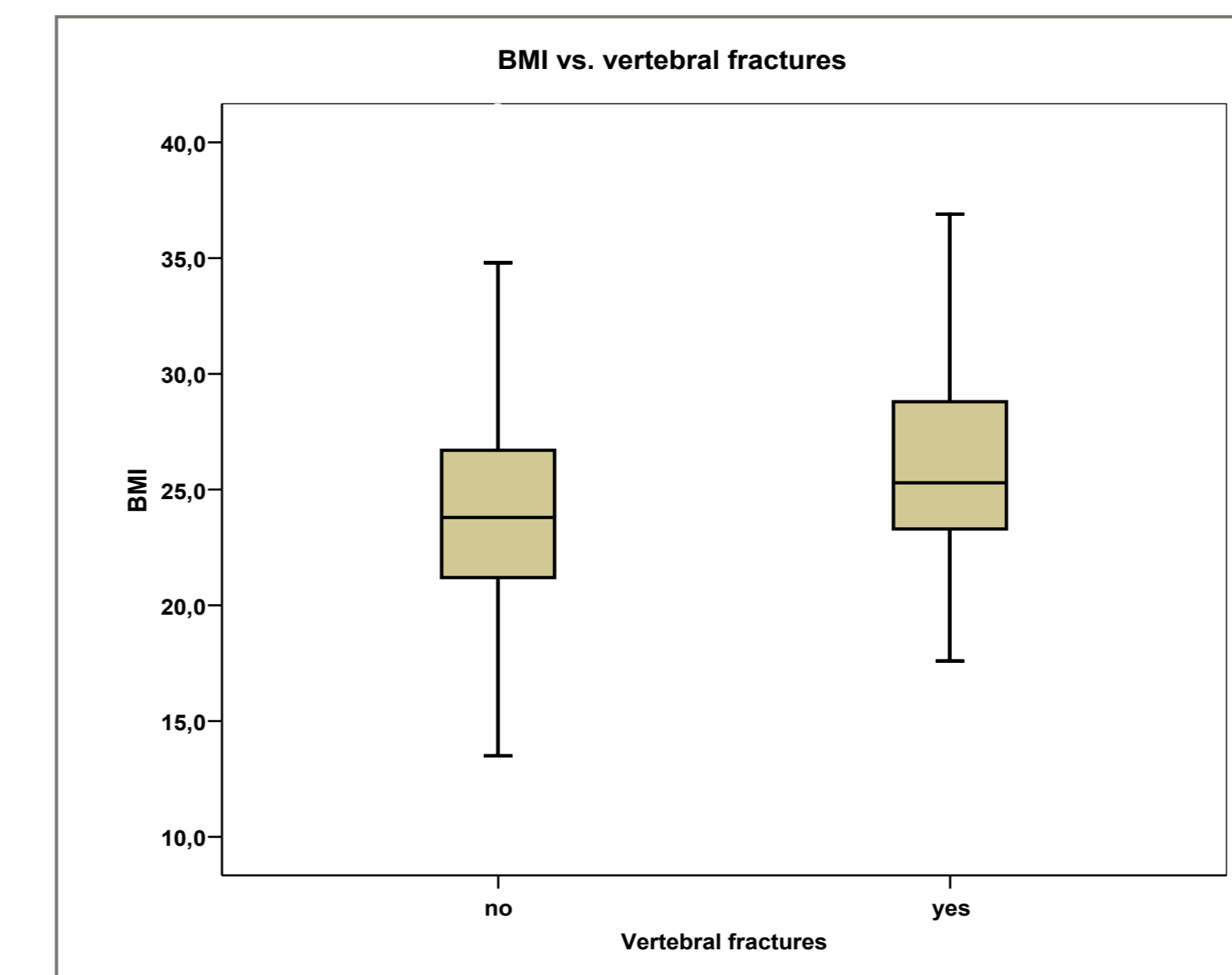


Fig 4. No protective effect of body weight on fracture prevention ( $p < 0.0001$ )

T-score at femoral neck was significantly higher in the patients with vertebral fractures compared to the patients without any fracture, showing a significant relationship femoral neck BMD to the occurrence of vertebral fractures ( $-1.72 \pm 0.53$  vs  $1.57 \pm 0.58$ ;  $p < 0.00001$ ).

49.1% of our patients with vertebral fractures had the lowest T-score at femoral neck, 20.1% at total hip and 30.8% at L1-L4 [fig 5].

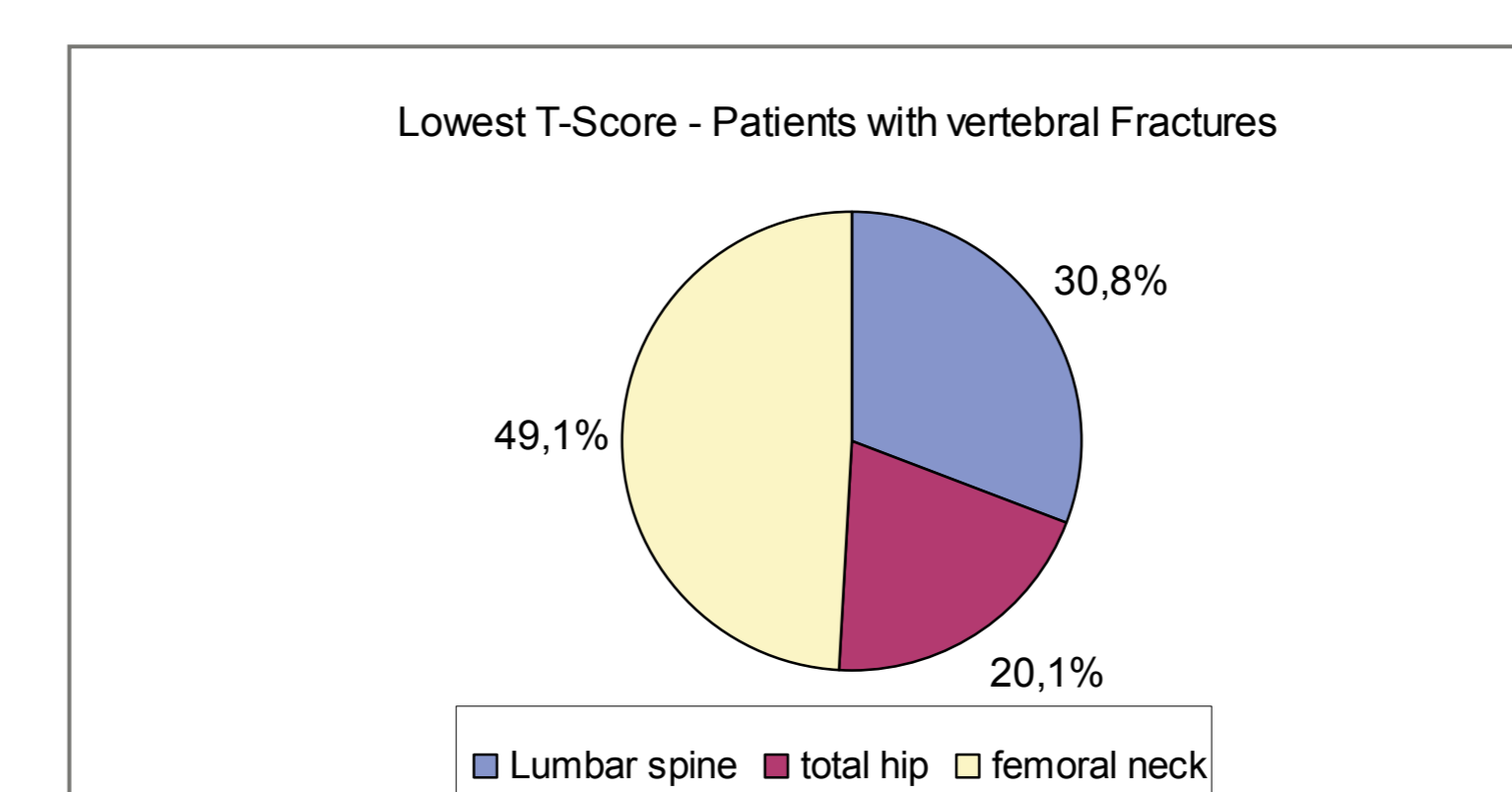


Fig 5. Lowest T-score according to anatomic sites in patients with vertebral fractures

According to our findings in patients with vertebral fractures and low T-score at femoral neck we calculated T-score of femoral neck vs vertebral fractures cumulatively.

50% of the patients had a T-score above  $-1.9$  standard deviations. At this threshold there is a linear progression of spine fractures leading to a vast increase of fracture occurrence [fig.6].

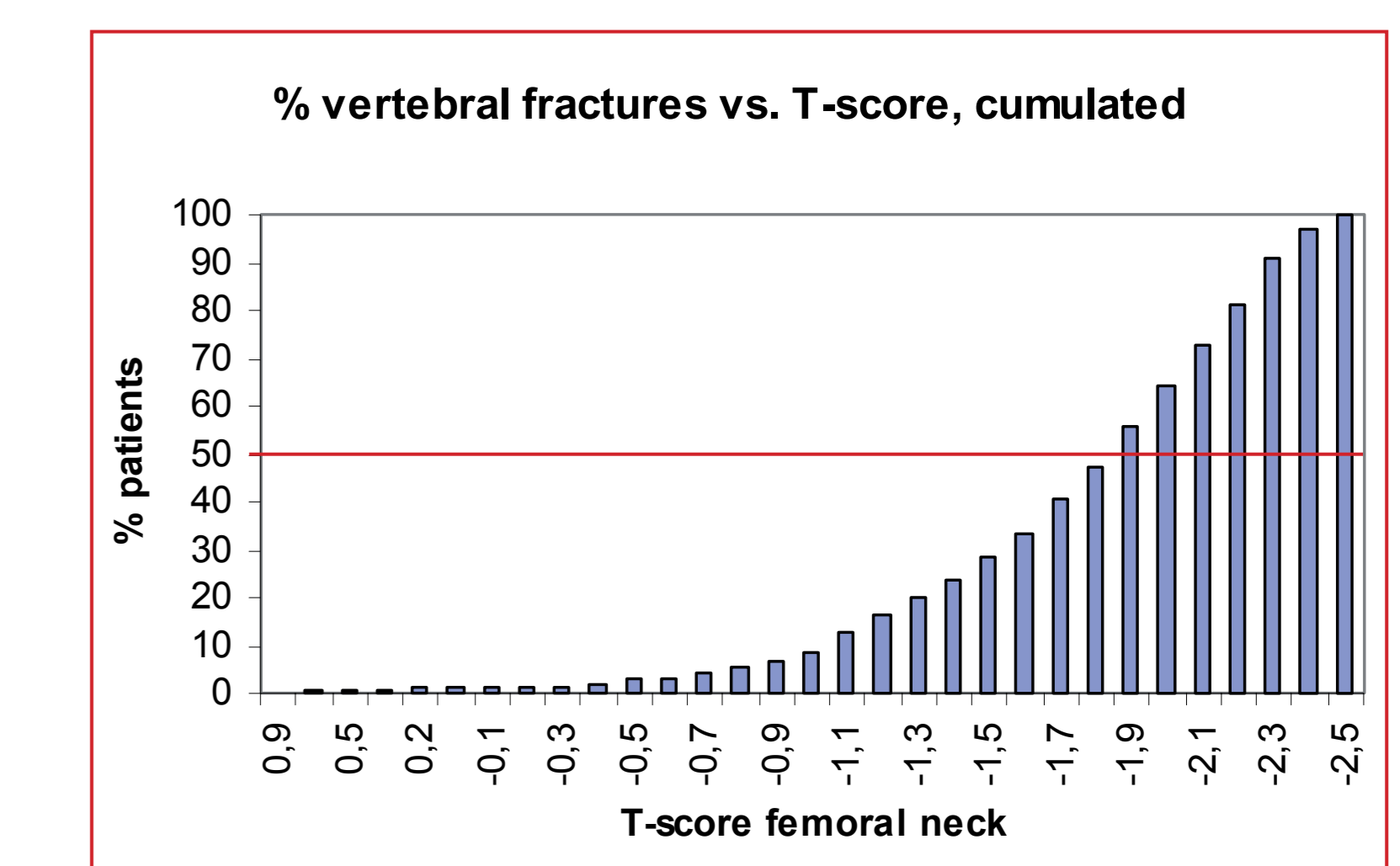


Fig 6. Linear progression of spine fractures at a threshold of  $-1.9$  at femoral neck

### Conclusion:

The analysis of our clinical practice has shown that more than 30% of women (mostly aged 60-80 years) that were diagnosed with osteopenia had a vertebral or non vertebral fracture. Most of the fractures occurred after a relatively minor trauma. To assess the fracture risk of the individual patient the above mentioned independent risk factors such as age, BMI and T-score at femoral neck must be taken into account. Based on our analysis, all women with osteopenia, showing a BMD value below a T-score of  $-1.9$  (our calculated fracture threshold) should receive treatment.

**Keywords:** Osteopenia, vertebral fractures, independent risk factors, treatment threshold

### Corresponding author:

Christian Muschitz, M.D.  
Medical Department II  
St. Vincent Hospital, Vienna, Austria  
email: christian.muschitz@bhs.at