



## Awareness of Orthopedic Surgeons and Neurosurgeons About Fragility Fractures and Fracture Liaison Services: A Survey Study

*Ortopedistlerin ve Beyin Cerrahlarının Frajilite Kırıkları ve Fraktür Liyezon Servisleri Üzerine Farkındalıkları: Bir Anket Çalışması*

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### Abstract

**Objective:** The aim of this study was to investigate the awareness of neurosurgeons and orthopedic surgeons working in Eskişehir about fragility fractures and fracture liaison services.

**Materials and Methods:** A total of 50 surgeons (21 neurosurgeons, 29 orthopedic surgeons) responded to a survey about fragility fractures and fracture liaison services.

**Results:** More than 95% of all the surgeons stated that they considered osteoporosis in patients who had a fracture with a low-level trauma. However, only 69% of the orthopedic surgeons and 61% of the neurosurgeons stated that they requested dual-energy X-ray absorptiometry in patients with fragility fractures. The rate of knowledge about the FRAX® algorithm was 17% in the orthopedic surgeons and 0% in the neurosurgeons. While 38% of the orthopedic surgeons stated that they performed both the treatment and follow-up of osteoporosis in patients with fragility fractures, 62% stated that they referred these patients. All the neurosurgeons stated that they did not perform osteoporosis treatment or follow-up and referred all their patients. Only one orthopedic surgeon was aware of fracture liaison services, while the other surgeons had no knowledge.

**Conclusion:** The awareness of both the orthopedic surgeons and neurosurgeons about the management of fragility fractures and fracture liaison services was lower than expected.

**Keywords:** Fragility, neurosurgery, orthopedics

### Öz

**Amaç:** Bu çalışmanın amacı Eskişehir’de çalışan beyin cerrahları ve ortopedistlerin frajilite kırıkları ve fraktür liyezon servisleri hakkındaki farkındalıklarını arařtırmaktır.

**Gereç ve Yöntem:** Toplam 50 cerraha (21 beyin cerrahı, 29 ortopedist) frajilite kırıkları ve fraktür liyezon servisleri hakkında sorular içeren anket uygulandı.

**Bulgular:** Tüm cerrahların %95’den fazlası düşük seviyeli travma ile oluşmuş kırıklarda osteoporoz düşündüğünü belirtti. Ancak sadece %69 ortopedist ve %61 beyin cerrahı, frajilite kırıklı hastalarda dual-enerji X-ışını absorpsiyometri istediğini belirtti. FRAX® algoritması hakkındaki bilgi yüzdesi ortopedistlerde %17, beyin cerrahlarında %0 idi. Ortopedistlerin %38’i frajilite kırığı olan hastalarda osteoporozun hem tedavisini hem de takibini yaptığını belirtirken, %62’si bu hastaları refere ettiğini belirtti. Tüm beyin cerrahları ise osteoporoz takip ve tedavisi yapmadıklarını, tüm hastaları refere ettiklerini belirtti. Sadece bir ortopedistin fraktür liyezon servisleri hakkında bir bilgisi varken, diğer cerrahların herhangi bir bilgisi yok idi.

**Sonuç:** Ortopedi ve beyin cerrahi hekimlerinin, frajilite kırıklarının yönetimi ve fraktür liyezon servisleri hakkındaki farkındalığı beklenenden düşüktür.

**Anahtar kelimeler:** Frajilite, beyin cerrahi, ortopedi

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## Introduction

The clinical significance of osteoporosis is that it can lead to fragility fractures occurring in the weakened bone through a low-energy trauma (1). In the FRACTURK study, it was reported that the risk of hip fracture was 3.5% in Turkish men and 14.6% in Turkish women after 50 years old. This means after the age of 50, almost one in seven women will sustain a hip fracture during their remaining lifetime. In 2009, 24,000 hip fractures occurred in Turkey, of which 73% were in women. In 2035, this number is expected to be almost 64,000 (2). Vertebral fractures are two to three times more common than hip fractures; however, only about a third of these are ever diagnosed (3).

Fragility fractures are related to both morbidity and mortality. The mortality rate of patients with hip fractures is approximately one in three, with 4% mortality in hospitalization and 10-24% mortality in the first year (4,5). Besides mortality, fragility fractures are also associated with loss of productivity and independent living, reduced quality-of-life and substantial morbidity (1). Twenty-five percent of patients were also reported to require long-term residential care (6). In addition, these fragility fractures cause a huge burden to the economies of individual countries. In 2005, this burden in Europe amounted to 32 billion Euros per year. In 2025, it is expected to rise to 37 billion Euros (7). Moreover, the full extent of the burden to patients, caregivers and society due to the attendant lifestyle changes and lost productivity is not fully known.

A fragility fracture is the greatest indicator of a future fragility fracture. Patients who have experienced any fracture at any site, are at almost twice the risk of a future fracture (8,9). Furthermore, patients with a fragility fracture of the radius, femur, humerus or ankle have almost four times the risk of suffering a future fracture (9). Half of patients with a vertebral fracture are expected to experience another vertebral fracture within three years, and most of these fractures occurs in the first year afterwards (10,11). It has been reported that starting medical treatment for patients with fragility fractures may decrease their risk of experiencing a new fragility fracture by up to 50% (12,13). In 2012, the International Osteoporosis Foundation (IOF) launched the "Capture the Fracture" campaign, with the aim of making fracture liaison services (FLS), a solution for post-fracture care, more globally widespread (14). FLS centers have been established in Turkey for almost ten years and can currently be found in İstanbul, Ankara, İzmir, Denizli, and Kayseri. The Eskişehir FLS was opened in June 2022, as part of Turkish FLS team run by representatives of the Turkish Osteoporosis Society. Considering the effect of fragility fractures on peoples' lives and society in general, it is important that osteoporosis treatment and rehabilitation programs be started as soon as fragility fractures are detected. Patients with vertebral fragility fractures are frequently referred to neurosurgeons, while patients with non-vertebral fragility fractures are more commonly referred to orthopedic surgeons. Both of these groups of healthcare professionals have the chance to prevent future fractures by

recognizing fragility fractures. However, in previous studies, orthopedic practice for both the diagnosis and treatment of osteoporosis was reported to be inadequate in patients with fragility fractures (15-17). No similar study for neurosurgical practice regarding vertebral fragility fractures could be found in the literature. The aim of this study was thus to evaluate (1) the approach to fragility fractures in daily orthopedic and neurosurgical practice, and (2) the awareness about fragility fractures and FLS of neurosurgeons and orthopedic surgeons in the province of Eskişehir.

## Materials and Methods

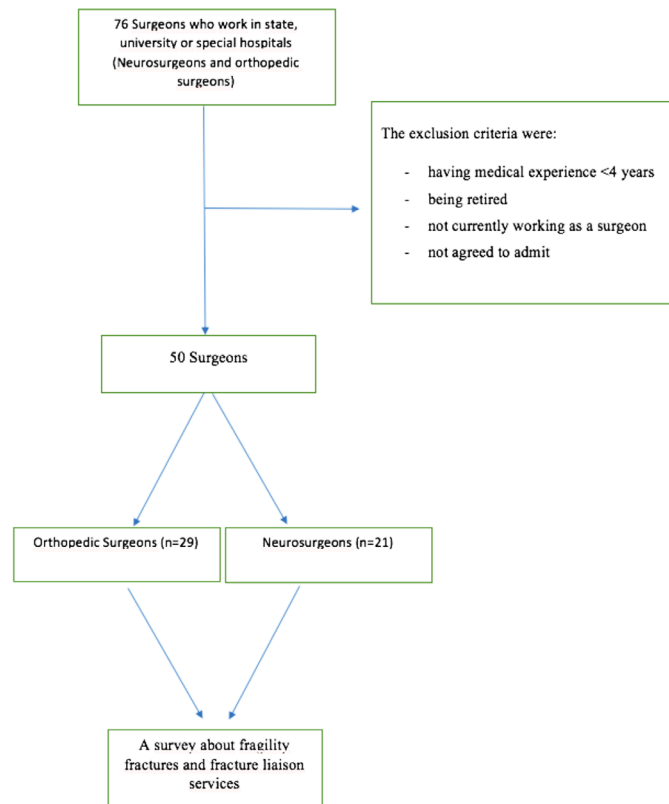
This survey study was conducted between March and April 2023 in the department of physical medicine and rehabilitation (PMR) at a university hospital. The inclusion criteria were: Being an orthopedic surgeon or a neurosurgeon in state hospitals, university hospitals and special hospitals in Eskişehir and agreeing to participate in the study. The exclusion criteria were: having medical experience <4 years, being retired and not currently working as a surgeon (Figure 1). The survey data included demographic characteristics (age, duration of medical experience, place of work) of the surgeons, knowledge of fragility fractures, FRAX® and FLS, and questions about whether they administered osteoporosis treatment or referred the patient to PMR or to the internal medicine/endocrinology/geriatric clinics and whether medication prescribed for osteoporosis would impair fracture healing. The survey was filled out by the surgeons themselves. Ethics approval was received from the Eskişehir Osmangazi University Non-invasive Clinical Research Ethics Committee with the decision dated 21/02/2023 and numbered 16. All surgeons were informed about the study and their verbal consent was obtained.

## Statistical Analysis

IBM SPSS Statistics 21.0 (SPSS Inc., Chicago, Illinois) program was used for statistical analysis. The categorical variables were evaluated using chi-square tests and presented as numbers (n) and percentages (%). Descriptive statistics were given as mean (standard deviation). A p-value <0.05 was considered significant.

## Results

A total of 50 male surgeons (21 neurosurgeons, 29 orthopedic surgeons) who agreed to participate in the survey were enrolled in this study. The mean age of the orthopedic surgeons was 46.72±9.47 years (minimum age: 29, maximum age: 62), the mean age of neurosurgeons was 44.0±11.23 years (minimum age: 27, maximum age: 65). The mean duration of medical experience was 22.40±9.85 years (minimum: 4, maximum: 38) in the orthopedic surgeons, the mean was 20.28±11.49 years (minimum: 4, maximum: 41) in the neurosurgeons. Of the 29 orthopedic surgeons, 41.4% were working in state hospitals, 31.0% of them were in special hospitals, and 27.6% of them were in university hospitals. Of the 21 neurosurgeons, 42.9%



**Figure 1.** Flow chart of the study

were working in state hospitals, 38.1% of them were in university hospitals, and 19.0% of them were in special hospitals (Table 1, 2).

All surgeons answered “Yes” to the question: “Do you have any knowledge about fragility fractures?”. Of the orthopedic surgeons, 96.6% answered “Yes” to: “Do you think that the risk of a new fracture increases in a patient with a fracture from a low-level trauma?” and “Would you consider osteoporosis in a patient who had a fracture from a low-level trauma?”, while these percentages were 95.2% and 100% respectively in the neurosurgeons. The most common fragility fractures seen by orthopedic surgeons were those of the femur and forearm, while for the neurosurgeons’ fractures were only seen in the vertebrae (Table 1, 2).

To evaluate osteoporosis in fractures caused by low-level trauma in daily practices, 69% of the orthopedic surgeons stated that they would want dual-energy X-ray absorptiometry (DXA), 31% of them stated they would want blood analysis for the level of calcium, phosphorus, albumin, Alkaline phosphatase (ALP), and 44.8% of them stated they would want to know the level of 25 hydroxyvitamin D. Of the neurosurgeons, 61.9% stated that they would want a DXA, while 14.3% of them stated that they would want a blood analysis. The rate of knowledge about the FRAX® algorithm was 17.2% in the orthopedic surgeons and 0% in neurosurgeons. While 37.9% of the orthopedic surgeons stated that they performed both the treatment and follow-up of osteoporosis in patients with fragility fractures, 44.8% referred

these patients to PMR, and 17.2% referred them to internal medicine, geriatrics or endocrinology. All the neurosurgeons stated that they did not perform osteoporosis treatment or follow-up and referred all their patients to PMR. To the question “Do you think that starting osteoporosis medication in the early period will impair fracture healing?” 20.7% of the orthopedic surgeons and 9.3% of the neurosurgeons answered “Yes”. Only one orthopedic surgeon answered “Yes”, while all the neurosurgeons answered “No”, to the questions “Do you have any knowledge about FLS?” and “Is there an FLS in Eskişehir?” (Table 1, 2).

## Discussion

This is the first study which evaluates the awareness of both orthopedic surgeons and neurosurgeons about fragility fractures. Osteoporosis is mostly a silent disease and these surgeons are often the first to see patients with the condition who have sustained with fragility fractures. The most important risk factor for a future fragility fracture is a previous one. Patients with a vertebral fracture have an approximately four times increased risk of a new vertebral fracture and are at twice the risk of non-vertebral fractures (1,8-11,18). Distal radius fragility fractures occur almost 15 years earlier than hip fragility fractures. Patients who have experienced a distal radius fracture, have two times risk of a future hip fracture (19). In patients with a hip fracture, 10.6% will go on to suffer a fracture in their contralateral hip (20).

The role of orthopedic surgeons and neurosurgeons is thus critical to prevent morbidity, mortality and the large economic burden arising from new fragility fractures.

In an international study (in England, Germany, Spain, Italy, France, New Zealand) conducted by IOF, it was revealed that orthopedic surgeons lack training on osteoporosis and recommended that they receive more education on this topic (15). In Turkey, Moradi and Atik (16) evaluated the rate of the initiation of osteoporotic treatment after surgical fragility

fractures in 844 patients between January 2002 and December 2011 and reported that awareness of diagnosis and treatment of fragility fractures declined over time. However, no study could be found in the literature about neurosurgeons' awareness and knowledge of osteoporosis or fragility fractures.

The American National IOF recommends that DXA be requested for all adults over 50 years of age with fractures (21). In the current study, although almost all of the orthopedic surgeons and neurosurgeons stated that they thought the risk

**Table 1. Fragility fracture and fracture liaison service assessment survey data in orthopedic surgeons**

	Orthopedic surgeons (n=29) n (%)
Age (years) (mean ± SD)	46.72±9.47
Medical experience (years) (mean ± SD)	22.40±9.85
<b>Working place</b>	
State hospital	12 (41.4%)
University	8 (27.6%)
Special hospital	9 (31%)
<b>Survey questions</b>	
Do you have any knowledge about fragility fractures? (yes)	29 (100%)
<b>Which part of the body do you see fragility fractures mostly?</b>	
Femur	21 (72.4%)
Forearm	14 (48.3%)
Vertebra	10 (34.5%)
Shoulder	3 (10.3%)
Costa	0 (0%)
Do you think that the risk of a new fracture increases in a patient with a fracture with a low-level trauma? (yes)	28 (96.6%)
Would you consider osteoporosis in a patient who had a fracture with a low-level trauma? (yes)	28 (96.6%)
Do you know about the FRAX® algorithm? (yes)	5 (17.2%)
Do you want an examination for osteoporosis in fractures caused by a low-level trauma that would not normally cause fractures in your daily practice? (yes)	20 (69.0%)
<b>Which examinations do you prefer?</b>	
DXA	20 (69.0%)
The level of calcium, phosphorus, albumin, ALP	9 (31%)
The level of 25 hydroxyvitamin D	13 (44.8%)
The level of magnesium	1 (3.4%)
Quantitative CT	0 (0%)
<b>Which branch do you refer to for the follow-up and treatment of osteoporosis of a patient with a low-level trauma and fracture?</b>	
Physical medicine and rehabilitation specialist	13 (44.8%)
Internal medicine/endocrinology/geriatrics	5 (17.2%)
No referral, treatment was made by myself	11 (37.9%)
Do you think that starting osteoporosis medication in the early period will impair fracture healing? (yes)	6 (20.7%)
Do you have any information about FLS? (yes)	1 (3.4%)
Is FLS in Eskişehir? (yes)	1 (3.4%)

SD: Standard deviation, ALP: Alkaline phosphatase, DXA: Dual-energy X-ray absorptiometry, CT: Computed tomography, FLS: Fracture liaison services

<b>Table 2. Fragility fracture and fracture liaison service assessment survey data in neurosurgeons</b>	
	<b>Neurosurgeons (n=21) n (%)</b>
Age (years) (mean ± SD)	44.0±11.23
Medical experience (years) (mean ± SD)	20.28±11.49
<b>Working place</b>	
State hospital	9 (42.9%)
University	8 (38.1%)
Special hospital	4 (19.0%)
<b>Survey questions</b>	
Do you have any knowledge about fragility fractures? (yes)	21 (100%)
<b>Which part of the body do you see fragility fractures mostly?</b>	
Vertebra	21 (100%)
Other	0 (0%)
Do you think that the risk of a new fracture increases in a patient with a fracture with a low-level trauma? (yes)	20 (95.2%)
Would you consider osteoporosis in a patient who had a fracture with a low-level trauma? (yes)	21 (100%)
Do you know about the FRAX® algorithm? (yes)	0 (0%)
Do you want an examination for osteoporosis in fractures caused by a low-level trauma that would not normally cause fractures in your daily practice? (yes)	13 (61.9%)
<b>Which examinations do you prefer?</b>	
DXA	13 (61.9%)
The level of calcium, phosphorus, albumin, ALP	3 (14.3%)
The level of 25 hydroxyvitamin D	3 (14.3%)
The level of magnesium	2 (9.5%)
Quantitative CT	0 (0%)
<b>Which branch do you refer to for the follow-up and treatment of osteoporosis of a patient with a low-level trauma and fracture?</b>	
Physical medicine and rehabilitation specialist	100 (100%)
Internal medicine/endocrinology/geriatrics	0 (0%)
No referral, treatment was made by myself	0 (0%)
Do you think that starting osteoporosis medication in the early period will impair fracture healing? (yes)	2 (9.3%)
Do you have any information about FLS? (yes)	0 (100%)
Is there a FLS in Eskişehir? (yes)	0 (100%)
SD: Standard deviation, DXA: Dual-energy X-ray absorptiometry, ALP: Alkaline phosphatase, CT: Computed tomography, FLS: Fracture liaison services	

of a new fracture increased after a fragility fracture, only 69% of the orthopedic surgeons stated that they requested a DXA in patients with fragility fractures, while this rate was 61% in the neurosurgeons. These rates are similar to those found in a previous study which conducted a survey of 166 orthopedic surgeons about osteoporosis in Turkey. Likewise, Aydın (17) reported that 30% of orthopedic surgeons did not request a DXA for any patient. After hip fractures, the rate of initiation of osteoporosis treatment ranges from 5-30% (2). The low rate of post-fracture DXA request by surgeons in two separate studies in Turkey explains the low rates of initiation of post-fracture osteoporosis treatment.

FRAX® is a computer-based algorithm which gives ten-year probability of hip fracture and a major osteoporotic fracture (22). The World Health Organization recommends the use of FRAX® to detect patients' risk of fractures. However, only 17.2% of the orthopedic surgeons, and not a single neurosurgeon, knew about the FRAX® algorithm. Measuring serum vitamin D levels is recommended for diagnosis and follow-up for osteoporosis by the Society of Endocrinology and Metabolism, and measuring calcium, phosphorus, ALP is recommended in vitamin D deficiency (23). Aydın (17) reported that 36% of orthopedic surgeons did not request the vitamin D levels of patients with a fragility fracture. The percentage of those



asking for vitamin D levels was even lower in the present study: 56% of the orthopedic surgeons and 86% of neurosurgeons stated that they did not do this. In addition, 69% of the orthopedic surgeons and 86% of the neurosurgeons stated that they did not request serum levels of calcium, phosphorus, albumin, and ALP. Similar to our study, Aydın (17) reported this rate to be 62%. Given the effect of vitamin D on falls and bone health (24), these low rates were disappointing. Osteoporosis is treated in many different branches of medicine. While physicians working in internal medicine, PMR, rheumatology, gynecology and obstetrics are authorized to write osteoporosis medication for osteoporosis, as are orthopedic surgeons, neurosurgeons in Turkey are not authorized to do so. With regard to patients with fragility fractures, 17% of the orthopedic surgeons stated that they referred these patients to internal medicine physicians and 45% referred them to PMR physicians, while only 38% of them stated that they provided treatment and follow-up osteoporosis themselves. All the neurosurgeons stated that they referred all patients with fragility fractures to PMR. Given that neurosurgeons are not authorized to prescribe osteoporosis medication, this is not a surprising result, because PMR physicians are better able to treat and follow-up these patients. Aydın (17) reported almost the same rates, finding that while 33% of orthopedic surgeons performed the follow-up and treatment of osteoporosis themselves, 60% of them referred patients to PMR. Orthopedic surgeons and neurosurgeons are generally the first physicians who are consulted when a fragility fracture occurs and they should be expected to know osteoporosis well. However, the rate of initiating osteoporosis treatment by orthopedic surgeons is low both in the province of Eskişehir and in Turkey as a whole, and they mostly refer patients with fragility fractures to other clinics for osteoporosis follow-up and treatment. The use of FLS has been an accepted approach to decrease fragility fractures, especially hip fractures, for approximately a decade. These services, which have been established in many countries, including Turkey, provide interventions to combat osteoporosis and to prevent future fragility fractures (25). There should ideally be a close relationship between FLS and neurosurgeons and orthopedic surgeons, who frequently see patients with fragility fractures. However, the results of this study showed that only one surgeon had some knowledge about FLS. This demonstrates the need for FLS to be promoted more in the orthopedics and neurosurgery communities. In this regard, establishing better contact with professional associations and bringing surgeons and physicians together in multidisciplinary conferences and meetings may offer a way forward. In addition, coordinated post-fracture systems should be established, so that when a fracture record in a patient aged 50 and over is entered into system, their contact information should automatically drop into the FLS system in the same city or region. Such a system would also make it easier to reach out to patients. The limitation of this study is that the surgeons filled in the survey by themselves. The actual approaches they

used in this practice could thus not be evaluated. There is a need for objective studies with patient data to determine the rates of initiation of osteoporotic treatment after a fragility fracture.

## Conclusion

In both the orthopedic surgeons and neurosurgeons knowledge of FRAX® and FLS, and general awareness about fragility fractures was lower than expected. These surgeons play a very important role in the diagnosis and treatment of osteoporosis after fragility fractures, and further professional training on these issues is required to increase awareness.

## Ethics

**Ethics Committee Approval:** Ethics approval was received from the Eskişehir Osmangazi University Non-invasive Clinical Research Ethics Committee with the decision dated 21/02/2023 and numbered 16.

**Informed Consent:** All surgeons were informed about the study and their verbal consent was obtained.

## Authorship Contributions

Surgical and Medical Practices: FB., Concept: FB., G.S., B.O., O.A., Design: FB., G.S., B.O., O.A., Data Collection or Processing: FB., G.S., Analysis or Interpretation: FB., B.O., O.A., Literature Search: FB., G.S., B.O., O.A., Writing: FB.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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