

(Monofixator)

가

[ ]	
: , 1 cm	
: 1 cm	
3 9 I , 6	(monofixator) 6 II
, 37.2 , I, II 15.9 (12~35), 19.3 (15~41)	가 I, II , 가 7 , 5 , 34.8
CMW 9.5	vancomycin
: I 9 3 26	6.1 ,
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11.8 m 10.2 , 90 44 1	
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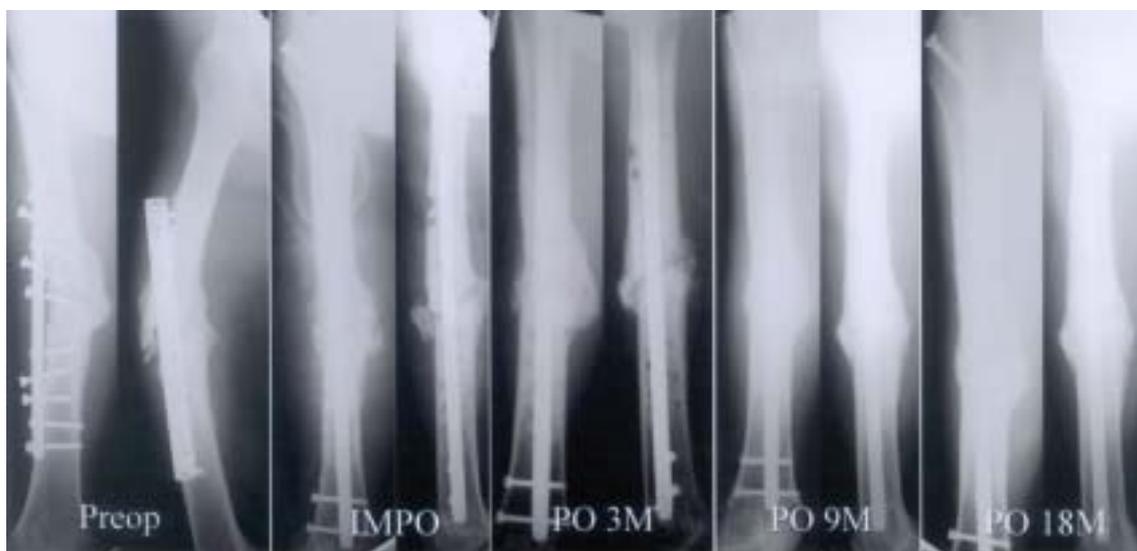
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\* 2002 46

가  
. I 가 7 , 가 2 II  
가 5 , 가 1 가  
, I, II 34.8 (26~53  
), 37.2 (20~63 )  
I 6 , 3 II  
<sup>24)</sup> 5 , 1  
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rov I, II 2.4 2.2 ,  
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I (S. au-  
reus) 3 ( MRSA가 2 ), (P. aureginosa)  
(mono- 2 , 가 3 Enterococ-  
coccus cloacae가 1 , II  
fixator) 2 ( MRSA), (P. aureginosa)  
가 3 Enterococcus cloacae가 1  
. CMW ,  
(monofixator) vancomycin powder . 가  
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, ,  
1995 2 2000 3 가 ,  
1 cm  
15  
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( )  
6  
3 9 I ,  
(monofixator) I 9 3 9.5  
6 II ,  
, 26 .



**Fig. 1.** This 22 year-old female patients had undergone IM nailing for the type IIIA open fracture of femur mid-shaft in our hospital, which resulted in infectious osteomyelitis with draining sinus. Wound culture was negative and initial CRP of 30 mg/dL was controlled to 2.1 mg/dL before surgery. At postoperative 9 months, she underwent vancomycin-cement coated unreamed intramedullary nailing, whose femur gained radiographically complete bony union at 12 months, and whose implant was removed at 15 months postoperatively. We allowed partial weight bearing at postoperative 6 weeks, full weight bearing at postoperative 3 months.



**Fig. 2.** This 26 year-old male patients had undergone plate and screw surgery for the closed fracture of femur mid-shaft in a local clinic, which resulted in infectious osteomyelitis with draining sinus and severe angulation deformity. *Pseudomonas aureginosa* was grown in wound culture and initial CRP of 7.0 mg/dL was controlled to 1.7 mg/dL before surgery. At postoperative 12 months, she underwent vancomycin-cement coated unreamed intramedullary nailing, whose femur gained radiographically complete bony union at 12 months, and whose implant was removed at 25 months postoperatively. We allowed partial weight bearing at postoperative 6 weeks, full weight bearing at postoperative 3 months.

**Table 1.** Summary of cases

Group-Case No.	Age/Sex	No of prev. Op.	Organism	Location	Union time (weeks)	Complications
I-1	42/M	4	<i>P. aureginosa</i>	Femur	25	
I-2	26/M	2	<i>P. aureginosa</i>	Femur	17	
I-3	23/F	1	Unknown	Femur	19	
I-4	53/M	3	Coag(-)Staph	Tibia	32	
I-5	40/F	3	Unknown	Femur	23	
I-6	30/M	3	Unknown	Tibia	25	
I-7	37/M	1	Enterocloa	Femur	23	
I-8	29/M	2	MRSA	Tibia	37	Ext.rotation
I-9	33/M	3	MRSA	Femur	33	
II-1	34/M	3	MRSA	Femur	57	Knee stiffness
II-2	37/M	1	<i>P. aureginosa</i>	Femur	43	
II-3	27/M	1	MRSA	Tibia	59	
II-4	20/M	2	<i>P. aureginosa</i>	Femur	14	
II-5	63/F	2	Enterocloa	Femur	42	
II-6	42/M	4	<i>P. aureginosa</i>	Femur	49	

가 , CRP  
 가 1.0  
 6.1  
 mm 가 , 100  
 1 5 , 9.2  
 II ,  
 44 ,  
 1 14 ,  
 , 5  
 12.5  
 II 5 ,  
 , 1 가  
 10.2 , 20)  
 90 1  
 11.8 m (Fig. 1, 2) (Table 1).

가 2~4,7,26). Keating 8)

11) 2~3B ,

. Shirtliff

22) Korkusuz 13) 가

24) Torne- 2

PMMA calcium hydroxyapatite

가 .

2~4,7), 가

CMW가 Palacos가 Si- .

plex CMW 가

가 가 .

8),

가

가

, Melcher 16) 가

(slotted) 가

(solid) 11,15,25)

가

가 . Dervin 6) 3B

가 ,

(dead space) , Court-Brown 5)

2~3

가

Ilizarov 12,23), 9,10,14,17,21)

(biofilm)

가

(overreaming)

1

가

가

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## Abstract

**Treatment of Infected Nonunion of Long Bone Shaft**  
**- Comparison between Fixation by Antibiotic-cement Loaded Intramedullary Nailing**  
**and Fixation by Antibiotic-cement Loaded External Monofixator -**

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**Purpose:** To evaluate the surgical results between fixations by antibiotic-cement loaded intramedullary nailing and antibiotic-cement loaded external monofixator in the treatment of infected nonunion of long bone shaft with mild bone loss and shortening of less than 1 cm.

**Materials and Methods:** Among the 15 cases of infected nonunion of long bone shaft, 6 cases treated with fixation by antibiotic-cement coated intramedullary nailing and 3 cases treated with fixation by intramedullary nailing along with antibiotic-cement beads insertion were divided as group I (n=9), and other 6 cases treated with fixation by external monofixator along with antibiotic-cement beads insertion were divided as group II (n=6). There was no difference between the two groups in the degree of infection in the laboratory data and clinical feature and degree of bone loss and shortening. Male was in 7 and 5 patients, average age of the patients was 34.8 (26~53) and 37.2 (20~63) years old and average follow-up period was 15.9 (12~35) and 19.3 (15~41) months in group I and II respectively.

**Results:** Among the nine cases of group I, 3 cases were newly converted into fixation by antibiotic-cement coated intramedullary nailing at average 9.5 weeks. Radiologic union was gained at the average of 26 weeks from the time of initial nail fixation. Infection was responsive at 6.1 weeks by laboratory data. Knee ROM of more than 100° was gained in all case and average shortening was 9.2 mm in the last follow-up. And external rotation deformity of more than 5° was noted in 1 case. Among the six cases of group II, radiologic union was gained at 14 weeks in 1 case without converting to internal fixation, and the other 5 cases were converted to antibiotic cement loaded intramedullary nailing at average 12.5 weeks because of delayed union or angulation deformity, and radiologic union was gained at average 44 weeks from the time of fixation by external fixator. Infection was responsive at 10.2 weeks by laboratory data. Knee ROM of more than 100° was gained in 5 cases, and average shortening was 11.8 mm in the last follow-up.

**Conclusion:** In the treatment of infected nonunion of long bone shaft with mild bone loss and shortening of less than 1 cm, the fixation by intramedullary nailing with the use of antibiotic-cement prefers to the fixation by external monofixator with the use of antibiotic-cement in the velocity of union, control of infection, and in the clinical aspects such as alignment, early ambulation and joint stiffness.

**Key Words:** Long bone shaft, Infected nonunion, Antibiotic-cement, Intramedullary nailing, External monofixator

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