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AOC3

Plm

- hybrid -

= Abstract =

Operative Results in AO Type C3 of Tibial Pilon Fracture

- Limited Internal Fixation and Hybrid External Fixation -

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The intraarticular fractures of the distal tibia has been the most difficult problem due to severe comminution of itself, little bone mass and poor circulation of soft tissue. Recently limited internal fixation with hybrid external fixation has been reported to provide a good clinical results for the severely comminuted or open pilon fractures as a AO type C3.

From February 1994 to February 1996, the authors analyzed the clinical and radiological results of 2 year follow-up in 7 cases of the AO type C3 pilon fractures who were treated with combination of limited internal fixation and hybrid external fixation.

6 cases had good or excellent clinical and radiological results without any serious

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1997





complications such as skin sloughs, skin infection, malunion and nonunion, but one case had a nonunion who were treated with internal fixation and autogenous iliac bone graft.

We believe that the combination of limited internal fixation and hybrid external fixation that does not cross the ankle joint, provides the good clinical results in AO type C3 pilon fractures by early ankle joint motion.

Key Words : Tibia, Pilon fracture, Limited internal fixation, Hybrid external fixation

2 3

pilon

1911 Destot¹²⁾

가

6,11,17,24)

pilon

가

8,9,15,20,26)

Ruedie

Allgower^{21,22)}

1994 2

1996 6

pilon

23

AO

A

4

B 8

C

(C1

2

,C2

2

,C3

7

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11

hybrid

C3

2

가

7

2

1

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7

가가

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2

3

23

27

68

45.6

가

15

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가

8

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C3

7

38

60

47.6

가

4

,

가

3

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23

13

가

¹⁸⁾ 1993

Tornetta

²⁶⁾

1994

Karas

Weiner¹⁴⁾

pilon

hybrid

14,18,20-22,26)

3

AO

pilon

AO

C3

C3

7

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가

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2

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C1, C2

1

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AO

C3

7

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가

14,18,20-22,26)

1994 2

1996 6

7

AO

C3

pilon

hybrid

hybrid

Ilizarov

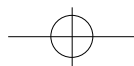


Fig 1-A. The plain roentgenogram of a 58-year-old man with AO C3 pilon fracture.

B. The CT roentgenogram shows severe intraarticular fracture of distal tibia.

C. Postoperative roentgenogram taken after limited internal fixation using malleolar and cannulated screws, hybrid external fixation and bone graft.

D. The plain roentgenogram taken 1 year 5 months after operation shows bone union and no evidence of arthrosis.

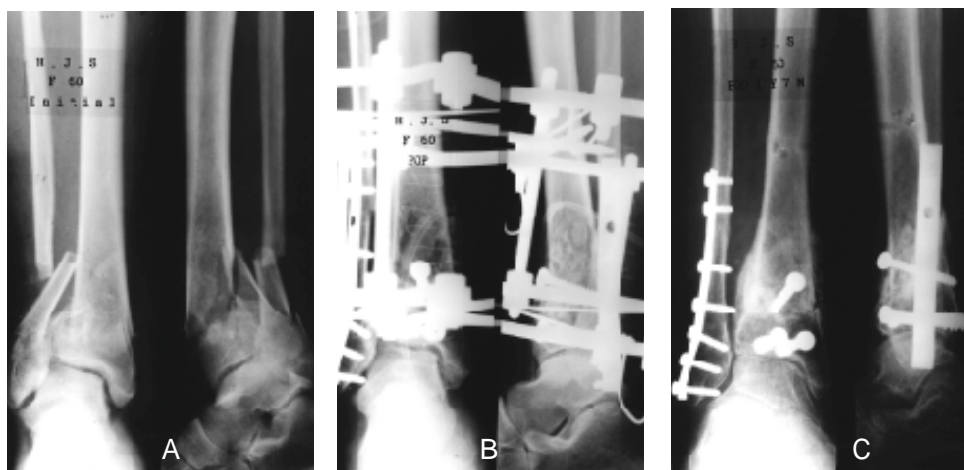


Fig 2-A. The plain roentgenogram of a 60-year-old woman with open AO C3 pilon fracture.

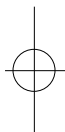
B. Postoperative roentgenogram taken after limited internal fixation using plate and screws, hybrid external fixation and bone graft.

C. The plain roentgenogram taken 1 year 7 months after operation shows bone union and no evidence of arthrosis.



Table 1. Datas of 7 cases of AO C3 type pilon fracture

| case | age/sex | cause | associated Injury | lateral malleolar fracture | bone graft | bone union | removal of ext. fixator |
|------|---------|------------------------|---------------------------------------|----------------------------|------------|------------|-------------------------|
| 1 | 60 / F | motor vehicle accident | open fracture | + | + | 17wks | 18wks |
| 2 | 58 / M | fall down | spine fracture | - | - | 13wks | 14wks |
| 3 | 38 / M | fall down | distal radius intraarticular fracture | + | + | nonunion | |
| 4 | 41 / M | fall down | calcaneal fracture | + | + | 16wks | 17wks |
| 5 | 52 / F | motor vehicle accident | open fracture | + | + | 15wks | 16wks |
| 6 | 45 / M | fall down | spine fracture | + | + | 12wks | 14wks |
| 7 | 39 / F | fall down | open fracture | + | + | 13wks | 15wks |



100kg
2-3cm
2
7cm
Schanz 1.8mm
1
K- 가 K- Schanz 4-0
K- cannulated screws 가 가
가
1 가
" hybrid " - - 2
K- Ilizarov 가 가 가
K- 1.8mm 가 Burwell Chanley¹⁰⁾ 가
(displacement), (anatomic), (fair), (poor)





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Table 2. Radiographic criteria of reduction (by Burwell and Chanley¹⁰⁾)

| Anatomic | 가 | 가 | Tornetta ²⁶⁾ | 가 |
|--|---------------------------|-------------------------|-------------------------|-----------------|
| No medial or lateral displacement of the medial and lateral malleoli | (excellent), | (good), | (fair), | (poor) |
| No angulation | | | | |
| No more than 1 mm longitudinal displacement of the medial and lateral malleoli | | | | |
| No more than 2 mm proximal displacement of a large posterior fragment | | | | |
| No displacement of the talus | 1 - 17) | 6 | 14.3 (12 - 18) | 15.7 (14 - 18) |
| Fair | | | | |
| No medial or lateral displacement of the medial and lateral malleoli | 가 Burwell | Charnley ¹⁰⁾ | 가(Table 2) | |
| No angulation | | 6 , | 1 | |
| 2-5 mm posterior displacement of the lateral malleolus | 가 Tornetta ²⁶⁾ | 가(Table 3) | 5 , | |
| 2-5 mm proximal displacement of a large posterior fragment | 1 , 1 | | 3 | |
| No displacement of the talus | 1 | 6 | 가 | |
| poor | | | 4 | |
| Any medial or lateral displacement of the medial and lateral malleoli | | | 가 | 가 |
| More than 5 mm posterior displacement of the lateral malleolus or more than 5 mm displacement of the posterior malleolus | 1 | | . 3 | |
| Any residual displacement of the talus | | | | |

Table 3. Criteria for clinical results. (by Tornetta²⁶⁾)

| Grade | Pain | Range of Motion | Angulation |
|-----------|---|-----------------------|------------------------|
| Excellent | None | D > 5 P > 40 | < 3 |
| Good | Intermittent, relieved by NSAID | D = 0-5 P = 30-40 | 3-5 valgus <3 varus |
| Fair | Pain activities of daily living relieved by narcotics | D = -5-0 P = 25-30 | 5-8 varus 3-5 varus |
| Poor | Intractable | D < -5 P < 25 | >8 valgus >5 varus |

pilon

(Axial compression)

14,18)

25)

Ruedi Allgower²²⁾

5%, Bone⁶⁾ 1%

1% - 10%

19,22)

Mast¹⁸⁾ Karas

Weiner¹⁴⁾



Table 4. Radiographic and clinical results and evaluations

| case | age/sex | *radiographic reduction | **clinical results and evaluation | | | | |
|------|---------|-------------------------|-----------------------------------|------------------|------------|---------------------|------------|
| | | | pain | range of motion | angulation | cx | evaluation |
| 1 | 60 / F | anatomic | none | D = 7 P = 45 | 0° | none | excellent |
| 2 | 58 / M | anatomic | none | D = 10 P = 40 | 2° valgus | pin tract infection | excellent |
| 3 | 38 / M | fair | intermitent relieved by NSAID | D = 0 P = 25 | 5° varus | nonunion | fair |
| 4 | 41 / M | anatomic | none | D = 8 P = 43 | 0° | none | excellent |
| 5 | 52 / F | anatomic | none | D = 7 P = 42 | 2° varus | pin tract infection | excellent |
| 6 | 42 / M | anatomic | none | D = 8 P = 43 | 0° | pin tract infection | excellent |
| 7 | 39 / F | anatomic | intermitent relieved by NSAID | D = 5 P = 34 | 2° valgus | none | good |

* by Burwell and Chanley¹⁰⁾** by Tornetta²⁶⁾

(rotational force)

4,12,15,22)

Kellam Waddell¹⁵⁾ 1) 2) Allgower²²⁾ 2

가

5 (71.4 %) 가

pilon Lauge-Hansen¹⁶⁾ 1,2,3

5 Ruedi Allgower²²⁾ 가

1 , 2 , 3 C1, C2, C3

가

pilon

Ruedi Allgower²²⁾ . Ovadia Beals²⁰⁾ 가

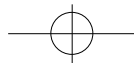
5가 2,3,4 Ruedi , AO

Ovadia Beals²⁰⁾ 6)

type A, type B, , type C

type A, B, C

type C



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3 13) 6,14,26)

3 , , 가

canulated screw

가 buttress plate 14) Salter 23)

가 , Kellam Weddell¹⁵⁾

8,11,17,24), 1969

가 Ruedi Allgower²¹⁾ 5가 . 1993

Tornetta²⁶⁾ Ruedi 3

hybrid 69%

1994 Karas

Weiner¹⁴⁾ pilon “biologic principles”

buttress plate

hybrid

70%-80%

pilon

15,19-22) pilon AO C3 pilon 6

가 AO C3 hybrid , 1

37 pilon 78%

Bourne⁹⁾ 19 가

Ruedi 3 44%

Teeny Wiss²⁵⁾ Ruedi 3 4

75%

Ruedi 3 14.3 (12 -17) 15.7

(14 -18) 3) 5)

1965 Scheck²⁴⁾ 4 가 5

가 pilon 가

5 7 , 4-6

가 hybrid

Waddell¹⁵⁾

half-pin (ligamentotaxis) , pilon

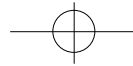
가 가 AO C Tornetta²⁶⁾ 1 , 1

8,18,26)



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