

## THE DIAGNOSTIC ROLE OF BONE SCAN IN PATIENTS WITH TRIANGULAR FIBROCARILAGE COMPLEX LESIONS

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### ÖZET

TRIANGULER FİBROKARTİLAG KOMPLEKS YIRTIKLARDA KEMİK SİNTİGROFİSİNİN TANISAL ROLÜ

**Giriş:** Bu çalışmada triangüler fibrokartilaj kompleks (TFCC) lezyonlarında kemik sintigrafisinin tanısai rolünü saptamak amaçlanmıştır.

**Hastalar ve Yöntem:** Bu amaçla distal radius kırığı olan 15 hasta (yaş 28-87; 8'i erkek, 7'si kadın) çalışmaya alınmıştır. Bu hastaların 9'unda artrografik olarak TFCC veya TFCC + interkarpal ligament (ICL) lezyonu olduğu gösterilmiştir. Kemik sintigrafisinin fraktürün erken döneminde pozitif olduğu iyi bilindiğinden, kemik sintigrafisi tüm hastalara son kontroller sırasında, fraktürden ortalama olarak 60 ay sonra (54-69 ay) yapılmıştır.

**Bulgular:** Kemik sintigrafisi artrografisi normal olan 6 hastanın tümünde normal (% 100) bulunmuştur. Artrografide TFCC veya TFCC + ICL lezyonu olan 9 hastanın 8'inde ise (%89) sintigrafide geç statik fazda radioulnar veya radiokarpal kompartmanda artmış aktivite tutulumu izlenmiştir. Bu vakalarda artmış aktivite tutulumundan, ligament veya kartilaj patolojisine bağlı gelişen erken dejeneratif değişikliklerin sorumlu olduğu düşünülmüştür.

**Tartışma:** Ligament veya kartilaj patolojisinden şüphe edilen hastalarda kemik sintigrafisinin yararlı olduğunu ve standart radyografiden sonra yapılması gerektiğini düşündük.

**Anahtar Kelimeler:** *Kemik sintigrafisi, distal radius kırığı, triangüler fibrokartilaj kompleksi, artrografi.*

### SUMMARY

**Introduction:** The aim of this study was to identify the diagnostic role of bone scintigraphy in triangular fibrocartilage complex (TFCC) lesions.

**Patients and Methods:** For this purpose, fifteen patients (aged 28-87 years; 8 males, 7 females) who had distal radius fractures 9 of who had TFCC or TFCC + intercarpal ligament (ICL) lesions, demonstrated by arthrography, were included in this study. It is well known that since bone scan is positive in the early phase of the fracture, bone scans were performed all patients during the in last controls with a mean period of 60 months (ranging from 54 to 69 months) after fracture.

**Results:** Bone scans were normal in 6 patients (100%) who had no demonstrated abnormality by arthrography, scintigraphies were found to be abnormal (increased uptake in radioulnar or radiocarpal compartment) in 8 out of 9 patients (89%) who had TFCC or TFCC + ICL lesions in the late static images. Mechanism responsible for the increased uptake in these cases may be related to early degenerative disease due to ligamentous or cartilaginous abnormality.

**Discussion:** We conclude that bone scintigraphy is helpful in patients with suspected cartilaginous or ligamentous abnormalities and should be performed after standard radiography.

**Key Words:** *Bone scan, distal radius fracture, triangular fibrocartilage complex, arthrography.*

### INTRODUCTION

Fractures of the forearm include 5-10% of all skeletal fractures and 75% of them are 1/3 distal radius fractures<sup>1</sup>. Generally, triangular fibrocartilage complex (TFCC) tears accompany these fractures. The triangular fibrocartilage (TFC) is a part of an extensive fibrous system that arises from the carpal margin of the sigmoid notch of the radius, cups the lunate and triquetral bones and reaches the volar base of the fifth metacarpal. TFC and ulnarpal ligaments have been termed as the

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triangular fibrocartilage complex (TFCC). The diagnosis is suggested by the history of a blow to the ulnar palm producing dorsiflexion and pronation. Persistent tenderness and pain localized to the dorsum of the distal radioulnar joint, increased local symptoms with sudden or forceful resistant rotation, or occasional "clicking" associated with localized pain and tenderness are associated findings<sup>2</sup>. Tear of 2/3 or more of the TFCC can result arthritis in the distal radioulnar and ulnocarpal joint<sup>3</sup>. Arthrography, computed tomography (CT) and magnetic resonance (MR) imaging may be helpful for diagnosis<sup>4</sup>. Scintigraphic evaluation has also been recommended by several investigators<sup>5,6</sup>.

The aim of this study is to determine the usefulness of bone scintigraphy in TFCC tears.

## PATIENTS AND METHODS

Fifteen patients (8 males, 7 females) treated for distal radius fractures, between 1992 and 1993, were included in this study. The mean age was 45 years (ranging from 23 to 87 years). Closed reduction and plaster cast immobilization were applied in all patients for 6 weeks. During this period, six pack exercises were ordered for all the patients to prevent finger stiffness. After removing the cast, the patients had to make active finger and elbow exercises for 2 weeks and then arthrography was performed to find out TFCC lesions. Since it is also well known that bone scan is positive in the early phase of the fracture. We didn't perform it in this period to avoid abnormal uptakes.

All of the 15 patients were reevaluated after a mean of 60 months (ranging from 54 to 69 months) from trauma. After physical examination, roentgenographic examinations, including routine four-view wrist survey, bone scanning was performed. The degree of arthritic changes in distal radiocarpal or radioulnar joints were graded from 0 to 3 according to the system suggested by Knirk and Jupiter from the routine X-ray<sup>7</sup> (Table I). Before scintigraphic examination there were 4 nonunions of ulnar styloid, 9 distal radioulnar pain, 5 minimal decrease of grasp strength, 8 decrease of wrist motion range, 1 problem of dorsal angle, 5 problems of carpal height, 7 arthritic changes in the radiocarpal joint according to X ray and 9 TFCC lesions according to the arthrographical examination in all patients.

Table I  
**Arthritis grading suggested by Knirk and Jupiter<sup>(7)</sup>**

Grade	Findings
0	None
1	Slight joint-space narrowing
2	Marked joint-space narrowing, osteophyte formation
3	Bone-on-bone, osteophyte formation, cyst formation

## TECHNIQUES

**Arthrography:** The hand was placed palm down with the wrist flexed. The forearm is positioned to make the normal volar tilt of the distal radial articular surface parallel to the vertical x ray beam. Under X ray control, radiocarpal ligament was determined. After skin preparation, 1 cc. local anesthetic was injected with a 22- gauge short beveled needle in to the radiocarpal joint. Joint fluid was aspirated before dye injection to avoid dilution. Following this, 2-3 cc. contrast material was injected. After this procedure the wrist was manipulated to distribute the contrast material and AP, lateral, medial oblique and lateral oblique graphies were taken.

The penetration of prestyloid recess and pisotriquetral joint was accepted as normal findings. Abnormal findings were penetration of the dye from either the radiocarpal joint to the distal radiocarpal joint or intercarpal joint. But penetration of extensor tendon sheath wasn't accepted abnormal finding.

**Scintigraphy:** Three phase bone scintigraphy was performed with LEAP collimator. After the intravenous injection of 740 MBq of Tc99m-MDP, images were obtained in these three phases as follows: (a) radionuclide angiography, (b) blood-pool imaging, (c) static imaging at 2.5 hours in both palmar and dorsal projection for 10 minutes (Toshiba GCA 602A) at the 256 x 256 matrix. Vascular and static images were evaluated as follows: 0: Normal uptake, +: slight uptake, ++: Moderate uptake and +++: Intense uptake.

## RESULTS

**Arthrographic results:** Nine out of 15 patients were diagnosed with TFCC or TFCC+ intercarpal ligament (ICL) lesions.

**Radiographic results:** The final radiographs were evaluated to determine the degree of arthritis in the radiocarpal and/or radioulnar joint according to the criteria of Knirk and Jupiter. Seven out of 9 patients with TFCC or TFCC+ICL lesions, had Grade I or Grade II arthritic changes, the other 2 patients were normal in terms of radiological examination. On the other hand, 6 patients with no demonstrable abnormality by arthrography had also no arthritic changes.

**Scintigraphic results:** Bone scans were normal in 6 patients with no TFCC and/or ICL lesions. In 8 out of 9 patients (89%) with TFCC or TFCC+ICL lesions, bone scans were positive on the static images and abnormal uptakes were localized in the radioulnar or radiocarpal compartment of the wrist. Fig.1a-b and 2 show that arthrographic and scintigraphic images in patients with TFCC tear. Radionuclide angiography and blood pool images were normal in all patients (Table II).

## DISCUSSION

In patients with distal radius fractures and related injuries, standart radiographic examination is satisfactory to solve clinic problems. However in

patients with distal radius fractures with suspected ligamentous or cartilaginous abnormality, further imaging techniques such as arthrography, CT, and MR imaging may be helpful for diagnosis<sup>4</sup>. Scintigraphic evaluation has also been recommended by several investigators<sup>5,6</sup>. As shown in the literature mild focal uptake is suggestive for a ligamentous or cartilaginous abnormality and normal bone scintigraphy excludes osteochondral involvement. Intense focal uptake represents occult carpal fractures and diffusely positive uptake represents reflex sympathetic dystrophy<sup>8-10</sup>.

In the acute phase after trauma (at 3 to 4 weeks), all three phases of bone scanning are positive. In the subacute phase (at 10 to 12 weeks) findings of radionuclide angiography become normal, and the findings of blood pool imaging, as well as that of static bone imaging, remain positive. In the late phase, the findings of radionuclide angiography and blood pool imaging are normal and the activity on static imaging decreases over 3 to 8 months and return to normal in two years with 90%<sup>11-14</sup>. It is well known that since bone scan is positive in the early phase of the fracture, we performed bone scans on all patients during the last controls with a mean period of 60 months after trauma.

Table II  
**Radiographic, scintigraphic and arthrographic results**

Case no.	Plain radiography	Arthrography	Scintigraphy Intensity, Localization, Pattern
1	Grade 1 Arthritis	TFCC+ICLT	++, RU, F
2	Grade 1 Arthritis	TFCC	++, RU, F
3	Normal	Normal	Normal
4	Normal	Normal	Normal
5	Normal	Normal	Normal
6	Grade 1 Arthritis	TFCC	++, RU, F
7	Normal	Normal	Normal
8	Normal	Normal	Normal
9	Grade 3 Arthritis	TFCC	Normal
10	Normal	TFCC	++, RU, F
11	Grade 2 Arthritis	TFCC	++, RC, D
12	Normal	TFCC	++, RU, F
13	Normal	Normal	Normal
14	Grade 1 Arthritis	TFCC+ICLT	++, RC, D
15	Grade 1 Arthritis	TFCC+ICLT	++, RU, F

RU; Radioulnar, RC; Radiocarpal, D; Diffuz, F; Focal, +++; Intense, ++; Moderate, +; Slight Uptake



**Fig 1a-b:** Arthrography shows TFCC lesion.



**Fig 1a-b:** Arthrography shows TFCC lesion.

In our study, arthrographic examination demonstrated that 9 patients had TFCC or TFCC + ICL lesions. In radiological examination, Grade 1 and 2 arthritis were seen in 7 of these patients and bone scans were positive. One of the remaining two patients (Case no: 9) had evident degenerative changes on plain radiographs and normal scintigraphic result. We explained normal bone scan by compensation (decreased loading, increased control) of the patient who has lived with



**Fig 2:** Palmar scintigraphy shows moderate diffusely increased activity in the right radiocarpal compartment in the same patients with TFCC lesion.

the instability for a long time. The other patient (Case no: 12) had normal radiological and abnormal scintigraphical results. In this case, we thought that abnormal scintigraphical result is a direct marker of increased osseous activity and this abnormal activity may indicate early degenerative changes before pathological changes have occurred radiographically.

On the other hand 6 patients with no demonstrable abnormality by arthrography had no arthritic changes by plain radiographic examination. Bone scans were also normal in all of these patients.

Pin et al<sup>15</sup> showed that scintigraphic evaluations of the patients with wrist pain corresponded with the ligamentous tears and fractures in 95% of cases. They found that scintigrams were normal in 96% of the patients with no demonstrable injury. In our study, bone scans were normal in all patients whose arthrographies revealed no demonstrable abnormality. On the other hand, scintigrams were abnormal on the delayed images in 8 out of 9 patients (89%) in TFCC tears. Abnormal uptakes were in radioulnar localization in 6 patients and radiocarpal in 2. The mechanism for increased tracer accumulation in these cases may be related to early degenerative disease due to ligamentous or cartilaginous abnormality.

Bone scan appears to be a sensitive method for evaluating patients with suspected TFCC lesions. Although abnormal scintigraphic findings are

generally nonspecific, negative bone scanning excludes many problems such as fractures, reflex sympathetic dystrophy and ligamentous or cartilaginous abnormality. Moderate increased activity suggests cartilaginous or ligamentous abnormality.

Although our patients are few in number, we suggest that moderately increased activity of the wrist in bone scintigraphy can be accepted as the diagnostic criteria for TFCC lesions and bone scintigraphy can be used to select the symptomatic patients who require operative treatment. Further investigations with larger series will confirm the role of bone scintigraphy in the diagnosis and the decision making among treatment options.

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