



Heterotopic ossification after total knee arthroplasty

Total diz artroplastisi sonrası heterotopik ossifikasyon

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Amaç: Bu çalışmada, total diz artroplastisinden (TDA) sonra heterotopik ossifikasyon (HO) gelişim sıklığı araştırıldı, gelişim zamanı ve klinik görünümü belirlenmeye çalışıldı.

Çalışma planı: Total diz artroplastisi uygulanan 226 dizin ilk bir yıl içinde çekilen ardışık (6. hafta, 3. ay, 6. ay ve 12 ay) radyografileri geriye dönük olarak değerlendirildi. Heterotopik ossifikasyon tanısı TDA öncesi ve sonrası grafilerin karşılaştırılmasıyla kondu. Heterotopik ossifikasyon Figgie ve ark.nın sistemiyle derecelendirildi, klinik ve radyografik seyri belirlendi. Heterotopik ossifikasyon gelişen olgularda olası etkenler araştırıldı. Derin ven trombozunun önlenmesi amacıyla mekanik yöntemler dışında farmakolojik profilaksi uygulanmadı.

Sonuçlar: Total diz artroplastisinden sonra, 226 dizin yalnızca ikisinde (%0.9), altıncı ayda, distal femurun suprakondiler bölgesinde 1. derece HO saptandı. Her iki olgunun da bu dönemde ayakta dururken diz bölgesinde ılımlı, nonspesifik bir ağrı dışında yakınması yoktu. Diz patolojisi her iki olguda da primer osteoartriti ve her ikisinde de HO 12. ay grafilerinde kendiliğinden kayboldu.

Çıkarımlar: Çalışmamızdaki HO sıklığının daha önceki çalışmalara göre düşük bulunmasının olası nedeninin, hastalarımızın tromboprofilaksi amaçlı farmakolojik tedavi almaları olduğu düşünüldü. Heterotopik ossifikasyonun daha geç ortaya çıkmış olması, TDA olgularının HO gelişimi yönünden daha uzun süre izlenmesi gerektiğini göstermektedir.

Anahtar sözcükler: Artrit, romatoid/cerrahi; artroplastisi, replasman, diz/yan etki; diz eklemi/cerrahi; ossifikasyon, heterotopik/epidemioloji; osteoartrit, diz/cerrahi; ameliyat sonrası komplikasyon.

Objectives: The purpose of this study was to determine the incidence, time to development and clinical presentation of heterotopic ossification (HO) after total knee arthroplasty (TKA).

Methods: We retrospectively reviewed consecutive radiographs of 226 knees that were obtained at the end of sixth week, third, sixth, and twelfth months following TKA. The radiographic diagnosis of HO was based on the comparison of pre- and postoperative serial radiographs. Grading of HO was made according to the classification of Figgie et al. The clinical and radiographic course of HO and possible predisposing factors were investigated. No pharmacological prophylaxis was used other than mechanical measures to prevent deep vein thrombosis.

Results: Heterotopic ossification was detected only in two knees (0.9%) at the sixth month evaluation of lateral radiographs. It was grade 1 in both knees and localized at the supracondylar area of the distal femur. Both patients had primary osteoarthritis. There were no complaints except for mild nonspecific pain around the knee while standing. In both cases, HO underwent spontaneous improvement and disappeared on the twelfth month radiographs.

Conclusion: Compared with previous studies, the incidence of HO after TKA was quite low and this could be attributed to the lack of pharmacological thromboprophylaxis. Delayed appearance of HO in two patients suggests that TKA cases be monitored for a longer period for HO development.

Key words: Arthritis, rheumatoid/surgery; arthroplasty, replacement, knee/adverse effects; knee joint/surgery; ossification, heterotopic/epidemiology; osteoarthritis, knee/surgery; postoperative complications.

Heterotopic ossification (HO) which is frequently seen after a total hip arthroplasty (THA) causes pain and stiffness that have clinically importance.^[1-3] However HO following total knee arthroplasty (TKA) is an unusual event. It is generally accepted that it appears firstly on the 6- week postoperative and all subsequent radiographs and its diagnosis is easily made after the radiographic appearance of ossification around the distal femur on the radiographs.^[4] The main clinical manifestations of HO include swelling, warmth, erythema, fever and pain.^[4]

In the first time, HO after TKA was reported as a case report by Freeman et al.^[5] However, recently, the incidence of HO after TKA has been shown to be higher than previously expected with a reported incidence ranging from 4% up to 42%.^[6,7]

HO may be an important problem since it can be a potential cause of difficulties and clinical manifestations in the postoperative rehabilitation of TKA.^[8,9] In this study, incidence of HO after TKA was investigated, and also its time of development and clinical presentation were determined.

Patients and methods

The radiographs of 226 knees (161 patients; 26 men, 135 women, mean age 63.4±3.7, range: 31 to 81) after having a TKA between January 1990 and January 2001 were evaluated. Of 161 patients, 96 had unilateral procedures, 65 patients had staged bilateral procedures. The diagnosis were osteoarthritis in 176 knees, rheumatoid arthritis in 41 knees, juvenile arthritis in 3 knees, posttraumatic arthritis in 2 knees, Behcet disease in 2 knees and arthrosis after chondromatosis and ankylosing spondylitis 1 for each.

Two surgeons performed all operations. Two surgical approaches based on surgeon's preference were used for TKA: (1) Subvastus approach (SVA) in 116 knees, (2) Standard medial parapatellar approach (SMPA) in 110 knees. While all the knees had cementless femoral and patellar components, the cemented and cementless tibial components were used in 109 and 177 knees, respectively. The reason of difference in using of cement was related with changing in manufacturing of prosthesis. Perioperative antibiotic prophylaxis with a first-generation cephalosporin was performed for 48 hours.

In order to prevent deep venous thrombosis (DVT), pharmacological prophylaxis (heparin, coumadin and low weight heparin) was not used. Only mechanical measures were used for this purpose. During the first 3 days after operation, all cases were administered nonsteroidal anti-inflammatory drugs (NSAIDs) parentally or orally for pain management, but not for a longer period and prophylaxis against HO.

Rehabilitation programme was started immediately after TKA with the isometric strengthening exercises of the quadriceps and tibialis muscles, and continued with using of continuous passive motion (CPM) for 2-3 times 1 hour a day. The progressive programme under the control of physiotherapist was used to obtain full extension and 90° flexion at the end of the first week in all patients. All patients started to walk on the 2nd postoperative day by using a walker. Within ten days after surgery, most patients were discharged from hospital.

Standard radiographs of the knee joint were obtained in all patients preoperatively and immediately after the operation and at the 6th week, 3rd, 6th and 12th month postoperatively. A panel of three experts (1 orthopaedist, 1 radiologist and 1 physiatrist) analysed radiographs for searching HO. If there was a HO, radiographs of 18th, 24th, 36th, 48th and 72nd month were also evaluated. The radiographic diagnosis of HO was based on the comparison of pre- and post-operative radiographic findings and, if present was classified according to the system of Figgie and Golberg (table 1).

Chi-square test was used for comparison of the groups when the patients were subdivided according to the possible causative factors for development of HO (gender, the pathology affected knee joint, type

Table 1. Classification of the degree of ossification according to Figgie et al.^[5]

Grade 0	No evidence of HO
Grade I	Progressive HO in at least 1 compartment of the knee, without spur formation.
Grade II	Progressive HO in at least 1 compartment of the knee, with spur formation (> 1mm)
Grade III	Complete bony ankylosis.

Table 2. Characteristics of two patients who had HO.

	1. Patient	2. Patient
Age	68	74
Sex	woman	woman
Side	left	right
AWeight (kg)	73	72
Diagnosis	osteoarthritis	osteoarthritis
Preoperative pain duration (month)	72	180
Preoperative walking distance (meter)	50	200
Preoperative ROM (degree):		
Right active/ passive	115/ 120	75/ 80
Left active/passive	100/ 120	90/ 90
Surgical approach	SVA	SVA

of surgical approach, type of tibial fixation). If number of the subjects was less than 5 in any group, the values of Fisher's exact test were admitted to analyses.

Results

HO was found in laterally radiographs of two of 226 knees in the study (2 of 161 patients) (Table 2). Both of the patients with HO, 68 and 74-year old women, had undergone TKA with subvastus approach for primary osteoarthritis. One of them had cemented tibial component; the other one had cementless one. The early postoperative period of both cases with HO was uncomplicated; findings such as swelling, warmth, erythema or fever and pain around the knee joint were not observed. There were no findings of HO on the radiographs taken just after the operation and at the 6th week and 3rd month postoperatively (Figure 1a, c). HO was evaluated as class I in both at 6th month. In both cases, HO localised in soft tissues around the supracondylar area of the distal femur, was seen on lateral radiographs (Figure 1b, d). At the time of radiographic appearance, the patients' complaints were activity related discomfort and non-specific findings that described by the patients as mild or middle. The range of motion was 0 to at least 90 degrees of flexion in both operated knees.

In both patients, active range of motion exercises was conducted and no other therapeutic modalities for HO were considered. At 12 months postoperatively,

clinically benign course pursued and there was no progress in the patients' complaints, neither in findings during physical examination. At that time, HO disappeared spontaneously on radiographs.

In our study, the incidence of HO was found as 0.9% and 1.1% in all cases and the cases with osteoarthritis, respectively. The incidence of HO in SVA group was 1.7%.

There was no effect of evaluated factors with respect to the development of HO. Because of small numbers of HO positive cases, gender ($p=0.73$), type of surgical approach ($p=0.26$), type of knee disorder ($p=0.61$) and type of tibial fixation ($p=0.73$) had no significant effect on the development of HO with Fisher's exact test.

Discussion

The available data concerning HO after TKA is far to make conclusion about in this field. Our study showed different findings when compared previous studies. Although it has been reported high incidence of HO up to 42%^[5], in our study, HO's incidence after TKA was considerably lower comparing to that of previous data. With statistical data, none of the parameters (gender, type of surgical approach, type of knee disorder and type of tibial fixation) had any significant effect on the development of HO. For this reason, we concluded that other parameters which were seen in our patients but different than that of previous data may have effect. The absence of pharmacological prophylaxis against DVT in our cases can be considered as a responsible factor for that. In fact, the influence of pharmacological thromboprophylaxis on the development of HO has not been examined enough to date. In this field, we could find only the study of Knahr et al^[10] that reported the consecutive analyses of cases with total hip arthroplasty. Concerning this report, either low-dose heparin or dextran 40 lead to considerable increase in the development of HO. Although they reported lower incidence of HO when NSAIDs were administered with thromboprophylaxis, this incidence was not as low as the cases that did not receive thromboprophylaxis.^[10] For our relatively lower incidence of HO than expected, the most likely explanation is that any pharmacological prophylaxis was not used against DVT in our cases. However, we are not able to conclude based on evidence in this field due to not having control subjects.

Although neither risk factors nor recommendations for prophylaxis were clearly defined for HO following TKA, the development of HO is generally related to the predisposing factors such as trauma, previous knee surgery, postoperative manipulation, osteoarthritis, immobilisation, infection and previ-

ous HO.^[4,11,12] None of our patients with HO had one of these predisposing factors other except osteoarthritis as an etiological factor. In our study, the facts that there was no finding of arthritis following trauma and we avoided immobilisation or postoperative manipulation in our patients can be



Figure 1. Lateral knee radiographs of the patients who had heterotopic ossification at 6th week (a and c) and at 6th month (b and d) after the operation.

thought that we had the cases with relatively low risk for HO.

In previous studies, the patients with rheumatoid arthritis (RA) are theoretically less likely to develop HO because these patients take more NSAIDs and steroids.^[13] It should be considered that these drugs could prevent to develop HO and also explain why we found low incidence of HO, although NSAIDs were used only for a limited time and not in doses and length proposed for HO prophylaxis.

In this series the surgical approach used in both cases with HO, was the subvastus approach (SVA). With the numbers available, it is not possible to drive any meaningful conclusion; but it might be an addition predisposing factor for the responsibility of this approach. Although it seems paradoxical since this approach is proposed as a more quadriceps integrity- protecting approach; larger forces that may be required to displace quadriceps muscle as a whole unit, might be responsible. However, small numbers of HO positive cases in both groups hindered to have significant difference between the groups for surgical approach.

Similarly, even through the higher incidence of HO in cases of cemented tibial fixation when compared with cases of cementless one has been recently reported,^[14] in our study we could not obtain any significant difference between the groups regarding type of tibial fixation.

According to the literature, the development time of HO after TKA is, in general, between 3 to 8 weeks post-operatively.^[15,16] The fact that HO was seen at sixth month radiographs in our both cases, may show that HO can be seen later than previously described in postoperative period.

In conclusion, in the absence of any pharmacological thromboprophylaxis, HO after TKA is seen in limited number of patients and seems to be non-significant event in the clinical practice. In contrast to expected, because it is possible to appear HO in longer period of time, up to 6th month, the patients with TKA should be control long time. However,

controlled clinical trials are needed to make conclusion concerning effective parameters.

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