Solitary Intra-Articular Osteochondroma of the Finger

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Background: A solitary osteochondroma of the finger occasionally occurs intra-articularly and may cause clinical symptoms, including limited motion and deformity. The present report describes the clinical features and the results of operative treatment for a series of patients who had a solitary intra-articular osteochondroma of the finger.

Methods: Ten patients with a solitary intra-articular osteochondroma of a phalanx of a finger were managed surgically. Eight patients were male, and two were female. The average age at the time of surgery was fourteen years. Treatment consisted of mass excision for three patients and mass excision with corrective osteotomy for six. One additional patient had a boutonniere deformity and underwent extensor tendon reconstruction combined with mass excision. The average duration of follow-up was forty-four months.

Results: The proximal phalanx was affected in six patients, and the middle phalanx was affected in four. All tumors involved the distal epiphysis. All patients had postoperative improvement in terms of deformity and/or limitation of motion. Six patients had a preoperative mean coronal plane deformity of 29°, which improved to 4° after surgery. The preoperative mean arc of flexion-extension improved from 54° to 78° in four patients who had a motion deficit at the proximal interphalangeal joint and from 60° to 80° in one patient who had a motion deficit at the distal interphalangeal joint. Two patients had a residual flexion contracture, one with preexisting osteoarthritis and one with a longstanding progressive boutonniere deformity. There were no other complications or recurrences.

Conclusions: Isolated intra-articular osteochondroma of the finger can cause deformity and/or motion limitation. Early mass excision and corrective osteotomy when indicated are recommended to restore full range of motion and to prevent osteoarthritis and secondary deformity.

Level of Evidence: Therapeutic Level IV. See Instructions to Authors for a complete description of levels of evidence.

Osteochondroma is the most frequent benign bone tumor and usually presents as a clinical form of hereditary multiple exostosis or as a solitary lesion[1,2]. In patients with hereditary multiple exostosis, the hand is a relatively common site of involvement (68% to 81% of cases)[3-5]. Solitary osteochondromas constitute 85% to 90%[1,6] of all osteochondromas; however, the hand is rarely affected (only 0.2% to 4% of cases[7-9]). A solitary osteochondroma of the hand occurring in the epiphysis of a phalangeal bone can be described as a solitary intra-articular osteochondroma.

Like osteochondromas at other locations, the majority of osteochondromas of the hand present as painless masses or remain asymptomatic until detected incidentally[3,10,11]. However, an osteochondroma of the finger can cause clinical symptoms, such as pain, stiffness, and deformities, including angulation, rotation, shortening, swan neck deformity, and mallet finger, depending on its location and size[1,3,12-16]. Although debate continues concerning the natural history of osteochondroma and the need for surgical intervention[3,6,11,13,17], early surgical excision of a phalangeal osteochondroma is advisable to prevent progression of deformity and to avoid secondary changes, including soft-tissue contracture, osteoarthritis, and secondary functional problems[13,14].

Most previous reports on phalangeal osteochondromas have been case reports with short-term follow-up[12,15,16,18], case reports of multiple phalangeal involvement[14,16], or case reports related to hereditary multiple exotosis[13-15]. The purpose of the present study was to analyze the clinical features and results of

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TABLE I Demographic Data and Surgical Outcomes for the Ten Patients

Case	Sex, Age* *(yr)*	Location			Coronal Deformity *(deg)*		Range of Motion (Flexion Contracture/Further Flexion) *(deg)*		Treatment	Duration of Follow-Up *(mo)*
		Digit	Joint Affected†	Side	Preop.	Postop.	Preop.†	Postop.†		
Proximal phalangeal osteochondroma										
1	M, 11	Ring	PIP	Dorsal	0	0	PIP: 20/90	PIP: 0/90	Mass excision	79
2	M, 10	Little	PIP	Ulnar	Radial deviation, 30	0	PIP: 5/85	PIP: 0/85	Mass excision and corrective osteotomy	70
3	M, 30	Ring	PIP	Radial volar	Ulnar deviation, 50	Ulnar deviation, 5	PIP: 50/85	PIP: 30/80	Mass excision and corrective osteotomy	43
4	F, 12	Long	PIP	Dorsal	0	0	PIP: 50/100	PIP: 20/100	Mass excision and extensor reconstruction†	34
5	M, 3	Index	PIP	Radial	Ulnar deviation, 30	0	PIP: 0/80	PIP: 0/85	Mass excision and corrective osteotomy	27
6	M, 36	Long	PIP	Volar	0	0	PIP: 0/60	PIP: 0/90	Mass excision	25
Middle phalangeal osteochondroma										
7	M, 4	Long	DIP	Radial	Ulnar deviation, 25	Ulnar deviation, 7	DIP: 0/85	DIP: 0/85	Mass excision and corrective osteotomy	57
8	M, 3	Long	DIP	Dorsal	0	0	DIP: 20/80	DIP: 0/80	Mass excision	45
9	M, 12	Ring	DIP	Ulnar	Radial deviation, 20	Radial deviation, 11	DIP: 0/80	DIP: 0/80	Mass excision and corrective osteotomy	43
10	F, 15	Ring	DIP	Ulnar	Radial deviation, 20	Radial deviation, 3	DIP: 0/85	DIP: 0/85	Mass excision and corrective osteotomy	21

*Age at time of surgery. †PIP = proximal interphalangeal joint, and DIP = distal interphalangeal joint. ‡Additional extensor reconstruction, including central band shortening, lateral band realignment, dermodesis, and temporary fixation with use of a Kirschner wire, was done because of boutonniere deformity.

surgical treatment of symptomatic solitary intra-articular osteochondromas of the finger.

Materials and Methods

We retrospectively reviewed the cases of ten patients with a solitary intra-articular osteochondroma of the finger, with accompanying deformity or limitation of motion, who were managed operatively from 2002 to 2007. During the same period, we surgically treated three cases of extra-articular phalangeal osteochondroma in patients with hereditary multiple exostosis. However, those cases were excluded from the present series because they were considered to represent a different disease entity. Of the ten patients in the present study, eight were male and two were female. The average age at the time of surgery was fourteen years (range, three to thirty-six years). No patient had a history of trauma, a family history of osteochondroma, or radiographic or clinical evidence of hereditary multiple exostosis or of any other musculoskeletal disorder.

Osteochondromas were diagnosed on the basis of preoperative clinical and radiographic findings. Grossly, they usually presented as a painless mass combined with angular deformity in the coronal plane, limitation of motion in the sagittal plane, or both. Plain radiographs were frequently diagnostic and usually showed a typical pattern of cortical continuation with medullary communication between the lesion and the host bone[1,15,19]. Diagnoses were confirmed histopathologically, and in all cases there was a hyaline cartilage cap with columns of cartilage cells and underlying bone.

In terms of surgical treatment, three patients were managed with simple mass excision alone, whereas six patients with coexisting coronal plane deformities were managed with a corrective closing-wedge osteotomy (five) or opening-wedge osteotomy (one) in addition to mass excision. All osteotomies were performed in the metaphysis with Kirschner wire fixation. Postoperative immobilization was continued for four weeks. In the case of the patient who was

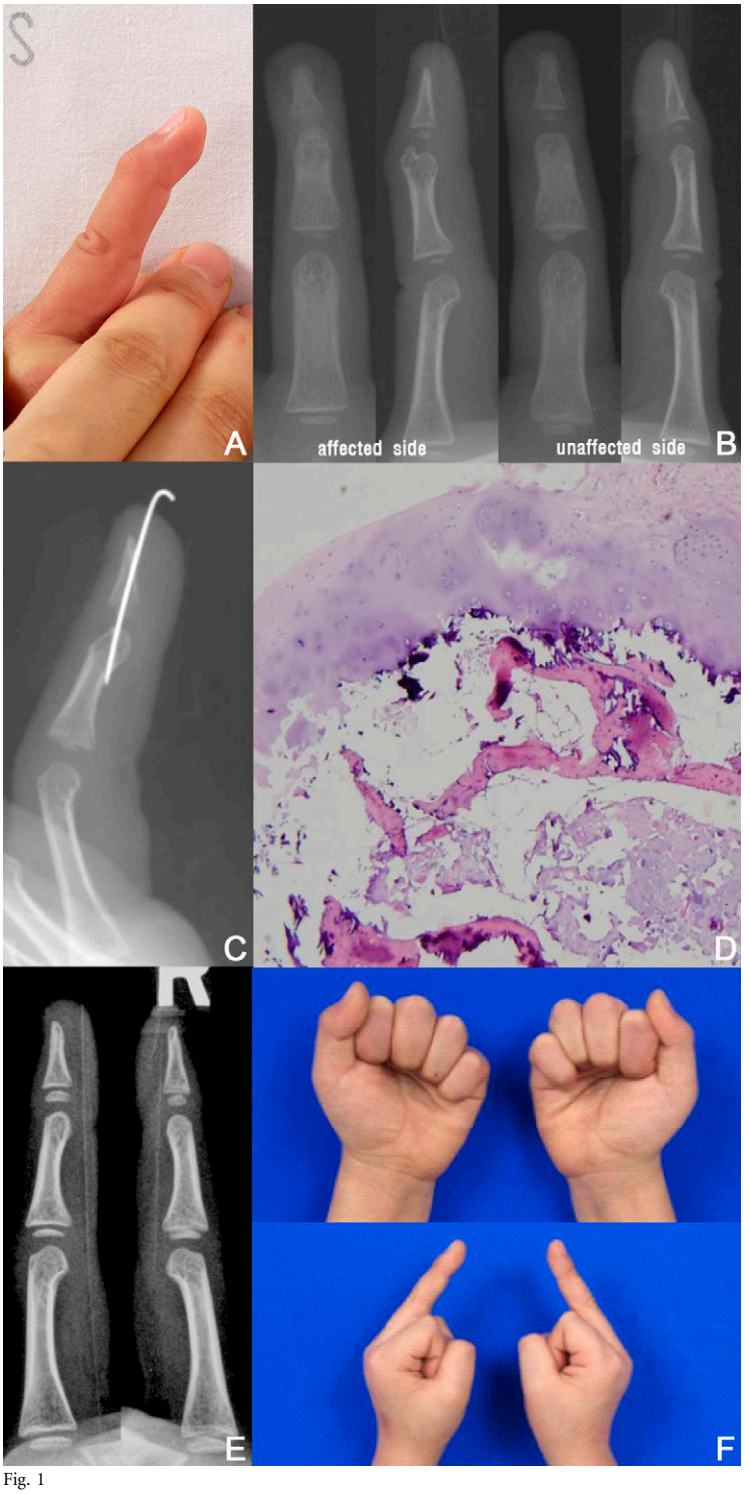

Fig. 1

A: A three-year-old boy (Case 8) was evaluated because of an extension deficit of the distal interphalangeal joint and a lump on the dorsum of the long finger. Painless enlargement and an extension deficit of the distal interphalangeal joint were observed. *B:* Radiographs of the finger, showing an osseous mass arising from the dorsum of the distal epiphysis of the middle phalanx, with medullary communication. *C:* The osseous mass was excised, and temporary fixation of the distal interphalangeal joint was achieved with a Kirschner wire. *D:* Histologically, there is an overlying cartilage cap with underlying trabecular bone, a pattern typical of osteochondroma (hematoxylin and eosin, ×40). *E:* At two and one-half years after surgery, there is no radiographic evidence of recurrence. *F:* The flexion deformity resolved completely.

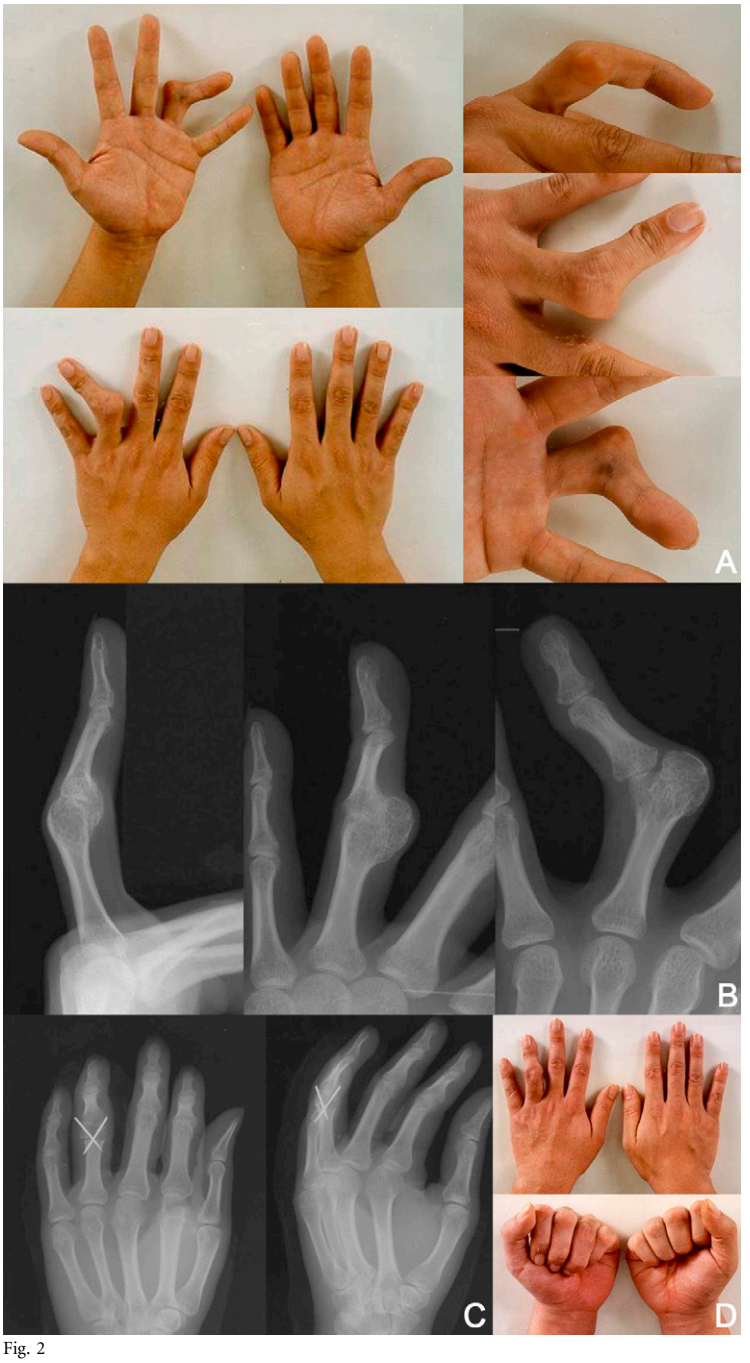

Fig. 2

A: A thirty-year-old man (Case 3) had development of a progressive angular deformity in the coronal plane and limited extension of the proximal interphalangeal joint of the ring finger. *B:* Preoperative radiographs demonstrating a large osseous mass of the distal epiphysis of the proximal phalanx with intra-articular extension and evidence of osteoarthritis. *C:* Mass excision and corrective osteotomy were performed. *D:* At the time of the two-year follow-up, the alignment and range of motion had improved substantially, but an extension deficit of 30° remained.

managed with opening-wedge osteotomy, a cancellous autograft from excised bone was used to fill the defect. The remaining patient had a boutonniere deformity and underwent extensor tendon reconstruction and dermodesis over the dorsum of the proximal interphalangeal joint in addition to mass excision from the head of the proximal phalanx. The

surgical excision consisted of resection of the entire overlying cartilaginous cap to prevent recurrence. Range of motion was measured with a goniometer clinically. Coronal plane angulation was measured on the anteroposterior radiograph by one author (G.H.B.) preoperatively and at the time of the latest follow-up. The patients were followed for an average of forty-four months (range, twenty-one to seventy-nine months) after surgery.

Source of Funding
There was no external funding source for this study.

Results

The long and ring fingers were most frequently affected (four patients each), followed by the index and little fingers (one patient each). In six patients, the proximal phalanx was involved and the tumor affected the proximal interphalangeal joint. In four patients, the middle phalanx was involved and the distal interphalangeal joint was affected. All osteochondromas were intra-articular and in the distal epiphysis.

Subjective complaints included angular deformity in the coronal plane (five patients), limitation of motion in the sagittal plane (four patients), and both angular deformity in the coronal plane and limitation of motion in the sagittal plane (one patient). One of the patients with limitation of motion in the sagittal plane also had a boutonniere deformity secondary to flexion contracture of the proximal interphalangeal joint. The tumor was located on the side of the phalanx opposite of the coronal plane deviation in all six patients (i.e., the radial side in patients with ulnar deviation and the ulnar side in patients with radial deviation). In four of five patients with a limited digital flexion-extension arc, the osteochondroma was located on the dorsal side in the presence of an extension block and on the volar side in the presence of a flexion block. The remaining patient had an osteochondroma on the side opposite to the motion deficit (that is, on the volar side in the presence of an extension deficit). All limitations of motion showed a fixed, rigid pattern. One patient with limitation of motion also complained of pain as an accompanying symptom, but the other patients did not have pain.

The preoperative mean coronal angulation in six patients (Cases 2, 3, 5, 7, 9, and 10) improved from 29° (range, 20° to 50°) to 4° (range, 0° to 11°) after mass excision and corrective osteotomy. The preoperative mean arc of flexion-extension improved from 54° (range, 35° to 70°) to 78° (range, 50° to 90°) in four patients (Cases 1, 3, 4, and 6) who complained of a motion deficit in the proximal interphalangeal joint and from 60° to 80° in one patient (Case 8) who had a motion deficit in the distal interphalangeal joint (Table I, Fig. 1).

While the overall arc of flexion-extension improved in all patients, two patients (Cases 3 and 4) had a residual flexion contracture. One patient (Case 3) with a residual flexion contracture was a thirty-year-old man who had neglected a painless mass for twenty years. The proximal interphalangeal joint of the affected ring finger had an extension deficit of 50° and ulnar deviation of 50° at the time of his first visit to our clinic (Fig. 2). In addition, plain radiography revealed advanced arthritic changes of the proximal interphalangeal joint. The patient underwent mass excision and corrective osteotomy. However, an extension deficit of 30° remained, despite complete restoration of coronal alignment. The other patient (Case 4) had an osteochondroma involving the dorsum of the head of the proximal phalanx of the long finger, with extension into the proximal interphalangeal joint. This mass caused an extension deficit of 50° (as a result of osseous impingement) as well as a boutonniere deformity. Mass excision and extensor reconstruction were performed by means of central band shortening, realignment of the lateral band, dermodesis, and temporary transarticular fixation of the proximal interphalangeal joint with use of a Kirschner wire. After surgery, the boutonniere deformity resolved. However, at the time of the latest follow-up, a residual 20° extension deficit remained. In all cases, excised specimens were examined histologically and the diagnosis was confirmed histopathologically. No postoperative complications or recurrences of tumor, motion limitation, or deformity occurred during the follow-up period.

Discussion

The solitary intra-articular osteochondroma of the finger should be differentiated from osteochondroma-mimicking conditions such as Trevor disease, or dysplasia epiphysealis hemimelica. Trevor disease is a developmental disorder that is typically characterized by asymmetric excessive growth of one or several epiphyses of the lower limb bones, and it usually involves either the medial or the lateral side of the epiphysis[20,21]. Although it is rare in the upper limb, Trevor disease has been reported in the radius and humerus and the carpal and metacarpal bones[22-26]. We report on a series of patients who had solitary intra-articular osteochondromas that affected a single phalanx, a lesion that is perhaps best named a solitary intra-articular osteochondroma of the finger.

Little is known about the clinical characteristics and the natural history of the solitary phalangeal osteochondroma, especially the sporadic form, because it is rare and often remains asymptomatic or even undetected[1,6,17]. Solitary phalangeal osteochondroma may occur at the epiphysis or metaphysis[13,14,16,17,19]. In the present series, only solitary distal epiphyseal intra-articular osteochondromas were included. During the course of the present study, we found some differences between intra-articular osteochondromas of the finger and conventional osteochondromas at other locations. First, because intra-articular osteochondromas of the finger grow in continuity with the articular cartilage of the affected phalanx, they can cause deformity or limitation of motion. Second, whereas the majority of conventional osteochondromas occur around the knee joint or at the proximal part of the humerus, both of which have abundant soft-tissue coverage, phalangeal bones usually have only a thin cutaneous cover[1,6,27]. Third, this tumor can be confused with conditions such as clinodactyly or camptodactyly,

whereas a classic osteochondroma can be easily diagnosed on the basis of physical findings and simple radiographs.

There have been several reports on solitary osteochondromas of the finger accompanied by deformities or functional limitation[12,14-16,19,28]. A neglected intra-articular phalangeal osteochondroma may lead to progressive deformity and limitation of motion[13,14]. In fact, the two patients in the present series in whom the mass had been neglected for a long time had relatively poor outcomes because of osteoarthritis, residual deformity, and permanent limitation of motion. Our results concur with those of several previous studies in which early surgical treatment was recommended for the treatment of symptomatic phalangeal osteochondromas[13-15].

Moore et al.[14], Murase et al.[15], and Karr et al.[13] reported on phalangeal osteochondromas, and all claimed good surgical outcomes and stressed the importance of early surgery. Kojima et al.[28] and Ozer and Peterson[19] presented cases of phalangeal osteochondroma that were associated with decreased range of motion, which was largely restored postoperatively. As shown in previous studies, the most frequent symptoms associated with phalangeal osteochondromas are coronal plane deformities and limitation of interphalangeal joint flexion and extension. Deformities may be caused by overgrowth of an osteochondroma or hyperplasia of articular cartilage and sometimes can occur secondary to changes induced by limitation of motion. Limitation of articular motion may be classified as limitation in the direction of the mass due to impingement or limitation in the opposite direction due to excessive tension in the antagonistic tendon. Conversely, pain is a relatively rare symptom in patients with intra-articular phalangeal osteochondromas, just as is the case in those with conventional osteochondroma.

The limitations of the present study include its retrospective nature, a relatively small study group, limited follow-up in some cases, and the lack of a control group. However, because this entity is uncommon, the retrospective study design and the small study population were unavoidable. Furthermore, some patients in the present study were not followed until skeletal maturity, and, thus, further development of deformity or functional impairment may yet occur.

Our findings suggest that, in these cases, a more aggressive early surgical approach should be adopted, with the dual objective of cosmetic and functional restoration, especially in children with a solitary intra-articular osteochondroma of the finger with deformity and/or limitation of motion. ■

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