Conservative Versus Surgical Treatment of Mallet Finger: A Pooled Quantitative Literature Evaluation

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Background: **Although common, mallet finger represents a spectrum of injuries for which there are many questions about the best form of treatment. A long-standing controversy continues as to strategies and techniques of treatment. This quantitative literature analysis is the first that makes use of an evidence-based evaluation process to pool across studies the outcomes of conservative versus surgical treatment of closed mallet finger injuries of both acute and chronic or recurrent types.**

Methods: **Published articles in English were sought using multiple methods, including the MEDLINE and EMBASE databases, reference review, and correspondence with selected experts. Both observational and randomized trials were included. Results were summarized in terms of 95 percent confidence intervals, and sensitivity analysis was performed for two other amounts of residual extensor lag.**

Results: **Of the 41 reports retrieved, 26 met inclusion criteria, including 21 for initial acute treatment (1146 pooled digits) and 5 for chronic or recurrent treatment (148 pooled digits). Successful outcomes were found in about 77 percent of mallet fingers treated conservatively by splintage, including 480 patients who were observed for a 2-year period. Patient satisfaction with conservative treatment was found to be about 83 percent in 6 studies recording overall patient satisfaction (315 pooled patients). Successful outcomes of surgical treatment for acute mallet finger averaged about 85 percent in 3 studies (60 pooled digits) and about 73 percent in 5 studies of chronic or recurrent mallet finger.**

Conclusions: **Conservative treatment of at least 80 percent of mallet finger injuries is safe, effective, well accepted by patients, and cost efficient compared with surgical treatment. Multiple types of surgical procedures are available when surgery is indicated for a limited number of open or otherwise complex mallet finger injuries as well as for chronic or recurrent mallet finger. (J Am Board Fam Pract 1998;11:382-90.)**

Mallet finger injuries are commonly encountered in everyday clinical practice. They involve disruption or rupture of the extensor tendon mechanism to the distal phalanx of the finger and can be associated with fractures of variable size of the distal phalanx. They often result from direct trauma to the tip of the extended finger, but they also result from minor forces, including everyday household tasks such as bed making, dressing, or undressing.

A familial predisposition has been described in some instances.[1] Although first called *mallet finger* in the context of common sports injury, the term is a misnomer; such a finger does not resemble a mallet, and many such injuries are not sports-related. The term *drop finger* has been proposed by some as more accurate[2,3] but has not caught on. The most commonly injured fingers, in decreasing order, are the long finger, ring finger, index finger, little finger, and thumb. Mallet fingers occur more often in men than women, and in most series women are about 10 years older than men with these injuries.[4]

First described in the late 1800s, mallet finger injuries have been a treatment challenge since that time. A number of treatments have been tried, ranging from reassurance (no treatment, especially in the first part of this century) to conservative splint treatment to various surgical procedures. During the last 40 to 50 years, many types of splints and surgical techniques have been introduced, but in many respects the treatment of this common problem still remains controversial today.[5,6] Although conservative splint treatment has been recommended for treatment of acute mallet finger, there is continued controversy regarding such issues as type of splint, duration of

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splinting, how to immobilize the proximal interphalangeal joint, and extent of symptoms or disability resulting from any residual decreased range of motion of either the proximal or distal interphalangeal joints.

In addition, many mallet fingers are associated with various types of mallet fractures, and indications vary considerably as to which mallet fractures should receive initial surgical treatment. Some authors argue for an expanded role of surgery in the treatment of acute mallet fingers.[7-9] It is now recognized that untreated mallet fingers have a considerable likelihood for some degree of functional impairment, often with pain and stiffness, so it is important to sort through treatment alternatives to offer an optimal treatment plan for patients with this problem.

In view of the frequency with which mallet finger occurs, the variable results of multiple small studies, and the continued controversial nature of its treatment, a pooled quantitative literature evaluation of published studies was performed to investigate the following questions: (1) What are the outcomes of treatment, from both physicians' and patients' perspective, of conservative versus surgical treatment as the initial treatment for closed acute mallet finger injuries? (2) What are the outcomes of treatment for chronic or recurrent mallet finger?

Methods

Literature Review

The literature review began with a computerized search of the MEDLINE and EMBASE databases using the key word "mallet finger." The MEDLINE search covered citations from 1 January 1966 to 9 February 1998. Because interpreters were not directly available for articles in other languages, the search was focused entirely on the English language literature and was further extended to references cited in retrieved articles. In addition, three experts were contacted to find other published or unpublished reports.

Inclusion criteria for this literature evaluation included all studies of treatment of closed mallet finger injury with (1) 20 or more patients or digits available for follow-up for conservative treatment or 15 patients or digits in the case of surgical treatment; (2) conservative treatment using any type of splint for 4 or more weeks and surgical procedures using any relevant technique; and (3) objective outcomes, including measurements of extensor lag, flexion arc, and residual symptoms. Exclusion criteria included (1) open injuries and (2) mallet fractures involving more than one third of articular surface.

Table 1. Outcome Criteria Applied to All Studies of Mallet Finger.

Outcome Measure	Success	Failure
Extensor lag (degrees)	≤ 20°	> 20°
Flexion arc (degrees)	≥ 50°	< 50°
Pain or stiffness	None or minimal	Noticeable to patient
Functional impairment	None or minimal	Noticeable to patient
Overall patient evaluation	Satisfied (at least 90% so in patient's judgment)	< 90%

The initial intent was to carry out a formal meta-analysis on the study questions. The literature search, however, retrieved only one randomized clinical trial, whereas all other published reports were observational clinical series. It was therefore decided to conduct a pooled quantitative literature analysis that incorporated as much as possible the principles of meta-analysis in the organization and summarizing of the data.[10] The goal was to carry out a literature review that could best clarify the study questions given the lack of sufficient randomized controlled trials for a formal meta-analysis. The cutoff numbers of patients or digits as inclusion criteria for conservative (20) and surgical (15) treatment were chosen as those numbers that best represented most available studies after the literature search was completed.

Outcome Measures

Because the objective outcome measures varied among different investigators, a reasonable average of outcome criteria, shown in Table 1, was applied to all studies. Some earlier investigators had used more stringent outcome measures for success, such as extensor lags of less than 5 degrees for success and 6 degrees to 15 degrees for improved.[3,11] The 20-degree extensor lag cutoff was used here in view of considerable evidence that most patients with this amount of extensor lag have good functional outcomes and desire no further treatment.[12-16] To be counted as successful, outcome studies were required to satisfy all of the above outcome criteria.

Table 2. Initial Treatment of Closed Mallet Finger Injuries: Summary of Studies Meeting Inclusion Criteria (21 Studies).

	Splint Treatment						Surgical Treatment					
Author, y	Digits No.	Mean Age y	Success %	Failure %	Success Weighted Average	Standard Error	Digits No.	Mean Age y	Success %	Failure %	Success Weighted Average	Standard Error
Okafor et al,[13] 1997*	31	54.5	77 (87)	23 (13)	2.43	0.07						
Garberman et al,[17] 1994	40	45	80	20	3.26	0.06						
Groth,[18] 1994	44	41.7	64	36	2.86	0.06						
Nakamura & Nanjyo,[7] 1994							15	40.3	85 est (80)	15 est (20)	15.00	0.13
Maitra & Dorani,[11] 1993	60	44.5	55	45	3.36	0.06						
Shankar & Goring,[14] 1992*	100	49.8	85	15	8.65	0.04						
Evans & Weightman,[19] 1988	25	38	84	16	2.14	0.07						
Warren et al,[20] 1988	107	46.1	52 (71)	48 (29)	5.66	0.05						
Hovgaard & Klareskov,[21] 1987*	25	40	100 (80)	0 (20)	2.54	0.02						
Clement & Wray Jr,[22] 1986	23	NA	52	48	1.22	0.10	24 (excluded)					
DiPaola, 1986[15]	38	48	82 (100)	18	3.17	0.06						
Kinninmonth & Holburn,[23] 1986	37	NA	90 est	10 est	3.39	0.05						
Niechajev,[24] 1985	92	NA	93 (90)	7 (10)	8.70	0.03	26	NA	92	8	39.87	0.05
Crawford,[25] 1984	61	NA	95	5	5.90	0.03						
Moss & Steingold,[16] 1983	100	44.4	NA									
Auchincloss,[26] 1982	22	41	86 (86)	14 (14)	1.92	0.07	19	NA	95 (95)	5 (5)	30.08	0.05
Mikic & Helal,[27] 1974	30	NA	100		3.05	0.02						
Abouna & Brown,[3] 1968*	100	NA	86	14	8.75	0.03						
Stark et al,[12] 1962	63	NA	NA	NA								
Hallberg & Lindholm,[28] 1960*	79	38.8	53	47	4.26	0.06						
Robb,[29] 1959	69	NA	88	12	6.18	0.04						
Total	1146†				77.44 77.4%	0.05	60				84.95 85%	0.08

*Follow up 2 or more years after injury.
est - estimated outcome when evaluation criteria not fully comparable, NA - information not available.
Percentages in parentheses = overall patient satisfaction.
†No reported outcome at 20° extensor lag for Shankar & Goring[14] and Groth et al [18]; pooled weighted success measures calculated without their 163 digits.

For example, even if the range of motion after treatment fell within the above limits, that patient or digit was considered a treatment failure if considerable pain or stiffness was sufficient to be reported by the patient.

Analysis

Rules were developed for abstraction of data from reports of all studies meeting the inclusion criteria. Two authors (JPG and KF) independently abstracted data on each study, and any discrepancies

Comments
Noncompliant patients excluded
Recommend surgery for better outcome in fresh mallet finger
Trial of 2 splints; followed Abouna & Brown[3] criteria: (extensor lag < 5° success and 6° - 15° improved)
Nine patients excluded with inadequate follow-up
All surgical patients excluded due to small sample size after exclusion of complex fractures and open injuries
12 patients excluded due to splinting < 4 weeks
Success percentage is estimated using overly stringent outcome criteria for "fair" category; 89 patients excluded with sizable fracture fragments, plus 1 patient with inadequate follow-up
Unclear outcome results for extensor lags of 20° and 30°; results calculated for 10° in sensitivity analysis
Only randomized controlled trial
38 patients excluded who failed full follow-up review
35 patients excluded not meeting inclusion criteria;unclear outcomes for extensor lags of 20° in remaining patients; sensitivity analyses done for 10° and 30° in thatsubgroup
48 patients excluded without adequate treatment or full follow-up evaluation
6 patients excluded without splint treatment

were reconciled. One of the authors (KF) was blinded to author(s), journal, title, and year of publication. Each study was reviewed for sample size, mean patient age, treatment method, evaluation criteria, outcomes, duration of follow-up, and percentage of overall success or failure of treatment. Patient satisfaction was recorded whenever that information was available. Injuries were considered acute if treated less than 2 months after injury and chronic if more than 2 months later. In the analysis of outcomes, the number of digits was recorded (not patients, since some patients had two mallet finger injuries). Patients who failed follow-up were not included in the analysis.

In addition to overall analysis, the data were further stratified on the basis of long-term follow-up (average of 2 years or more after treatment) as well as for overall patient satisfaction. Sensitivity analyses were done with variations of extensor lag outcomes of 10 degrees and 30 degrees. Because there was only one randomized controlled trial available for analysis, it was not possible to calculate inferential statistics, such as pooled odds ratios. Pooled weighted success averages were calculated for each treatment category; success averages were derived for each study weighted against the numbers of patients or digits represented in each study. Confidence intervals (95 percent) were determined for each category of study where patients were pooled.

Results

The literature search found 41 reports of studies dealing with treatment of mallet finger injuries. Of these, 26 met inclusion criteria, including 21 for initial acute treatment and 5 for chronic or recurrent treatment. In the acute-treatment group, 20 involved conservative treatment and 3 involved surgical treatment for initial treatment of fresh mallet finger. All but one report were clinical series, including two comparing conservative versus surgical treatment; only one was a randomized controlled trial. No additional citations were found by the three experts.

Table 2 displays the major features of the 21 studies that met inclusion criteria for initial treatment of fresh mallet finger (1146 pooled digits).[3,7,11-29] Table 3 lists the same information for five additional studies assessing treatment for chronic or recurrent mallet finger, representing 148 pooled digits.[30-34] Fifteen other studies were excluded based on established exclusion criteria, most commonly small sample size, more complex injuries, or unclear outcome criteria.[8,35-48]

Physician-evaluated outcomes for initial conservative treatment of closed mallet finger injuries

Table 3. Surgical Treatment for Chronic/Recurrent Mallet Finger Injuries: Summary of Five Studies Meeting Inclusion Criteria.

Author	Digits No.	Mean Age y	Success %	Failure %	Success Weighted Average	Standard Error	95 Percent Confidence Interval Range	Comments
Houpt et al[30]	35	52.0	97 est	3 est	22.94	0.03	91.1 - 102.9	Patients with closed injuries who failed splint for 4 - 8 weeks; average 4.5 months after injury before surgery; no outcome data for residual symptoms or patient satisfaction
Lind & Hansen[31]	40	44.2	60	40	16.22	0.08	44.3 - 75.7	Average of 5 months' duration of mallet finger before operation; average splintage time was 5.4 weeks
Grundberg & Reagan[32]	20	37.0	60 est	40 est	8.11	0.11	38.4 - 81.6	Surgery performed to correct deformity after failed splint treatment for 2 months; 3 patients excluded because of open injuries
Kon & Bloem[33]	27	NA	96	4	17.51	0.04	88.2 - 103.8	
Iselin et al[34]	26	NA	50	50	8.78	0.10	30.4 - 69.6	
Total	148				73.56 73.6%	0.07	59.8 - 87.3	

Est - estimated, NA - information not available.

are displayed in Table 2. Twenty studies were included representing 1146 pooled digits. It can be seen that an overall weighted average of successful outcomes (as previously defined in terms of extension, flexion, and symptoms) occurred in 77.4 percent of patients with an average weighted standard error of 0.05. There were 6 studies of initial conservative treatment with physician-evaluated outcomes at least 2 years after injury. Table 4 summarizes these outcomes (77.5 percent overall success).

Table 4. Results for Initial Conservative Treatment: Objective Outcomes Criteria Based on Follow Up at Least 2 Years.

Study	Digits No.	Success %	Success Weighted Average	Standard Error
Shankar & Goring[14]	100	85	17.71	0.04
Hovgaard & Klareskov[21]	25	96	5.00	0.04
DiPaola[15]	38	82	6.49	0.06
Moss & Steingold[16]	100	85	17.71	0.04
Abouna & Brown[3]	110	85	19.48	0.03
Hallberg & Lindholm[28]	107	50	11.15	0.05
Total	480		77.54 77.5%	0.04

Table 5 displays the overall assessments by patients in terms of patient satisfaction, with 83.4 percent (315 patients) being satisfied with their outcomes of conservative treatment. Outcomes for surgical treatment are shown in Table 2 for initial treatment of fresh mallet finger injuries and in Table 3 for secondary treatment of chronic or recurrent mallet finger. Successful outcomes were achieved in 85.0 percent and 73.6 percent of these groups, respectively, representing small studies pooling to 60 and 148 digits in each group.

All of these results are displayed in Table 6 comparing conservative with surgical treatment for fresh mallet finger in terms of successful outcomes with 95 percent confidence intervals. Successful outcomes for conservative treatment were quite similar to those for surgery. Within the conservative treatment group, successful outcomes for more than 77 percent of patients were consistently realized in all stratified subgroups, and overall patient satisfaction averaged 83.4 percent for the 315 patients for whom such information was recorded.

Sensitivity analyses for extensor lags of 10 degrees and 30 degrees are shown in Table 7. Successful outcomes were achieved for conservative treatment in 53.6 percent and 89.5 percent of cases at 10 degrees and 30 degrees, respectively. Successful outcomes at 10 degrees and 30 degrees were realized in 67.5 percent and 82.7 percent of patients

Table 5. Results for Initial Conservative Treatment: Overall Patient Satisfaction.

Study	Digits No.	Success %	Success Weighted Average	Standard Error
Okafor et al[13]	31	87	8.56	0.06
Warren et al[20]	107	71	24.12	0.04
Hovgaard & Klareskov[21]	25	80	6.35	0.08
DiPaola[15]	38	100	12.06	—
Niechajev[24]	92	90	26.29	0.03
Auchincloss[26]	22	86	6.01	0.07
Total	315		83.39 83.4%	0.06

in the initial surgery group and 61.6 percent and 75.3 percent of patients receiving surgical treatment of chronic or recurrent mallet finger.

Discussion

The results of this pooled quantitative literature evaluation support the notion that the initial treatment of closed mallet finger injuries should be conservative. This conclusion is strengthened by the overlapping confidence intervals of treatment outcomes in the conservative and surgical groups as well as the results of sensitivity analyses. This study showed that 83.4 percent of 315 patients were satisfied with the results of initial conservative treatment. The sensitivity analysis for 30 degrees of extensor lag revealed that successful outcomes of conservative treatment were achieved in 89.5 percent of patients. Taken together with the observation by other clinicians previously that patients tolerate mild residual deformities without complaint unless fingers are stiff or painful,[11-15] the case appears solid that initial conservative treatment should be widely adopted. The cost implications of this approach are obvious. Conservative treatment generally involves only a few office visits, a single radiograph, and inexpensive splint materials, whereas surgical treatment requires the facility and professional costs of surgery and anesthesia as well as additional related costs of follow-up.

Although there remains considerable debate as to specific techniques of both conservative and surgical treatment of mallet finger injuries, there appears to be a growing consensus in the published literature that conservative treatment should be the initial approach for fresh mallet finger. This literature review found a 1991 article by Damron and colleagues[49] at the University of Wisconsin, where they have developed considerable experience with the treatment of mallet finger injuries. Based on their experience, they have proposed a treatment algorithm that limits initial surgical intervention to a small number of complex injuries which fail closed reduction, as well as for failed conservative treatment only after a full 6 months of observation after injury. The extent to which this apparent consensus in the literature represents practice patterns of orthopedic and hand surgeons is unknown, however. In a single case in which the first author was involved about 2 years ago, the community-based orthopedic surgeon saw no role for initial conservative treatment, proceeding directly to a surgical approach with the patient's concurrence.

As is the case with multiple surgical procedures for mallet finger injuries, many types of splints have been recommended for conservative treatment, including taping,[50] Stack splint,[11,20] padded aluminum malleable splint,[11] Piplex splint,[19] elastic double finger bandage,[21] perforated plastic splint,[23] molded polythene splint[25] and Abouna splint.[20,51] Regardless of the type of splint used, there is general agreement that careful attention needs to be paid to details of treatment, particularly to avoid complications and loss of position during splint changes and cleaning. Based on the recommendations of authors reported here who have extensive experience with conservative treatment of mallet finger injuries, the following principles stand out:

Table 6. Results of Initial Treatment: Overall Confidence Intervals.

Treatment	Pooled Number	Success Weighted Average	Standard Error Weighted Average	95 Percent Confidence Interval Range
Conservative				
Single RCT	22	86.0	0.08	70.3 - 101.7
Clinical series	961	79.2	0.05	69.4 - 89.0
All studies	983	77.4	0.05	67.6 - 87.2
Long-term follow-up	480	77.5	0.04	69.7 - 85.3
Patient satisfaction	315	83.4	0.05	73.6 - 93.2
Surgical				
Single RCT	19	95.0	0.05	85.2 - 104.8
Clinical series	41	80.3	0.09	62.7 - 97.9
All studies	60	85.0	0.07	71.3 - 98.7

RCT - Randomized controlled trial.

Table 7. Sensitivity Analyses for Varied Extensor Lags.

Treatment	Digits No.	Percent Success 20°	Success Weighted Average	Percent Success 10°	Success Weighted Average	Percent Success 30°	Success Weighted Average
Conservative							
Okafor et al[13]	31	77	2.43	65	3.62	77	8.53
Garberman et al[17]	40	80	3.26	80	5.76	NA	NA
Groth et al[18]	44	64	2.86	64	5.06	NA	NA
Maitra & Dorani[11]	60	55	3.36	NA	NA	NA	NA
Shankar & Goring[14]	100	85	8.65	NA	NA	NA	NA
Evans & Weightman[19]	25	84	2.14	60	2.70	92	8.21
Warren et al[20]	107	52	5.66	NA	NA	NA	NA
Hovgaard & Klareskov[21]	25	100	2.54	96	4.32	100	8.93
Clement & Wray[22]	23	52	1.22	52	2.15	52	4.27
DiPaola[15]	38	82	3.17	NA	NA	NA	NA
Kinninmonth & Holburn[23]	37	90	3.39	NA	NA	NA	NA
Niechajev[24]	92	93	8.70	82	13.57	NA	NA
Crawford[25]	61	95	5.90	80	8.78	95	20.7
Moss & Steingold[16]	100	NA	NA	46	8.27	NA	NA
Auchincloss[26]	22	86	1.92	59	2.33	95	7.46
Mikic & Helal[27]	30	100	3.05	80	4.32	100	10.71
Abouna & Brown[3]	100	86	8.75	NA	NA	NA	NA
Stark et al[12]	63	NA	NA	41	4.65	92	20.70
Hallberg & Lindholm[28]	79	53	4.26	NA	NA	NA	NA
Robb[29]	69	88	6.18	NA	NA	NA	NA
Success weighted averages (Pooled number of digits)		77.4 (983)		53.6 (556)		89.5 (280)	
Initial surgical							
Nakamura & Nanjyo[7]	15	60	15.00	53	23.38	67	29.56
Niechajev[24]	26	92	39.87	NA	NA	NA	
Auchincloss[26]	19	95	30.08	79	44.15	95	53.09
Success weighted averages (Pooled number of digits)		85 (60)		67.5 (34)		82.7 (34)	
Chronic or recurrent surgery							
Houpt et al[30]	35	97	22.94	74	31.98	100	43.21
Lind & Hansen[31]	40	60	16.22	NA	NA	NA	NA
Grundberg & Reagan[32]	20	60	8.11	55	13.58	65	16.05
Kon & Bloem[33]	27	96	17.51	NA	NA	NA	NA
Iselin et al[34]		50	8.78	50	16.05	50	16.05
Success weighted averages (Pooled number of digits)		73.6 (148)		61.6 (81)		75.3 (81)	

NA - not available because these outcomes were not specifically recorded.

1. The involved finger should be splinted in slight hyperextension of the distal interphalangeal joint and moderate flexion of the proximal interphalangeal joint.

2. Patients should be shown how to change the splint carefully, with assistance as necessary, for periodic cleaning without allowing *any* flexion of the distal interphalangeal joint.

3. Continuous immobilization should be maintained for at least 6 weeks (some suggest 8 weeks), followed by an additional 2 weeks at night.

Conclusions

Based upon this pooled quantitative literature evaluation, the following conclusions can be drawn: (1) conservative treatment by external splintage is the treatment of choice and is effective for most cases of closed mallet finger injuries, including those with associated mallet fractures involving up to one third of the articular surface; (2) residual extensor lags up to 20 degrees or even 30 degrees, if present after conservative treatment, are quite acceptable to patients without noticeable symptoms

or disability; (3) careful attention to detail and appropriate patient education are required to maximize the outcomes of conservative treatment of mallet finger injuries; and (4) various surgical techniques are available and are indicated for a limited number of complex mallet finger injuries as well as for chronic or recurrent mallet finger.

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