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Neglected Bennett's Fracture Dislocation in Manual Laborers by Tension Fixation

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Abstract

Purpose—To report the results of open reduction and internal fixation of Bennett fractures in young, active patients using a K-wire and wire-loop construct to achieve anatomical reduction and to allow return to manual labor.

Methods—In this prospective series, we treated 10 male manual laborers (mean age 30, range 20–44 ys) with Bennett fractures diagnosed after a minimum of 12 weeks (mean 16, range 12–18 ws). Open reduction with internal fixation using 2 K-wires with a wire loop and a neutralizing transarticular K-wire was performed with direct articular visualization. Patients were evaluated for range of motion, grip strength, and pinch strength, and a visual analog scale (VAS) score rated pain preoperatively and 12 months later.

Results—The mean follow-up was 16 months (12–36 ms). The average VAS improved from 6 to 2, mean palmar abduction improved from 15° to 40°, mean radial abduction increased from 22° to 39°, average pinch strength improved from 9.9 kg to 15.5 kg, and average grip strength increased from 34 kg to 49 kg. Complications included transient irritation of the radial sensory nerve or lateral cutaneous nerve of the forearm in 3 patients, pin track granuloma formation in 2 patients, and marginal osteophyte formation in 2 patients. Union was achieved in all 10 patients, and 9 patients returned to their previous manual labor occupation.

Conclusion—Our results suggest that neglected Bennett fractures can be effectively managed by open reduction and internal fixation using K-wires and a wire loop without compromising strength or motion. This technique reliably restored the anatomy and provided adequate thumb motion and strength to allow a return to manual labor.

Type of study/level of evidence—Therapeutic IV.

Keywords

internal fixation; k-wires; manual laborers; Neglected Bennett's; wire loops

INTRODUCTION

Described by Bennett in 1882, fractures of the palmar articular surface of the first metacarpal can be difficult to manage, particularly in young active patients who are initially left untreated. The resulting malunion and consequent arthritis of the trapeziometacarpal joint can cause pain, limit motion, and compromise function. Manual laborers are particularly susceptible to disability with this condition (1). We have had the opportunity to treat a number of late presenting or neglected Bennett fractures, which resulted from improper diagnosis, poor choice of management, or limited resources in the setting of a major metropolitan center in the developing world.

Surgical options for the management of neglected Bennett fractures include intra-articular osteotomy, extra-articular metacarpal osteotomy, trapezium resection with or without tendon interpositional arthroplasty, fascial or implant arthroplasty, and arthrodesis of the trapeziometacarpal joint (2–7, 12). Such options are often successful in providing relief of symptoms but may be complicated by postoperative weakness or limited motion preventing their use in manual laborers. There are many surgical procedures performed at the basal joint for diverse ailments. The comparison of outcomes from these procedures is difficult as populations eligible for such procedures differ in many characteristics. For example, basal joint arthroplasty and arthrodesis are performed in patients who may not be the best candidates for open reduction and fixation, especially in the chronic situation.

We performed open reduction and internal fixation using K-wires and a wire loop to achieve anatomical reduction to return active patients to their previous occupation in manual labor. All patients had Bennett fractures neglected in the post injury period (Figure 1). K-wire fixation was described in 1944 by Johnson in closed reductions, but the addition of a wire loop potentially provides additional stability (Figure 2), thus allowing earlier joint motion (8). We present a prospective case series of 10 patients treated in this manner.

METHODS

Ten male manual laborers, average age 30 years (range, 20–44 ys) with healed Bennett fractures greater than 12 weeks from injury (average 16, range 12–18 ws) underwent evaluation of range of motion, grip strength, pinch strength, radiographs and computed tomographic scans to confirm subluxation and arthrosis (Figure 1), and visual analog scores for pain preoperatively (Table 1). Five patients had been treated nonoperatively with a cast or orthosis and developed malunions. The injuries in the other 5 patients had not been diagnosed or left totally untreated due to improper diagnosis or lack of medical care. Our institutional review board for research approved this study, and informed consent and privacy consent were obtained from each patient. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki.

Surgical Technique

Along along the subcutaneous border of the thumb metacarpal base, a 2–3 cm incision was made and gently curved to a transverse limb 1–2 cm long, parallel and distal to the distal wrist crease as described by Wagner (9). Care was taken to avoid injury to cutaneous nerves in the area. Subperiosteal elevation of the thenar muscles reflected them anteriorly and distally without detaching the abductor pollicis longus. The joint was then opened and explored to assess the degree of arthrosis.

Using a fine osteotome and working from distal to proximal, the periosteum and the excess callus were stripped off of the bone until the malunion site was reached. Gentle supination of the thumb allowed careful separation of the volar lip with the callus attached as 1 piece and preservation of the capsular attachment to the volar fragment. Within the malunion site, the bone was freshened by using a rongeur to excise fibrous tissue, callus, and debris. The articular component was then repositioned and fixed temporarily with a percutaneous 0.8 mm (.031 in) K-wire from the subcutaneous border running immediately subchondral and into the volar ulnar fragment. The articular component was reduced to within a mm of normal to reestablish the anatomic relationship of the metacarpal base. If a metaphyseal defect was present after reduction, the excised callus was used as graft to fill that defect. A second 1 mm (.039 in) K-wire was then applied through the incision from the radial border of the metacarpal directed towards the small medial fragment. Then, a heavy nonabsorbable suture (used for the first 2 patients) or a wire loop (used for the remaining patients) was applied between the 2 wire ends of the second wire and tightened (Figure 3, Panel B). Finally, the trapeziometacarpal joint was fixed, with a 1.2 mm (.047 in) neutralization K-wire, inserted percutaneously from the base of the thumb to the trapezium and used to reduce the stresses on internal fixation and prevent further subluxation (Figure 3, Panel C).

We found that the volar fragment was 1 piece in each case and large enough to be supported by the internal fixation. Vigilance was required to avoid fragmentation of the volar fragment and to carefully maintain the soft tissue attachment. This allowed a sound reduction and fixation.

Closure of the soft tissue envelope and skin was completed in layered fashion. The thumb was immobilized in a thumb spica cast for 4–6 weeks after which the temporary K-wire was removed. Range of motion and physiotherapy was initiated after wire removal.

RESULTS

Before surgery, all 10 patients complained of pain interfering with daily activities, 8 patients noted swelling at the base of the thumb, and 7 patients had limited motion. The mean postoperative follow-up period was 16 months (12–36 ms). Statistically significant improvements were noted postoperatively in VAS pain scale score, palmar abduction, radial abduction, pinch strength, and grip strength (Table 2) Improvement in both motion and pain score was achieved between 3 months and 6 months postoperatively.

Chondromalacia of the articular surfaces at the base of the thumb was noted intraoperatively in 4 patients. Two of these patients had isolated involvement at the base of the metacarpal,

one had isolated chondromalacia at the trapezium and one patient had involvement at both the metacarpal base and the trapezium. A large metaphyseal defect requiring grafting of callus removed during dissection was required in 8 of 10 patients. Postoperative transient irritation of superficial radial nerve or lateral antebrachial cutaneous nerve branches was encountered in 3 patients but resolved spontaneously. Pin track infection and granuloma formation occurred in 2 patients, and 2 patients had formed marginal osteophytes on final follow-up radiographs. Union was achieved in all 10 patients, and 9 patients returned to their previous occupation at an average of 18 weeks (12–20) postoperatively.

DISCUSSION

Malunited Bennett fracture with pain and disability is an indication for intra-articular osteotomy, interpositional arthroplasty, implant arthroplasty, arthrodesis, and corrective osteotomy (3–5, 10, 12). Interpositional arthroplasty may reduce symptoms but may result in loss of pinch strength (3). Implant arthroplasty may improve symptoms but is associated with complications, such as synovitis (4), fracture (5), and loosening or dislocation of the implant. Arthrodesis of the trapeziometacarpal joint is an option to provide stability and pain relief but compromises thumb motion (3–5). Intra-articular osteotomy and pin fixation was described by Bunnell, who used a volar approach (10). Vasko reported on 3 cases where this technique was modified to use cotton pullout sutures through the volar lip that were tightened on the dorsal cortex. The rationale behind this technique was to restore normal joint anatomy and correct subluxation to restore thumb mobility and strength (11). Although this procedure achieved an excellent functional outcome in the small number of recorded cases, follow-up data included only anecdotal reports and small series. Jebson and Blair described the correction of malunited Bennets fractures using intra-articular osteotomy in 2 patients. They favored arthrodesis of the trapeziometacarpal joint or trapezial resection with ligament reconstruction because of the difficulty in restoring the articular surface and unpredictable outcome in degenerative joints or those with comminuted fractures (12).

All the patients in our series were manual laborers. In Bennett fractures, the average time to union of the volar fragment is 6 weeks. We therefore considered 12 weeks enough time to classify untreated Bennett fractures as neglected fractures. Such an arbitrary duration may be subject of consideration in future studies. The use of wire or suture loops to achieve and maintain anatomic reduction and rigid fixation allowed for mobilization and return to normal activity. The addition of wire loops allowed mobilization after removal of the temporary K-wire without excessive concern for displacement or subluxation. Near anatomic reduction was achieved in all our cases with an articular step-off of less than 1 mm consistent with a report from Kjaer-Peterson, which emphasized the importance of anatomic reduction. In that paper, 86% of patients with a step-off of less than 1 mm were symptom-free, whereas less than half of patients (were symptom-free when a step-off of more than 1 mm was present (13).

Our series has several weaknesses. No comparison group treated with alternative methods was studied. Patients were not treated differently based on the presence of degenerative changes at the time of surgery, and follow-up was relatively short, average 16 months. However in this small series of consecutive patients, no fixation failures were encountered.

All patients achieved union, and 9/10 returned to their previous occupation. Our method may not be appropriate in the setting of advanced arthrosis where salvage procedures may be more suitable. Nonetheless, our technique of K-wire and tension band fixation may be a viable option for neglected Bennett fractures. We have employed the wire loop but it may well be that pin fixation alone would suffice in selected cases. In our opinion, the wire loop offers compression critical to the fixation, however a more rigorous clinical trial designed to compare results of simple fixation to our technique would be necessary to prove the importance of the wire loop.

Not all neglected Bennett fractures require surgical intervention. Incidental findings of a malunion at the first carpometacarpal joint on a radiograph are relatively common in our experience. Studies that have assessed various fixation techniques have also reported asymptomatic patients with malunion. Gedda and Moberg (14) performed open reduction internal fixation on 29 patients, and they classified 12 as having poor maintenance of anatomic reduction. Of these 12 patients 4 had a complete loss of reduction, and all but one developed degenerative osteoarthritis, however none had major clinical symptoms. Salgeback et al (15) used a modified Wagner technique for reduction and transarticular K-wire fixation of the trapeziometacarpal joint and found 63% of patients still developed osteoarthritis although only 13% reported any symptoms. Kjaer-Petersen et al (13) assessed the effectiveness of percutaneous versus open reduction and internal fixation compared with closed reduction with plaster immobilization and found fracture displacement in 13 patients after a median of 7 years following treatment. In those patients, 6 remained asymptomatic despite loss of reduction. However, of the 18 patients with excellent maintenance of reduction at the articular surface, 15 remained asymptomatic. Taken together, these data along with our own experience argue that some patients seem to tolerate malreduction of these fractures even after attempts at operative fixation.

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Figure 1.
CASE 1: Preoperative radiograph (left) and coronal computed tomographic scan (right) of patient number 4 from table 1 showing Bennett fracture with subluxation of the base of the thumb.

Figure 2.

Diagrams showing A. Bennett fracture malunion. B. Reduction of the fracture, with temporary fixation by K-wire (1). C. Second K-wire (2), wire loop (3,) and bone graft to fill the defect. D - Temporary K-wire crossing the trapeziometacarpal joint to prevent subluxation (4).

Figure 3. (A) Preoperative radiograph showing Bennett fracture malunion, (B) after reduction with fixation with K-wire and wire loop, (C) radiograph showing reduction and wire configuration immediately after surgery.

Table 1

Patient Information

Case No.	Age	Duration since injury (weeks)	Injury	Initial Management	Operative Findings
1	35	13	fall	none	
2	25	15	fight	orthosis, 4 w	
3	24	13	fall	none	chondromalacia base of metacarpal
4	32	15	direct	cast, 4 w	chondral ulcer lateral border trapezium & chondromalacia base of metacarpal
5	44	18	fall	cast, 6 w	
6	40	18	fall	orthosis, 4 w	
7	20	17	sport	cast, 3 w	chondromalacia base of metacarpal
8	20	16	sport	none	
9	28	18	sport	none	
10	34	17	fall	none	chondromalacia trapezium
average	30	16			
min	20	13			
max	44	18			

Table 2

Preoperative and postoperative assessments

Case No.	Radial Abduction		Palmar Abduction		Grip Strength		Pinch Strength		VAS	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	10	30	20	35	25	40	5	15	5	1
2	22	33	25	35	43	50	8	18	2	0
3	20	35	22	40	40	55	6	15	3	0
4	35	40	30	38	45	56	4	12	6	1
5	36	40	30	42	25	45	6	19	2	2
6	30	45	28	40	18	39	7	15	2	0
7	28	30	25	38	30	40	8	19	1	0
8	32	35	28	33	40	60	6	17	1	0
9	28	30	15	39	38	55	7	12	1	1
10	18	30	20	35	39	45	6	13	2	0
average	26	35	24	38	34	49	6	16	2.5	0.5
min	10	30	15	33	18	39	4	12	1	0
max	36	45	30	42	45	60	8	19	6	2