

104kg 68.3kg ,
61-70kg가 31 (41.3%), 71-80kg가 18 (24.0%)

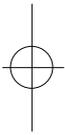
Weber33) Lauge-Hansen²¹⁾ Danis-
35 (46.7%) 가 , 가 23
(30.7%), 9 (12.0%)

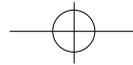
가 . ,
가 , Joy¹⁷⁾ - 2.
, Petrone²⁸⁾ 40 2 가
, Mont²⁵⁾ 40 , 1 1-21) , 4-7 가 32 (42.7%) 가
, 3 가 17 (22.7%), 8-10 15
, 2 (20.0%)
가 .

(repair)
, K- ,
K- , (tension band wiring)
, (transfixation screw)

1 2 , K-
K- , (tension band
가 wiring)
1994 5 2000 8
, 16
225 1 가가
75 . 1 (syndes-
가 68 , 53 mosis)
27 , 2

1 1 7 3
, 3 3
가 52 (69.3%), 가 23
(30.7%) 가 . 16 65
, 40.5 30 가 18 가
(24.0%) 가 , 50 가 14 (18.7%), 40 가
13 (17.3%), 20 가 11 (14.7%)
42 (56.0%), 33 (44.0%)
50kg, 6
25%
, 25%
(impingement)
1 (PTB)
(walker boots, Cam walker)
3.2 (: 6-





1)
 touch) 1 가 (toe-
 , 3-4
 , 10-12
 .
 3. 가
 AOFAS(American Orthopaedic Foot and Ankle Society)
 - 가¹⁸⁾
 . AOFAS 가
 100 90-100 (Excellent), 80-89
 (Good), 70-79 (Fair), 69
 (Poor)
 , , , , , ,
 , , .
 , - ,
 , -
 Joy¹⁷⁾, Sarkisian Cody²⁹⁾가
 ,
 1
 SPSS
 T- (Independent samples T-test)

Table 2. Classification of ankle fracture by Lauge-Hansen

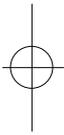
Type	Stage	Number	AOFAS score	Total(%)
S/ER*		0		
		0		
		5		
		37	80.6	42(56.0)
S/Add [†]		0		
		11	77.3	11(14.7)
P/ER [‡]		0		
		0		
		5		
		8	83.2	13(17.3)
P/Abd [§]		0		
		1		
		5	87.3	6(8.0)
P/DF		0		
		0		
		1		
		0	78.0	1(1.3)
Unclassified ¶			75.5	2(2.7)
Total				75(100)

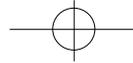
* Supination-external rotation type; † Supination-adduction type;
 ‡ Pronation-external rotation type; § Pronation-abduction type;
 ¶ Pronation-dorsiflexion type; †† Unclassified type

Table 1. AOFAS Ankle-Hindfoot Scale scores according to the evaluation categories

Evaluation categories	Max. score*	AOFAS [†] score	%
Pain	40	29.8	74.5
Activity limitation & support requirement	10	7.2	72.0
Maximum walking distance	5	4.1	82.0
Walking surfaces	5	3.4	68.0
Gait abnormality	8	6.4	80.0
Sagittal motion(flexion plus extension)	8	6.6	82.5
Hindfoot motion(inversion plus eversion)	6	5.7	95.0
Ankle-hindfoot stability (anteroposterior, varus-valgus)	8	7.8	97.5
Alignment	10	9.8	98.0
Total	100		

*Maximum score; † American Orthopaedic Foot and Ankle Society





SPSS (Multivariate Analysis of variance - ANOVA)

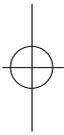
1. AOFAS 가 81.0 (: 100-49) 가 23 (30.7%), 가 17 (22.7%), 18 (24.0%), 17 (22.7%) AOFAS 가 가 80% , (pain), (activity limitations), (walking surface) (Table 3). Lauge-Hansen - 42 (56.0%) 가 , - 13 (17.3%), - 11 (14.7%) (Table 2). Danis-Weber type B가 44 (58.7%) 가 , type C가 20 (26.7%), type A가 11 (14.7%) 93.6 (: 200-25) 90 -119 가 33 (44.0%) 가 , 45 -89 가 30 (40.0%), 120 9 (12.0%) 가 2mm 71 (94.7%)가, 67 (89.3%)가 4.5mm(: 18 - 1mm) , 2.4mm(: 5 - 1mm) 4mm 7 (9.3%) 4mm 가 6 , 5mm 가 1 . 3.2 (: 8 - 0) 5,가 12 (16%) . 12.8 (: 19 - 4) 8 - 15, 24 (32%) , & 4 , 15, 가 20 . - 9.3mm(: 15 - 6mm) 10mm

Table 3. Results of demographic data

Specific Demographic Factors	Number	AOFAS Score	Significance
Sex			
Male	52	83.1	NS *
Female	23	76.2	NS
Age			
40	39	89.2	(P<0.001)
41	36	72.0	(P<0.001)
Side of injury			
Left	42	83.4	NS
Right	33	77.9	NS
Operation time			
89 minutes	33	89.1	(P<0.001)
90 minutes	42	74.8	(P<0.001)
Cause of injury			
Slip down	35	79.5	NS
T.A	23	80.1	NS
Sports injury	9	90.9	NS
Fall down	3	70.3	NS
Other injury	5	83.5	NS

* Not significant

가 44 (58.7%) 가 6mm 2 7mm . - 3.5mm(: 7 - 1mm) 5mm가 가 3 (4%) .. 16.5 (: 25-5) , 39.7 (: 50-10) , (: 13-1) 6 가 , 1 , 1 , 4 가 . 2. 1) AOFAS , , ,



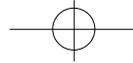
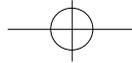


Table 4. Results of demographic data

Specific Radiographic Factors	Number	AOFAS Score	Significance
Anatomical Reduction			
Medial malleolar Reduction	71	82.2	(P<0.005)
Non-reduction	4	59.3	(P<0.005)
Lateral malleolar Reduction	67	82.4	(P<0.005)
Non-reduction	8	68.4	(P<0.005)
Preoperative medial clear space			
< 4mm	37	83.0	NS *
4mm	38	78.5	NS
Postoperative medial clear space			
< 3mm	43	88.2	NS
3mm	32	70.9	NS
Talar tilt			
5 °	63	81.3	NS
5 °	12	78.9	NS
Talo-crural angle			
8 - 15 °	51	81.2	NS
other angle	24	80.5	NS
Tibio-fibular clear space			
5mm	72	81.0	NS
> 5mm	3	79.9	NS
Tibio-fibular overlap space			
< 10mm	44	80.1	NS
10mm	31	82.0	NS

* Not significant

(Table ?). SPSS 76.1 ± 16.7 (9) .
 T- 가 90 89.1
 , , , 20 90
 , 90.8 ± 7.8 (10), 21-40 ± 11.1, 90 74.8 ± 11.2
 88.7 ± 10.9 (29), 41-60 73.2 ± 8.8 (27 (P<0.001).
), 61 68.4 ± 11.3 (9) 가 90.9 ± 6.2
 . 가 40 가 가 20.6 ,
 40 10.8 가
 89.2 ± 10.1 , 41 72.0 ± 9.6 T-
 (P<0.001). 45
 94.7 ± 5.5 (3), 45-89 88.5 ± 11.4 (30 26.3
), 90-119 74.4 ± 9.5 (33), 120 42.4



가

2)

SPSS

T-

6.8,16)

가

5,14,17,18)

, Burwell

Chamley⁷⁾

(Table ?).

Lauge-Hansen

Danis-Weber

Lauge-Hansen

42 (56.0%) 가

AOFAS

가 87.3

가,

(Table 2). Danis-Weber

A (11)

77.3 , B (44)

80.5 , C (20)

84.1 C

가 2mm

82.2±

12.2 (71) , 2mm

가

59.3 ± 10.1 (4)

1922

(P<0.005)

Ashurst Bromer¹⁾

가 2mm

82.4 ± 12.9

(67) , 2mm

68.6 ± 7.5 (8)

(P<0.005)

1950 Lauge-Hansen²¹⁾

3mm

가

가 , 3mm

. Lauge-Hansen²¹⁾

88.2 ± 9.4 (43) , 3mm

70.9±

11.0 (32)

T-

- 가

7,13,17,18,22)

가

15,27,34)

3mm

42 (56.0%) 가

. Mont ²⁵⁾, Pettrone ²⁸⁾

36.1 82.8 , 3mm

가

46.8 106.4

, Cedel⁹⁾

가

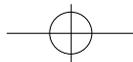
가

가

31)

가

. Mont ²⁵⁾, Pettrone ²⁸⁾ 40



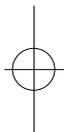
가 41

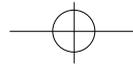
90

가

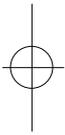
, , , .
 , , ,
 , - , , - , -
 ,
 3mm
 가
 가 .

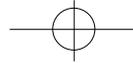
- 1) **Ashurst APC and Bromer RS**: Classification and mechanisms of fractures of the leg bone involving the ankle. *Arch Surg*, 4: 51-56, 1922.
- 2) **Beauchamp CG, Clay NR and Thexton PW**: Displaced ankle fractures in patient over 50 years of age. *J Bone Joint Surg*, 65-B: 329-332, 1983.
- 3) **Bonnin JG**: Injuries to the ankle. New York, Grune and Stratton, 1950(cited from McDade WC. Treatment of ankle fractures. Instructional Course Lectures, AAOS, 24:251-293, 1975.)
- 4) **Braunstein PW and Wade PA**: Treatment of unstable fractures of the ankle. *Annals of Surgery*, 5: 149-217, 1959.
- 5) **Brodie IAO and Denham RA**: The treatment of unstable ankle fracture. *J Bone Joint Surg*, 56-B: 256-262, 1974.
- 6) **Burgess E**: Fractures of the ankle. *J Bone Joint Surg*, 26: 721-732, 1944.
- 7) **Burwell HN and Charnley AD**: The treatment of displaced fractures at the ankle by rigid fixation and early joint movement. *J Bone Joint Surg*, 47-B: 634-660, 1965.
- 8) **Cedell CA**: Ankle lesions, *Acta Orthop Scand*, 46: 425-445, 1975.
- 9) **Cedell CA**: Is closed treatment of ankle fractures advisable? *Acta Orthop Scand*, 56: 101-102, 1985.
- 10) **Cho HO, Kwak KD, Cho SD and Lee SR**: Factors affecting the outcome of the ankle fractures. *J Korean Orthop Assoc*, 26: 1654-1659, 1991.
- 11) **Colton CL**: The treatment of Dupuytren 's fracture-dislocation of the ankle. *J Bone Joint Surg*, 53-B: 63-71, 1971.
- 12) **Dahners LE**: The pathogenesis and treatment of bimalleolar ankle fractures. *Instructional Course Lectures*, 39: 85-94, 1990.
- 13) **Eventov J, Saloma R, Goodwin DRA and Weissman SL**: An evaluation of surgical and conservative treatment of fractures of the ankle in 200 patients. *J Trauma*, 18: 271-274, 1978.
- 14) **Ha KI, Hahn SH, Chung MY, Kim HJ and Chung JY**: A clinical study of ankle fracture. *J Korean Orthop Assoc*, 24: 701-707, 1989.
- 15) **Han CD, Park BM and Chang JS**: A clinical study of ankle fracture. *J Korean Orthop Assoc*, 17: 90-100, 1982.
- 16) **Heppenstall RB**: Fracture treatment and healing. 1st ed, Philadelphia, WB Saunders Co: 803-838, 1980.
- 17) **Joy G, Patzakis MJ and Harvey JP**: Precise evaluation of the reduction of severe ankle fractures. *J Bone Joint Surg*, 59-A: 979-993, 1974.
- 18) **Kim ID, Lee SY, Kim PT, Park BC and Choi YD**: A clinical study of ankle fracture. *J Korean Orthop Assoc*, 20: 131-140, 1985.
- 19) **Kim JO, Choi HY and Yoo YW**: Measurement of radiologic criteria for evaluation of the syndesmosis in Korean Men. *J Korean Society of Fracture*, 8: 600-605, 1995.
- 20) **Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA and Myerson MS**: Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. *Foot & Ankle Int*, 349-353, 1994.
- 21) **Lauge-Hansen N**: Fractures of the ankle . Combined experimental-surgical and experimental-roentgenologic investigations. *Arch Surg*, 60: 957-985, 1950.





- 22) **Lauge-Hansen N**: Fractures of ankle . Genetic roentgenologic diagnosis of fractures of the ankle. Am J Roentgenol, 71: 456-471, 1954.
- 23) **Lee JY, Sohn SK, Kim KT, Lee KY and Moon YH**: Clinical study of the operative treatment of ankle fractures. J Korean Orthop Assoc, 28: 2143-2152, 1993.
- 24) **Lindsjo ULF**: Operative treatment of ankle fracture-dislocation. Clin Orthop, 199: 28-38, 1985.
- 25) **Mont MA, Sedlin EA, Weiner LS and Miller AR**: Postoperative radiographs as predictors of clinical outcome in unstable ankle fractures. J Orthopaedic Trauma, 6: 352-357, 1992.
- 26) **Oh JK, Wang JM, Roh KJ, Yun YH, Kim DJ and Jeong H**: Diagnostic landmarks of ankle syndesmosis separation measured on standard ankle anterior-posterior radiographs of normal Korean adults. J Korean Orthop Assoc, 33: 1263-1266, 1998.
- 27) **Park MS and Song KJ**: A clinical study of the ankle fracture. J Korean Orthop Assoc, 19: 839-848, 1984.
- 28) **Pettrone FA, Gail M, Fitzpatrick T and Herpe LB**: Quantitative criteria for prediction of the results after displaced fracture of the ankle. J Bone Joint Surg, 65-A: 667-677, 1983.
- 29) **Sarkisian JS and Cody GW**: Closed treatment of ankle fractures. A new criterion for evaluation-a review of 250 cases. J trauma 16: 323-326, 1976
- 30) **Segal D**: Displaced ankle fractures treated surgically and postoperative management. Instructional Course Lectures, 33: 107-123, 1984.
- 31) **Song EK, Chung GH and Hong DY**: A clinical analysis of open reduction of the ankle fracture. J Korean Society of Fracture, 9: 212-219, 1996.
- 32) **Stiehl JB**: Ankle fractures with diastasis. Instructional Course Lectures, 39: 95-103, 1990. 33. Walling AK: Classification of ankle fractures, which system to use? Instructional Course Lectures. The American Academy of Orthopaedic Surgeons. St. Louis, C Mosby Co. 37: 251-256, 1988.
- 34) **Wilson FC and Skilbred LA**: Long term results in the treatment of displaced bimalleolar fractures. J Bone Joint Surg, 48-A: 1065-1078, 1966.
- 35) **Yablon GI and Heller FG**: The key role of the lateral malleolus in displaced fracture of the ankle. J Bone Joint Surg, 59-A: 169-173, 1977.





Abstract

The Evaluation of Clinical and Radiographic Prognostic Factors for the Surgically Treated Unstable Ankle Fractures

Hong-geun Jung, M.D., Hee-kon Park, M.D.,
Moon-jib Yoo, M.D. and Tai-won Kim, M.D.

*Department of Orthopaedic Surgery,
Dankook University College of Medicine, Cheonan, Korea*

Purpose : The purpose of this study is to analyze the clinical and radiographic prognostic factors which may affect the postoperative clinical results of the unstable ankle fractures.

Materials and Methods : This study is based on 75 unstable ankle fractures treated by open reduction and internal fixation from May 1994 to August 2000, with a minimum follow-up period of 12 months(range : 13 months-7 years 3 months). The 75 patients were average 40.5 years old with male: female ratio of 52:23. Based on Lauge-Hansen classification, the supination-external rotation type was the most common with 42 (56.0%) cases. The clinical results was assessed by American Orthopaedic Foot and Ankle Society(AOFAS) functional scale. The sex, age, side of injury, body weight, trauma-operation interval, operation time, cause of injury as the possible postoperative clinical prognostic factors and fracture type, anatomical reduction of fracture, preoperative medial clear space, postoperative medial clear space, talo-crural angle, talar tilt, tibio-fibular clear space, tibio-fibular overlap space as the possible radiographic prognostic factor were statistically analyzed

Results : Postoperative AOFAS functional scale was average 81.0 points with 23(30.7%) cases excellent, 17(22.7%) good, 18(24.0%) fair and 17(22.7%) cases poor results. The age, the operation time($p<0.001$) and the anatomical reduction of fracture($p<0.005$) were found to be statistically significant factors affecting the prognosis. The other clinical and radiographic factors did not significantly affect the clinical results.

Conclusion : The surgically treated unstable ankle fractures in patients whose age was above 41 years old or operation time exceeding 90 minutes or unsatisfied anatomical reduction of fractures showed significantly poor clinical results.

Key Words : Unstable ankle fractures, Clinical prognostic factors, Radiographic prognostic factors, Age, Operation time, Anatomical reduction

Address reprint requests to _____

Hong-geun Jung, M.D.

Department of Orthopaedic Surgery, Dankook University College of Medicine

16-5, Anseo-dong, Cheonan, Choongnam Province, Korea 330-715,

Tel: (8241) 550-3059 Fax: (8241) 556-3238

E-mail : doctorj@anseo.dankook.ac.kr