

비골 이식술로 치료한 상완골 과간 분쇄 골절 불유합 - 증례 보고 -

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정형외과 임상외과에 상완골 원위부 분쇄골절의 불유합은 난제 중의 하나이다. 현재까지도 상기 문제에 대한 적절한 치료법에 대해 논란이 많은 상태이다. 이에 저자들은 상완골 원위부 분쇄골절을 관혈적 정복술과 금속내고정술, 자가장골이식술을 통해 치료받은 후 발생한 불유합으로 재수술이 필요하였던 59세 여환을 증례보고하고자 한다. 저자들은 상완골 과간 골절의 골편 내에 비골 내재골이식술을 이용하여 상완골과를 재건하는 방법으로 뛰어난 방사선적, 기능적 결과를 얻어 이에 보고하는 바이다.

색인 단어: 상완골, 과간골절, 비골이식, 불유합

Nonunion of Humeral Intercondylar Comminuted Fracture Treated with Fibular Graft - A Case Report -

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Nonunion of comminuted distal humeral fracture is troublesome problem to orthopedic surgeon. We report a case of 59 years old woman, who suffered nonunion of comminuted distal humeral fracture previously treated by open reduction and internal fixation with plate and screws concomitantly autoiliac bone graft. We reconstructed humeral condyle with fibular inlay graft inside cortical shell of intercondylar bone fragment and obtained excellent result in radiological and functional outcome.

Key Words: Humerus, Intercondylar fracture, Fibular graft, Non-union

It has difficulty to treat distal humeral fracture in elderly over six decades because of extensive comminution and poor bone quality. Even though the bone defects due to severe comminution could be filled with iliac bone graft, the cancellous bone portion of iliac bone is easily resorbed. So, non-union was developed frequently in open reduction and internal fixation with iliac bone graft. In order to solve this problem, we could choose total elbow arthroplasty as alternative method for repair-

ing non-union of distal humerus. But, complications of elbow arthroplasty itself are obstacle to choose this rising method. So, we reconstructed humeral condyle with fibular inlay graft making triangular structure inside cortical shell of intercondylar bone fragments. It obtained relatively good clinical result. So, we introduce this procedure for one of treatment option for repairing non-union of comminuted distal humeral fractures.

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CASE REPORT

A 59 year old woman suffered severely comminuted intercondylar fracture caused by falling on her right arm outstretched (Fig. 1A). Open reduction and internal fixation using plate and screws with iliac bone graft was performed (Fig. 1B).

Two years later, she was still complaining of pain and limitation of movements. She had an arc of flexion of from 45° to 90°, pronation of 40° and supination of 60°, and she had another slip down injury during observation period. Radiographs show resorption of grafted bone and new fracture near proximal portion of the plate in addition to nonunion of initial fracture of the distal humerus (Fig. 2).



Fig. 1. (A) Anterior-posterior and lateral view showed fracture with severe comminution on intercondylar and supracondylar area.

(B) The patient was treated by open reduction and internal fixation with plates and screws concomitantly autologous iliac bone graft.

Operation was performed under general anesthesia with the patient in the lateral decubitus position with the shoulder at 90 degrees of abduction and the elbow at 90 degrees of flexion, over bolsters. The posterior approach was used, with sterile pneumatic tourniquet⁵⁾. The ulnar nerve was identified and tagged with a vessel loop. All fixation devices which were used in previous operation were removed. The olecranon was osteotomized and flipped proximally and the distal end of the humerus was visualized directly. The trochlea and the capitellum were comminuted into three fragments. The supracondylar area of distal humerus was comminuted in a multifragmentary manner. According to radiograph of initial trauma (Fig. 1A), this fracture type was categorized as type C3-3 according to AO/ASIF classification⁴⁾, which is defined as T or Y bicondylar fracture with severe comminution on intercondylar and supracondylar area. Radiographs at the time of nonunion showed most supracondylar fragments were small and osteoporotic.

Fibular free graft was harvested at once and divided into 3 parts for reconstruction of condyles. Fibular inlay graft was made into triangular shape to fit humeral condyles. The articular surfaces were temporarily stabilized using a small bone reduction forceps and a few 1.8 mm Kirschner wires. Then the articular fragments were held in place with reconstruction plates and cortical and cancellous screw that was placed transversely from outside to inside to hold the condyles. Allo-bone confounded with cancellous bone was impacted on gap between graft and cortex. New fracture near proximal

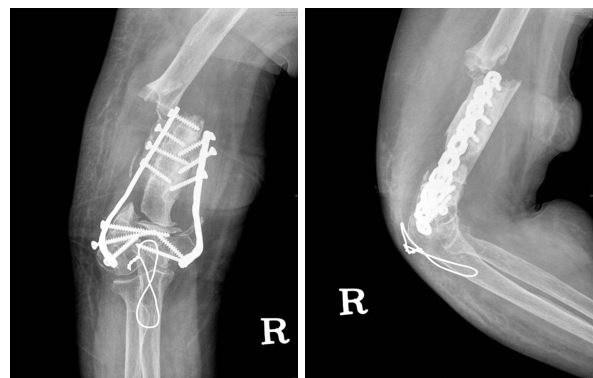


Fig. 2. Two years later, radiographs show the bone resorption of grafted bone and newly developed fracture near proximal portion of the plate.

portion of the plate was reduced and fixed by plate and screws. Finally, the olecranon was reduced and fixed with two Kirshner wires, tension band wire and plate & screws. It was confirmed that all fragments were stable and the olecranon and coronoid fossa were not compromised by bone fragments or hardware (Fig. 3).

The patient was placed into long arm splint and was elevated for 48 hours. Physical therapy was begun 2 weeks postoperatively.

She felt no instability or pain on activity of daily living. One hundred and ten degrees of range of motion (120 degrees of flexion and 10 degrees of loss of extension) was achieved at 10 months after the operation (Fig. 4). Radiograph shows bony union of entire humerus (Fig. 5). The functional result was excellent according to Broberg and Morrey's functional scale at 10 months after operation²⁾.

DISCUSSION

The internal fixation of comminuted fractures of the distal end of humerus is difficult, especially if bone is osteoporotic. McKee et al. reported that open reduction and internal fixation could be effective even in the elderly if only rigid fixation was obtained to allow early exercise⁷⁾. And Ahn et al. insisted to obtain the satisfactory results in distal humeral fractures, stable fixation followed by early motion is required in most distal humeral fractures¹⁾. So, authors did open reduction and internal fixation with autologous iliac bone graft for initial treatment. But, resorption of grafted iliac bone, severe comminution and poor bone quality led to nonunion. So we needed salvage operation by open reduction and internal fixation with bone grafting again or total elbow arthroplasty, which are considerably challenging proce-



Fig. 3. Anteriorposterior and translateral radiographs of the right elbow after re-operation.



Fig. 5. Anteroposterior & translateral radiographs of the right elbow 10 months after the operation.

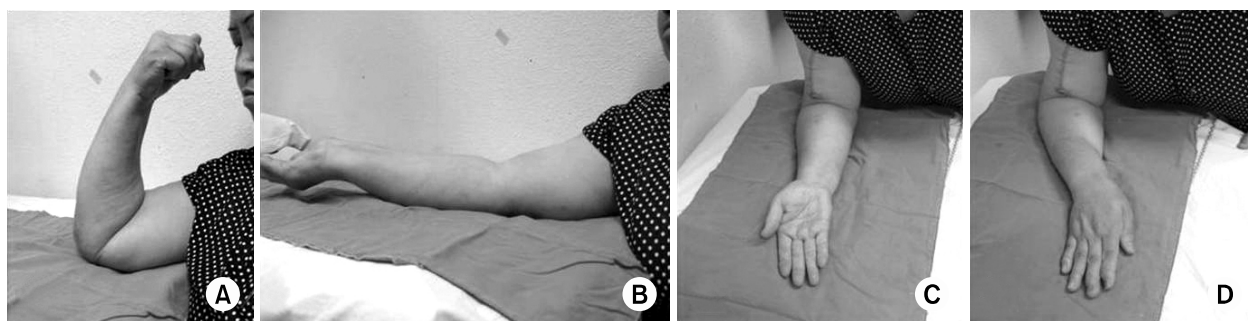


Fig. 4. Excellent pain-free (A) flexion and (B) extension (C) supination (D) pronation resulted.

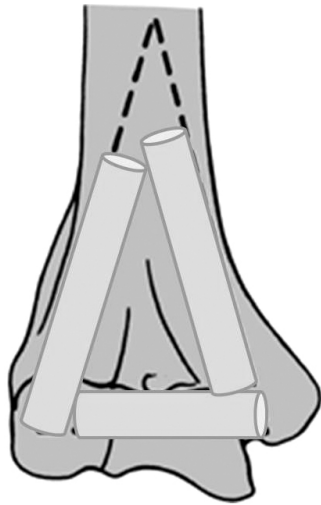


Fig. 6. Schematic view shows reconstructed condyle of distal humerus with three divided fibular graft.

dures because its own complication. We therefore hypothesized that reconstruction using free fibular inlay graft by making triangular structure could be a recommendable surgical method treating a certain case of humeral intercondylar comminuted fracture which only cortical shell remained. Although vascularized fibular graft was recommended theoretically but free non-vascularized fibular graft reported good outcome as treatment of post-traumatic bone defects³⁾. And in this case, authors made triangular structure by dividing single fibular bone, all three block couldn't get vessel supplied.

In recent few years total elbow arthroplasty was appeared alternative method for intra-articular, comminuted distal humeral fractures for elderly^{6,10)}. But, complications of total elbow arthroplasty such as neurolysis, instability, infection, revisional surgery was remained obstacle to choose arthroplasty as primary method for fracture treatment^{6,8,9)}. Especially in nonunion, controversy was existed. So, authors devised procedure that could provide structural support by triangular shape like condyles using fibular graft with plate & screws. It achieved great radiological & functional results. We hope this procedure to become one of the options for treatment for commin-

uted fracture of the elbow in the elderly.

REFERENCES

- 1) **Ahn HS, Cho YH, Byun YS, Kwon DY, Nam SO, Kim DY:** Elbow function and complications after internal fixation for fractures of the distal humerus. *J Korean Fracture Soc*, **19**: 56-61, 2006.
- 2) **Azmi I, Razak M, Hyzan Y:** The results of treatment of dislocation and fracture--dislocation of the elbow--a review of 41 patients. *Med J Malaysia*, **53(Suppl A)**: 59-70, 1998.
- 3) **El-Sayed M, El-Hadidi M, El-Adl W:** Free non-vascularised fibular graft for treatment of post-traumatic bone defects. *Acta Orthop Belg*, **73**: 70-76, 2007.
- 4) **Fracture and dislocation compendium.** Orthopaedic trauma association committee for coding and classification. *J Orthop Trauma*, **10(Suppl 1)**: v-ix, 1-154, 1996.
- 5) **Helfet DL, Kloen P, Anand N, Rosen HS:** ORIF of delayed unions and nonunions of distal humeral fractures. Surgical technique. *J Bone Joint Surg Am*, **86(Suppl 1)**: 18-29, 2004.
- 6) **McKee MD, Veillette CJ, Hall JA, et al:** A multicenter, prospective, randomized, controlled trial of open reduction--internal fixation versus total elbow arthroplasty for displaced intra-articular distal humeral fractures in elderly patients. *J Shoulder Elbow Surg*, **18**: 3-12, 2009.
- 7) **McKee MD, Wilson TL, Winston L, Schemitsch EH, Richards RR:** Functional outcome following surgical treatment of intra-articular distal humeral fractures through a posterior approach. *J Bone Joint Surg Am*, **82**: 1701-1707, 2000.
- 8) **Ring D:** Instability after total elbow arthroplasty. *Hand Clin*, **24**: 105-112, 2008.
- 9) **Rispoli DM, Athwal GS, Morrey BF:** Neurolysis of the ulnar nerve for neuropathy following total elbow replacement. *J Bone Joint Surg Br*, **90**: 1348-1351, 2008.
- 10) **Strauss EJ, Alaia M, Egol KA:** Management of distal humeral fractures in the elderly. *Injury*, **38(Suppl 3)**: S10-16, 2007.