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Retrospective study of 35 cases of Bennett fracture treated operative with K wire

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Abstract

Introduction: Metacarpal fracture are third most common hand and forearm fracture following distal end radius and phalanx fractures. Their treatment always remain debatable as there is option for open reduction, closed reduction and k- wiring, and conservative treat using thumb spica. The purpose of study is to find outcome of Bennett's fracture using operative methods.

Materials and Method: We did retrospective study of 35 patients of Bennett's fracture treated between June 2015 to 2019 by means of operative management. Long term arthritic changes noted. Functional outcome assessed by clinically as well as radiologically at 3, 6 and 12 month.

Results: Follow-up 23 patients had no arthritic changes, 10 had stage 3 changes and 02 had stage 4 disease. Functional testing with the Jamar Dynamometer showed no significant difference.

Conclusion: Our satisfactory results suggest that closed reduction and percutaneous pinning is a valuable method of treatment for these fractures.

Keywords: Bennett's fracture, operative management, arthritis, K-wire

Introduction

The thumb saddle joint made possible by the special shape of articular surfaces the opposition of the thumb and thus the characteristic gripping form of the human hand. Bony and / or ligamentous injuries often lead to restricted mobility limitation, loss of strength and painful arthrosis (Gedda 1954, Griffiths 1964) ^[1, 2].

Bennett fracture now refers to an intra-articular fracture separating the volar ulnar aspect of the metacarpal base from the remaining thumb metacarpal ^[3].

The Bennett dislocation fracture is caused by axial force on the thumb. The distal main fragment dislocates by pulling the abductor pollicis muscle proximally, dorsally.

The remaining in the saddle joint Bennett fragment is through the trapeziometacarpal ligament is fixed to the trapezium (Bennett 1882, Gedda and Moberg 1953) ^[4]. With 0.4% of all fractures Bennett's fracture is a rare injury.

Post-traumatic arthritis of the trapezio metacarpal joint of the thumb is a frequent sequel to a Bennett's type fracture-dislocation of the thumb metacarpal. The investigations of Gedda¹ and Moberg ^[4] have shown that after open reduction and pin fixation better Results are expected to be after conservative treatment.

Since then, several surgical procedures have been used of Bennett's dislocation fracture (Foster and Hastings 1987, Gedda and Moberg 1953, Iselin and Mitarb.1956, Sälgeback and co-workers. 1971, Spångberg and ThorØn19631, Wagner 19501) ^[5, 4, 1, 6-9].

While the unfavorable radiological and functional results after conservative therapy well documented in the literature (Gedda 1954, Griffiths 1964, Pollen 1968, Livesley 1990) ^[1, 10, 11, 12], reports of results after surgical Therapy be critically discussed.

Patients and Method

Between June 2015 to 2019, 35 Bennett's fractures were treated at our department. All 35 patients were available for follow-up examination. We included patients

1. With age above 18 year
2. No previous injury on the 1st meta carpal
3. History of fresh trauma

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The patients included 23 men and 12 women with ages ranging from 19 to 59 years (average 37 year). The right hand (dominant) was injured in 16 cases and the left (non-dominant) in 19. The mechanism of injury was a fall on the hand in 22 patients, a street or household brawl in 04, motor vehicle accident in 06, and due to sports 3. The operations were performed within a period from several hours to 15 days after the accident. All operations were performed under brachial plexus anesthesia (axillary or supraclavicular access). In all 35 patients closed reduction under fluoroscopic control was performed followed by percutaneous fixation with one or two K-wires through the thumb metacarpal shaft into the trapezium (fig. 1). In seven patients anatomical restoration of the articular surface was not achieved. In five delayed cases in which closed reduction was unsuccessful, open reduction and K-wire pinning were performed. After operation the hand was immobilized with four fingers free for 45 days. Subsequently K-wires were removed and rehabilitation was promptly started. Final assessment was performed from six months to three years after the treatment (mean: 1.5 years).

The following clinical parameters were recorded

- Pain at rest, pain at low or pain under heavy load
- Range of motion in the thumb saddle joint in a side comparison according to the neutral zero method
- Force (grip, point grip) in side comparison

Radiological parameters

- The arthrosis in the thumb saddle joint was correspondingly the Eaton and Littler classification modified according to van Niekerk determined Eaton and Littler 1969^[13], van Niekerk and co-workers. 1989^[14].

Grade 1: No arthritis

Grade 2: Osteophytes < 2mm

Grade 3: Osteophytes > 2mm and joint space narrowing

Grade 4: Joint space lifted

- The shaft joint angle of the first metacarpal bone was determined on the X-ray image in the lateral beam path (Fig. 1). This angle was postoperative and at follow-up determined.

Intensity of pain, total grip strength and thumb opposition (thumb to little finger pinch grip) were evaluated. Total grip strength was measured with a Jamar dynamometer; the results were compared with standard values matched for gender, age and dominant side and were finally presented as a percentage of the expected standard value. Patients' subjective estimation of hand function was expressed on an analogue scale from 1 (normal hand function) to 5 (total disability). On x-ray, the angle between thumb and second metacarpal bones was measured, and the appearance of the trapeziometacarpal joint was evaluated.

Results

Patients were seen for follow-up after 1, 3, 6 and 12 months.

At 1 ½ -month follow-up, radiographs were made to confirm consolidation. When callus formation was present, the K-wires were removed under local anaesthesia. In the absence of callus formation, the patient was re-examined with radiographs 1 or 2 weeks after the first evaluation. At 3-and 6-month follow-up, wound healing and functional recovery were evaluated. At the final follow-up, 30 of the 35 patients were pain free, 4 had mild pain during strenuous work and only one reported moderate pain during daily activities. At follow-up 23 patients had no arthritic changes, 10 had stage 3 changes and 02 had stage 4 disease.

Functional testing with the Jamar Dynamometer showed no significant difference in pinch or grip strength between the injured and non-injured hand of each patient. Reported pain did not influence the functional outcome. All patients returned to their previous work after 3month.

Discussion

Intraarticular fractures of the thumb metacarpal base are considered to be relatively rare; their incidence is estimated to be 1.4% of all fractures within the hand^[15]. Proper reduction of these fractures appears necessary for the normal function and power grip of the hand^[16]. Except in delayed cases, anatomical reduction of the base of the thumb metacarpal base is relatively easy, but it is more difficult to maintain this position as long as healing is not sufficient. To maintain anatomical position after reduction Iselin *et al.* used K-wire fixation of the first to second metacarpal bone⁶. Secondary displacements are frequently observed during conservative treatment, which results in consolidation of the fracture in a non-anatomic position. This may lead to secondary degenerative changes and subluxations in the trapeziometacarpal joint, and eventually pain and diminished range of motion of the thumb.

The purpose of this study was to evaluate intra-articular fractures could be treated successfully with van Niekerk's closed reduction and percutaneous fixation.¹⁴ The described technique gave adequate fixation of the fracture in all 35 patients. No dislocations of the fractures occurred during treatment. All patients with intra-articular fractures returned to their former work and hobby.

The treatment of articular fractures and fracture dislocations at the base of the first metacarpal are challenging. Previous authors have stated that the quality of the reduction is correlated with the development of arthritis, although it had developed in almost all cases, even after exact reduction. The amount of anatomic incongruity that can be accepted is still debated. Several authors accept an intra-articular step-off of 2 mm. Other authors will not accept any displacement and choose open reduction and internal fixation to achieve this. Extensive dissection for open reduction can result in further damaging of the already injured hand. Percutaneous techniques cause less damage to the surrounding soft tissues and are associated with less infections and ligament damage. Huang and Fernandez stated that most Bennett fractures could be treated with closed reduction with Kirschner wire fixation.

Patient 1

Fig 1: Closed reduction of Bennett fractures is obtained by applying axial traction, palmar abduction and pronation to the thumb metacarpal while providing pressure over the dorsal-radial metacarpal base.

Fig 2: Pre op x-ray

Fig 3: Post op x-ray

Fig 4: Follow up at 3 month

Fig 5: Patient 2

Table 1: Master chart

No	Age	Sex	Fracture site	Trauma mechanism	Operation time	K-wire removal (days)	Cast immobilization	Complications
1	23	M	Right	Fall	35	45 Days	Yes	Pintract infection
2	53	M	Right	Fall	26	45 Days	Yes	
3	47	M	Left	Fall	27	45 Days	Yes	Pintract infection
4	21	M	Left	Rta	35	45 Days	Yes	None
5	40	M	Left	Fall	40	45 Days	Yes	None
6	39	F	Left	Fall	35	45 Days	Yes	None
7	44	F	Left	Fall	44	45 Days	Yes	None
8	37	M	Left	Fall	35	45 Days	Yes	None
9	42	F	Right	Fall	30	45 Days	Yes	Pintract infection
10	18	M	Right	Fall	40	45 Days	Yes	None
11	22	M	Right	Rta	25	45 Days	Yes	None
12	27	M	Right	Sport	20	45 Days	Yes	Pintract infection
13	37	F	Left	Brawl	35	45 Days	Yes	None
14	59	M	Left	Rta	40	45 Days	Yes	None
15	26	F	Right	Sports	35	45 Days	Yes	None
16	34	M	Right	Rta	45	45 Days	Yes	None
17	35	F	Left	Fall	35	45 Days	Yes	None
18	42	F	Left	Fall	40	45 Days	Yes	None
19	37	M	Left	Rta	25	45 Days	Yes	Pintract infection
20	39	F	Left	Brawl	45	45 Days	Yes	None
21	54	F	Right	Fall	40	45 Days	Yes	None
22	41	M	Right	Fall	35	45 Days	Yes	None
23	47	F	Left	Fall	45	45 Days	Yes	Pintract infection
24	35	M	Left	Fall	50	45 Days	Yes	None
25	19	F	Right	Brawl	40	45 Days	Yes	Accidentally pin remove during dressing
26	47	M	Left	Rta	45	45 Days	Yes	Pin loosening
27	23	M	Right	Fall	35	45 Days	Yes	Pintract infection
28	27	M	Right	Fall	40	45 Days	Yes	None
29	37	F	Left	Fall	40	45 Days	Yes	None
30	21	M	Left	Brawl	25	45 Days	Yes	None
31	24	M	Right	Fall	25	45 Days	Yes	None
32	47	M	Right	Fall	35	45 Days	Yes	None
33	59	M	Right	Fall	40	45 Days	Yes	None
34	43	M	Left	Fall	35	45 Days	Yes	None
35	34	M	Left	Fall	40	45 Days	Yes	none

Conclusion

The optimal treatment of Bennett fractures continues to be controversial among orthopaedic surgeons. The lack of randomized, long-term studies with large patient numbers

means there are no definitive treatment algorithms available. While most physicians would agree that displaced fractures require operative intervention, the treatment option of choice continues to be debated. Regardless of the ultimate treatment

method decided on, the treating physician must make sure that the fracture is well reduced without residual subluxation prior to leaving the operating room.

Our satisfactory results suggest that closed reduction and percutaneous pinning is a valuable method of treatment for these fractures. Immediately after injury this technique is relatively easy and should guarantee the maintenance of repositioning until fracture healing. Nevertheless in delayed cases closed reduction is more difficult, and an open operative approach is necessary.

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