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A Systematic Review of Treatment Interventions for Metacarpal Shaft Fractures in Adults

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Abstract

Metacarpal shaft fractures are common hand injuries that predominantly affect younger patients. There is wide variability in their treatment with no consensus on best practice. We performed a systematic review to assess the breadth and quality of available evidence supporting different treatment modalities for metacarpal shaft fractures of the finger digits in adults. A comprehensive search was conducted across multiple databases, in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. A total of 1600 records were identified; 7 studies fulfilled eligibility criteria and were included. No randomized controlled trials directly comparing surgery with nonsurgical treatment were found. One retrospective study compared nonsurgical with surgical treatment, whereas 6 compared surgical or nonsurgical treatments. Considerable heterogeneity between studies along with a high or critical risk of bias restricts direct comparison and conclusions. There is a lack of high-quality evidence to guide treatment, supporting the need for well-designed, multicenter trials to identify the most effective and cost-efficient treatment for metacarpal shaft fractures in adults.

Keywords: fracture/dislocation, diagnosis, finger, trauma, treatment, research and health outcomes, evaluation

Introduction

Metacarpal shaft fractures (MSF) are common injuries, accounting for 10% to 31% of all hand fractures.[1-6] They place a significant burden on healthcare resources and society, commonly affecting young economically active patients.

Despite their prevalence, acceptable parameters of deformity vary widely in the literature,[7-9] and there is no consensus on the best-practice management approach. Nonsurgical treatment includes closed reduction, different casting techniques and splints, or free mobilization. Surgical techniques include Kirschner wire (K-wire) fixation, intraosseous wires, interfragmentary compression screws, plates, or external fixators.

Both nonsurgical and surgical treatments require significant resources and a period of rehabilitation of weeks to months, during which use of the hand is restricted. Surgical treatment is perceived to be more costly due to the need for specialist resources, additional equipment, and theater use.

Although most patients have excellent outcomes, if not appropriately treated, MSF can limit range of motion (ROM) and grip strength, lead to an extensor lag from shortening, and (rarely) lead to rotational deformity of the digit.[10,11] This may impair hand function and affect ability to work and live at the preinjury level. As they predominantly affect those of working age, reduced ability to work during hand recovery may lead to substantial societal costs, increasing the cumulative morbidity of MSF. Therefore, establishing the most effective treatment for MSF will lead to optimal patient care and has the potential to provide economic value to the National Health Service.

We report the findings of a systematic review of the treatment of MSF. This review was undertaken to establish the benefits and risks of surgical and nonsurgical treatments and to assess the quality and strength of evidence supporting each treatment modality. In analyzing the available literature, we hope to highlight areas of uncertainty and identify learning points for the design of future studies.

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Supplemental material is available in the online version of the article.

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Table 1. Eligibility Criteria.

Inclusion criteria	Exclusion criteria
Types of participants	
Adults, however defined, with 1 or more fracture(s) of the metacarpal shaft affecting the fingers (index to little)	• Intra-articular fracture(s) • Fracture(s) of the metacarpal neck and/or base • Fracture(s) of the thumb metacarpal • In studies of mixed populations (excluding adults and children), a study will be included if ≥90% of the population meets the review inclusion criteria
Study design	
Randomized controlled trials Studies stated to be "randomized" but for which there is inadequate information about sequence generation and/or concealment of allocation Controlled clinical trials Quasi-randomized trials, such as those with alternate allocation or allocation based on day of the week or clinic Cohort studies	• Cadaveric studies • Biomechanical studies • Case series • Case reports • Review articles
Publication type	
Full study reports published in peer review journals Separate publications of economic evaluation of the primary study Studies in any language	• Abstracts of completed studies, if full published report is not yet available • Unpublished trials • Ongoing trials/studies

Materials and Methods

We developed a protocol in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement[12] and prospectively registered the review on PROSPERO (CRD42018106950).

Eligibility Criteria

The eligibility criteria are detailed in Table 1. We included studies if they compared any form of treatment, either surgical or nonsurgical, for acute fracture(s) of the metacarpal shaft of the finger digits in adult patients, however defined.

Search Strategy and Study Selection

A comprehensive search strategy was compiled by an information specialist (D.G.) that included a comprehensive list of search terms and synonyms for the concepts: metacarpal bones, fractures, and shaft/diaphysis (Supplemental Material). The following bibliographic databases were searched on September 16, 2019: PubMed, Ovid MEDLINE, Ovid Embase, Cochrane Central Register of Controlled Trials, CINAHL, Web of Science and PEDro (Supplemental Table S1). We devised a strategy specific to each database, ensuring use of the relevant subject headings where available. We screened the reference list of included studies for further eligible studies and searched the gray literature at the time of the primary search via Google Scholar. No date or language limits were applied.

Study selection is reported in a PRISMA flow diagram. Two authors (R.H.M.T. and D.G.) independently screened titles and abstracts for eligibility. Full-text articles were reviewed where abstracts were unclear. Disagreements were resolved by discussion with a third author (A.K.). EndNote version X8 (Thomas Reuters, New York City, New York) was used to manage search results and filter duplicate articles.

Data Management and Risk-of-Bias Assessment

Data extraction and assessment of methodological quality were performed in duplicate using a piloted data collection form (R.H.M.T. and S.D.). Risk of bias was assessed using the Cochrane Risk-of-Bias Tool for Randomized Controlled Trials and quasi-random studies[13] and the Risk of Bias in Nonrandomized Studies of Interventions (ROBINS-I) for comparative nonrandomized studies.[14,15]

Data Synthesis

Data collected included information on study design, population, intervention, and outcomes, including use of clinical and patient-reported outcome measures (PROMs) and results. A meta-analysis was planned, if appropriate, but not performed due to study heterogeneity and risk of bias in included studies; a narrative synthesis is therefore presented.

Results

The study selection process is demonstrated via a PRISMA flow diagram (Figure 1). A total of 1600 records were identified through database searches; 7 studies fulfilled the eligibility criteria and were included.

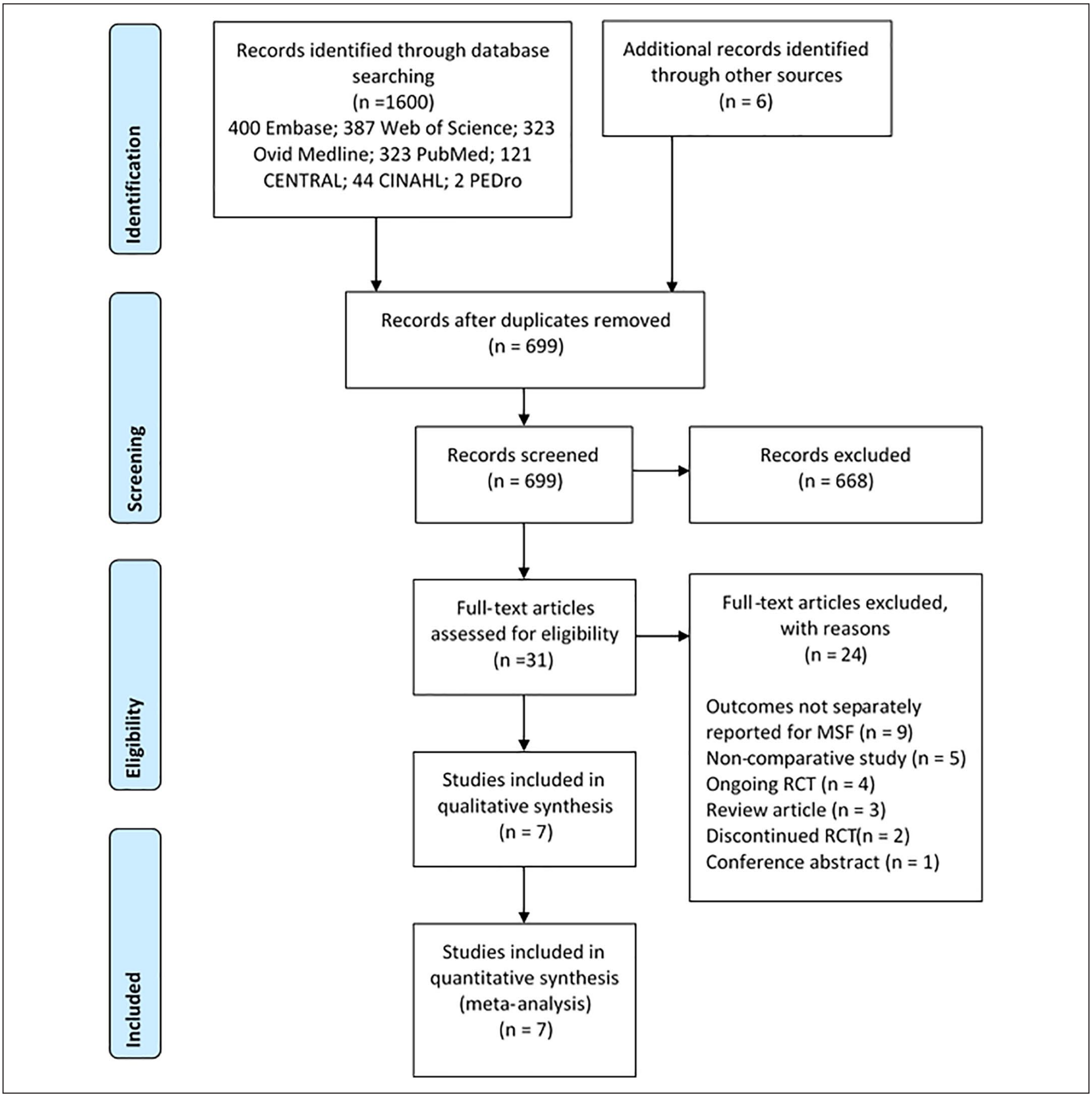

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram detailing study selection. CENTRAL = Cochrane Central Register of Controlled Trials; RCT = randomized controlled trial.

Two discontinued and 4 ongoing trials were identified via the World Health Organization International Clinical Trials Registry Platform portal, and a further 6 records were identified on searching the gray literature and reference lists of included studies (Supplemental Table S2).

Study Design Characteristics

There were no published randomized controlled trials (RCTs) directly comparing surgical with nonsurgical treatment for MSF in adult patients. One observational study compared nonsurgical with surgical treatment. This was a retrospective, 2-center cohort study of metacarpal neck and shaft fractures.[16]

Six studies made comparisons between surgical and nonsurgical treatments, as summarized in Table 2. These included 2 RCTs,[20,21] 1 multicenter retrospective study,[19] 1 dual-center retrospective study, and 3 single-center retrospective cohort studies, as defined by the literature.[16-18,22-24] Of these, 3 compared 2 forms of surgical treatment,[17-19] and 3 compared

Table 2. Characteristics of the Included Studies.

Study	Methods	Participants: no. of patients (shaft)	Fracture	Intervention: no. of patients (shaft)	Comparator: no. of patients (shaft)	Follow-up: mean (range)	Primary outcome of interest (other outcomes assessed)	Risk of bias as per Cochrane assessment tool[a]
Surgical vs nonsurgical treatment								
Westbrook et al[16]	Retrospective cohort study Dual center Nottingham, UK	262 (139)	Isolated closed shaft or neck fracture of the little finger metacarpal bone, sustained at least 2 y previously	44 (26) Any form of surgical fixation	218 (113) Nonsurgical treatment; early mobilization or temporary immobilization in a plaster	I: 25 mo (14-79 mo) C: 48 mo (28-76 mo), median (range)	Angulation Grip strength DASH Sports DASH Cosmesis	Critical
Surgical vs surgical treatment								
Biz and Iacobellis[17]	Retrospective Single center Padova, Italy	49 (26)	Closed, unstable metacarpal fracture, with dorsal angulation >30° or shortening >3 mm.	31 (6) Percutaneous intramedullary K-wire fixation	22 (20) Interfragmentary screw fixation	28.4 mo (18-55)	Mayo DASH Radiographic; shortening, anteroposterior and lateral angulation, presence of bridging bone callus Pain Grip strength Sensitivity	Critical
Dreyfuss et al[18]	Retrospective Single center Haifa, Israel	59 (59)	Adult patient with metacarpal shaft fracture, fracture line does not extend into proximal or distal end segment square	30 (30) Closed reduction and percutaneous K-wire pinning	29 (29) Locking plate and screws	I: 45 mo (27-65) C: 23 mo (15-32)	ROM Grip strength Rotational deformity DASH Radiographic: angulation, shortening Time to bony union of at least 3 cortices	Serious
Vasilakis et al[19]	Retrospective Multicenter New York, USA	70 (56)	>16 y, isolated, closed, single-digit extra-articular metacarpal fractures	44 (33) Closed reduction and percutaneous pinning	26 (23) Open reduction internal fixation; mini-plate or lag screws	I: 2.9 (SD, 2.4) mo C: 4.2 (SD. 6.8) mo	Time from injury to surgery Immobilization time TAM Complication Reoperation rate OT referral rates Duration of OT QuickDASH	Critical

(continued)

Table 2. (continued)

Study	Methods	Participants: no. of patients (shaft)	Fracture	Intervention: no. of patients (shaft)	Comparator: no. of patients (shaft)	Follow-up: mean (range)	Primary outcome of interest (other outcomes assessed)	Risk of bias as per Cochrane assessment tool[a]
Nonsurgical vs nonsurgical treatment								
Konradsen et al[20]	RCT Single center Hillerød, Denmark	100 (42)	Shaft or neck fracture index to little finger metacarpal	50 (22) Immobilization in functional cast, allowing free movement of the wrist and fingers, and strapping of injured finger to adjacent digit for 3 wk	50 (20) Immobilization in plaster cast, immobilizing the MCP and PIP joints of the injured and adjacent digit for 3 wk	3 mo	Angulation	High
McMahon et al[21]	RCT Single center Oxford, UK	42 (42)	Unilateral, fresh closed stable fractures of the shaft of single finger metacarpal	21 (21) Immobilization in palmar plaster slab, with MCP joints flexed and PIP joints extended	21 (21) Application of compression glove and immediate mobilization	3 wk	ROM Hand volume Finger circumference	High
Braakman[22]	Retrospective Single center Sittard, The Netherlands	200 (74)	Conservatively treated primary fracture of fourth or fifth metacarpal	100 (37) Near-anatomical reduction (residual angulation <5°) + immobilization in antebrachial cast, wrist 45° and IP joints 0°-10°	100 (37) Partial reduction (residual angulation >5° + immobilization in antebrachial cast, wrist 45° and IP joints 0°-10°	4 wk	Residual fracture angulation at 4 wk	Critical

Note. I = intervention; C = comparator; ROM = range of motion; TAM = total active motion; RCT = randomized controlled trial; DASH = Disabilities of the Arm, Shoulder, and Hand; QuickDASH = Quick Disabilities of the Arm, Shoulder, and Hand; MCP = metacarpophalangeal; PIP = proximal interphalangeal; IP = interphalangeal; K-wire = Kirschner wire; OT = Occupational Therapy.

[a]Revised Cochrane Risk-of-Bias tool for randomized trials (RoB 2) used for randomized controlled trials. Risk of Bias in Nonrandomized Studies of Interventions (ROBINS-I) tool was used for nonrandomized studies.

Table 3. Consolidated Summary of Risk of Bias for Nonrandomized Studies.

Study	Domain[a] 1	2	3	4	5	6	7	Overall risk of bias
Biz and Iacobellis[17]	Critical	Serious	Low	NI	Low	Serious	Moderate	Critical
Braakman[22]	Critical	Critical	Serious	NI	NI	Low	Serious	Critical
Dreyfuss et al[18]	Low	Serious	Low	NI	Moderate	Serious	Moderate	Serious
Vasilakis et al[19]	Critical	Serious	Low	NI	Serious	NI	Serious	Critical
Westbrook et al[16]	Critical	Serious	Moderate	NI	Critical	Serious	Moderate	Critical

Note. NI = no information.
[a]Domain 1: Bias due to confounding. Domain 2: Bias in selection of participants into the study. Domain 3: Bias in classification of interventions. Domain 4: Bias due to deviations from intended interventions. Domain 5: Bias due to missing data. Domain 6: Bias in measurement of outcomes. Domain 7: Bias in the selection of the reported result.

Table 4. Summary of Risk-of-Bias Assessment for Randomized Studies.

Study	Domain[a] 1	2	3	4	5	Overall risk of bias
Konradsen et al[20]	Some concerns	High	Low	High	Some	High
McMahon et al[21]	Some concerns	Some concerns	Low	High	Some	High

[a]Domain 1: Risk of bias arising from the randomization process. Domain 2: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention). Domain 3: Missing outcome data. Domain 4: Risk of bias in measurement of the outcome. Domain 5: Risk of bias in the selection of the reported result.

nonsurgical treatments.[20-22] Two studies assessed MSF only,[18,21] with the remainder being mixed-population studies, which reported results for MSF as separate subgroups.

Risk-of-Bias Assessment

All studies were assessed to be at critical risk of bias in at least 1 domain or at serious risk of bias in 2 or more domains (Tables 2-4). Supplemental Material detailing the quality assessment for each individual study is available on request.

As most studies are retrospective, allocation of treatment may be influenced by multiple confounding factors, including clinician preference, injury pattern, and severity of fracture. Of the 2 RCTs, one used an inadequate method of randomization (sequentially numbered sealed envelopes),[21] and another did not specify the method used.[20] Only 1 study provided a prior sample size calculation[21]; therefore, studies may lack the power required to detect meaningful differences between interventions.

Studies had variable length of follow-up, ranging from 3 weeks to 65 months, with wide interparticipant variability within individual studies, ranging from 3 weeks to 15 to 65 months,[18,21] as well as a disproportionate loss to follow-up between intervention groups.[16,19]

Insufficient information regarding blinding of outcome measurements was provided,[19] or assessment of outcomes occurred at variable time points.[16-18] Outcome measurements were unblinded in all studies bar one,[22] and intervention groups were therefore identifiable (either due to the presence of surgical scars or due to the use of cast/splints in nonsurgical interventions); thus, risk of bias was assessed as "serious" for all subjectively reported outcomes.

In some studies, there was a disparity between planned methods described and reported results, thus leading to bias in the selection of reported results. Furthermore, no protocols were published a priori for any of the included studies, further potentiating the risk of selective reporting.

Most studies did not provide sufficient information to assess bias due to deviations from intended interventions[16-22] or missing data.[22] Therefore, bias in these domains was not demonstrably measured.

Participant and Fracture Characteristics

A total of 438 participants with MSF were included in the 7 studies. All studies had a small sample size, with a mean of 63 (range, 26-139).

Participants varied widely, with some studies defining age restrictions, whereas others did not. Gender was not documented in 3 studies: 2 studies had higher proportions of male participants[17,19] and 1 contained no female participants.[18]

Eligibility criteria varied markedly between studies, particularly in the definition of displacement, affected digits, multiplicity of fingers fractured, inclusion criterion, and indications for surgery. One study defined displacement as dorsal angulation >30° or shortening >3 mm,[17] whereas 2 did not specify minimum parameters of deformity or indications for surgery.[18,19] All 3 comparative studies of surgical treatments excluded open fractures, and 2 excluded high-energy polytrauma or patients with multiple fractures.

One RCT included only closed stable MSF of the fingers, defined as <50% displacement of the width of the shaft, <40° angulation, and displaying an angle >60° between the plane of the fracture and the axis of the shaft,[21] whereas the second RCT did not specify any exclusion criteria, simply recruiting 100 consecutive patients.[20] Information regarding inclusion criterion, selection of participants, indications for treatment, and choice of intervention was not provided in 2 studies.[20,22]

Interventions and Rehabilitation

Surgical interventions, time to surgery, surgical technique, and choice of metalwork varied considerably among studies, with some including the addition of crossed K-wires as well as intramedullary fixation[18] and variability in surgical plates, including dynamic compression, locking plates, or unspecified types. One study compared closed reduction and K-wire fixation to open reduction and internal fixation (ORIF) using locking plates and screws.[18] Another compared intramedullary K-wire fixation with interfragmentary screw fixation,[17] whereas the third compared percutaneous K-wire fixation with ORIF using plate-screw fixation or interfragmentary lag screws.[19]

There was a lack of consistency in the mode of immobilization, position, material used (plaster, thermoplastic, or other), and period of immobilization among the 3 comparative studies of nonsurgical treatments (Table 2).[20-22]

Outcome Measures

A combination of outcome measurements was used at varying time points. Five studies reported radiographic parameters, such as anteroposterior angulation, shortening, or the presence of bridging callus.[16-18,20,22] Total active motion was reported in 3 studies[18,19,21] and grip strength in 3.[16-18]

A PROM was reported in 4 of the 7 studies, with the MAYO,[17] Quick Disabilities of the Arm, Shoulder and Hand,[16,19] and Disabilities of the Arm, Shoulder and Hand (DASH) most frequently used.[16-18] Other clinical parameters reported included hand volume and finger circumference as surrogate markers of edema,[21] whereas postoperative rehabilitation and therapy use were only reported in 1 study.[19] Although return to work was recorded by Konradsen et al,[20] it was not separately reported for MSF.

Results of Included Studies

Only 1 study directly compared surgical with non-surgical treatment, assessing outcomes of metacarpal fractures at ≥2 years after injury.[16] Although baseline demographics were similar between the groups, there was significant disparity in the number of patients per intervention, 113 treated nonsurgically versus 26 surgically, as well as greater palmar angulation at presentation in the surgically treated group. No significant differences in grip strength were reported, although improved DASH scores and aesthetic outcome were noted in those managed nonsurgically, along with a worse Sports DASH score.[16] The reported findings suggest nonsurgical treatment might be preferable to surgical fixation in the treatment of a single MSF.

Two of the 3 studies of surgical treatments found no evidence of any difference in either functional outcomes or PROMs between the treatment groups. Biz and Iacobellis[17] found no evidence of difference when comparing intramedullary fixation with interfragmentary screw fixation at a mean follow-up of 28.4 months. These findings were supported by Vasilakis et al who found no difference in functional outcomes, outpatient follow-up, or hand therapy referral rates between ORIF and percutaneous pinning using K-wires. They noted that both interfragmentary screws and plate-screw fixation resulted in earlier splint removal and mobilization compared with closed reduction and percutaneous pinning.[19] Only 1 paper reported improved outcomes in grip strength, ROM, and DASH scores with plate-screw fixation over percutaneous K-wire fixation, which they attributed to the use of low-profile locking plates and screws that allowed for aggressive mobilization after surgery.[18] One study reported reduced immobilization time with ORIF (plate-screw fixation or screw fixation only),[19] whereas another reported a higher incidence of malunion in those treated with intramedullary wire fixation over interfragmentary screw fixation.[17] Given the variability in surgical interventions and lack of clearly reported indications for surgery within studies, comparisons between type of fixation and functional outcomes are not appropriate.

Of the comparative studies of nonsurgical treatments, few reported subgroup results for MSF. Konradsen et al[20] described good outcomes following their "functional cast"; however, rotation, pain, cast inconvenience, length of time before returning to work, ROM, and grip strength were not separately reported for MSF. McMahon et al[21] demonstrated improved ROM with immediate mobilization and a compression glove in the first 3 weeks after injury, although this improvement was not sustained at 4 weeks. Braakman[22] concluded that near-anatomical reduction of MSF resulted in reduced residual angulation at 4 weeks. However, these clinical improvements were not correlated with functional assessments or PROMs; therefore, extrapolating these conclusions to guide patient treatment may not be appropriate.

Discussion

This review highlights the paucity of high-quality evidence demonstrating superiority of any one form of treatment over another for the management of MSF of the finger digits. Despite their prevalence, there is considerable variability in the management of MSF with no agreement in the literature as to acceptable parameters of deformity or a consensus on treatment strategies. The limited studies identified lacked consistency of end points, surgical techniques, rehabilitation regimens, and outcome measures used. This makes meaningful comparison difficult due to considerable heterogeneity.

Only 1 retrospective study directly compared surgical with non-surgical treatment for MSF.[16] As intervention and comparator groups were defined some time following injury, any differences identified may be due to confounding of either patient or fracture characteristics. The low follow-up rate, imbalance in numbers per intervention, and variable length of follow-up challenge the conclusions drawn that outcomes are favorable following either form of treatment.[16] There was also differential attrition in the treatment groups, which is likely due to systematic differences between the 2 groups.

Despite increasing trends toward surgical fixation in current practice, no single technique has been demonstrated to be superior in the treatment of MSF. Only 1 retrospective study reported improved outcomes with plate-screw fixation over percutaneous pinning with K-wires.[18] However, the small sample size (59 patients), significant disparity in length of follow-up between groups, and serious overall risk of bias impede the use of this study in drawing conclusions about the superiority of either form of treatment. A recent meta-analysis of plate fixation versus percutaneous pinning for unstable metacarpal fractures concluded that although percutaneous pinning resulted in higher motion scores, there were no differences in functional scores, grip strength, radiographic parameters, time to union, or complications.[25] However, this review was limited by the small number of eligible studies (only 4 comparative studies, of which only 3 reported total active motion and 2 reported DASH), a lack of standard reporting, and limited use of functional outcome scores or PROMs.[25]

Given the heterogeneity of data and inconsistency in reporting throughout the literature, there is no evidence to support any one treatment over another for MSF. Furthermore, the following inconsistencies compounded analysis of the literature:

1. There is no clear definition of the metacarpal "shaft," with most studies containing a heterogeneous group of neck and shaft fractures. One suggested definition may be that described by the Arbeitsgemeinschaft für Osteosynthesefragen Foundation/Orthopedic Trauma Association as that part of the bone between the 2 end segments, with the end segment defined by "a square whose sides are the same length as the widest part of the epiphysis/metaphysis in question (Heim's system of squares)."[26] However, only 1 study defined the shaft using this method.[18] Accurate denotation of the metacarpal shaft is required to differentiate mixed-population studies that include subcapital/neck fractures, which most agree tolerate far greater angulation than MSF.
2. There is no consensus on definition of instability or acceptable parameters of deformity in MSF. One study defined displacement,[17] whereas others did not specify minimum parameters of deformity or indications for surgical treatment.[18,19] Diao suggested up to 10° angulation was acceptable in the index and middle fingers and 20° to 30° in the ring and little fingers,[27] whereas some authors accept up to 50° angulation in the little and 30° to 35° in the ring ringer.[28] Others are more conservative, accepting 60° of angulation in the little finger and 45°in the ring finger.[29] Similarly, although some authors opine that finger metacarpals may tolerate 3 to 4 mm of shortening,[30] sometimes more[18,28,29] with minimal clinical deformity and functional loss, cadaveric studies demonstrate that every 2 mm of metacarpal shortening may result in as much as 8% loss of grip strength.[31] The inconsistency in the reporting of fracture characteristics and deformity increases the risk of selection bias when comparing treatments for MSF and highlights the uncertainties within the hand surgery community regarding acceptable parameters of deformity in MSF. Future studies should use clear definitions of deformity alongside standardized methods of assessment to allow head-to-head comparison of treatments.
3. Although angulation and shortening were assessed in most studies, precise methods of measuring deformity in MSF are not described in the literature, with some remaining as vague as stating radiographs were "scanned for metacarpal angulation and shortening."[18] Angulation is often measured on lateral radiographs of the hand using mid-medullary measurement; however, this method has only been validated in the assessment of metacarpal neck fractures.[32] Furthermore, normal reference values for angulation are only documented for the ring and little finger metacarpal.[33] An accurate and reliable method of measuring angulation and shortening in MSF is required to ensure consistency in assessment across studies. Furthermore, there is no clear evidence that radiographic outcomes directly correlate with function. Standardizing radiographic assessment alongside collection of PROMs would aid our understanding of this.
4. Most studies did not examine rehabilitation/therapy regimens or other key variables such as the time from injury to surgery or length of immobilization, which may also have a prognostic impact on outcomes following MSF.

Table 5. Our Recommended Minimum Data Set for Future Metacarpal Shaft Studies.

Definitions	Patient details	Fracture details	Details of fracture diagnosis and treatment	Details of outcome assessment	Economic evaluation
Metacarpal shaft	Age	Method of assessment of fracture deformity	Implants used	PROM	Time off work
Instability	Gender	Fracture angulation	Cast/splint details	Comparable follow-up between treatment groups	Treatment costs
MCID for selected PROM	Occupation	Shortening	Length of immobilization	TAM	Personal impact of injury and treatment
Indication for treatment or surgery	Hand dominance	Presence of "step-off" deformity	Rehabilitation	Grip strength	
	Number of patients identified, recruited, and followed up				

Note. PROM = patient-reported outcome measure; TAM = total active motion; MCID = minimal clinically important difference.

5. Where cosmesis or inconvenience of treatment has been assessed, arbitrary measures selected by study authors were used.[16,17,20] Patients may have widely differing views to clinicians, and acceptability to patients may vary significantly from the parameters selected by clinicians; therefore, future studies must address the views of patients.
6. There is incongruity in outcomes assessed, with studies measuring a variety of outcomes at varying time points. All studies focused on clinical and radiographic outcomes, with no study reporting a PROM as the primary outcome of interest. The lack of standardized reporting and assessment is compounded by the fact that there is no core outcome set for trials/studies in hand surgery. Consensus on a minimum data set in future trials is required to ensure consistency in reporting and to allow future meta-analysis.
7. Low recruitment and retention are inherent issues in studies of metacarpal fractures and have led to the termination of several RCTs, including a multicenter RCT of intramedullary wiring and conservative treatment for subcapital and shaft fractures of the little finger metacarpal.[34] This limits the pool of available clinical trials and reduces the robustness of evidence available for the synthesis of meaningful conclusions regarding treatments for MSF. Future studies must minimize attrition using novel techniques, remote data collection, timely, focused follow-up, and reducing research burden.
8. Studies rarely examined the socioeconomic impact of time off work, lost productivity, or need for additional support/care while undergoing treatment for MSF. There is no evaluation of the cost-effectiveness of treatments for MSF, with utilization of resources rarely recorded in studies. Only 1 study recorded length of surgery and hospital stay.[17] Such evidence is required to inform healthcare allocation.

Our conclusions must be considered in lieu of the study limitations. Our review is limited by the small number of eligible studies, which mostly provide level IV evidence. Although a comprehensive search strategy was devised, it is possible that relevant publications may not have been identified. As with any review, reporting bias, both within individual studies and in relation to published findings, limits the available data from which to pool results. This is compounded by the small sample size in individual studies. Furthermore, the high risk of bias and associated limitations of included studies impede any meaningful assessment of specific intervention types and associated outcomes. We recommend that future researchers address the deficiencies of prior studies so that direct comparisons can be made between treatments (Table 5).

This review highlights the need for large, well-designed randomized studies to inform current practice and guide management of these common injuries. Although RCTs are difficult to implement, identifying the most beneficial and cost-effective treatment for MSF will aid clinicians and patients to make informed treatment choices while maximizing value for health service providers.

Ethical Approval

This is not applicable to this systematic review article.

Statement of Human and Animal Rights

This is not applicable to this systematic review article.

Statement of Informed Consent

This is not applicable to this systematic review article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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