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Long-term results of autograft and allograft applications in hand enchondromas

El yerleşimli enkondromların tedavisinde otogreft veya allogreft uygulamalarının geç dönem sonuçları

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Amaç: El yerleşimli enkondrom nedeniyle küretaj sonrasında otogreft veya allogreft uygulanan olguların geç dönem sonuçları değerlendirildi.

Çalışma planı: On beş yıllık bir dönem içinde 76 hasta (41 erkek, 35 kadın; ort. yaş 32; dağılım 14-47) el enkondromu tanısıyla ameliyat edildi. Küretajdan sonra 61 hastada kavite iliak kanattan alınan otogreft ile, 15 hastada dehidrate spongiöz allogreft ile doldurduldu. Tüm olgularda tanı histolojik olarak doğrulandı. Fonksiyonel sonuçlar Enneking'in skorlama sistemine göre, radyografik sonuçlar ise Tordai sınıflamasına göre değerlendirildi. Ortalama izlem süresi otogreft grubunda 13.5 yıl (dağılım 10-22 yıl), allogreft grubunda 7.4 yıl (dağılım 6-11 yıl) idi.

Sonuçlar: Otogreft grubunda greft ortalama 38 günde konsolide oldu, tam kavrama gücü ortalama 46 günde elde edildi. Allogreft grubunda bu süreler sırasıyla 51 ve 55 gün idi. İlk grupta fonksiyonel sonuçlar olguların %64'ünde çok iyi-mükemmel, %23'ünde iyi, %13.1'inde kötü bulundu; radyografik değerlendirmede, olguların %78.7'si grup I'de, %18'i grup II'de, %3.3'ü grup III'te yer aldı. İkinci gruptaki olguların %66.7'sinde mükemmel-çok iyi, %26.7'sinde iyi, %6.7'sinde kötü sonuç elde edildi; Tordai sınıflamasına göre olguların %80'i grup I'de, %13.3'ü grup II'de, %6.7'si grup III'te yer aldı. İlk grupta iki hastada, ikinci grupta multipl enkondromatozisli bir hastada nüks saptandı. Bu hastada malign dejenerasyon nedeniyle amputasyon uygulandı.

Çıkarımlar: El yerleşimli enkondromların tedavisinde otogreft ve allogreft uygulamalarının başarısı arasında önemli bir fark olmadığı görünmektedir.

Anahtar sözcükler: Kemik neoplazileri/cerrahi; kemik transplantasyonu; kondroma/cerrahi/radyografi; küretaj; el/cerrahi; parmak/cerrahi; ileum/transplantasyon.

Objectives: We evaluated the long-term results of treatment with curettage followed by an autograft or allograft application in patients with enchondroma of the hand.

Methods: Within a 15-year period, 76 patients (41 males, 35 females; mean age 32 years; range 14 to 47 years) were operated on for enchondroma of the hand. Following curettage of the lesion, reconstruction of the defect was made either by an autograft obtained from the iliac crest (n=76) or by a dehydrated cancellous allograft (n=15). The diagnosis was histologically confirmed in all the cases. Functional and radiographic results were assessed according to the Enneking scoring system and the Tordai classification system, respectively. The mean follow-up periods were 13.5 years (10-22 years) and 7.4 years (6-11 years) in autograft and allograft applications, respectively.

Results: Consolidation of the autografts took a mean of 38 days and maximum grasp force was obtained in a mean of 46 days. These periods were 51 and 55 days, respectively, for the allografts. Functional results were excellent/very good in 64%, good in 23%, and poor in 13.1% with autografts; radiographically, 78.7% of the patients were in group I, 18% were in group II, and 3.3% were in group III. Of the allograft group, the results were excellent/very good in 66.7%, good in 26.7%, and poor in 6.7%. Radiographically, 80%, 13.3%, and 6.7% of the patients were classified in group I, II, and III, respectively. There were two recurrences in the autograft group, while one patient, in the allograft group, who had multiple enchondromatosis required a ray amputation because of malignant transformation.

Conclusion: Autograft and allograft applications seem to yield similar success rates in the treatment of enchondroma of the hand.

Key words: Bone neoplasms/surgery; bone transplantation; chondroma/surgery/radiography; curettage; fingers/surgery; hand/surgery; ilium/transplantation.

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An enchondroma is a hamartomateous deposition of hyaline cartilage which has fully grown inside the bone. This deposition results from the deficiency of normal enchondral ossification taking place under the growth cartilage. The reason why the cartilage islet is transformed into an enchondroma is not known.[1]

Approximately 40-70% of enchondromas develop in hand; Proximal phalanx is the most common site involved by enchondroma, followed by metacarpus and middle phalanx; the most rarely observed is the enchondroma of distal phalanx. In 15-20% of the patients consulting a physician for swelling and/or pain and pathological fractures, diagnosis is generally made by coincidence. Patients may present with interesting events including location at carpal bones and formation of pathological fractures, location at distal phalanx and development of traumatic deep flexor tendon avulsion.

The purpose of the surgical treatment of enchondromas is to prevent formation of fractures and development of deformity and to confirm the diagnosis histologically. The most common method used is filling the cavity formed after the curettage of the lesion with an autograft, allograft or various osteoconductive materials.[5,9] Another treatment method is to only perform a curettage of the tumor located at certain sites, using endoscopic or open technique.[10-14]

In our study, we investigated the long-term treatment outcomes in cases where the cavity was filled with two different graft materials-autograft or allograft- following the curettage of enchondromas of the hand, and evaluated the graft options used.

Table 1. Graft types applied to enchondromas by distribution, type, location and form.

		Autograft	Allograft
Distribution	Monoostotic	61	11
	Polyostotic	–	4
Type	Monocentric	61	12
	Polycentric	–	3
Location	Central	47	10
	Eccentric	14	5
Form	Expanded	53	8
	Non-expanded	8	7

Patients and method

Between 1980 and 1995, 76 patients (41 males, 35 females; mean age 32 years; range 14 to 47 years) were operated on for enchondroma of the hand. The reason for seeking medical consultation was pathological fracture in 39 patients (51.3%), and deformity and swelling in 22 patients (29%) (Figure 1 and 2). In 15 patients, the diagnosis was made by the evaluation of radiographies performed for other reasons. Enchondromas were observed in right, left and dominant hand, respectively in 53%, 47% and 46% of the patients. Lesions were evaluated according to their distribution, type and form (Table 1).

Patients were classified into two groups based on the graft option used following the curettage. In 61 patients, an autograft obtained from the iliac crest was used to fill the cavity, while dehydrated cancellous allograft was used in 15 patients. In both groups, the operation was performed after the fracture was completely healed.

Information regarding the age, gender, duration of operation, hospitalization period and follow-up time of patients receiving allograft and autograft is presented in Table 2. In autograft recipients, enchondromas were mostly observed in the second finger (26 patients, 49.2%) and in allograft recipients, they were mostly observed in the fifth finger (6 patients, 40%) and metacarps (40%).

Immobilization was performed for 3 weeks after operation, using volar plaster splint. A histological examination was performed in the materials extracted during the operation and diagnosis was confirmed

Table 2. Distribution of age, gender, duration of operation, hospitalization period and follow-up time in study population.

	Autograft group	Allograft group
Female	36	5
Male	25	10
Mean age	33.4	29.1
Range	17-47	14-34
Duration of operation (minutes)	72	62
Hospitalization period (days)	4.2	1.8
Range	2-7	1-5
Follow-up time (years)	13.5	7.4
Range	10-22	6-11

in all the patients. Postoperative results and complications were determined.

During follow-up, the functional outcomes of patients were evaluated according to the Enneking functional scoring system defined for each joint, which is accepted by ISOLS (International Symposium on Limb Salvage)15, and the results in the final radiographies were evaluated according to Tordai classification system.[11]

Results

There were two recurrences of enchondroma in the autograft group (3.3%). By the radiographies, it was determined that grafts were consolidated in a mean period of 38 days. Maximum grasp force of the hand was achieved in a mean of 46 days. At the site where graft was applied, 10 patients (16.4%) had iliac crest pain with a mean duration of 12 days and two patients (3.3%) had infection that responded to treatment with antibiotics.

Functional outcomes were excellent/very good in 39 patients (64%), good in 14 patients (23%) and poor in 8 patients (13.1%). Poor outcomes were obtained mostly due to stiffness of phalangeal joints and deficiency of grasping force resulting from this. In the radiographic evaluation, 48 patients (78.7%) were classified in group I, 11 patients (18%) in group II and two patients in group III (3.3%) based on the Tordai classification.

In the allograft group, only one patient (6.7%) presented with pain at fourth and fifth fingers at the 18th month of follow-up. A relapsed mass was observed on the radiographies of this patient who had been treated for enchondromatosis; upon the detection of chondrosarcoma by the histological evaluation of the biopsy material, ray amputation was performed on the fourth and fifth fingers.

In this group, allografts were determined to be consolidated in a mean period of 51 days, through radiographies. Maximum grasping force of the hand was achieved in a mean of 55 days.Functional outcomes were excellent/very good in 10 patients (66.7%), good in 4 patients (26.7%) and poor in 1 patient (6.7%). Poor outcomes were obtained in the patient who had difficulty in using his hand due to the ray amputation performed on fourth and fifth fingers. According to the Tordai classification, 12 patients were classified in group I (80%), 2 patients (13%) in group II and one patient (6.7%) in group III.

Discussion

Treatment of enchondromas aims to prevent the potential malignant degeneration of the lesion and

Figure 1. (a) enchondroma-related pathological fracture at the fifth metacarpal diaphysis **(b)** Curettage and autograft application after the bone has knitted **(c)** Image at the 18th postoperative month.

eliminate the potential for deformity and pathological fracture which may develop due to the eroded of the bone by expansion of tumor. It is important to confirm the diagnosis of enchondroma through the histological examination of the operation material. Potential of malignancy, which is very low for single lesions, but increasingly rising for multiple enchondromas, is one of the primary reasons for a choice of surgery.(1,16) Although there are various radiographic and clinical criteria for the chondrosarcoma change of enchondroma, these findings are not prominent, particularly in grade I chondrosarcoma ; the diagnosis should be histologically confirmed. [17]

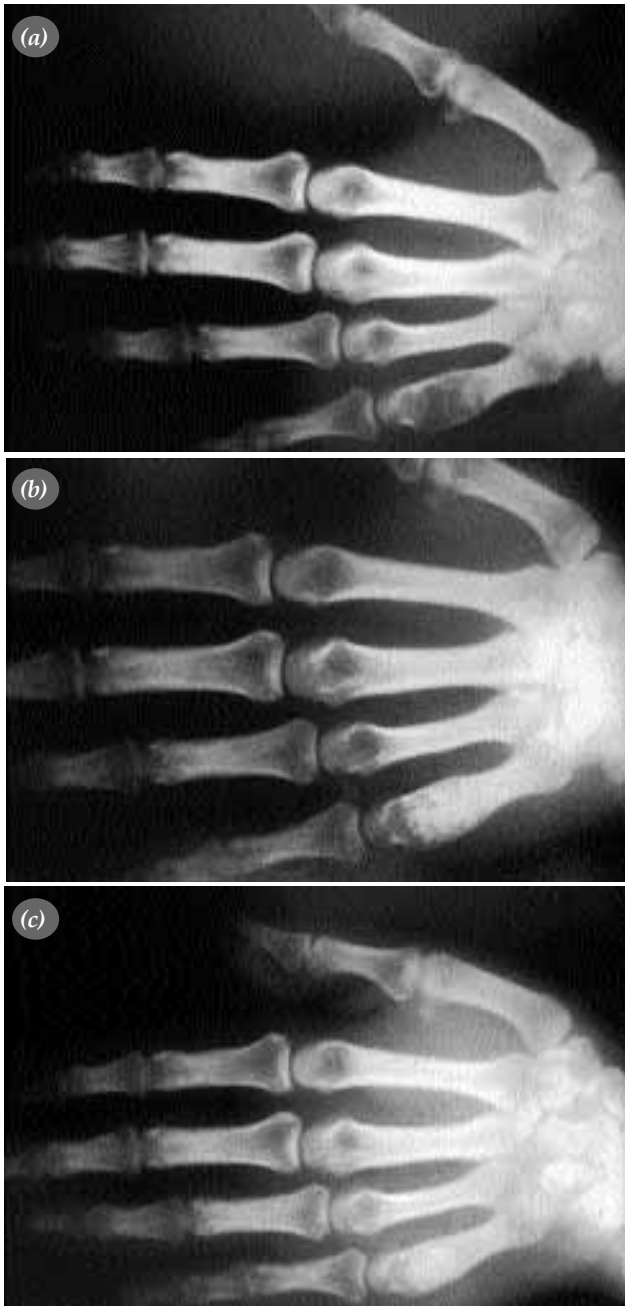

Figure 2. (a) Enchondroma at the fifth metacarpal metaphysis-diaphysis region. **(b)** Allograft application following curettage of lesion **(c)** Image at the first postoperative year.

Patients with enchondromas most commonly present with pathological fractures (Figure 1a-c). Our study also supports this. Among the cases we investigated, the second most common reason for seeking medical consultation was pain and swelling. Since concurrent intervention to the fracture and the enchondroma will increase the complication rate in patients presenting with pathological fractures, operation was performed after the bone has completely healed in such patients.

The most commonly used method in enchondroma treatment is the curettage of the lesion followed by the filling of the cavity formed, with the preferred material. Cancellous morselized autografts obtained from the iliac crest, lyophilized morselized allografts or osteoconductive materials have been recommended for this procedure.[5,9] In our study, we preferred allografts due to the esthetic concerns of female patients and to the fact that relatively more graft material is required in patients with enchondromatosis (Figure 2a-c). Some investigators have advocated that simple curettage of single lesions without bone grafting is a quite successful method. [10-13] In addition, there are other investigators recommending endoscopic curettage without bone grafting. [14] In a study by Hasselgen et al.[10], 28 patients receiving treatment were allowed to use their hand following a 1-3-week immobilization performed after curettage; no recurrences or fractures were observed as a result. In a study by Tordai et al.[11] 44 patients with enchondroma were operated, using no method other than curettage; only one patient was reported to require operation due to recurrence. Kuur et al. [13] has set a limitation for such applications and reported that only eccentric type of enchondroma can be treated adequately by curettage alone. Considering that majority of the patients present with pathological fractures, we believe immediate intervention and application of curettage alone will make the lesion region unstable. Under the circumstances, although it doesn't contribute much to stability, filling the cavity with morselized autograft or

allograft is more effective than leaving it empty. If the tumor has widely spread and the location is appropriate, amputation may be considered for considerably deformed fingers.[5] In our study, no primary amputation was performed; it was only required as a rescue operation in one patient with enchondromatosis who showed malignant degeneration.

According to the literature, recurrence rate of enchondroma ranges between 0% and 13.3%. [5,14] A good level of elimination of the tumor via curettage plays an important role in preventing recurrence. Among the cases we studied, recurrence rate was 3.3% in the autograft group and 6.7% in the allograft group. In the allograft recipients, there were no recurrences except the patient who showed chondrosarcoma change. Although rate of recurrence seem to be higher in the second group, this may result from the significant difference between the groups in number of patients.

When the functional outcomes in the two groups are taken into consideration, the primary factor to affect the outcomes is detected to be the motion limitation at the finger where tumor is located. In cases where autograft is obtained form the iliac crest, complications including hemorrhage, prolonged hospitalization, superficial infection and undesirable scars may be observed as well as major complications such as deep infection, iliac fracture, chronic iliac crest pain, abdominal herniation.[18,21] In our study, no serious complications were observed in patients due to the minor surgical incision and the careful surgical technique employed.

The significantly longer period of consolidation observed in the allograft recipients is notable. This results from the fact that morselized allografts only have an osteoconductive effect and don't have osteogenic or osteoinductive properties as seen in autografts. Nevertheless, delayed graft consolidation, which is also determined radiographically didn't adversely affect the clinical course.[7] Allografts have certain disadvantages: they may show a prolonged duration of adaptation to the region they are placed, they may be immunologically rejected by the recipient or act as a viral infection carrier. Although very low, lyophilized grafts also have the potential for transmitting diseases and immunological rejection.[22] However, Bauer et al.[7] reported that they had never observed such complications.

Not only the bone grafts, but also sterile plasters and materials such as hydroxyapatite have been used to fill the cavities.[8,9] Use of sterile plasters has a quite long history and is based on other reasons. The difficulty of preparing the mixture, reactions occurring during the contact with the soft tissue and even the development of fistulas have caused this method to be quitted.[23] Placement of hydroxyapatite in the cavity has recently become a common application, with the aim of utilizing its osteoconductive effect. In a study by Baer et al.[9], marginal bone integration was reported to be completed within 6-8 weeks in 22 patients who have received hydroxyapatite application following curettage. Yamamoto et al.[8] reported that incorporation of the material to the bone took approximately 4.2 months in 75 patients who have received hydroxyapatite application following curettage of benign tumors. Same investigators attributed the local pain observed in some cases to the irritation, the material caused at the soft tissue.

In conclusion, autograft and allograft applications seem to yield similar success rates in the treatment of enchondroma of the hand. The relatively high cost and the late incorporation are the main disadvantages of allograft application. The concerns of female patients regarding additional scar formation and the need for relatively more graft material are the main disadvantages of autograft application.

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