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Different Modalities in Management of Mallet Finger

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Abstract

The term mallet finger refers to a common injury of the terminal extensor mechanism resulting in loss of active extension at the level of the distal interphalangeal joint. Nonoperative management has been suggested as first-line treatment option for almost all mallet finger injuries. In the case of mallet finger associated with an underlying distal phalanx fracture, surgery is recommended if the fracture involves more than 30% of the articular surface or if there is palmar subluxation of the distal phalanx.To evaluate the different modalities used in management of mallet finger.We performed this systematic review and meta-analysis in accordance to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and Meta-analysis Of Observational Studies in Epidemiology (MOOSE) statement. PRISMA and MOOSE are reporting checklists for Authors, Editors, and Reviewers of Meta-analyses of interventional and observational studies.We searched Medline via PubMed, SCOPUS, Web of Science, Cochrane Central Register of Controlled Trials (CENTRAL), and Google Scholar from their inception till August 2019. The search retrieved 1192 unique records. We then retained 246 potentially eligible records for full-texts screening. Finally, 44 studies (No. of patients =1609 patients) were included**.**The objective of this study was to determine if any conclusions can be drawn concerning the indications for surgery in mallet finger injuries; the treatment outcomes of surgical and nonsurgical management; and the most common treatment complications of mallet finger injuries.

Keywords: Mallet finger, Distal interphalangeal joint, DIPJ.

1.Introduction

Hammer finger Previously, Grown-ups is a traumatic lese greatness of the terminal extensor band On zone 1, Also is portrayed by soundness skin What's more division of the tendon insertion alone (tendinous mallet) alternately a separation about short of what you quit offering on that one third of the articular surface of the distal phalanx (bony mallet)[1]. The analysis from claiming hammer finger may be basically clinical. Those patient's later historical backdrop generally incorporates the inclined system about damage. Those tolerant regularly displays in a crisis setting alternately looks mind after Now and again a few weeks following those damage. The tolerant as a rule complains from claiming ache Furthermore of continuously unabated will perform full dynamic development of the DIPJ. Upon examination, a passively reducible hammer deformity, swelling, or ecchymosis of the dorsal angle of the DIPJ may be found [2]. This harm is usually seen over ball sports for example, such that baseball What's more football. The tolerant may be unabated with actively augment those digit In those distal interphalangeal joint (DIP joint) Also there might a chance to be a observable hang In those dip joint [3]. Hammer finger stays An clinical finding that obliges An nitty gritty history taking connected with An careful physical examination of the hand. Imaging investigations require to make incorporated inside the diagnosis, as it is significant with avoid whatever connected hard wounds and also disfigurement starting with osteoarthritis or rheumatoid joint inflammation. A AP and parallel see x-beams focused In the DIPJ of the influenced finger would obliged these x-beams need aid used to separate the middle of An hard damage What's more An tendinous hammer damage. Parallel radiographs uncover those vicinity about volar subluxation of the distal phalanx [4]. Those grade objective On the whole routines of medicine is rebuilding of the coherence from claiming harmed tendon for most extreme recuperation from claiming work. In spite of the fact that Different medication conventions bring been proposed, splinting of the distal inter-phalangeal joint in development for 6 should 8 weeks need been the gold standard with negligible horribleness in the greater part of patients for shut hammer harm. This camwood a chance to be attained Eventually Tom's perusing thermoplastic stack (mallet) splints or plaster throws splints. For this span of immobilization tolerant agreeability stays a critical Conclusion component. It need as of late been demonstrated that delay for initiating medicine didn't influence fundamentally those dip joint development alternately development slack [5]. There are an assortment from claiming agent fixation strategies depicted. Shut decrease camwood make performed Eventually Tom's perusing making a development square Toward pinning those part with two Kirschner wires [6] On those harm may be reducible by shut means, pinning of the DIPJ in development ought further bolstering a chance to be endeavored Likewise this will be a simple, cost-effective, Also lesquerella dismal system relative will open medication. Various variants from claiming percutaneous pinning need been described, including the prevalent development piece pinning for huge hard mallets or basic retrograde pinning for tendinous alternately little hard mallets [7]. Open diminishment Furthermore inner fixation Might make performed utilizing Kirschner wiring, little screws, snare plate, pull-through wires or sutures, figure from claiming eight wiring alternately bio-degradable screws [8]. A late ponder depicted the utilization about open diminishment Furthermore snare plate obsession. The justification might have

been In view of the hypothetical points of interest of upkeep of anatolian dialect reduction, inflexible fixation, and early movement. In examination should percutaneous development square pinning, no noteworthy contrasts Previously, post-agent torment alternately extensor slack were noted, Be that snare plate obsession might have been that's only the tip of the iceberg unreasonable Also obliged All the more delicate tissue analyzation [9]. Hammer fingers introducing a couple months then afterward damage would viewed as unending. Medication choices need aid guided To a limited extent Toward the adaptability of the hammer or those swan-neck disfigurement Furthermore To some degree Toward those patient's foreseen agreeability Also exercises. The accessible choices incorporate prolonged development splinting, tenodermodesis, focal slip tenotomy, alternately winding angled retinacular ligament (SORL) reproduction [10].

2.Materials and methods

The present review included studies that fulfilled the following criteria: - Studies that included adults patients (aged ≥ 18years old) with Mallet Finger who were scheduled to undergo different modalities of treatment; -Studies that assessed the safety and effectiveness of different modalities for treatment of Mallet Finger - Studies that compared these modalities with conventional treatment -Studies that reported any of the following outcomes: Crawford Criteria (1984) Table (1) , Abouna and Brown Criteria (1968) Table (2) ,Visual Analogue scale ,Satisfaction rates and Complications and reinterventions. - Studies that were prospective or retrospective or nonrandomized or randomized controlled trials. An electronic search was conducted from the inception till August 2019 in the following bibliographic databases: Medline via PubMed, SCOPUS, Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science to identify relevant articles. We used different combinations of the following queries: ("mallet finger" AND "management").

Table (1) Crawford criteria (1984) Assessment of Mallet finger outcomes

Excellent	Characteristics of DIP Joint
Grande	Full extension
	Full flexion
	No pain
Good	Extension deficit 0^o to 10^o
	Full flexion
	No pain
Fair	Extension deficit 10^o to 25^o
	Any flexion loss
	No pain
Poor	Extension deficit > 25^o
	Persistent pain

Table (2) Abouna and Brown Criteria (1968)

Grade	Characteristics of DIP Joint
Success	Extension deficit > 5^o
	Normal flexion
	No stiffness
Improved	Extension deficit 6^o to 15^o
	Normal flexion
	No stiffness
Failure	Extension deficit >15^o
	Any flexion loss
	DIP stiffness

Screening: Retrieved citations were imported into EndNote X7 for duplicates removal. Subsequently, unique citations were imported into an Excel sheet and screened; the screening was conducted in two steps: title and abstract screening, followed by a full-texts screening of potentially eligible records.

Data Extraction: Data entry and processing were carried out using a standardized Excel sheet and reviewers extracted the data from the included studies. The extracted data included the following domains: -

Summary characteristics of the included studies; - Baseline characteristics of studied populations; and - Study outcomes.

Direct Analysis: Continuous outcomes were pooled as mean difference (MD) or standardized mean difference (SMD) using inverse variance method, and dichotomous outcomes will be pooled as relative risk (RR) using Mantel-Haenszel method. The random-effects method was used under the assumption of existing significant clinical and methodological

heterogeneity. We performed all statistical analyses using Review Manager (RevMan) 5.3 or Open Meta-analyst for windows.

Assessment of Heterogeneity: We assessed heterogeneity by visual inspection of the forest plots, chi-square, and I-square tests. According to the recommendations of Cochrane Handbook of Systematic Reviews and meta-analysis, chi-square p-value less than 0.1 denote significant heterogeneity while I-square values show no important heterogeneity between 0% and 40%, moderate heterogeneity from 30% to 60%, substantial heterogeneity from 50% to 100%. If any trials were judged to affect the homogeneity of the pooled estimates, we planned to perform a sensitivity analysis to assess outcomes with and without the trials that were affecting the homogeneity of the effect estimates.

Assessment of publication biases: We intended to test for publication bias using funnel plots if any of the pooled analysis included more than 10 studies in the review .

3.Results

Non-Surgical Management : Five studies reported the rates of excellent Crawford Criteria. The overall effect estimates showed that the rates of excellent Crawford Criteria after conservative management was 74.6% (95% CI 64 – 85.3%). The pooled studies showed significant heterogeneity (p <0.001; I2 =81% Fig (1).

Five studies reported the rates of goodCrawford Criteria. The overall effect estimates showed that the rates of good Crawford Criteria after conservative management was 23.5% (95% CI 11.2 – 35.7%). The pooled studies showed significant heterogeneity (p <0.001; I2 =87%; Fig (2).

Five studies reported the rates of fair Crawford Criteria. The overall effect estimates showed that the rates of fair Crawford Criteria after conservative management was 11.8% (95% CI 6.9 – 16.7%). The pooled studies showed no significant heterogeneity (=0.18; I2 =42%; Fig (3).

Five studies reported the rates of poor Crawford Criteria. The overall effect estimates showed that the rates of poor Crawford Criteria after conservative management was 3.5% (95% CI 8 – 6.2%). The pooled studies showed no significant heterogeneity (p =0.135; I2 =43%; Fig (4).

six studies reported the success rate according to Abouna and Brown Criteria. The overall effect estimates showed that the success rate after conservative management was 63.4% (95% CI 39 – 87.9%). The pooled studies showed significant heterogeneity (p <0.001; I2 =96%; Fig (5).

Four studies reported the improvement rate according to Abouna and Brown Criteria. The overall effect estimates showed that the improvement rates after conservative management was 22.9% (95% CI 16.3 – 29.6%). The pooled studies showed no significant heterogeneity (p =0.23; I2 =29%; Fig (6).

Five studies reported the failure rate according to Abouna and Brown Criteria. The overall effect estimates showed that failure rate after conservative management was 20.4% (95% CI 7 – 33.9%). The pooled studies showed significant heterogeneity (p <0.001; I2 =93%; Fig (7).

Twelve studies reported the rates of DIP Joint Extension Deficit > 10. The overall effect estimates showed that the rate of DIP Joint Extension Deficit > 10 was 7% (95% CI 5.1 – 8.9%). The pooled studies showed no significant heterogeneity (p =0.56; I2 =0%; Fig (8).

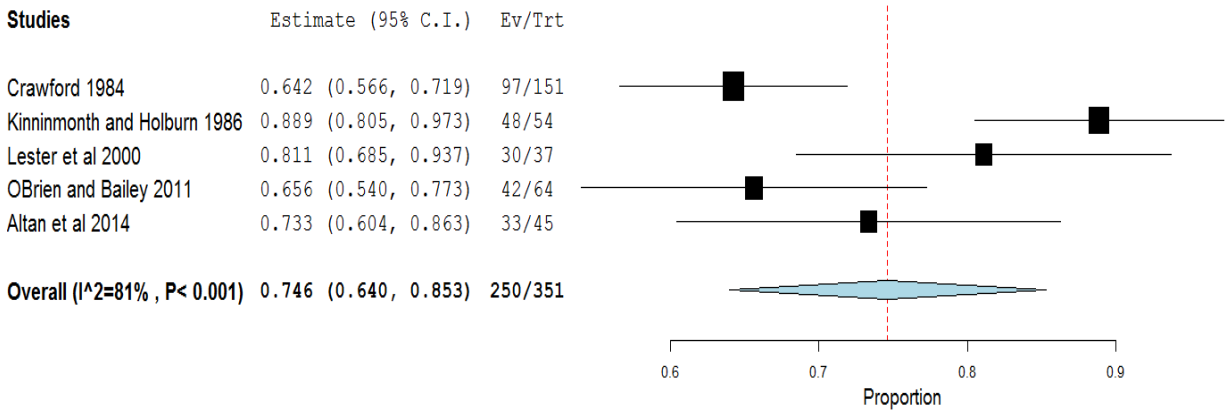

Fig (1) Forest Plot of rates of excellent Crawford Criteria

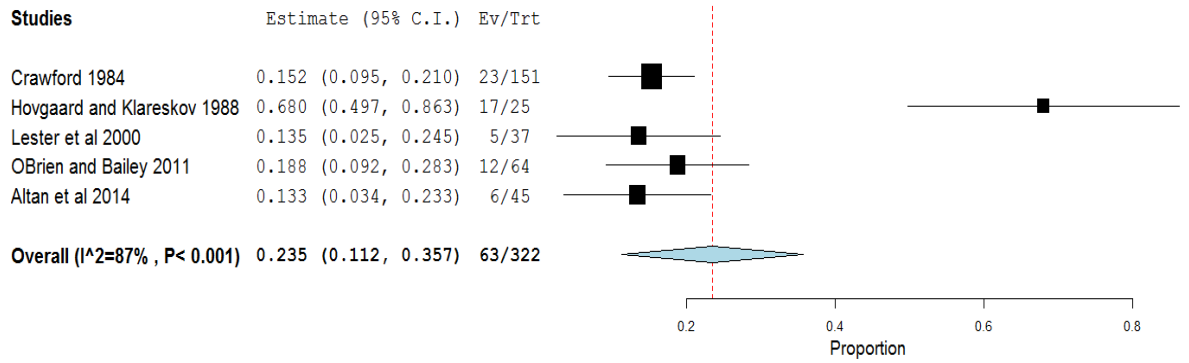

Fig (2) Forest Plot of rates of good Crawford Criteria

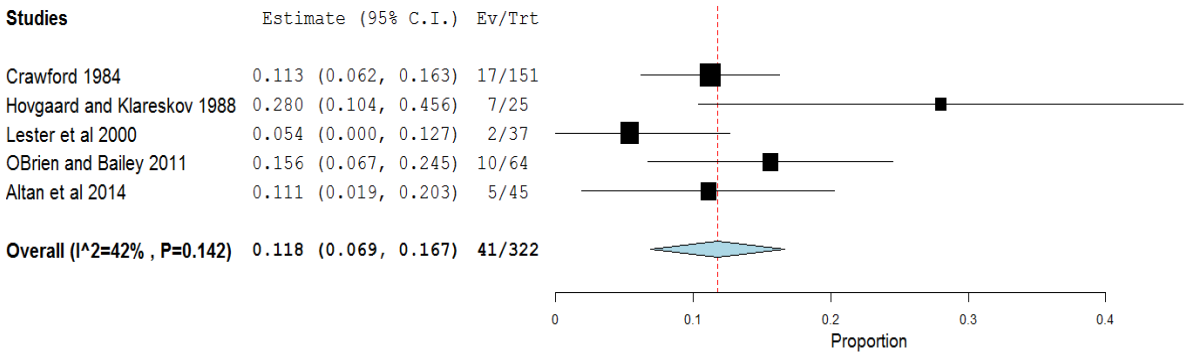

Fig (3) Forest Plot of rates of fair Crawford Criteria

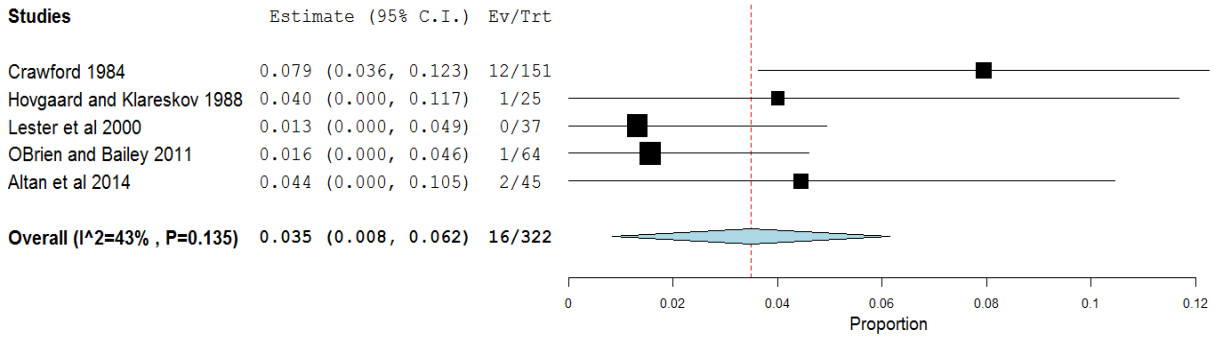

Fig (4) Forest Plot of rates of poor Crawford Criteria

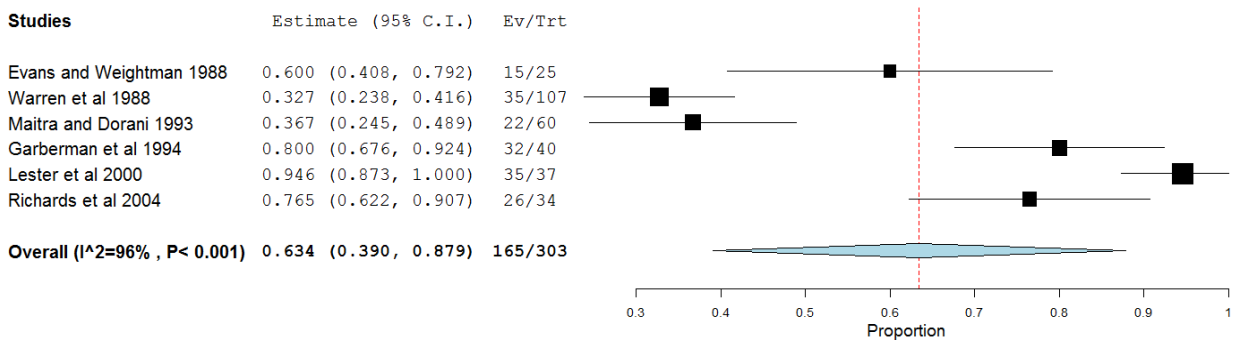

Fig (5) Forest Plot of rates of success rate according to Abouna and Brown Criteria

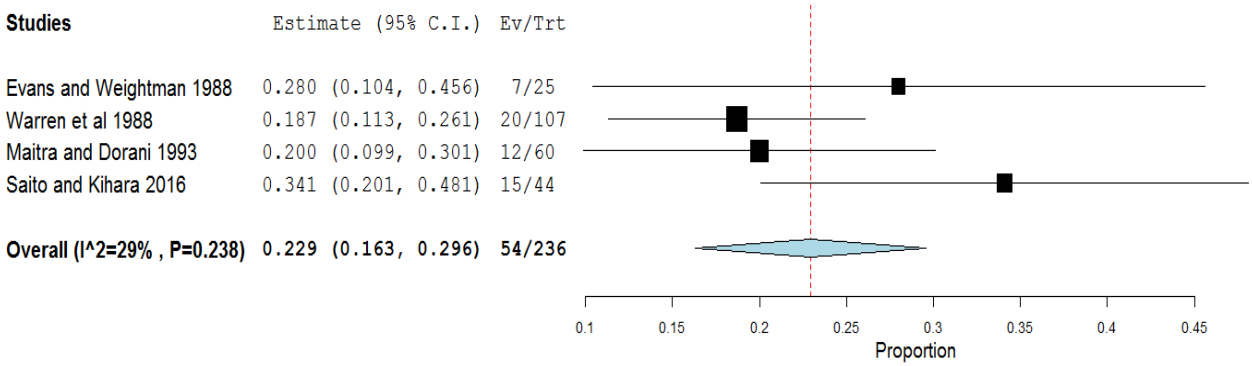

Fig (6) Forest Plot of improvement rate according to Abouna and Brown Criteria

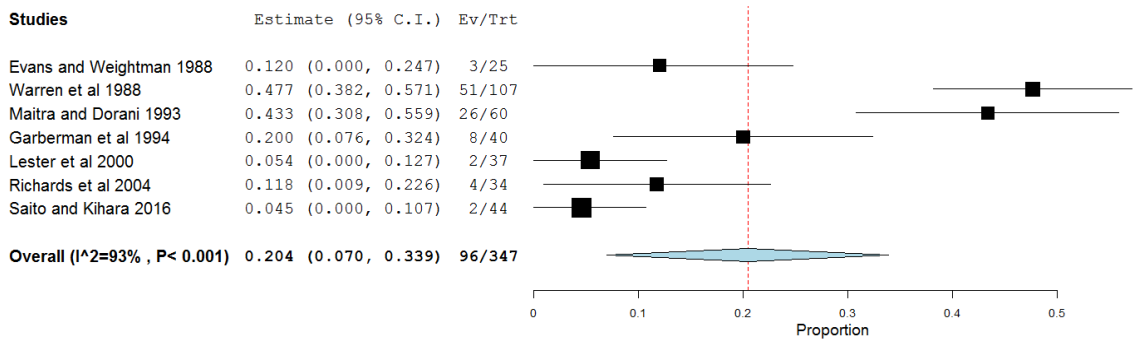

Fig (7) Forest Plot of rates of failure rate according to Abouna and Brown Criteria

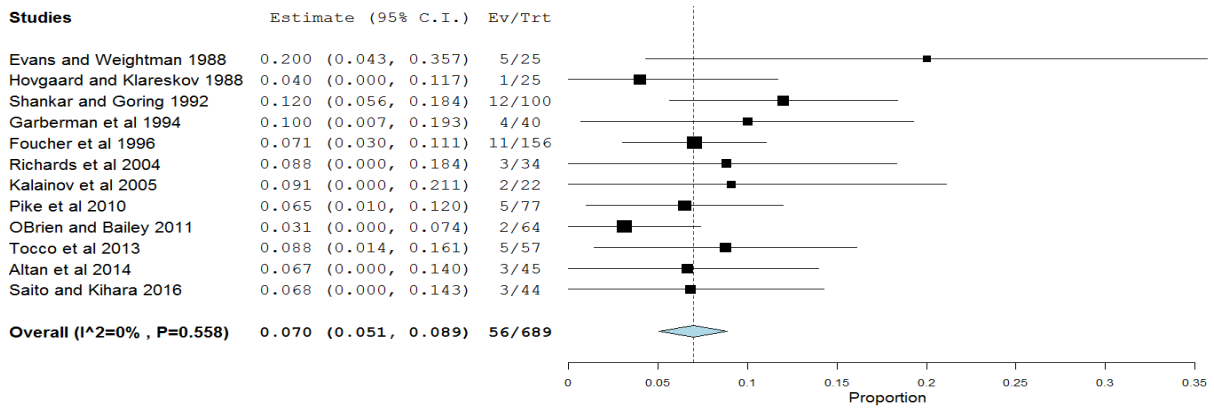

Fig (8) Forest Plot of rates of DIP Joint Extension Deficit > 10

Surgical Management: Sixteen studies reported the rates of excellent Crawford Criteria. The overall effect estimates showed that the rates of excellent Crawford Criteria after surgical management was 61.4% (95% CI 52 – 71%). The pooled studies showed significant heterogeneity (p <0.001; I2 =79%; Fig (9).

Sixteen studies reported the rates of goodCrawford Criteria. The overall effect estimates showed that the rates of good Crawford Criteria after surgical management was 27% (95% CI 19.1 – 34.8%). The pooled studies showed significant heterogeneity (p <0.001; I2 =75%; Fig (10).

Twelve studies reported the rates of fair Crawford Criteria. The overall effect estimates showed that the rates of fair Crawford Criteria after surgical management was 18.7% (95% CI 9.3 – 28.1%). The pooled studies showed significant heterogeneity (P <0.001; I2 =90%; Fig (11).

Three studies reported the rates of poor Crawford Criteria. The overall effect estimates showed that the rates of poor Crawford Criteria after surgical management was 3.5% (95% CI 0 – 6.1%). The pooled studies showed no significant heterogeneity (p =0.84; I2 =0%; Fig (12).

Thirteen studies reported the rates of DIP Joint Extension Deficit > 10. The overall effect estimates showed that the rate of DIP Joint Extension Deficit > 10 was 4.9% (95% CI 2.5 – 7.3%). The pooled studies showed no significant heterogeneity (p =0.89; I2 =0%; Fig (13).

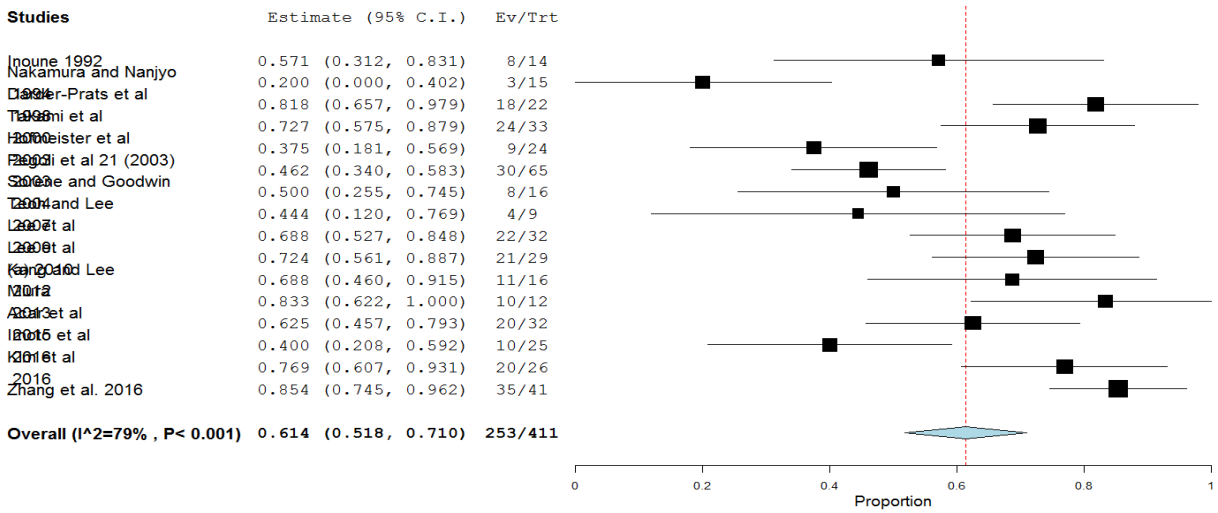

Fig (9) Forest Plot of rates of excellent Crawford Criteria

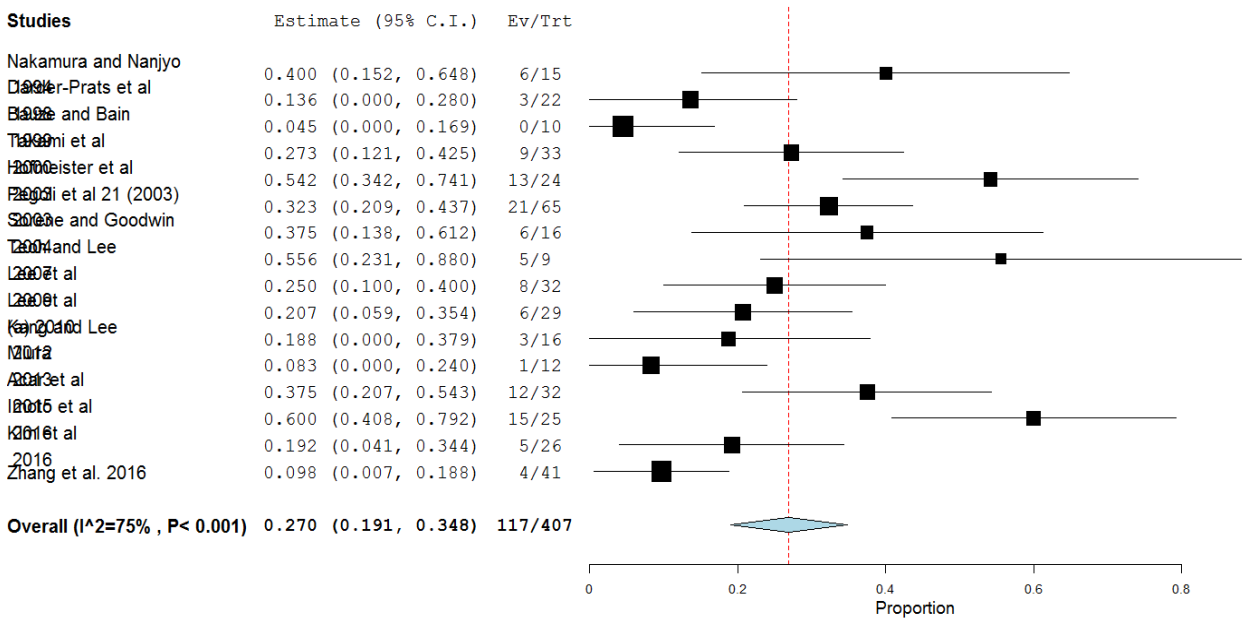

Fig (10) Forest Plot of rates of good Crawford Criteria

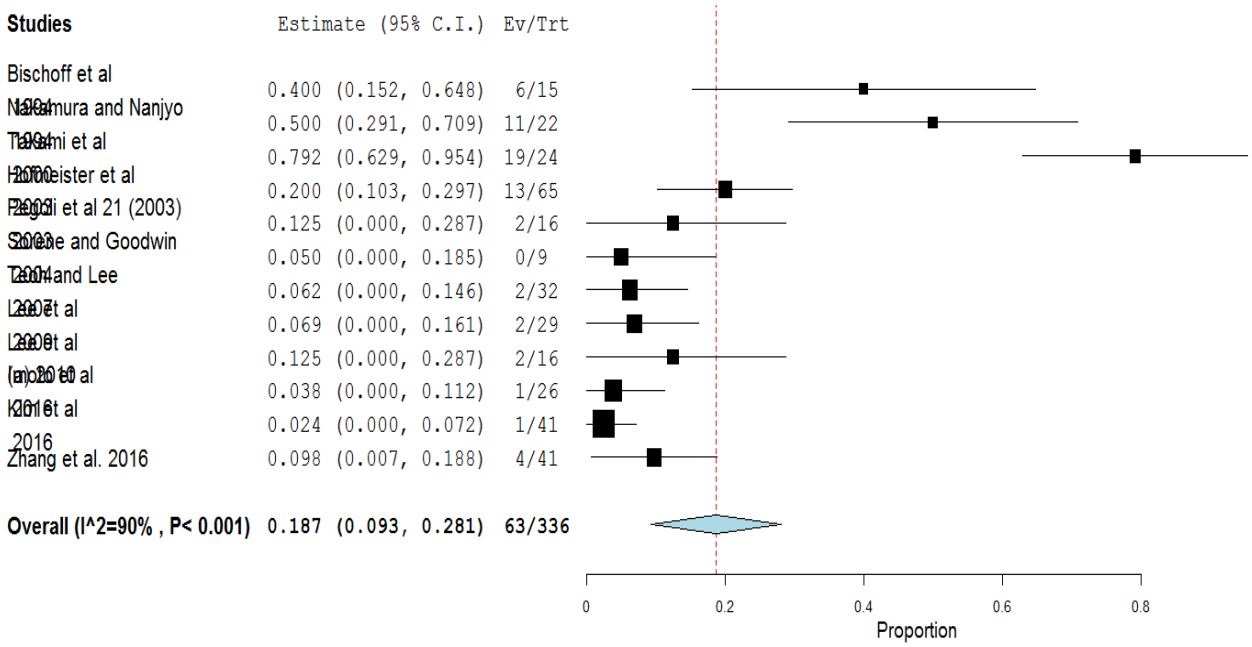

Fig (11) Forest Plot of rates of fair Crawford Criteria

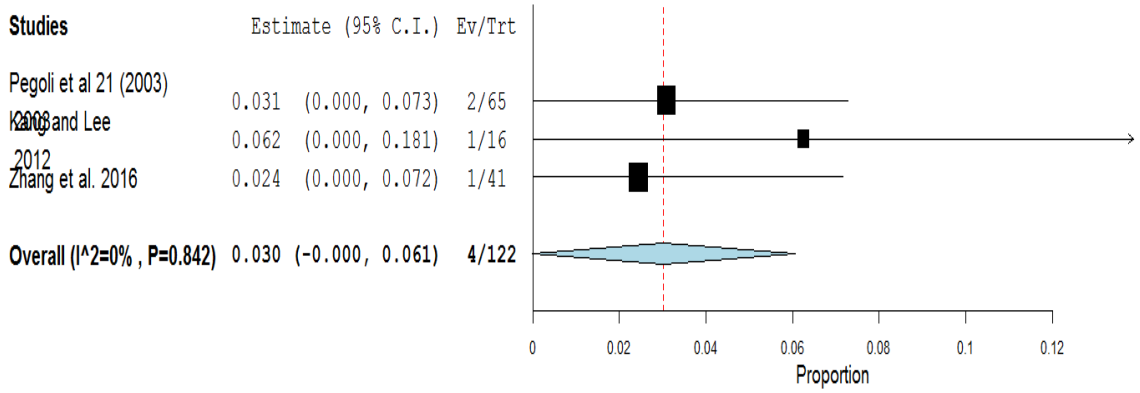

Fig (12) Forest Plot of rates of poor Crawford Criteria

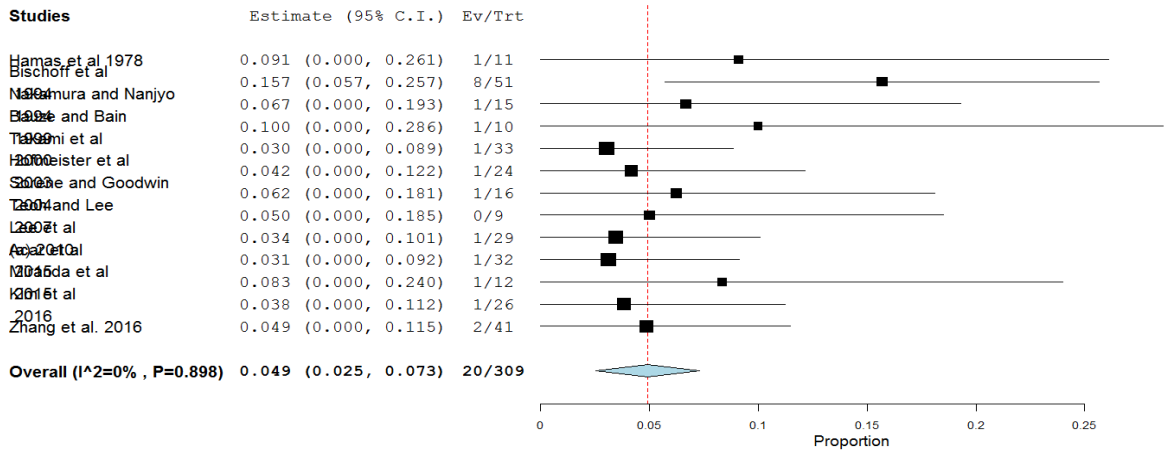

Fig (13) Forest Plot of rates of DIP Joint Extension Deficit > 10

4.Discussion

Those haul hammer finger alludes will a normal damage of the terminal extensor system bringing about passing about animated development In the level of the distal interphalangeal joint. Habitually encountered in sports, those harm outcomes Emulating compelling flexion or hyperextension of an broadened distal phalanx, making extensor tendon disruption, whichever disconnected or to consolidation for An distal phalanx separation crack. Those coming about disfigurement may be a development slack during those distal interphalangeal joint. Whether left untreated, An hammer finger might be muddled by advancement from claiming osteoarthritis In those distal interphalangeal joint or potentially hyperextension (swan-neck) disfigurement toward the level of the proximal interphalangeal joint Likewise an aftereffect for proximal withdrawal of the national slip [11]. Nonoperative management need been recommended Similarly as first-line medicine choice to Just about the greater part hammer finger damages. It is right now acknowledged those standard of administer to at damages for no cohorted fracture, no volar subluxation of the distal phalanx, or instances for contribution from claiming less one-third of the articular surface. Medicine includes finish

immobilization of the included joint in full development alternately slight overextension for in any event 6 weeks, trailed Toward 2 weeks about evening splinting [12]. On account of hammer finger connected with an underlying distal phalanx fracture, surgery will be recommended On the crack includes more than 30% of the articular surface alternately whether there may be palmar subluxation of the distal phalanx. Choices to surgical oversaw economy incorporate whichever shut decrease with percutaneous pinning alternately open diminishment What's more fixation [13]. Preservationist medicines shift viewing the immobilization position, sort about splint, and medicine duration [14]. In the introduce precise Audit What's more meta-analysis, what added up to 1,098 hammer fingers in 17 investigations were figured out how nonsurgically. Seven hundred Furthermore twenty cases were delicate tissue-only wounds. Everything except a standout amongst these investigations assessed exactly structure of splinting. [15] in regards to those viability for preservationist management to hammer finger, we found that the general triumph rate following preservationist administration might have been 63. 4% (95% ci 39 – 87. 9%); same time the change rates then afterward preservationist oversaw economy might have been 22. 9% (95% ci 16. 3 – 29. 6%). The generally impact estimates demonstrated that disappointment rate then afterward preservationist oversaw economy might have been 20. 4% (95% ci 7 – 33. 9%). The generally impact estimates indicated that the rate about dip joint development deficiency > 10 might have been 7% (95% ci 5. 1 – 8. 9%). Likewise, richards What's more colleagues [16] performed An prospective contemplate evaluated those effects of a uniquely designed thermoplastic support to medication from claiming hammer finger disfigurement. Starting with april 1999 should april 2000, 42 patients for hammer finger disfigurement were recruited. The general prosperity rate then afterward preservationist management might have been 88%. A hammer finger medicine result appraisal arrangement might have been recommended Toward crawford. It will be those The majority regularly utilized arrangement to result evaluation then afterward hammer finger. An phenomenal result is no torment for full extent about movement In those dip joint, short of what 10-degree development deficiency is a great outcome, 10–25 degrees for development deficiency with no ache may be a reasonable outcome, and more than 25 degrees about development deficiency or constant agony will be recognized a poor outcome [17]. In the display precise Audit What's more meta-analysis, the Generally speaking impact estimates demonstrated that the rates from claiming phenomenal crawford Criteria following preservationist administration might have been 74. 6% (95% ci 64 – 85. 3%); same time the rates from claiming useful crawford Criteria following preservationist administration might have been 23. 5% (95% ci 11. 2 – 35. 7%).

Surgery will be questionable over shut intense hammer finger However may be shown altogether open wounds Furthermore in wounds for an extensive hard hammer part for subluxation of the dip joint. Fractures directing, including 30–50 % of the joint surface bring been depicted Similarly as flimsy and oblige surgery. Surgery is Additionally shown in patients with bigotry should splints [18]. In the exhibit deliberate survey Furthermore meta-analysis, the the vast majority every now and again portrayed surgical signs were measure from claiming crack (more over one-third for articular surface involvement) Also subluxation of the distal phalanx. Cosmea motivations Furthermore patients requiring fine manual ability were likewise cited Similarly as surgical indications, each showing up once Previously, these investigations. [19] meant will determine, through a written works review, On any conclusions camwood a chance to be drawn concerning the signs to surgery done hammer finger wounds. A precise survey of numerous databases might have been performed. 22 investigations assessing surgical medicines were incorporated. The practically as a relatable point surgical signs were extent of crack (more over one-third for articular surface involvement) Furthermore subluxation of the distal phalanx. As far as those results from claiming surgical treatment, the available meta-analysis demonstrated that the rates from claiming phenomenal crawford Criteria after surgical administration might have been 61. 4% (95% ci 52 – 71%); same time the rates about useful crawford Criteria after surgical management might have been 27%. The generally impact estimates indicated that those rate of dip joint development deficiency > 10 might have been 4. 9% (95% ci 2. 5 – 7. 3%).

5.Conclusion

Although the current literature describes multiple surgical and nonsurgical techniques for the management of mallet finger injuries, there is no consensus on the indications for surgical treatment. The objective of this study was to determine, through a literature review, if any conclusions can be drawn concerning the indications for surgery in mallet finger injuries; the treatment outcomes of surgical and nonsurgical management; and the most common treatment complications of mallet finger injuries.

5.1Financial support & sponsorship

None.

5.2Conflicts of interest

There are no conflicts of interest

References

[1] J L .Matzon, D J. Bozentka, Extensor tendon injuries. J Hand Surg Am;vol.35(5),pp.854–861,2010.

[2] K R. Hanz, M. Saint-Cyr, M J .Semmler, R J. Rohrich, Extensor tendon injuries: acute

management and secondary reconstruction. Plast Reconstr Surg;vol.121(3),pp.109e–120e,2008.
[3] M H .Gonzalez, R .Sohlberg, A .Brown, N.Weinzweig, The first dorsal extensor compartment: an anatomic study. J Hand Surg Am;vol.20(4),pp.657–660,1995.
[4] H P. von Schroeder, M J. Botte, Functional anatomy of the extensor tendons of the digits. Hand Clin;vol.13(1),pp.51–62,1997.
[5] H P .von Schroeder, M J. Botte, Anatomy and functional significance of the long extensors to the fingers and thumb. Clin Orthop Relat Res;vol.(383),pp.74–83 ,2001.
[6] J R. Doyle Philadelphia, PA: Elsevier Churchill Livingstone;. Extensors tendons-acute injuries;vol. 10(3) ,pp. 195–219,1999.
[7] G. Salva-Coll, M .Garcia-Elias, M M .Leon-Lopez, M .Llusa-Perez, A.Rodríguez-Baeza, Role of the extensor carpi ulnaris and its sheath on dynamic carpal stability. J Hand Surg Eur ; Vol. 37(6),pp.544–548,2012.
[8] C.Verdan, Syndrome of the quadriga. Surg Clin North Am;vol.40,pp.425–426,1960.
[9] T .Tanaka, P C. Amadio, C .Zhao, M E .Zobitz, K N. An, Effect of wrist and ulna head position on gliding resistance of the extensor digitorum minimi and extensor digitorum communis III tendons: a cadaver study. J Orthop Res;vol.24(4),pp.757–762,2006.
[10] K .Kutsumi, P C. Amadio, C .Zhao, M E. Zobitz, K N. An, Gliding resistance of the extensor pollicis brevis tendon and abductor pollicis longus tendon within the first dorsal compartment in fixed wrist positions. J Orthop Res;vol.23(2),pp.243–248,2005.
[11] LJ .O'Brien, MJ.Bailey ,Single blind, prospective, randomized controlled trial comparing Dorsal aluminum and custom thermoplastic splints to stack splint for acute mallet finger. Arch Phys Med Rehabil;vol.92(2),pp.191–8,2011.
[12] E .Altan, NB. Alp, R .Baser, L.Yalçin, Soft-tissue mallet injuries: A comparison of early and delayed treatment. J Hand Surg Am;vol.39(10),pp.1982–5,2014.
[13] SR .Alla, ND. Deal, IJ.Dempsey, Current concepts: Mallet finger. Hand;vol.9(2),pp.138–44,2014.
[14] JS. Lin, JB .Samora, Surgical and Nonsurgical Management of Mallet Finger: A Systematic Review. J Hand Surg Am;vol.43(2),pp.146–63.e2,2018.
[15] HH .Handoll, M V. Vaghela, Interventions for treating mallet finger injuries. Cochrane Database Syst Rev; vol.20(5),pp.1990–10 ,2004. [16] SD .Richards, G .Kumar, S .Booth, SZ. Naqui, SR. Murali, A model for the conservative management of mallet finger. J Hand Surg Am;vol.29 B(1),pp.61–3,2004.
[17] GP.Crawford, The molded polythene splint for mallet finger deformities. J Hand Surg Am;vol.9(2),pp.231–7,1984.
[18] SD. Richards, G .Kumar, S .Booth, SZ .Naqui, SR.Murali, A model for the conservative management of mallet finger. J Hand Surg Am;vol.29 B(1),pp.61–3,2004.
[19] GP. Crawford, The molded polythene splint for mallet finger deformities. J Hand Surg Am;vol.9(2),pp.231–7,1984.