Are We Over Treating Hand Fractures? Current Practice of Single Metacarpal Fractures

Plastic Surgery
2018, Vol. 26(3) 148-153
© 2018 The Author(s)
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/2292550318767926
journals.sagepub.com/home/psg

En avons-nous fini avec le traitement des fractures de la main? Les pratiques actuelles à l'égard des fractures fermées des métacarpiens

Helene Retrouvey, MDCM^{1,2} , Alexander Morzycki, MSc³,
Annie M. Q. Wang, BSc⁴, The Canadian Plastic Surgery Research Collaborative,
and Paul Binhammer, MSc, MD, FRCS(C)²

Abstract

Purpose: We conducted a national survey of Canadian plastic surgeons to assess if inconsistencies in management strategies exist for single metacarpal fractures. **Methods:** A cross-sectional study of Canadian plastic surgeons who perform hand surgeries was conducted. A 15-question survey was distributed to all members of the Canadian Society of Plastic Surgeons. Participants' demographics, practice settings, and current treatment strategies for patients presenting with single metacarpal fractures were evaluated. **Results:** A total of 113 Canadian plastic surgeons met inclusion criteria. The majority of respondents were male (76%), with 50% in practice for more than 15 years. Canadian surgeons used a wide variety of surgical techniques for the management of single metacarpal fractures, with close reduction (94%), Kirshner wires (94%), and splinting and immobilization (89%) being the most common. The majority of plastic surgeons stated that rotational deformity (81%) was the most important indication for surgery. Surgeons demonstrated a trend toward immobilization after splinting (48%), instead of early mobilization after splinting (21%). When results were stratified by years in practice, no differences in surgical and non-surgical management were found, although surgeons in practice for less than 15 years were more likely to suggest hand therapy. **Conclusion:** These findings demonstrate inconsistencies in management of single metacarpal fractures among Canadian plastic surgeons. Surprisingly, surgeons in the survey tended to favor immobilization, as oppose to the literature that favors mobilization. The study highlights the lack of clear guidelines dictating treatment, possibly leading to these inconsistencies.

Résumé

Objectif : Les auteurs ont réalisé un sondage national auprès des plasticiens canadiens afin d'évaluer s'il y a des incohérences dans les stratégies de prise en charge des fractures fermées des métacarpiens. **Méthodologie :** Les auteurs ont mené une étude transversale des plasticiens canadiens qui effectuent des interventions chirurgicales de la main. Ils ont distribué un sondage de 15 questions à tous les membres de la Société canadienne des chirurgiens plasticiens. Ils ont évalué les données démographiques, les lieux d'exercice et les stratégies de traitement actuelles des participants auprès des patients qui consultent à cause d'une fracture fermée des métacarpiens. **Résultats :** Au total, 113 plasticiens canadiens respectaient les critères d'inclusion. La majorité des répondants étaient de sexe masculin (76 %), et 50 % exerçaient depuis plus de 15 ans. Les chirurgiens canadiens utilisent un

¹ Division of Plastic and Reconstructive Surgery, Department of Surgery, University of Toronto, Toronto, Ontario, Canada

² Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada

³ Faculty of Medicine, Dalhousie University, Halifax, Nova Scotia, Canada

⁴ Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada

Corresponding Author:

Helene Retrouvey, Division of Plastic and Reconstructive Surgery, University of Toronto, 149 College Street, Suite 508, Toronto, Ontario, Canada M5T 1P5.
Email: helene.retrouvey@mail.utoronto.ca

vaste éventail de techniques chirurgicales pour prendre en charge les fractures fermées des métacarpiens. La réduction à peau fermée (94 %), les broches de Kirschner (94 %) et la pose d'attelles et l'immobilisation (89 %) sont les plus courantes. La majorité des plasticiens affirmaient qu'une déformation en rotation (81 %) était la principale indication d'opérer. Après la pose d'attelles, les chirurgiens avaient tendance à procéder à l'immobilisation (48 %) plutôt qu'à privilégier une mobilisation rapide (21 %). Lorsque les résultats étaient stratifiés par années de pratique, il n'y avait pas de différence entre la prise en charge chirurgicale et non chirurgicale, même si les chirurgiens en exercice depuis moins de 15 ans étaient plus susceptibles de proposer une thérapie de la main. **Conclusion :** Ces observations démontrent des incohérences dans la prise en charge des fractures fermées des métacarpiens chez les plasticiens canadiens. Fait surprenant, les chirurgiens du sondage tendaient à favoriser l'immobilisation, alors que les publications scientifiques préconisent la mobilisation. L'étude fait ressortir l'absence de lignes directrices claires en matière de traitement, qui est peut-être responsable de ces incohérences.

Keywords

survey, Canada, hand, metacarpal fracture, treatment

Introduction

Metacarpal fractures are common and account for 18% to 44% of all hand fractures.¹⁻⁴ These fractures can either be treated non-surgically with splint or cast immobilization or surgically through external or internal fixation.^{1,3-6} The goal of treatment is to achieve optimal hand function with acceptable fracture alignment, strong bony union, and unrestricted motion.^{3,4,7}

Despite the prevalence of metacarpal fractures, the evidence guiding the management of these fractures is limited and there is no consensus on the best practice management approach.⁸⁻¹¹ For non-operative management, studies report several different rehabilitation protocols with varying periods of immobilization.^{6,8,12-15} With respect to operative management, a number of surgical techniques exist to fixate the fracture site.^{4,5,16} The evidence suggests that surgical intervention usually provides the best outcomes for patients with multiple fractures, polytrauma, irreducible fractures, open fractures, intra-articular fractures, segmental bony loss, rotational deformity, unacceptable angulation, and/or shortening.^{1,3,5,7,12,17} The definitions of unacceptable angulation and shortening vary widely. Some authors report that the index and long fingers can tolerate up to 20° of angulation, whereas others state that only up to 5° are acceptable.³⁻⁵ Similar differences are reported for the ring and small fingers.³⁻⁵ For shortening, most agree that more than 5 mm is unacceptable, but some authors are more restrictive, accepting only up to 2 mm of shortening before proceeding to surgical intervention.^{3-5,12}

Despite many available management options, to-date there is a lack of consensus regarding the optimal management of metacarpal fractures, with no standardization of care. For these reasons, we conducted a survey of Canadian plastic surgeons through a national survey. The questionnaire was aimed at determining the current treatment approaches to patients presenting with single metacarpal fractures in Canada and to identify any inconsistencies in management strategies in the Canadian context.

Methods

To assess single metacarpal fracture management strategies utilized by Canadian plastic surgeons, we devised a 15-question survey based on a review of the literature. This study was

conducted by the Canadian Plastic Surgery Research Collaborative, a national trainee-led network dedicated to conducting high-quality multi-centered research in plastic and reconstructive surgery, and the survey was validated by members of the collaborative (including medical students, residents, and staff physicians) through 3 iterations of review. Apparent validity, content validity, construct validity, and face validity were evaluated at each stage of review.

The first section of the survey captured participant demographics and practice setting. The second section of the survey focused on the participants' current treatment strategies for patients presenting with single metacarpal fractures, including indications for surgery, treatment techniques, and the use of immobilization (Table 1). Question types included short answer, multiple-choice questions, and responses based on a 5-point Likert scale.

The survey was distributed by e-mail to practicing staff plastic surgeons. Consultant plastic surgeons who were active members of the Canadian Society of Plastic Surgeons (CSPS) met inclusion criteria. Exclusion criteria were members still in training, plastic surgeons no longer in practice, surgeons who do not treat hand injuries, and surgeons who have an exclusive pediatric practice. Recipients were invited to complete the questionnaire online using the survey tool SurveyMonkey (SurveyMonkey Inc, San Mateo, CA, 2017). One reminder e-mail was sent 1 week later. This cross-sectional study was approved by the ethics review board of the Sunnybrook Health Sciences Centre. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975.

After data collection, descriptive statistics were generated, with frequencies and percentage of responses calculated for each multiple-choice survey question. Non-parametric statistics, including median (M) and interquartile range (IQR), were used to describe all Likert-scale data. Statistical analyses were done in SPSS version 24.0.0 (IBM SPSS Statistics, Armonk, New York).

Survey results were then stratified by surgeons' years in practice (less than 15 years vs greater than 15 years). Fifteen years was selected to mark the midpoint in a surgeon's career.

Table 1. Survey Questions That Addressed the Participants' Current Treatment Strategies for Patients Presenting With Single Metacarpal Fractures.

Question
1. In your current practice, which techniques do you use to treat patients who present with single metacarpal fractures?
2. In your current practice, how often do patients with a single metacarpal fracture require closed reduction?
3. In your current practice, how often do patients with a single metacarpal fracture require surgical intervention?
4. What criteria do you use to determine which patients require surgical intervention?
5. Which criteria is most important in determining which patients require surgical intervention?
6. If you use shortening as a criterion for surgical management, how much shortening is acceptable?
7. In your current practice, how often do you use splinting with immobilization to treat patients with a single metacarpal fracture?
8. If you treat patients with splinting with immobilization, how long should patients be immobilized?
9. In your current practice, how often do you use splinting with immediate (early) mobilization to treat patients with a single metacarpal fracture?
10. In your current practice, how often do you suggest hand therapy as part of the treatment of patients with a single metacarpal fracture?

After stratification, Mann-Whitney Test was used to determine differences for continuous variables. Chi-square or Fisher exact test was used to determine differences between categorical variables. The free-text comments were reviewed by 2 members of the research team (H.R. and A.M.), and qualitative descriptive methodology was used to analyze and interpret responses.¹⁸

Using MatLab Version 2016b (Mathworks®, Natick, Massachusetts), postal codes provided by respondents were converted to geographic coordinates with the aid of Google Maps Application Programming Interface and plotted. All other graphics were developed using Prism Version 7.0c (GraphPad, San Diego, California), and Microsoft Excel Version 14.6.2 (Microsoft, Redmond, Washington).

Results

A total of 113 (113/413, 27%) Canadian plastic surgeons responded to the online survey. The demographics of the respondents are presented in Table 2. The majority of respondents were male (76%), and 50% had been in practice for more than 15 years. The geographic distribution of respondents is shown in Figure 1, which demonstrates a higher concentration of respondents from the province of Ontario. Almost half of the respondents (47%) dedicated 25% or less of their practice to the management of hand pathologies.

Canadian surgeons used a wide variety of surgical techniques for the management of single metacarpal fractures, including closed reduction (94%), Kirshner wires (94%), splinting and immobilization (89%), plate fixation (85%), lag

Table 2. Demographics of Respondents.^a

Characteristics	Frequency, n (%)
Years in practice	
More than 20 years	41 (36)
15-19 years	16 (14)
10-14 years	19 (17)
5-9 years	26 (23)
Less than 5 years	11 (10)
Gender	
Male	86 (76)
Female	25 (22)
Prefer not to share	2 (2)
Practice type ^b	
Medium or large community practice	41 (36)
Academic practice	38 (34)
Mixed private aesthetic and academic practice	34 (30)
Small community practice	6 (5)
Private aesthetic	1 (2)
Military practice	0 (0)
Other	1 (1)
Percentage of practice dedicated to hand surgery	
0%	0 (0)
1%-25%	53 (47)
26%-50%	37 (33)
51%-75%	17 (15)
76%-100%	6 (5)

^an = 113.

^bPercentages do not add up to a 100% as respondents were able to select multiple responses.

Figure 1. Geographic distribution of survey respondents.

screw fixation (78%), and splinting and early active range of motion (73%). Less commonly used strategies included intramedullary fixation (19%), trans-osseous wiring/tension banding (11%).

Although surgeons employed a wide range of criteria when warranting the need for surgical intervention (Figure 2), almost all surgeons (97%) considered rotation deformity to be an indication. Most (81%) considered rotation deformity to be the most important surgical indication. Other indications considered to be “the most” important include significant

Figure 2. Criteria used by surgeons when determining if a patient requires a surgical intervention for single metacarpal fractures.

intra-articular fracture (30%), shaft angulation (23%), shaft shortening (14%), open fracture (14%), segmental bone loss (14%), polytrauma with hand fractures (12%), neck angulation (9%), and displacement (3%). With regard to other indications, 64% used shortening as one of the criteria for surgery. Of those using shortening, 3 mm (24%), 4 mm (14%), and 5 mm (21%) were the most commonly employed thresholds for surgical management (Figure 3). Nineteen percent of surgeons selected “other” when asked how much shortening was acceptable, with themes including: “based on the fractured metacarpal” ($n = 6$), “based on the functional demands” ($n = 3$), “based on the general state of the patients” ($n = 3$), “presence of extensor lag” ($n = 3$), and “based on patient’s wishes” ($n = 2$).

With regard to non-surgical management of metacarpal fractures, splinting and immobilization was more commonly employed strategy for managing single metacarpal fractures ($M = 3$, IQR 3-4) than splinting with early mobilization ($M = 2$, IQR 2-3; Figure 4). Further, Canadian plastic surgeons demonstrated a trend toward immobilization after splinting (Figure 4): 48% “very often” or “always” immobilize after splinting, while only 21% “very often” or “always” choose early mobilization after splinting.

For patients treated with splinting and immobilization, this was carried out most commonly for 3 or 4 weeks (74%). A small portion of surgeons (8%) reported that the duration of immobilization after splinting varied “based on patient factors” ($n = 4$) and “based on fracture factors” ($n = 3$).

When results were stratified by years in practice, no difference in the selection of shortening criteria or length of immobilization was found. Additionally, we found no differences in practice patterns when the use of surgery, closed reduction, splinting with immobilization, and splinting with early mobilization were examined. Surgeons in practice for less than 15 years, however, were more likely to suggest hand therapy as

Figure 3. Acceptable length of shortening when determining the need for surgical intervention for single metacarpal fractures.

part of the management of single metacarpal fractures (63% vs 51%, $P = .034$).

Discussion

This cross-sectional study surveyed Canadian plastic surgeons on their management strategies of single metacarpal fractures. Canadian surgeons applied a wide range of criteria when determining the need for operative management, with rotational deformity as the most commonly cited surgical indication (97%). With regards to non-surgical management, half of the respondents generally favored splinting and immobilization, and only one-fifth favored splinting with active mobilization for the majority of cases. This highlighted the popularity of immobilization if conservative management was indicated. Finally, there was little difference in practice patterns among surgeons in practice less than or greater than 15 years. This suggests that practice patterns have not changed drastically over a plastic surgeon’s career.

To our knowledge, only 2 prior studies attempted to perform a survey of the management of single metacarpal fracture among surgeons.^{8,19} Neither study was conducted in the Canadian setting, and both only focused on the little finger (the boxer’s fracture). Jones and colleagues⁸ revealed that opinion varied greatly concerning the angle of displacement warranting surgical reduction. The choice of conservative management approaches was also very heterogeneous, with treatment ranging from buddy taping (43%) to plaster cast immobilization (39%) to full immediate mobilization (10%). Plaster cast immobilization was carried out for 2 weeks (22%), 3 weeks (72%), or 4 weeks (2%). Sahu and colleagues¹⁹ also found that management of these fractures varied widely, with the most important indications for surgical intervention being identified as rotational deformity (84.0%) and open fracture

Figure 4. Responses to Likert scale questions by Canadian plastic surgeons.

(70.5%). Responses regarding the period of immobilization also varied, with immediate mobilization (28.0%), 2 weeks of immobilization (23.3%), or 3 weeks of immobilization (39.3%), among the preferred management approaches. Our findings align with these previous studies, and further confirms the heterogeneity in practice patterns among surgeons in treating metacarpal fractures.

A specific question that emerged from our study is whether patients who had undergone splinting should be immediately mobilized to allow free motion at the metacarpal phalangeal joint, or immobilized for a period of time. While Canadian plastic surgeons generally favored immobilization after splinting, this is an area of contention in the literature. A previous systematic review emphasized benefits to early motion after simple closed metacarpal fracture, including earlier recovery of mobility and strength, earlier return to work and no negative effect to fracture alignment.²⁰ In addition, Khan and Giddins reported that non-surgical management was an effective treatment option in patients with spiral metacarpal fractures even in the presence of malrotation,¹² finding that these “can usually be treated reliably with early mobilization as any malrotation corrects with flexion and the degree of shortening is limited.”¹² Furthermore, Al-Qattan also evaluated conservative management for spiral/long oblique fractures of the shaft of the metacarpal with resulting shortening. The authors found that palmar wrist splint and immediate mobilization provided patients with good outcomes.¹³ Despite this recent evidence, some

articles continue to advocate for a period of immobilization after splinting in order to prevent shortening.^{17,21}

A limitation of our study is the low response rate of only 27%. However, this percentage is derived from using the sum of all members of the CSPS as the total sample size. There was no data on the number of Canadian plastic surgeons that did not meet our inclusion criteria, such as those who have an exclusively pediatric practice or do not treat patients with hand pathologies. If we could account for the response rate among only plastic surgeons managing adult patients with hand pathologies, we anticipate that our response rate would be higher. Another limitation of our study was the lack of specificity within some of the survey questions. We asked broad questions that focused on the general concepts in the management of single metacarpal fracture and acknowledge that treatment strategies may differ based on patient and fracture characteristics. Our cross-sectional study allowed for the identification of general areas of inconsistencies, such as mobilization protocols for the non-surgical management of metacarpal fracture, as well as the use of shortening as an indication for surgical management. Future research should thus evaluate the subtleties of the management of hand fractures and incorporate patient and fracture level details. Furthermore, our study was limited by recall bias, as respondents were asked to recollect and report their current and past treatment strategies for metacarpal fractures. Lastly, the method by which the survey was distributed allowed for sampling of only Canadian plastic surgeons.

These findings demonstrate inconsistencies in management of single metacarpal fractures among Canadian plastic surgeons. Surprisingly, surgeons tended to favor immobilization, as oppose to the literature that favors mobilization. These findings also exemplify not only the complexity of metacarpal fractures and the broad range of available treatment options, they also reveal the paucity of available data.⁵ This highlights the lack of clear guidelines dictating treatment, possibly leading to these inconsistencies. In the face of minimal high-level evidence, surgeons must sometimes rely only on clinical experience and low-level evidence to guide management. Free-text responses in the study described the use of patient-related factors (age, functional status, gender) and fracture-related factors (clinical exam), without explicit criteria, driving decision-making in the management of single metacarpal fractures. High-quality studies such as prospective high-quality observational studies or randomized clinical trials are needed to provide evidence to guide the management of single metacarpal fractures and allow for the creation of care protocols to standardize treatment strategies.

Authors' Note

Authors listed as part of the Canadian Plastic Surgery Research Collaborative: Mona Al-Taha, Danielle Dumestre, Haley Augustine, Johnny Ionut Efanov, Lisette Christopherson, Michael Stein, Emma Ambrose, Alexei Berdnikov, and Grayson Roumeliotis.

Acknowledgements

The authors would like to thank Stephen Driscoll for his help developing the coordinate map.

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.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Helene Retrouvey, MDCM <http://orcid.org/0000-0001-5215-0404>

References

- Kollitz KM, Hammert WC, Vedder NB, Huang JI. Metacarpal fractures: treatment and complications. *Hand (N Y)*. 2014;9(1):16-23.
- Kamath JB, Harshvardhan, Naik DM, Bansal A. Current concepts in managing fractures of metacarpal and phalangess. *Indian J Plast Surg*. 2011;44(2):203-211.
- Diaz-Garcia R, Waljee JF. Current management of metacarpal fractures. *Hand Clin*. 2013;29(4):507-518.
- Chin SH, Vedder NB. MOC-PSSM CME article: metacarpal fractures. *Plast Reconstr Surg*. 2008;121(1 suppl):1-13.
- Wong VW, Higgins JP. Evidence-based medicine: management of metacarpal fractures. *Plast Reconstr Surg*. 2017;140(1):140e-151e.
- Hansen PB, Hansen TB. The treatment of fractures of the ring and little metacarpal necks. A prospective randomized study of three different types of treatment. *J Hand Surg Br*. 1998;23(2):245-247.
- Kozin SH, Thoder JJ, Lieberman G. Operative treatment of metacarpal and phalangeal shaft fractures. *J Am Acad Orthop Surg*. 2000;8(2):111-121.
- Jones R, Burdett S, Jefferies M, Guha AR. Treating the boxer's fracture in Wales: a postal survey. *Ann R Coll Surg Engl*. 2010;92(3):236-239; quiz 239.
- Poolman RW, Goslings JC, Lee JB, Statius Muller M, Steller EP, Struijs PA. Conservative treatment for closed fifth (small finger) metacarpal neck fractures. *Cochrane Database Syst Rev*. 2005(3):CD003210.
- Statius Muller MG, Poolman RW, van Hoogstraten MJ, Steller EP. Immediate mobilization gives good results in boxer's fractures with volar angulation up to 70 degrees: a prospective randomized trial comparing immediate mobilization with cast immobilization. *Arch Orthop Trauma Surg*. 2003;123(10):534-537.
- van Aaken J, Kampfen S, Berli M, Fritschy D, Della Santa D, Fusetti C. Outcome of boxer's fractures treated by a soft wrap and buddy taping: a prospective study. *Hand (N Y)*. 2007;2(4):212-217.
- Khan A, Giddins G. The outcome of conservative treatment of spiral metacarpal fractures and the role of the deep transverse metacarpal ligaments in stabilizing these injuries. *J Hand Surg Eur Vol*. 2015;40(1):59-62.
- Al-Qattan MM. Outcome of conservative management of spiral/long oblique fractures of the metacarpal shaft of the fingers using a palmar wrist splint and immediate mobilisation of the fingers. *J Hand Surg Eur Vol*. 2008;33(6):723-727.
- Konradsen L, Nielsen PT, Albrecht-Beste E. Functional treatment of metacarpal fractures 100 randomized cases with or without fixation. *Acta Orthop Scand*. 1990;61(6):531-534.
- Dunn JC, Kusnezov N, Orr JD, Pallis M, Mitchell JS. The Boxer's fracture: splint immobilization is not necessary. *Orthopedics*. 2016;39(3):188-192.
- Gonzalez MH, Hall RF Jr. Intramedullary fixation of metacarpal and proximal phalangeal fractures of the hand. *Clin Orthop Relat Res*. 1996;(327):47-54.
- Ben-Amotz O, Sammer DM. Practical management of metacarpal fractures. *Plast Reconstr Surg*. 2015;136(3):370e-379e.
- Sandelowski M. Whatever happened to qualitative description? *Res Nurs Health*. 2000;23(4):334-340.
- Sahu A, Gujral SS, Batra S, Mills SP, Srinivasan MS. The current practice of the management of little finger metacarpal fractures—a review of the literature and results of a survey conducted among upper limb surgeons in the United Kingdom. *Hand Surg*. 2012;17(1):55-63.
- Feehan LM, Bassett K. Is there evidence for early mobilization following an extraarticular hand fracture? *J Hand Ther*. 2004;17(2):300-308.
- Soong M, Chase S, George Kasparyan N. Metacarpal fractures in the athlete. *Curr Rev Musculoskelet Med*. 2017;10(1):23-27.