

14, 2, 2001 4

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24

가 가 3 21

: 21 19 , 2

4.4 ,

4.9

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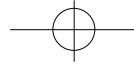
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5).

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1993 1

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12 (57%),

9 (43%) .

6.

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14.3 (6 -36) 2

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. 30-49 가 9 (43%) 가

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10 (48%) 가

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1

(38%), 3 (14%) .

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2 ,

18 (86%) 가

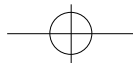
1/3 2 (10%),

가 1 .

1/3 1 (5%) .

2

4.5mm



238 • / 14 2

3.
8 29 13.2
2
4.
9. (1) 1
39
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(Fig. 1A). 9
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(Fig. 1B).

1.
21 19 , 2 (2) 2
49
1/3 6
4.4 , 4.9 , (Fig. 2A). 6
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2 1 , 1
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3 (drill bit) (Fig. 4A). 6
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(Fig. 4B).

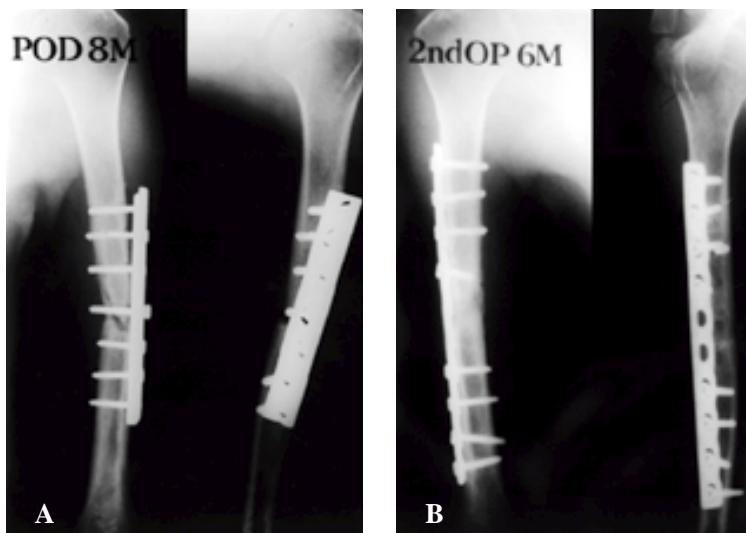
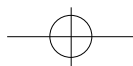


Fig 1A-B. Anteroposterior and lateral radiographs of humerus of 39 year-old man. (A) At postop. 8 months, dissociation of screws and plates were noted, and breakage of one screw was noted at proximal portion nonunion. (B) At 2nd postop. 9 months, longer and more broad plate was noted and bone union was seen.

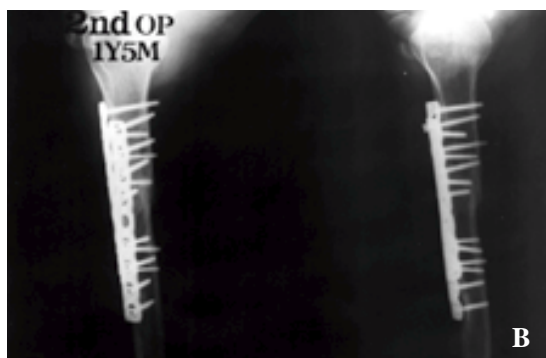
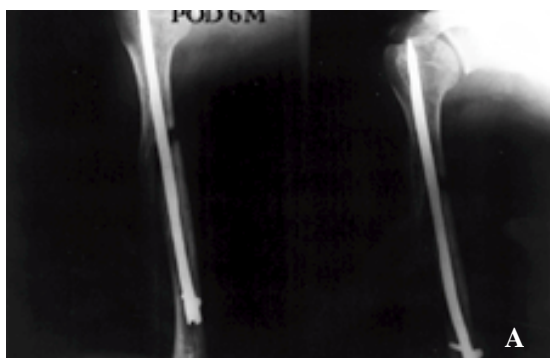


Fig 2A-B. Anteroposterior and lateral radiographs of humerus of 49 year-old man. (A) At postop. 6 months, distraction between fracture fragments was noted. (B) At 2nd postop. 17 months, dual plate was noted and bone union was seen.

Table 1. Fracture configurations.

Classification of Fx.	No. of cases
Transverse	10 (48%)
Spinal	8 (38%)
Oblique	3 (14%)

Table 2. Site of nonunion.

Site of fracture	No. of cases
Middle one-third	18 (86%)
Proximal one-third	2 (10%)
Distal one-third	1 (5%)

Table 3. Primary treatment.

Primary treatment	No. of cases
OR/IF with plate	12 (57%)
CR/IF with IM nail	9 (43%)

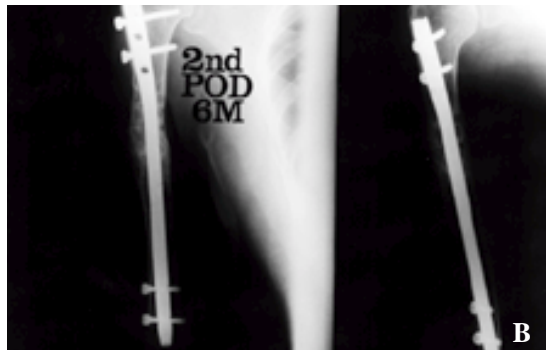
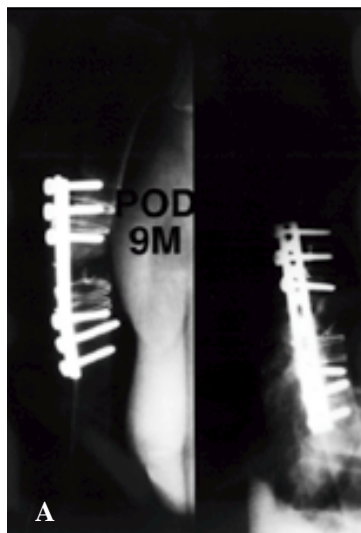
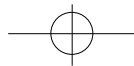


Fig 3A-B. Anteroposterior and lateral radiographs of humerus of 66 year-old woman. (A) At postop. 9 months, severe osteopenia, dissociation of plate and screws were noted. (B) At 2nd postop. 5 months, IM nail was noted and bone union was seen.

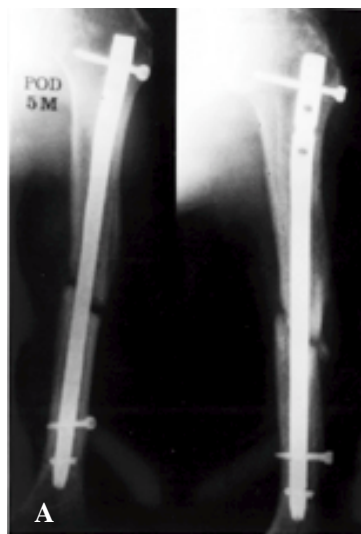


Fig 4A-B. Anteroposterior and lateral radiographs of humerus of 70 year-old man. (A) At postop. 5 months, distraction between fracture fragments and breakage of drill bit were noted. (B) At 2nd postop. 22 months, bone union was seen after cancellous bone graft only.

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Watson-Jones²²⁾
slow-union,

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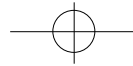
2).

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Campbell¹⁰⁾
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8

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**Table 4.** Causes of nonunion.

Causes of nonunion	No. of cases
Distraction between fracture fragments with IM nailing	9
Dissociation of plate and screws	11
Dissociation of IM nail	1

Table 5. Operation for nonunion after primary plate fixation

Treatment of nonunion	No. of cases
Longer and more broad plate fixation and cancellous bone graft	5
Dual plate fixation and cancellous bone graft	3
IM nail and cancellous bone graft	2
Plate fixation and strut bone graft	1
IM nail and onlay bone graft	1

Table 6. Operation for nonunion after primary IM nailing

Treatment of nonunion	No. of cases
Plate fixation and cancellous bone graft	6
Dual plate fixation and cancellous bone graft	2
Cancellous bone graft only	1

Table 7. Operation for nonunion and union time

Treatment of nonunion	Union time(mo)
Plate fixation and cancellous bone graft	4.4
IM nail and cancellous bone graft	4.9
Cancellous bone graft only	5.5
IM nail and onlay bone graft	?
Plate fixation and strut bone graft	?

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Chales¹¹⁾

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. Watson-Jones²²⁾

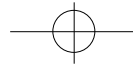
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1/3

Heppenstall¹²⁾, Steen²⁰⁾Laing¹⁴⁾, Sever¹⁹⁾

가





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1/3 가 .

, 4,6,7).

9

가

3).

Muller¹⁵⁾

6

2

Aufranc⁹⁾

3

. Chales¹¹⁾, Campbell¹⁰⁾ 가

Okhotsky

Souvalyn¹⁶⁾

가

. Ring 8)

Blade

4.5mm

6.5mm

16

2

4.5mm

2

21

19

. Muller¹⁵⁾

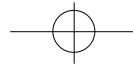
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Rosen 18)

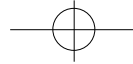
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REFERENCES

- 1) , , , , : 5: 91-97, 1992.
- 2) : , 9: 187-195, 1986.
- 3) , , : , 30: 424-429, 1995.
- 4) , , : , 30: 740-746, 1995.
- 5) , , , , : , 23: 237-247, 1988.
- 6) , , , , , , : , 32: 735-740, 1997.
- 7) , , , , : 869-878, 1982.
- 8) , , , : , 17: 869-878, 1982.
- 9) **Aufranc EO** : Nonunion of humerus. *JAMA*, 175: 140-143, 1961.
- 10) **Campbell CW** : Ununited fractures of the humerus.



- Ann of Surg*, 105: 135-149, 1937.
- 11) **Charles HE Jr**: Fractures of the shaft of the humerus. *Fractures*, Rockwood and Green, JP Lippincott Co: 295-300, 1986.
- 12) **Heppenstall RB**: Fractures of the humeral shaft. *Fractures treatment and healing*, 1st ed. 424-437, 1980.
- 13) **Jupiter JB and von Deck M**: Ununited humeral diaphyses. *J Shoulder Elbow Surg*, 7: 644-653, 1998.
- 14) **Laing PG**: The arterial supply of adult humerus. *J Bone and Joint Surg*, 45-B: 176, 1963.
- 15) **Muller EM**: Treatment of nonunion by compression. *Clin Orthop*, 43: 83-88, 1965.
- 16) **Okhotsky VP and Souvalyan AG**: The treatment of nonunion and pathogenesis and pseudoarthrosis of a long bone with thick nails. *Injury*, 10: 92-98, 1978.
- 17) **Ring D, Perey BH and Jupiter JB**: The functional outcome of operative treatment of united fractures of the humeral diaphysis in older patient. *J Bone Joint Surg*, 81-A: 177-190, 1999.
- 18) **Rosen H**: The treatment of nonunions and pseudoarthroses of the humeral shaft. *Orthop Clin N Am*, 21: 725-742, 1990.
- 19) **Sever JW**: Nonunion in fractures of the shaft of the humerus, report of 5 cases. *JAMA*, 104: 382, 1935.
- 20) **Steen C**: Humeral shaft fractures, operative and conservative treatment. *Acta Chir Scand*, 133: 455-460, 1967.
- 21) **Urist MR, Mazet R and Mclean FC**: The pathogenesis and treatment of delayed union and nonunion. *J Bone Joint Surg*, 36-A: 931, 1954.
- 22) **Wilsom JN**: *Watson-Jones Fractures and Joint injuries*, 6th ed. Edinburg, Churchill Livingstone Co: 124-129, 1982.



Abstract

Treatment of Humeral Shaft Nonunion after Primary Internal Fixation

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Purpose : To evaluate the methods of treatment to obtain rigid fixation for nonunion of humerus shaft fractures developed after operative treatment

Materials and Methods : From January 1993 to January 2000, twenty-one patients of nonunion of humerus shaft after primary internal fixation were reviewed and the results were analyzed. Three cases who have loss of follow-up were excluded.

Results : In twenty-one cases, nineteen had union but, two cases have failed. In the group of compression plate fixation and bone graft, bone union was completed at mean 4.4 months, in the group of IM nailing and bone graft at 4.9 months, in case of bone graft only with state of IM nailing at 5.5 months. Mean time until bone union was 4.6 months.

Conclusion : Distraction should be avoided during IM nailing at primary internal fixation. Secondly, To obtain rigid fixation in nonunion of humerus shaft after primary internal fixation, use larger and more broad plate, dual plate or IM nail.

Key Words : Humerus, Shaft, Nonunion, Internal fixation, Bone graft

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