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1 : 가 가 23 20 3  
10 , 8 , Rush 3 , 2  
Rush 가 , , 가 . Neer  
: 14 , 4 , 5 .  
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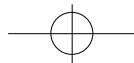
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(Fig. 1).

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, Neer<sup>10)</sup>

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(Table 1).

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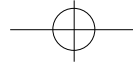
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3

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8

7 (87.5%)

**Table 1.** Functional Evaluation of Shoulder by Neer Criteria

1. Pain(35units)	
2. Function(30units)	Strength(10) Reaching(10) Stability(10)
3. Range of Motion(25units)	Flexion(6) Extension(3) Abduction(6) External rotation(5) Internal rotation(5)
4. Anatomy(10units)	
Total	100units
Excellent	>89units
Satisfactory	80-89
Unsatisfactory	70-79
Failure	<70

**Table 2** Functional Results according to Fixation Methods

Fixation Result	Pin	Screw	Rush	Rush+Pin	Rush+Screw
Excellent	7	7	0	0	0
Satisfactory	1	0	1	1	1
Unsatisfactory	2	1	2	0	0
Failure	0	0	0	0	0
Total	10	8	3	1	1

, 10 8 (80%) 3,4,13, 20%

(Table 2). Rush 3

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Rush

1,2,6,9,16)

(Fig. 2).

5,14,15)

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- (Scapulothoracic motion)

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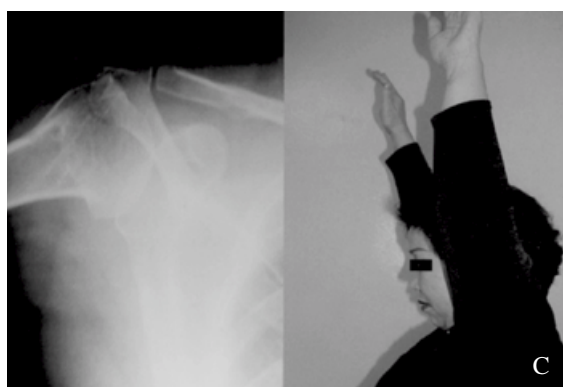
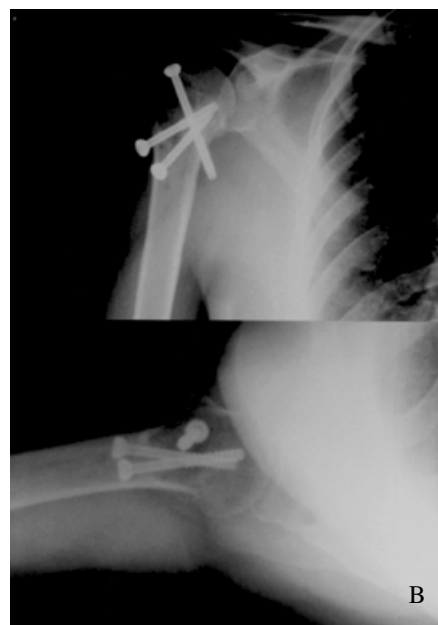
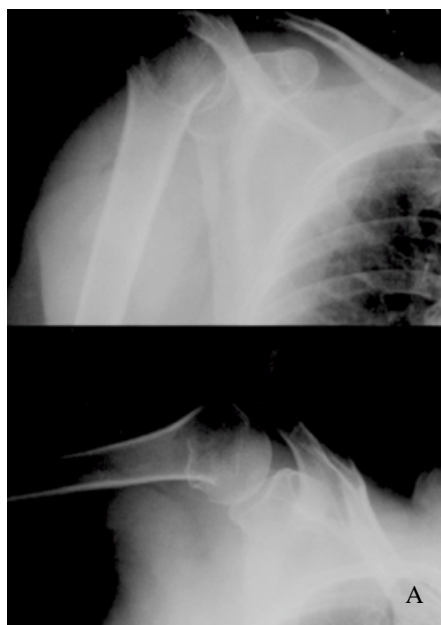
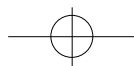
. Jaberg <sup>5)</sup>

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**Fig. 1**

(A) Preoperative radiographs show 2-part proximal humerus fractures in 53-year old female patient.  
 (B) After closed reduction, 3 cannulated screws were inserted for the stability.  
 (C) At 2 years follow-up, bone union and full ROM was obtained.

Kristiansen<sup>7,8)</sup> Steinmann

Resch<sup>12)</sup>

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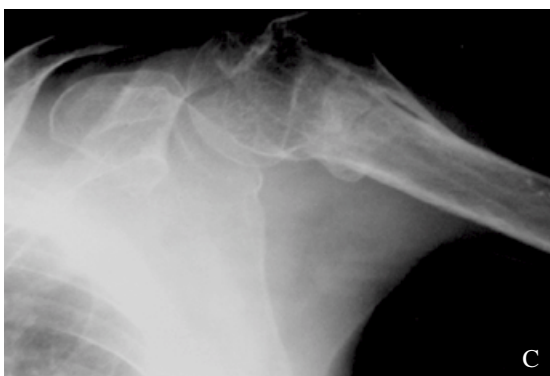
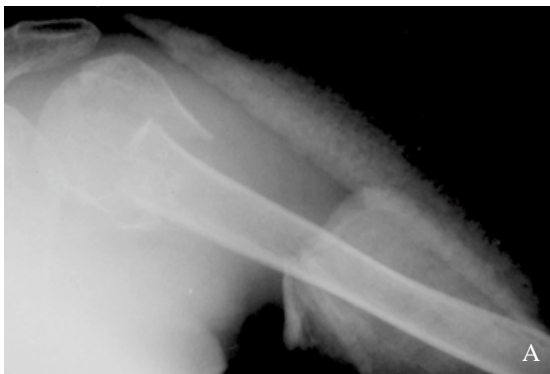
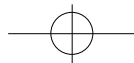
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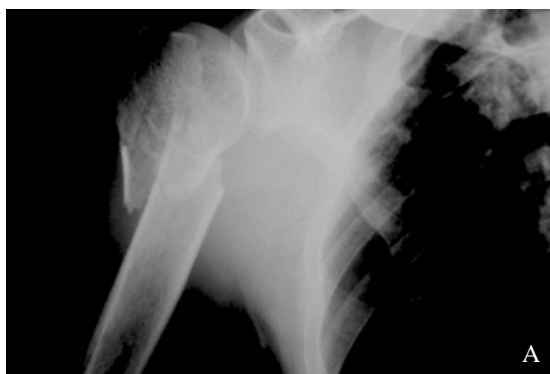
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towel clip

**Fig. 2**

- (A) Preoperative radiograph shows 2-part proximal humerus fracture in 75-year old female patient.  
 (B) 3 Rush pins were inserted but the greater tuberosity was displaced.  
 (C) Bone union was obtained, but displaced greater tuberosity resulted in impingement.

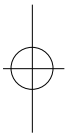
**Fig. 3**

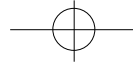
- (A) Preoperative radiograph shows 3-part proximal humerus fracture in 50-year old male patient.  
 (B) For the stability, Rush pin was inserted after fixation of greater tuberosity with one cannulated screw.  
 (C) Excellent functional result was obtained.



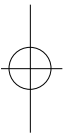
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## Abstract

## Closed Reduction and Percutaneous Fixation in the Treatment of Proximal Humerus Fractures

Seung-Ju Jeon, M.D., Hyung-Ku Yoon, M.D., Ho-Seung Jeon, M.D.,  
Kye-Nam Cho. and Hyung-Sam Kim, M.D.

*Department of Orthopedic Surgery, Kwangmyung Sung-Ae Hospital, Kwangmyung, Korea*

**Purpose :** This is a retrospective study to analyze the functional results of closed reduction and percutaneous fixation of displaced unstable proximal humerus fractures.

**Materials and Methods :** We report 23 patients, 20 with 2-part and 3 with 3-part proximal humerus fractures that can be reduced closed but remain unstable in which percutaneous fixation was performed. The fixation methods were multiple pinning in 10, multiple cannulated screw fixation in 8, Rush pin fixation in 3 and Rush pin combined with other methods in 2. The functional results were analyzed with Neer,s criteria.

**Results :** The functional results were excellent in 14, satisfactory in 4 and unsatisfactory in 5. No significant difference was not noted in the long term follow-up results according to the fixation methods but Rush pin resulted in impingement and displacement of greater tuberosity.

**Conclusion :** Closed reduction and percutaneous fixation is a useful alternative to open reduction and internal fixation for the displaced 2-part or 3-part proximal humerus fractures that can be reduced closed but remain unstable.

**Key Words :** Proximal Humerus, Unstable Fracture, Percutaneous Fixation

**Address reprint requests to** \_\_\_\_\_

Department of Orthopedic Surgery, SungAe General Hospital,  
Shingil-1 Dong 451-5, YoungDeungPo-Gu, Seoul, Korea  
TEL : 02-840-7235  
FAX : 02-840-7237