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Early Functional Outcome of Closed Reduction and Percutaneous Pinning of Proximal Phalangeal and Metacarpal Fractures Done Under Conventional Radiograph Guidance

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ABSTRACT

Background. Fluoroscopy is the standard intraoperative imaging in orthopaedic surgery. Real-time visualization of fracture reduction and implant placement is essential, especially during closed reduction and percutaneous pin (CRPP) fixation. In the absence of fluoroscopy, conventional radiographs are used.

Objective. This study evaluated the early functional outcomes of CRPP fixation for proximal phalangeal and metacarpal fractures done under conventional radiograph guidance.

Methodology. Fifty-four patients with 72 fractures of the metacarpal or proximal phalanx in 70 fingers underwent CRPP fixation at the emergency room. Radiographs were used to assess reduction and fixation. Primary outcome measures were Total Active Motion (TAM), and Disabilities of the Arm, Shoulder, and Hand (DASH) score, while secondary outcome measures included fracture reduction, union rate, and complications. These were all evaluated at a mean of 12 weeks after surgery.

Results. An average of 2.9 radiographs were taken for each fracture, with a mean surgical time of 40 minutes. The TAM was "excellent to good" in 47% of fingers (mean = 258°), while the rest had "fair" scores (mean = 235°). Seventy-six percent of patients had a mean DASH score of 4.9. Thirty-five percent of fractures achieved anatomic reduction and maintained until union. Short procedure time did not influence the DASH scores. Complications reported were malunion (2), stiffness (5), and extension lag (7). There was no reported nonunion.

Conclusion. Closed reduction with pinning of proximal phalangeal and metacarpal fractures guided by conventional radiograph in the absence of fluoroscopy, remains to be effective and reliable with favorable early outcomes.

Keywords. radiograph, closed reduction with percutaneous pinning, metacarpal, finger proximal phalanx, fracture

INTRODUCTION

Hand fractures are the most common injuries seen in the emergency room.[1-4] While most are treated nonsurgically using closed reduction and immobilization, fractures that are irreducible, unstable, or open with concomitant soft tissue injuries require surgical intervention.[1,4-7] Closed reduction and percutaneous pin (CRPP) fixation have remained a popular surgical intervention despite innovations in orthopaedic implants and techniques.[8,9] This method allows for early joint mobilization to avoid complications such as adhesions, stiffness, and contractures.[4,7]

The use of fluoroscopy in CRPP for hand fractures is universally accepted and has greatly improved outcomes.[1,8-11] Its use has in part led to predictable results in terms of operative time, anatomic reduction, and accuracy of pin placement.[10,11] In low-resource settings such as the Philippines however,

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many institutions continue to perform CRPP fixation using conventional biplanar radiographs in the absence of fluoroscopy. Performing this procedure in the emergency room was quicker and cheaper than open reduction with internal fixation in the operating theater. Although, compared to fluoroscopy, this practice is considered time-consuming and potentially frustrating for orthopaedic trainees.[11]

At a time when the fluoroscope at the emergency room of our institution was under repair, orthopaedic residents-in-training fixed hand fractures without real-time imaging. This study was conducted to evaluate the early functional outcomes of these CRPP fixations of phalangeal and metacarpal fractures performed under conventional radiograph guidance.

METHODOLOGY

Study design and setting

This was a single-center prospective study and was approved by the institution's Ethics Review Board.

Patients and methods

All sixty patients with closed, displaced, unstable fractures of the proximal phalanx and/or metacarpal treated at the emergency room of our institution between March to December 2016 were included. This was the period when the fluoroscope at the emergency room was not available. Six patients were lost to follow-up and dropped from the study. A total of 54 patients with 72 fractures in 70 fingers were included in the final analysis. All injuries were sustained within one week of the emergency room visit. Fracture configurations of any kind involving one or more proximal phalanx or metacarpal, in one or both hands, were included. Excluded from the study were open or severely comminuted fractures, patients less than 15 years old, and patients with concurrent limb- or life-threatening injuries. All patients were informed of the unavailability of fluoroscopic imaging upon admission to the emergency room. Informed consent was similarly secured from all patients before inclusion in the study.

The procedures were done under Wide Awake Local Anesthesia No Tourniquet (WALANT) technique using locally manufactured Kirschner wires (0.45-inch diameter). Fractures were reduced with manual traction and manipulation and verified by palpation of the dorsal cortex and inspection of the plane of the nail plate. Wires were introduced at both the radial and ulnar corners of the base of the proximal phalanx, or the medial and lateral collateral ligament recesses of the metacarpal head, as entry points. After penetrating the intramedullary canal, wires were pushed until they reached the opposite subchondral end of the bone. Surgeries were performed by orthopaedic residents-in-training going on ER duties. Conventional radiographs were done intra-operatively by a licensed radiologic technologist. Antero-posterior and lateral radiographs were taken for phalangeal fractures, with an additional oblique view for metacarpal fractures. Unacceptable reduction for metacarpal shaft fractures was defined as apex dorsal angulation of more than 30°, 20°, 10°, and 10° for the small, ring, long, and index fingers, respectively. Metacarpal shortening of more than 5mm and malrotation leading to scissoring on finger flexion were not accepted.[9] Unacceptable reduction for proximal phalangeal shaft fractures was defined as more than 10° sagittal or coronal angulation, more than 20° sagittal angulation at the metaphyseal region, and any shortening or malrotation.[12] Only anatomic reduction or precise restoration of the position of fracture fragments was acceptable for head or base fractures with intra-articular extensions. Accurate fixation was defined as visualizing radiographically both pins traversing both proximal and distal ends of the fractured bone. Five failed attempts at reduction or fixation of a fracture would warrant the exclusion of the patient from the study to avoid further trauma to the injured bone.

Once acceptable reduction and fixation were achieved, wires were bent and cut close to the bone, then buried under the skin. Wounds were dressed and no external immobilization was applied. Patients were sent home on the same day with oral analgesics and second-generation cephalosporins, prescribed for five days. Instructions for immediate interphalangeal as well as metacarpophalangeal flexion and extension exercises as tolerated were given. Follow-up was done every three weeks to record outcome measures. Telephone interviews were conducted as needed.

Outcome measure

Primary outcome measures were Total Active Motion (TAM), and Disability Assessment of the Hand and Shoulder (DASH) scores, while secondary outcome measures included maintenance of fracture reduction on radiograph, time to union, and complications.

Total active motion was measured using a metal goniometer. Measurements were classified as "excellent" (260–270°), "good" (250–259°), "fair" (200–249°), or "poor" (<200°).[8] The 30-item DASH questionnaire was made available in both English and Filipino versions. Time to union was based on radiographic evidence of callus or absence of cortical gap at the previous fracture site. Complications were monitored and reported. Malrotation was described as the presence of finger overlapping on simultaneous flexion of the metacarpophalangeal joint (MCPJ) and the interphalangeal joints (IPJs). Extensor lag was defined as the inability to fully extend the MCPJ and the IPJs. Stiffness was defined by difficulty initiating finger motion at the MCPJ or the IPJs, or both. All measurements were done by the orthopaedic resident in charge of the patient.

Statistical analysis

Test for normal distribution was done using the Shapiro-Wilk test. The correlation between the duration of surgery and the DASH score was determined through the Pearson R test. Statistical tests were performed using Stata © Statistical

Software (StataCorp 2013, College Station, TX, USA) with the level of significance set at $p < 0.05$.

RESULTS

Patient and fracture demography

Seventy-two fractures in 70 fingers from 54 patients were evaluated, mostly involving the dominant hand (55%) (Appendix). There were 38 isolated proximal phalangeal and 30 isolated metacarpal fractures recorded. Two patients sustained multiple fractures in one digit. The average follow-up duration was 12.6 weeks (range, 11–15 weeks). Most patients (94%) were male, more than half were in the second and third decades of life (54%), and half of the patients (N = 27) were involved in heavy manual labor (Table 1).

Table 1. Patient demographics (n = 54)

	Male (n = 51)	Female (n = 3)
Age (in years)		
<20	6	0
21-30	22	1
31-40	6	1
41-50	10	0
51-60	7	0
<60	0	1
Mean (SD)	33.6 (13.05)	40.6 (22.37)
Occupation		
Manual laborer*	27	
Service related**	7	
Clerical work***	10	
Unemployed****	10	

**construction, carpentry, machine operator, mechanic, etc.*
***security guard, service crew, tailor, driver, etc.*
****call center agents, teacher, desk officer, etc.*
*****student, housewife, etc.*

Table 2. Fracture demographics based on AO classification

Region/Bone	Metacarpals (32)			
Finger	Index (2)	Middle (3)	Ring (4)	Small (5)
	5	7	12	8
Segment		Fracture pattern		
Proximal (1)	7	Extraarticular (A)		6
		Partial articular (B)		0
		Complete articular (C)		1
Diaphyseal (2)	20	Simple (A)		20
		Wedge (B)		0
		Comminuted (C)		0
Distal (3)	5	Extraarticular (1)		5
		Partial Articular (2)		0
		Complete Articular (3)		0
Region/ Bone	Proximal Phalanx (40)			
Finger	Index (2.1)	Middle (3.1)	Ring (4.1)	Small (5.1)
	12	9	10	9
Segment		Fracture pattern		
Proximal (1)	13	Extraarticular (A)		8
		Partial articular (B)		1
		Complete Articular (C)		4
Diaphyseal (2)	23	Simple (A)		15
		Wedge (B)		3
		Comminuted (C)		5
Distal (3)	4	Extraarticular (1)		4
		Partial Articular (2)		0
		Complete Articular (3)		0

Most patients had single bone involvement (N = 41, 76%), with phalangeal fractures (N = 40) being more common than metacarpal fractures (N = 32). The most common fracture configuration was transverse (50%) (Table 2).

Surgical procedure

The mean surgical time for all fractures was 40 minutes (range, 15–50 minutes). Transverse metacarpal and oblique proximal phalangeal fractures took the longest (75 and 78 minutes) and the most attempts at pin insertion (means, 3.4 times and 4.6 times). A total of 156 radiographs were taken for 54 patients, averaging 2.9 radiographs per patient (range = 1–6 radiographs). Anatomic reduction was achieved in 25 fractures (35%), most frequently in transverse configurations (64%). Among all cases, only two proximal phalangeal fractures developed fracture displacement on the final follow-up. Both cases led to malunion.

Outcome measures

Total active motion

The mean finger TAM was 246° (range, 205–270°). Thirty-three fingers (47%) had "excellent to good" TAM (mean = 258°) at 12 weeks; the rest of the fingers had "fair" TAM (mean = 235°). The mean TAM for isolated proximal phalangeal fractures (38 fingers in 32 patients) was 242.2°. The mean TAM for isolated metacarpal fractures (30 fingers in 21 patients) was 251° (Table 3). The mean TAM improved with time (Table 4; Figure 1).

Table 3. TAM of isolated proximal phalanx and isolated metacarpal fractures

	Proximal phalanx TAM [N = 38 fingers (in 32 patients)] Mean TAM: 242.2	Metacarpal TAM [N = 30 fingers (in 21 patients)] Mean TAM: 251
Excellent (260-270)	7 (18.4%)	9 (30%)
Good (250-259)	7 (18.4%)	8 (26.7%)
Fair (200-249)	24 (63.2%)	13 (43.3%)
Poor (<200)	0	0

Table 4. Mean Total Active Motion (TAM)*

	6th week	9th week	12th week
Index finger	178 (155-215)	219 (190-255)	246 (205-265)
Long finger	186 (150-245)	216 (190-255)	246 (230-270)
Ring finger	178 (140-250)	209 (165-255)	245 (210-270)
Small finger	179 (130-255)	214 (135-265)	245 (220-265)

*Eberlin KR et al.[7]: TAM Interpretation: Excellent: 260-270; Good: 250-259; Fair: 200-249; Poor: >200

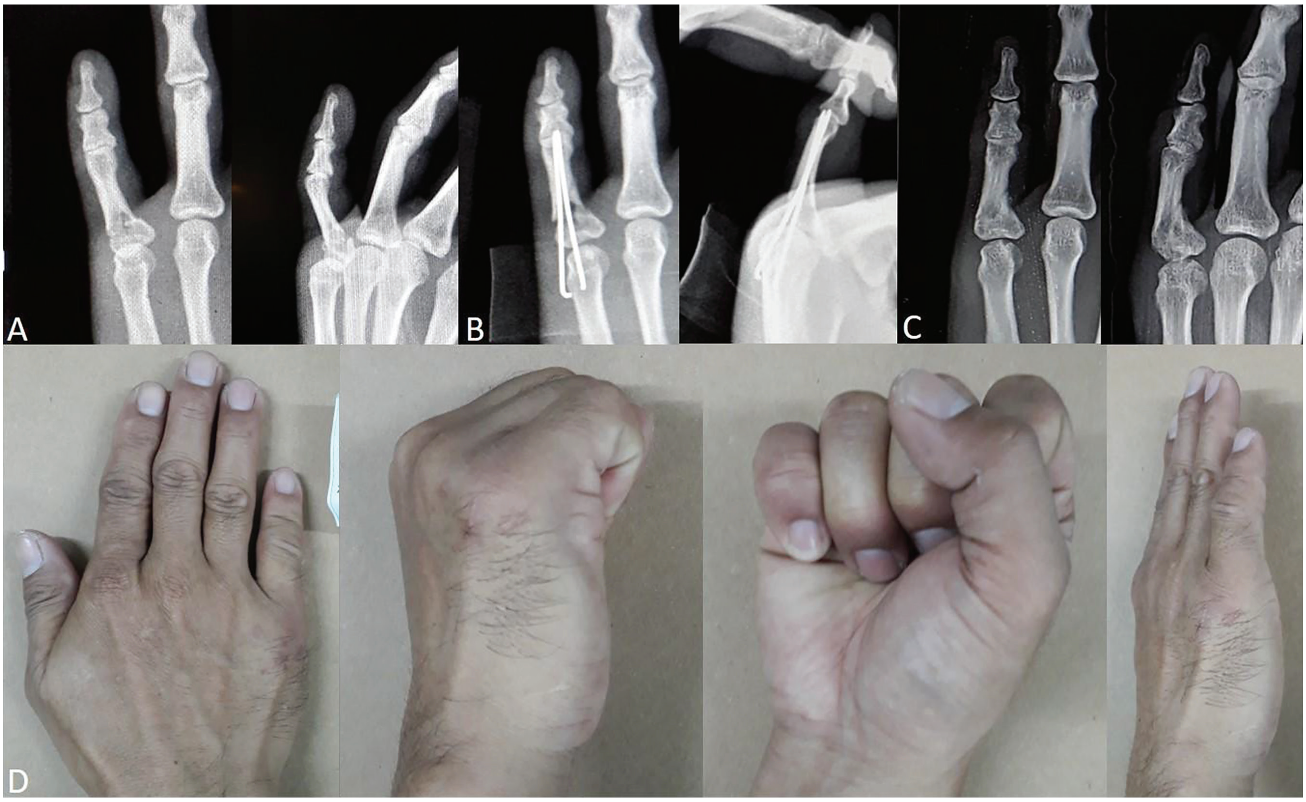

Figure 1. Patient 24 with small finger proximal phalangeal fracture. Injury radiograph **(A)**, immediate postoperative radiograph **(B)**, radiograph at 12th week follow-up **(C)**, range of motion at 12th week follow-up **(D)**.

DASH scores

Forty-one patients (76%) had DASH scores (mean score 4.9) corresponding to "no longer considering their injury a problem" at 12 weeks. Thirteen patients (24%) had scores (mean = 13.5) corresponding to "still aware of their limitations." No patient had a DASH score corresponding to "having a lot of difficulty in their daily chores."[13]

Time to union and removal of pins

The mean time to radiographic union was six and a half weeks (4–10 weeks). Pins were removed at an average of eight weeks after surgery (6–9.8 weeks). No non-union was observed.

Complications

There were 14 complications in 54 patients (26%). These were extensor lag (7), stiffness (5), and malrotation (2) (Table 5; Figure 2). Complaints of mild pains and irritation from the buried pins were immediately relieved after pin removal.

Analysis of data

Duration of aurgery

There was no significant correlation between the duration of surgery (in hours) and DASH scores ($r = 0.03$; $p = 0.85$).

DISCUSSION

Roentgen's discovery of X-rays in 1895 led to the development of an objective tool for evaluating bones and fractures.[14] The use of conventional radiography allowed for a detailed assessment of skeletal injuries and treatment outcomes. Real-time visualization, known as fluoroscopy, was eventually developed for visualization of fracture reduction and fixation intraoperatively.[14] Since then, fluoroscopic imaging has been an indispensable tool in orthopaedic practice, particularly in modern hand surgery.[15,16] Conventional radiography continues to be used for skeletal evaluation but has become less popular as an intra-operative imaging tool.

Despite fluoroscopy's utility and convenience, its accuracy has been questioned. A study found that intra-articular step-off and displacement of simulated Bennett's fractures in cadavers were underestimated by fluoroscopy after CRPP.[17] Another study showed that fluoroscopy underestimates the length of smooth pins protruding from upper extremity bone models.[18] These observations are critical in closed percutaneous pinning of fractures, especially with intra-articular involvement.

Numerous studies have evaluated the functional outcomes of pinning in hand fractures. Hsu reported minimal complications with pinning of phalangeal, metacarpal, and wrist bone fractures.[19] A study by Eberlin showed good to excellent results, with only 7% developing stiffness requiring tenolysis, and only two cases of pin site infection after phalangeal

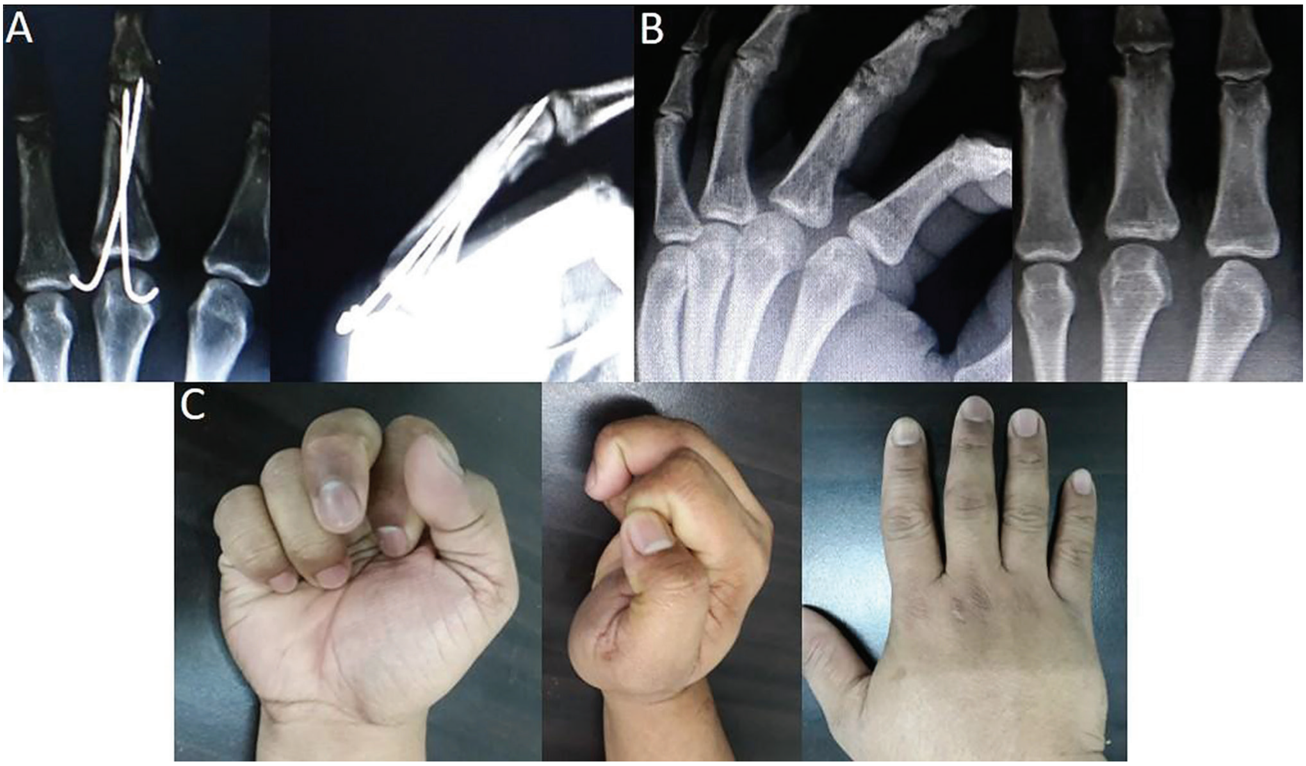

Figure 2. Patient 12 with malrotation noted at the final follow up. Immediate post-operative radiograph **(A)**, radiograph at final follow-up **(B)**, range of motion at final follow-up showing malrotation of middle finger **(C)**.

Table 5. Patients with complications

Patient number	Age/ Gender	Complication	Mechanism of injury	Fracture pattern	Days with pin	Surgical time in hours	Pinning attempts	Anatomic reduction
6	40/M	Extension lag	Industrial accident	Spiral MC	50	1	5	No
7	22/M	Extension lag	Motor vehicular accident	Transverse MC	54	1	4	No
8	48/M	Stiff finger	Fall from height	Oblique P1	54	1	4	No
9	57/M	Stiff finger	Industrial accident	Multiple P1	45	2	5	No
12	23/M	Malrotation	Motor vehicular accident	Spiral P1	58	1	4	No
22	32/M	Stiff finger	Industrial accident	Transverse P1	47	0.75	2	No
23	19/M	Extension lag	Sports injury	Transverse P1	55	0.5	2	No
27	58/M	Extension lag	Industrial accident	Mild Comminution P1	68	0.25	2	No
31	43/M	Extension lag	Industrial accident	Multiple P1	63	0.5	2	No
47	36/F	Malrotation	Sports injury	Mild Comminution P1	59	0.5	2	No
50	26/M	Stiff finger	Industrial accident	Transverse MC	52	1	4	No
51	26/M	Stiff finger	Motor Vehicular accident	Spiral P1	60	0.5	2	Yes
52	22/M	Extension lag	Fall from height	Multiple P1 MC	52	1	3	Yes
59	21/M	Extension lag	Motor vehicular accident	Oblique MC	69	0.25	1	Yes

P1 = Proximal Phalanx; MC = Metacarpal

pinning.[8] Faruqui however, found a significant decrease in TAM in almost half of the fingers treated with phalangeal trans-articular or extra-articular pin fixation.[20] Although it is now standard to do this procedure under fluoroscopy, modifications were adopted in low-resource settings. It was for the same reason that our patients agreed to proceed with the surgery despite lacking fluoroscopy. With this limitation, surgery became more difficult but functional outcome was not far behind compared to previous studies. The mean TAM score for isolated proximal phalangeal fractures was 242.2° (fair), while the score for isolated metacarpal fractures was 251° (good). Unfortunately, these previous studies lack consistency in reporting TAM for accurate comparison.[8,18,21–25]

The absence of real-time imaging during the performance of CRPP in this series was challenging. Actual restoration of length, rotation, and alignment were accomplished "blind" with just traction and palpation of these bones. The sequential radiographs confirmed the adequacy of fracture reduction and fixation. Generally, anatomic restoration of a fractured bone is desired. In the finger, however, a stable, functional reduction of shaft fractures is enough for a favorable outcome and acceptable function.[26] In this series, less than half (35%) achieved anatomic reduction, while the rest fell within acceptable parameters. Oblique proximal phalangeal and transverse metacarpal fracture fixations were more challenging than the others as shown by more pinning attempts and longer surgical time. Still, TAM and DASH scores were good. This confirmed the observations of Baldwin, who found that radiographic findings do not always correlate with functional recovery.[5]

Early joint mobilization has been shown to improve finger motion in proximal phalangeal pinning.[23,26,27] The stable fixation achieved in this group allowed for immediate mobilization. In addition, performing the procedure under WALANT allowed the surgeons to give timely instructions, which provided patients with a better understanding of their condition and the surgery, as well as the confidence to perform early active exercises.[28] Both early mobilization and performance under the WALANT technique proved beneficial for this group.

Among the benefits of CRPP done under conventional radiography is the possibility of lower radiation exposure compared to a fluoroscopic-guided procedure.[10,29] Fluoroscopy has been found to expose both the patient and the surgeon to a greater amount of ionizing radiation,[30–32] which in turn may cause deleterious effects on the eyes, thyroid, and hands.[14,32] Despite refinements made in more compact mobile fluoroscopic devices such as the "mini C-arm", associated radiation risks have not been significantly mitigated. The mini C-arm for example, may release lower ionizing radiation, but the machine layout brings the beam source closer to the surgeon.[29,33] This, combined with a false sense of safety, can lead to longer use with direct exposure of the hand while performing surgery.[14,29,30,32]

Complications reported in this study were comparable to previous studies.[8,19,20] The two malunions were phalangeal malrotations, which may have resulted from gradual loss of reduction during active mobilization. These two patients did not achieve an anatomic reduction from the beginning of treatment and were inconsistent with follow-up. The soft tissue complications reported (five cases of stiffness and seven cases of extension lag) were considered by the patients as mild and did not cause restrictions in their daily activities. The causes were multifactorial and associated with high-impact injury, non-anatomic fracture reduction, and a longer stay of pins (Table 4).

The decision to bury Kirschner wires underneath the skin in this study stems from the anecdotal experience of the lead author in the local setting. Most patients in this study are members of the labor sector, and early return to work was key to remaining employed. Hence, buried pins prevented accidental implant pullout while working, and minimized potential areas for infection.

LIMITATIONS

The main limitation of this study was irregular patient follow-up. Over half of patients were unable to comply with scheduled consults every three weeks, and only 20% were able to follow-up beyond 12 weeks. The primary reason for this was occupation-related. For some of these patients, telephone interviews were conducted to augment actual follow-up. This was a potential source of bias.

Surgeons that performed the procedure were orthopaedic residents-in-training. The procedure's learning curve and the varying levels of skill affect the quality of reduction and fixation. The number of previous similar cases performed as well as the number of weeks spent learning in the Hand Surgery Unit may have influenced the duration and quality of the surgical intervention. Likewise, TAM measurements should have been repeated by a second investigator to eliminate bias.

This study reported short-term outcomes. Long-term follow-up, although difficult to achieve, can provide a better picture of functional outcomes and potential late complications. Similarly, another study on CRPP done under fluoroscopy in the same institution in the future may provide a more valid comparison for this study.

CONCLUSION

While we don't recommend choosing conventional radiography over fluoroscopy in performing CRPP for proximal phalangeal and metacarpal fractures, it was a good alternative. The option for open reduction with internal fixation would require more expense and preparations for the patient, and aggravate the long queue for surgery at the operating theater. This technique was reliable even in the hands of a novice orthopaedic surgeon, was useful for most fracture configurations, and was associated with favorable early outcomes.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

AUTHOR DISCLOSURE

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Appendix. Patients with demographics and injury details

Pt #	Age	Sex	Occupation	Dominant hand involvement	Mechanism of injury	Diagnosis	Complaints / Complications
1	46	M	Maintenance worker	no	Industrial accident	proximal phalanx, small finger	none
2	44	M	Businessman	no	Motor vehicle accident (MVA)	metacarpal, long finger metacarpal, ring finger	none
4	28	M	Factory worker	yes	Industrial accident	proximal phalanx, index finger	none
5	21	M	Student	no	MVA	proximal phalanx, small finger	none
6	40	M	Construction worker	no	Industrial accident	metacarpal, ring finger	Extension lag
7	22	M	Call center agent	yes	MVA	metacarpal, index finger	Extension lag
8	48	M	Clothing ironing man	no	fall from height	proximal phalanx, index finger	Stiff finger
9	57	M	Factory worker	no	Industrial accident	proximal phalanx, index finger proximal phalanx, long finger proximal phalanx, ring finger	Stiff finger
11	25	M	Carpenter	yes	Industrial accident	proximal phalanx, index finger	none
12	23	M	Food vendor	yes	MVA	proximal phalanx, long finger	malrotation
13	29	M	Liaison officer	no	MVA	proximal phalanx, index finger	None
14	56	M	Mechanic	yes	Industrial accident	metacarpal, ring finger	None
15	44	M	Mechanic	no	Industrial accident	metacarpal, index finger metacarpal, long finger metacarpal, ring finger	None
17	25	M	Machine operator	yes	MVA	proximal phalanx, long finger	None
18	22	M	Construction worker	no	Industrial accident	proximal phalanx, index finger	none
19	31	M	Service Crew	no	MVA	proximal phalanx, index finger	None
20	43	M	Mechanic	no	Industrial accident	metacarpal, small finger	None
21	17	M	Student	yes	sport injury	proximal phalanx, ring finger	None
22	32	M	Factory worker	yes	Industrial accident	proximal phalanx, index finger	Stiff finger
23	19	M	Student	yes	sports injury	proximal phalanx, index finger	Extension lag
24	44	M	Book keeper	yes	MVA	proximal phalanx, small finger	None
25	18	M	Student	no	sport injury	proximal phalanx, long finger proximal phalanx, ring finger	None
27	58	M	Unemployed	no	fall from height	proximal phalanx, ring finger	Extension lag
28	59	M	Driver	yes	Industrial accident	proximal phalanx, ring finger	None
29	35	M	Factory worker	yes	MVA	proximal phalanx, ring finger	None
30	30	M	Construction worker	no	Industrial accident	proximal phalanx, long finger proximal phalanx, ring finger	None
31	43	M	Machine operator	yes	Industrial accident	proximal phalanx, ring finger proximal phalanx, small finger	Extension lag
32	65	F	Engineer	no	Industrial accident	proximal phalanx, small finger metacarpal, small finger	None
34	28	M	Barista	no	MVA	proximal phalanx, small finger	None
36	53	M	Driver	yes	MVA	metacarpal, small finger	None
37	44	M	Guard	yes	MVA	metacarpal, ring finger metacarpal, small finger	None
38	28	M	Machine operator	no	Industrial accident	metacarpal, index finger metacarpal, long finger metacarpal, ring finger	None
39	29	M	Merchandiser	no	MVA	proximal phalanx, long finger proximal phalanx, ring finger proximal phalanx, small finger metacarpal, small finger	None
40	24	M	Real estate agent	yes	Punched the wall	metacarpal, small finger	None
41	32	M	Teacher	yes	MVA	metacarpal, long finger	None
42	40	M	Messenger	no	MVA	metacarpal, long finger	None
43	51	M	Construction worker	yes	Industrial accident	metacarpal, ring finger metacarpal, small finger	None
44	21	M	Carpenter	yes	Industrial accident	proximal phalanx, ring finger	None
45	15	M	Student	yes	Punched the wall	metacarpal, ring finger	None

Appendix. Patients with demographics and injury details *(continued)*

Pt #	Age	Sex	Occupation	Dominant hand involvement	Mechanism of injury	Diagnosis	Complaints / Complications
46	21	F	Machine operator	yes	MVA	proximal phalanx, index finger	None
						proximal phalanx, long finger	
47	36	F	Housewife	no	sports injury	proximal phalanx, ring finger	malrotation
48	29	M	Helper	no	Industrial accident	metacarpal, ring finger	None
						metacarpal, small finger	
49	23	M	Crane assistant	no	Industrial accident	proximal phalanx, index finger	None
50	26	M	Delivery Helper	yes	Industrial accident	metacarpal, small finger	Stiff finger
51	26	M	Merchandiser	yes	MVA	proximal phalanx, long finger	Stiff finger
52	22	M	Unemployed	yes	fall from height	metacarpal, index finger	Extension lag
						metacarpal, long finger	
53	42	M	Tailor	no	MVA	proximal phalanx, small finger	None
54	23	M	IT consultant	no	MVA	metacarpal, long finger	None
						metacarpal, ring finger	
55	16	M	Student	yes	sports injury	proximal phalanx, long finger	None
56	59	M	construction worker	yes	industrial injury	metacarpal, ring finger	None
57	46	M	carpenter	yes	fall from height	proximal phalanx, index finger	None
58	15	M	student	yes	sport injury	proximal phalanx, small finger	None
59	21	M	service ambassador	no	MVA	metacarpal, ring finger	Extension lag
60	26	M	elctrical technician	yes	industrial injury	metacarpal, ring finger	None