

# Measurement of Arm Span-Height Difference in Postmenopausal Osteoporotic Women<sup>¶</sup>

## POSTMENOPOZAL OSTEOPOROTİK KADINLARDA KULAÇ-BOY FARKININ ÖLÇÜMÜ

Özlem BÖLGEN ÇİMEN\*, Hayal GÜLER\*\*, Günşah ŞAHİN\*, Sacettin ÖZİŞİK\*\*,  
Selda BAĞIŞ\*, Ali BİÇER\*, Canan ERDOĞAN\*\*\*

\* Yrd.Doç.Dr., Mersin Üniversitesi Tıp Fakültesi Fiziksel Tıp ve Rehabilitasyon AD,

\*\* Araş.Gör.Dr., Mersin Üniversitesi Tıp Fakültesi Fiziksel Tıp ve Rehabilitasyon AD,

\*\*\*Prof.Dr., Mersin Üniversitesi Tıp Fakültesi Fiziksel Tıp ve Rehabilitasyon AD, MERSİN

### Summary

Thoracal kyphosis due to vertebral fractures affect the standing height. For that reason, arm span measurements are preferred to standing height measurements in elderly patients with osteoporosis. The aim of this study is to determine arm span- standing height difference of patients with osteoporosis without any vertebral fractures and to compare with healthy controls. We also aimed to investigate the value of this measurement in diagnosis of osteoporosis as a screening test.

Eighty-eight postmenopausal osteoporotic patients and fifty-four healthy postmenopausal women were included in this study. None of the patients were under any medication for osteoporosis and none of them had any spinal compression fractures. Arm span and standing height of the patients and controls were recorded. Bone mineral density (BMD) of patients and controls were evaluated using Dual Energy X-ray Absorptiometry (DXA) (Hologic QDR 4500).

Osteoporotic patients had significantly higher values for the difference of arm span-height measurements ( $3.03 \pm 2.67$ ,  $2.02 \pm 2.80$ ;  $p < 0.05$ ).

As a result we can say that, arm span-height difference may be a very simple and useful measurement in evaluating osteoporotic patients even though they don't have any compression fractures.

**Key Words:** Osteoporosis, Bone mineral density,  
Arm span –height difference

T Klin J PM & R 2002, 2:104-107

### Özet

Vertebral fraktürlere bağlı torakal kifoz ayakta ölçülen boy uzunluğunu etkiler. Bu nedenle osteoporozlu yaşlı hastalarda kulaç mesafesi ölçümleri ayakta ölçülen boy uzunluğuna tercih edilmektedir.

Bu çalışmanın amacı, vertebral kompresyon fraktürü olmayan postmenopozal osteoporotik hastaların kulaç mesafesi-boy ölçüm değerleri farkının ölçülerek, osteoporozu olmayan postmenopozal kadınlarla karşılaştırılması ve bu ölçümün özellikle birinci basamak sağlık hizmetlerinde tanılabilir olarak kullanımını değerlendirmektir.

Çalışmaya Dünya Sağlık Örgütü kriterlerine göre osteoporoz tanısı almış, ancak henüz bir tedavi başlanmamış 88 postmenopozal hasta alındı. Yaş ve vücut kitle indeksleri uyumlu osteoporozu olmayan 54 postmenopozal kadından kontrol grubu oluşturuldu. Hasta ve kontrollerin kemik mineral yoğunlukları Dual Energy X-ray Absorptiometry (DXA) (Hologic QDR 4500) ile değerlendirildi. Kulaç mesafeleri kaydedildi.

Osteoporotik hastaların kulaç mesafesi-boy ölçüm değerlerinin farkı kontrollerle karşılaştırıldığında anlamlı derecede yüksek olarak tespit edildi ( $3.03 \pm 2.67$ ,  $2.02 \pm 2.80$ ;  $p < 0.05$ ).

Sonuç olarak torakal kompresyon fraktürü olmayan postmenopozal osteoporotik hastalarda kulaç mesafesi –boy farkının basit, kullanışlı bir değerlendirme yöntemi olduğunu söyleyebiliriz.

**Anahtar Kelimeler:** Osteoporoz, Kemik mineral yoğunluğu,  
Kulaç mesafesi- boy ölçümü

T Klin FTR 2002, 2:104-107

Osteoporosis is defined as a disease characterised by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture risk (1). Osteoporosis is a major disease in adults, resulting in 1.5 million fractures and over \$10 billion

in medical expenditures annually. Osteoporosis is of growing interest in the research, public health, and health consumer-lay communities and to the many primary care and specialty physicians and other health care professionals who work directly with patients with osteoporosis (2).

Vertebral changes due to osteoporosis results in spinal pain, disability and an overall decrease in quality of life (3). Diagnosis of osteoporosis is based on DEXA measurements, which is an expensive method and is not available in all health centers nationwide. X-ray evaluations are not diagnostic and objective especially in early stages of osteoporosis. Thoracal kyphosis due to vertebral fractures affect the standing height. For that reason, arm span measurements are preferred to standing height measurements in elderly patients with osteoporosis (4). It is recommended to use an arm span-height difference of at least 3 cm as one of the criteria for suspected osteoporosis (5).

In this study, we aimed to determine arm span-standing height difference of patients with osteoporosis without any vertebral fractures and to compare with healthy controls. We also aimed to investigate the value of this measurement in diagnosis of osteoporosis as a simple screening test.

### Subjects and Methods

Eighty-eight postmenopausal patients admitted to our outpatient clinic of the Department of Physical Medicine and Rehabilitation were included in this study. All patients were recently diagnosed as osteoporosis according to World Health Organisation osteoporosis diagnosis criteria (6). None of the patients were under any medication for osteoporosis and none of them had any spinal compression fractures. Fifty-four postmenopausal women suffering from other locomotion system problems whose DEXA measurements did not reveal osteoporosis according to WHO criteria formed the control group. All patients underwent a standardised interview regarding their medical history. Patients with secondary osteoporosis, with a history of known primary pulmonary disease (pulmonary fibrosis, emphysema, bronchial asthma, cardiothoracic surgery, chronic bronchitis) and neurological disorder were excluded from the study. Both of the groups underwent a detailed clinical examination.

Radiography of the anteroposterior and lateral thoracic and lumbar spine were evaluated in order to determine any compression fractures. Measure-

ment of BMD at lumbar spine (antero-posterior) and femur was performed using Dual Energy X-ray Absorpsiometry (DXA) (Hologic QDR 4500).

Arm span was measured with a tape-measure as the distance between the tips of the middle fingers as subjects stood against a wall with their arms extended laterally at shoulder level (7).

All subjects were given information about the study before the measurements.

Statistical analysis were assessed by SPSS for Windows 6.0. An independent sample t-test was used for intergroup comparison. Values were correlated using Pearson's correlation analysis. Sensitivity, specificity and predictive values of the arm span- height difference were analyzed.

### Results

The mean values of different parameters of osteoporotic patients and healthy postmenopausal women are shown in Table 1. There was no significant difference between the patients and the control group regarding age and Body Mass Index (BMI).

Neither patients nor controls had any evidence of vertebral compression fractures in their antero-posterior and lateral thoracic and lumbar spine X-rays.

Patients had significantly lower lumbar and total femur BMD values than the controls ( $p < 0,001$ ). Their lumbar and femur T scores were also signifi-

**Table 1.** Comparison of Parameters in Osteoporosis and Control Group

Parameter	Patient (n= 88)	Control (n=54)	P
Age	56.27±10.97	53.44±7.09	n.s.
BMI	28.27±6.14	29.96±4.55	n.s.
A-P L1-4 BMD (g/cm <sup>2</sup> )	0.81±0.11	1.09±0.12	< 0.001
Lumbar T (L1-4)	-2.85±0.83	-0.06±1.05	< 0.001
Femur BMD (g/cm <sup>2</sup> )	0.76±0.11	0.90±0.09	< 0.001
Femur T	-1.82±0.89	-0.17±0.71	< 0.001
Height (cm)	155.23±6.46	158.52±4.67	<0.001
Arm span (cm)	158.32±7.27	160.95±4.38	<0.025
Arm span-height difference	3.03±2.67	2.02±2.80	<0.05

n.s: not significant

L: Lumbar

cantly lower than those of the control group ( $p<0,001$ ).

The mean standing height was measured as  $155.23\pm 6.46$  in osteoporotic patients and  $158.52\pm 4.67$  in healthy controls ( $p<0.001$ ). The mean value of arm span of osteoporotic women was  $158.32\pm 7.16$  and it was  $160.95\pm 4.38$  in the control group ( $p<0.025$ ). Osteoporotic patients had significantly higher values for arm span-height difference measurements ( $3.03\pm 2.67$ ,  $2.02\pm 2.80$ ;  $p< 0.05$ ). Correlation analysis did not determine any relationship between BMD, T values and arm span-height difference.

Sensitivity, specificity, positive and negative predictive values of arm span-height difference were respectively 60%, 55%, 70% and 44%.

### Discussion

In this study we investigated the height, arm span and arm span-height difference of osteoporotic patients without spinal fractures and compared these values with healthy postmenopausal, age and BMI matched controls. We observed that mean value of arm span-height difference in osteoporotic patients is higher than 3cm which is accepted as a suspicion criteria for osteoporosis.

A consensus report on osteoporosis in The Netherlands recommends general practitioners to use an arm span-height difference of at least 3 cm as one of the criteria for suspecting osteoporosis (5).

Verhaar et al investigated how well this criterion discriminates between patients with established osteoporosis and controls in a group of postmenopausal women (5). They concluded that, this measurement leads to a sensitivity of 81% while the specificity amounts to 64% when the age and arm span category was taken into account. This seems quite satisfactory for such a simple method and clearly improves on the original single criterion of arm span-height difference. Our results revealed sensitivity of 60% and specificity of 55% for arm span - height difference. These may be also satisfactory when we consider that osteoporotic patients in this study have no vertebral fractures.

Height estimated from arm span is recommended as an important measurement in elderly people with osteoporosis especially for the assessment of predicted value of lung volumes (8). Leech et al report that, arm span should be used in hyperkyphotic women due to osteoporosis (9).

Aging and osteoporosis have been associated with skeletal changes. Osteoporosis affect the estimated standing height. Patients with osteoporosis tend to have kyphotic posture. Back extensor strength is also an important determinant of posture in healthy women (10). Disproportionate weakness in the back extensor musculature relative to body weight or flexor strength considerably increases the risk of kyphotic posture and compressing porous vertebrae (11).

Histologic studies have demonstrated decrease both in size and loss in number of type II muscle fibers with increasing age. Although these age-related histologic changes are believed to result in decreased strength and functional capacity, age-related changes in muscle force dynamics have not been clearly elucidated (12). The exponential loss of bone at the postmenopausal stage is not accompanied by an incremental loss of muscle strength. The loss of muscle strength follows a more gradual course and is not affected significantly by a sudden hormonal decline, as is the case with bone loss. This muscle loss may contribute to osteoporosis-related skeletal disfigurements (11).

As our patients didn't have any determined osteoporotic fractures their decreased arm span-height measurements can be due to reduced extensor muscular stature.

Further studies evaluating lateral spine and L3 vertebra corpus BMD could give better results, because anterior-posterior lumbar spine measurements which are also used in this study can be affected from spinal degenerative changes, hiperostosis and aortic calcifications.

We can conclude that, arm span-height difference may be a very simple and useful measurement in evaluating osteoporotic patients eventhough they don't have any compression fractures.

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**Geliş Tarihi:** 07.09.2001

**Yazışma Adresi:** Dr.Özlem BÖLGEN ÇİMEN  
Mersin Üniversitesi Tıp Fakültesi  
FTR AD, 33070, Mersin  
obolgencimen@mersin.edu.tr

\*This study is presented in XVIIIth. National Congress of Physical Medicine and Rehabilitation, May 12-17, 2001, Antalya as a poster.