



## Research Articles

# Fifth Metacarpal Neck Fractures in the United States: Trends in Current Management

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Keywords: fifth metacarpal neck, metacarpal fracture, boxer's fracture, little finger, survey

<https://doi.org/10.58616/001c.90485>

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## SurgiColl

Vol. 1, Issue 4, 2023

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### Objectives

Management of fifth metacarpal neck fractures lacks consensus and is highly variable. Our study aims to examine patterns and trends in nonoperative treatment, surgical indications, and surgical techniques for fifth metacarpal neck fractures amongst hand surgeons of different demographic backgrounds within the United States of America.

### Methods

A survey of 18 questions was hosted online and distributed to the American Society for Surgery of the Hand (ASSH) members via email. Questions sought to determine the demographics of the surgeon, the preferred treatment for metacarpal fractures of varying degrees of angulation, immobilization technique, factors leading to surgical intervention, and preferred surgical intervention. Responses were analyzed for significant patterns and trends.

### Results

A total of 581 responses were received (17% response rate). Most respondents utilize intramedullary lines on lateral radiographs to measure fracture angulation, prefer splinting in the intrinsic-plus position, and prefer closed reduction and percutaneous pinning for surgical management. Average measurements indicating patients for surgery were 9.2° of rotation, 41.6° of sagittal malalignment, 20.2° of coronal malalignment, or 6.1 mm of shortening. On average, orthopaedic surgeons tolerated greater degrees of volar angulation (43.8°) than general surgeons (30.7°) or plastic surgeons (27.9°).

### Conclusions

Our study reveals several significant differences regarding managing fifth metacarpal neck fractures between hand surgeons with different residency backgrounds, variable years of experience, and different practice settings. The geographic region of practice and primary consultant were less impactful. Ultimately, management decisions appear to be a result of patient-specific factors as well as surgeon preference.

## INTRODUCTION

Metacarpal fractures are among the most common fractures seen in the hand.<sup>1</sup> Fractures involving the fifth metacarpal neck, colloquially referred to as “boxer’s fractures,” are the

most common type of metacarpal fracture.<sup>2</sup> These fractures involve young males and typically result from striking a solid surface with a clenched fist.<sup>3</sup> Despite various treatment options, the current literature lacks a consensus regarding the standard management of these fractures.<sup>4,5</sup>

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There remains considerable variability among surgeons regarding the acceptable degree of volar angulation that can be tolerated in the non-operative management of boxer fractures.<sup>5</sup> Cadaveric biomechanical studies have demonstrated that fracture shortening may result in subsequent loss of function and cosmetic deformity.<sup>6,7</sup> However, several studies have shown that the fifth metacarpal neck has a high tolerance for malalignment with acceptable clinical outcomes.<sup>8-10</sup> Radiographic parameters for acceptable angulation cited in the literature have ranged from 20° to 70° of flexion at the fracture site.<sup>9-14</sup> Additionally, there is no consensus on the standardized radiographic methodology used to measure these parameters, with inter- and intra-observer reliability and validity arising between lateral and oblique views.<sup>15-17</sup>

Concerning both operative and non-operative treatment modalities, a broad spectrum of management techniques exists in the hand surgeon's arsenal, with no explicit agreement on the superiority of one technique over the others.<sup>8,18</sup> Non-operative management includes cast immobilization, with or without reduction, functional buddy taping, bracing, and splinting.<sup>8</sup> Surgical techniques traditionally consist of closed reduction and pinning plate and screw fixation, and intramedullary fixation.<sup>18</sup> Despite the high incidence of these fractures, there continues to be a lack of standardized protocol for their treatment.<sup>18,19</sup>

Our literature search found only two survey studies that attempted to determine current practice among upper extremity surgeons.<sup>11,20</sup> These studies were conducted in Wales and the UK in 2010 and 2011, respectively. Our research aims to determine current practice trends regarding fifth metacarpal neck fractures among upper extremity surgeons in the United States. We hypothesize that within the hand surgery community, significant variability in nonoperative treatment techniques, surgical indications, and preferred surgical technique for fifth metacarpal neck fractures exists between surgeons of varying backgrounds.

## METHODS

Following approval by our Institutional Review Board (IRB), a survey consisting of 18 questions regarding the management of fifth metacarpal neck fractures (Appendix 1) was constructed and hosted online by SurveyMonkey® (San Mateo, CA). Of these questions, 15 were multiple choice, one was select-all, and two were free text. The questions sought to determine the demographics of the surgeon, preferred initial treatment for fifth metacarpal neck fractures of varying degrees of angulation, preferred immobilization technique, factors leading to surgical intervention, and preferred method of surgical intervention. The survey link was sent to the American Society for Surgery of the Hand (ASSH) members via email. A second reminder email was sent to the same members after four weeks to increase the response rate. Per the rules and regulations of the ASSH, the mailing list is only to be used for a maximum of two occasions for queries. Most respondents report practicing in the South Atlantic, while the fewest report practicing in the East-South Central region [Table 1].

After completion of the survey, data was collected and analyzed. Responses to free text questions were read and sorted into the representative answer choice for that question or into a new answer choice created when multiple identical responses were received. Responses to free-text questions that were not relevant within the scope of the question were omitted. Results were analyzed for significant patterns and trends. Subgroup analyses were performed for surgeons of different demographic groups, years in practice, residency training background, region, practice setting, and primary consultant service. A chi-square test for independence was conducted for further analysis of categorical variables, and ANOVA was performed for quantitative responses. Significant differences found with ANOVA were then subjected to a post hoc analysis to compare the means between groups. A significance level of  $\alpha = 0.05$  was used for all statistical tests.

## RESULTS

A total of 3,363 hand surgeons were emailed the questionnaire, of which 581 responses were collected (17% response rate). The survey population included respondents from various demographic backgrounds [Table 1]. Treatment techniques are summarized in Table 2, initial treatments for varying degrees of angulation are summarized in Table 3, and factors impacting surgical indication are summarized in Table 4.

When measuring the degree of flexion at the fracture site radiographically, most respondents prefer a lateral hand x-ray over an oblique view (67% vs 16%). Respondents favor drawing lines through the axis of the bone (intramedullary) to determine angulation rather than drawing lines against the dorsal cortices (61% vs 22%). Notably, senior surgeons, defined as practicing for  $\geq 25$  years, were 2.04 times as likely as their junior colleagues to judge fracture angulation based on a lateral radiograph ( $P = 0.005$ ).

Splinting is preferred over casting in the acute setting, regardless of the degree of angulation. Rates of attempted closed reduction increased with increasing angulation for both splinting and casting across our hypothetical spectrum of deformity. The most popular immobilization positions were intrinsic-plus (77%) and full extension (16%). In addition, several alternative responses were received, including "the functional position," comfort bracing, a Galveston brace, or a proximal phalangeal blocking device. There were no significant differences among demographic groups with respect to immobilization time or position [Table 2].

The average measurements to indicate a patient for surgery were 9.2° of rotation ( $n = 437$ ,  $s = 12^\circ$ ,  $[0 - 90^\circ]$ ), 41.6° of sagittal malalignment ( $n = 426$ ,  $s = 20.6^\circ$ ,  $[0 - 90^\circ]$ ), 20.2° of coronal malalignment ( $n = 388$ ,  $s = 16^\circ$ ,  $[0 - 90^\circ]$ ), or 6.1 mm of shortening ( $n = 379$ ,  $s = 3.1$  mm,  $[0 - 20$  mm]). On average, orthopaedic surgeons tolerated greater degrees of volar angulation ( $\bar{x} = 44^\circ$ ) than general surgeons ( $\bar{x} = 31^\circ$ ) or plastic surgeons ( $\bar{x} = 28^\circ$ ) ( $P < 0.001$ ). Orthopaedic surgeons, however, tolerated lesser degrees of rotation ( $\bar{x} = 8.6^\circ$ ) than plastic surgeons ( $\bar{x} = 12^\circ$ ) ( $P < 0.001$ ). [Table 3]

**Table 1. Respondent Demographic Data**

Variable	Percent	Variable	Percent
Years Practicing as a Hand Surgeon		Residency Training Background	
<5	26%	Orthopaedic Surgery	84%
5-9	13%	Plastic Surgery	12%
10-14	8.3%	General Surgery	4.5%
15-19	11%	Primary Institution Type	
20-24	13%	Academic	22%
≥25	29%	Private	58%
Region of Practice		Hybrid Model	17%
New England	6.6%	Other	3.6%
Middle Atlantic	16%	Primary Consulting Individual	
East North Central	15%	Yourself or Other Hand Surgeon	76%
West North Central	5.7%	Resident or Fellow	14%
South Atlantic	21%	Hand Surgery Physician Assistant	4.3%
East South Central	2.8%	Emergency Department Staff	2.8%
West South Central	10%	Other	2.8%
Mountain	7.9%		
Pacific	15%		

Of the respondents, 57% choose to attempt closed reduction and nonoperative treatment if the initial fracture pattern meets their operative criteria, whereas 43% do not. Plastic surgeons were 1.8 times more likely than orthopaedic surgeons and 3.98 times more likely than general surgeons to attempt closed reduction and nonoperative treatment ( $P = 0.013$ ). Senior surgeons were 1.89 times more likely than their junior colleagues to attempt closed reduction and nonoperative treatment ( $P = 0.008$ ).

Although overall preference for plate and screw fixation was low (5.4%), surgeons in private practice were 5.3 times as likely as academic surgeons to prefer it over other surgical options, and academic surgeons were 2.13 times more likely than those in all other practice settings to prefer closed reduction and pinning ( $P = 0.006$ ). [Table 4]

## DISCUSSION

Fifth metacarpal neck fractures are among the most common fractures in the hand, yet there remains extensive variability in described management algorithms through the current literature. To date, there is a paucity of literature evaluating the differences in radiographic evaluation, immobilization construct, and operative criteria, as well as preferred surgical techniques. Our study sought to evaluate the preferences of United States based hand surgeons to elucidate factors that could potentially explain this variability.

Regarding initial diagnosis and radiographic evaluation, disparity exists between hand surgeons regarding the preferred roentgenographic view to assess angulation at the fracture site. Potential contributing factors to this disparity include metacarpal overlap evident on lateral views, which

can obscure fine details at the fracture site. Our survey showed that most respondents choose to draw intramedullary lines on a lateral X-ray when measuring volar angulation. Others prefer an oblique view and/or referencing lines off the dorsal cortices instead. Sletten et al.<sup>17</sup> showed that although these methods have excellent inter- and intra-observer reliability alone, the mean measurements between methods differed. The researchers acknowledge that intramedullary referencing on oblique radiographs minimizes the problem of metacarpal overlap and offers excellent reliability; it tends to overestimate angulation by 10 degrees. As a result of the unique anatomy and obliquity of the ulnar-sided carpometacarpal (CMC) joints, the plane of the fourth and fifth metacarpals is flexed from that of the second and third, which can result in overestimation of volar angulation in the setting of fifth metacarpal neck fractures. Additionally, studies have shown that measurements taken off oblique views consistently produce readings up to 35° greater than lateral views.<sup>16</sup> This could be attributed to large variability in methodology for acquiring oblique films, ranging from 30-45° of supination as stated by different sources.<sup>17</sup> Thus, Sletten et al. recommend the intramedullary lateral method, which they showed to be sufficiently reliable and valid.

Following evaluation and diagnosis, immobilization is a common treatment for the initial management of fifth metacarpal neck fractures. Survey studies conducted in Wales (2010) and the UK (2011) revealed buddy taping as the preferred immobilization method.<sup>11,20</sup> Our study showed a general preference for ulnar gutter splinting followed by casting. Unfortunately, our survey did not list buddy taping as an answer choice, although multiple respondents included it as a free text response. Poolman et

**Table 2. Respondent Technique Preference**

Variable	Percent	
	Oblique	Lateral
Method for measuring angulation		
A line through medullary canals	11%	50%
Line against dorsal cortices	5.4%	17%
Greatest on multiple views	2.5%	
Gross estimation	14%	
Clinical	1.0%	
Duration of immobilization/ support		
Full movement	2.6%	
≤ 2 weeks	7.4%	
3 weeks	32%	
4 weeks	51%	
≥ 5 weeks	6.3%	
Position of immobilization/ support		
Intrinsic plus	77%	
Full extension	16%	
Between intrinsic plus/full extension	2.7%	
Support up to/just past MCP joint	2.3%	
Other	3.0%	
Preferred surgical technique		
CRPP†	72%	
IM <sup>Δ</sup> fixation	20%	
OR <sup>Ψ</sup> + plate/screw fixation	5.4%	
OR <sup>Ψ</sup> + pinning	0.5%	
CRPP† + IM <sup>Δ</sup> fixation	0.2%	
IO <sup>‡</sup> loop wire fixation	0.2%	
Not specified	2.3%	

†Closed Reduction and Percutaneous Pinning

ΔIntramedullary

ΨOperating Room

‡Intraosseous

al.<sup>21</sup> determined in their 2005 Cochrane review that no conservative management method (cast, splint, brace, buddy taping) was superior to another. However, they acknowledge that hand function was not a primary outcome measure in any of the five pooled studies. Regarding treatment duration, 90% of clinicians who utilize casting or splinting immobilize their patients for three weeks or more, with 6.3% opting to immobilize for five weeks or more.

However, the preferred position of immobilization for the injured hand is less consistent between surgeons. Although most participants in our study were immobilized in the intrinsic plus position, nearly one-quarter of respondents preferred hand extension or some position between the two. Theoretical advantages of intrinsic plus po-

sitioning during immobilization are based upon the idea that flexion at the metacarpophalangeal joints maintains stretch on the collateral ligaments via the cam effect and reduces the risk of stiffness after the cast or splint is discontinued. In an active duty military population, Hofmeister et al.<sup>22</sup> found no differences in final range of motion, grip strength, or post-reduction angulation between casting in full extension and casting with the metacarpophalangeal joint in flexion.

Our demographic analysis evaluated the respondents based on differences in residency training type, years of experience, practice settings, region, and primary consultants. Our goal was to identify potential sources for variations in management strategies. Overall, we found no significant disparities in management between different regions or primary consultants during our subgroup analysis.

Regarding fracture and patient characteristics, academic surgeons and surgeons in practice for ≥ 25 years (senior surgeons) are less likely to operate based on a patient's request. It is possible that surgeons with greater practice experience are more likely to recognize fracture characteristics and patient-specific factors that portend to better outcomes. This may also highlight a trend towards earlier operative intervention in younger practitioners. Interestingly, a patient profession requiring hand dexterity only leads 15.9% of respondents to proceed to surgery. Studies have shown that surgical treatment for manual laborers may be preferred over non-surgical treatment due to a quicker return to work time.<sup>18,23</sup>

The degree of volar angulation considered acceptable for non-operative management is one of the biggest debates in the treatment of fifth metacarpal neck fractures. This considerable variability in management can be at least partially attributed to the extensive degree of conflicting results in the literature. Early biomechanical studies showed that fracture angulation greater than 30° is associated with decreased flexor digiti minimi grip strength and impaired range of motion.<sup>6</sup> However, more recent studies have shown that fractures with up to 50° angulation had no harmful effect on functional outcomes assessed by either the DASH questionnaire or grip strength despite an aesthetic deformity.<sup>10</sup> Some respondents do not factor numerical measurements into their decision-making, focusing instead on clinical factors (e.g., extensor lag, scissoring, or gapping of the ring and small fingers) or patient-specific factors/requests. The average parameters for our survey respondents to indicate a patient for surgery are 9° of rotation, 41.6° of volar angulation, 20.2° of ulnar/radial angulation, and 6.1 mm of shortening. The data ranges received for all parameters are deceiving, as rotation, volar angulation, and ulnar/radial angulation all had ranges of 0-90° due to a few outliers. We believe some respondents may have misunderstood the wording of this question. Regardless, the average values are close to defined ranges in the literature.<sup>18</sup>

Discrepancy remains over whether attempting closed reduction of fifth metacarpal neck fractures is beneficial. Multiple studies have shown that although closed reduction

**Table 3. Preferred Initial Treatment for Increasing Volar Angulation**

Treatment	Volar angulation				
	<20°	20-30°	30-40°	40-50°	>50°
Full movement	6.2%	4.5%	3.7%	2.1%	1.4%
Ulnar gutter splint without reduction	48%*	38%*	25%*	17%	9.1%
Ulnar gutter splint w with reduction	11%	19%	30%*	34%*	32%*
Cast without reduction	20%*	15%	9.7%	3.9%	2.3%
Cast with reduction	9.1%	16%	19%	23%*	24%*
Buddy tape +/- splint	2.5%	2.4%	2.1%	1.9%	1.4%
Other splint/brace	2.5%	3%	2.8%	2.7%	2.5%
Surgery	0.0%	0.9%	4.9%	13%	25%*
Unspecified	1.2%	1.6%	1.2%	2.3%	2.8%

\* Significant Result,  $p < 0.001$ **Table 4. Factors Impacting Surgical Indication of Fifth Metacarpal Neck Fractures**

Factor	Responded “yes” if the presence of factor leads to operative management	Demographic groups <b>significantly more likely / significantly less likely</b> to operate	
Open fracture	88%	Orthopaedic surgeons	
Intra-articular fracture	65%	Hybrid model; General surgeons	
Associated 4 <sup>th</sup> metacarpal fracture	42%	N/A	
Patient request	35%	Academic; Practice ≥ 25 years	
Comminution	18%	Orthopaedic surgeons; Self primary consultant	
Patient profession requires hand dexterity	16%		
Pediatric patient	1.6%	General surgeons	
Dominant hand affected	1.1%		
	Average value to indicate surgery	Not considered an indication	Prefer clinical judgment
Rotation	9.2° (n = 437)	2.3%	14%
Volar angulation	42° (n = 426)	4.3%	5.1%
Ulnar/radial angulation	20° (n = 388)	6.6%	7.7%
Shortening	6.1 mm (n = 379)	8.9%	7.1%

significantly improves fracture angulation at the time of reduction, the alignment improvement is often not sufficiently maintained at follow-up and subsequent fracture healing.<sup>24,25</sup> Whether this failure to maintain reduction is due to an inherent fracture instability or inability to create a supportive mold remains to be answered. In our survey, private practice surgeons and surgeons in practice for < 25 years were more aggressive in pursuing surgical treatment over attempting closed reduction. This could represent an evolving trend in the surgical community towards earlier operative intervention or a patient's desire for a quicker return to work given shorter immobilization periods following surgical fixation.

Of note, plastic surgeons were the least aggressive in proceeding directly to surgery over attempting closed re-

duction and immobilization. Regarding surgical technique, private practice surgeons are more likely to choose plate and screw fixation than their academic colleagues. One theory is that earlier mobilization post-operatively following a plate and screw construct may allow for an earlier return to work and activity.

Our study has several limitations. The study population may not be representative of the overall population of practicing hand surgeons in the U.S. Furthermore, fifth metacarpal neck fractures are common injuries that are sometimes managed by general practice orthopedists in community settings and not hand specialists. Our mailing list was not representative of these physicians. Coupled with a response rate of 17%, these results may not be generalizable to all hand surgeons. Additionally, using variable

terminology for similar concepts (e.g., sagittal malalignment versus volar angulation) and the term “preferred initial treatment” may have confused the respondent.

## CONCLUSIONS

As with any survey study based predominately on choosing ‘best fit’ answers, it is difficult to embody the complete picture of management fully. Establishing a generalized treatment algorithm may serve as a good initial step. However, it minimizes the ‘human element’ and limits a physician’s clinical gestalt. Factors such as patient history, perceived trustworthiness, clinical examination, and age of injury further complicate the decision-making process and may alter the treatment method. The findings of this survey demonstrate that current patterns and trends in the management of fifth metacarpal neck fractures are highly varied among hand surgeons of different demographic backgrounds. These results may serve to offer a starting point for the establishment of a more standardized algorithm for the treatment of fifth metacarpal neck fractures. Still, ultimately, many factors outside the realm of radiographic parameters need to be weighed when determining the treatment plan for an individual patient.

## DECLARATION OF CONFLICT OF INTEREST

The authors do NOT have any potential conflicts of interest for this manuscript.

## DECLARATION OF FUNDING

The authors received NO financial support for the preparation, research, authorship, and publication of this manuscript.

## DECLARATION OF ETHICAL APPROVAL FOR STUDY

Manuscript does not require ethical approval to report its findings

## DECLARATION OF INFORMED CONSENT

No information (names, initials, hospital identification numbers, or photographs) in the submitted manuscript can be used to identify patients or participants.

Submitted: August 04, 2023 EST, Accepted: December 13, 2023 EST



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## REFERENCES

1. Cotterell IH, Richard MJ. Metacarpal and phalangeal fractures in athletes. *Clin Sports Med*. 2015;34(1):69-98. [doi:10.1016/j.csm.2014.09.009](https://doi.org/10.1016/j.csm.2014.09.009)
2. Ozturk I, Erturer E, Sahin F, et al. Effects of fusion angle on functional results following non-operative treatment for fracture of the neck of the fifth metacarpal. *Injury*. 2008;39(12):1464-1466. [doi:10.1016/j.injury.2008.03.016](https://doi.org/10.1016/j.injury.2008.03.016)
3. Stanton JS, Dias JJ, Burke FD. Fractures of the tubular bones of the hand. *J Hand Surg Eur Vol*. 2007;32(6):626-636. [doi:10.1016/j.jhse.2007.06.017](https://doi.org/10.1016/j.jhse.2007.06.017)
4. Beredjiklian PK. Small finger metacarpal neck fractures. *J Hand Surg Am*. 2009;34(8):1524-1526. [doi:10.1016/j.jhsa.2009.06.015](https://doi.org/10.1016/j.jhsa.2009.06.015)
5. Chin SH, Vedder NB. MOC-PSSM CME article: Metacarpal fractures. *Plast Reconstr Surg*. 2008;121(1 Suppl):1-13. [doi:10.1097/01.prs.0000294704.48126.8c](https://doi.org/10.1097/01.prs.0000294704.48126.8c)
6. Ali A, Hamman J, Mass DP. The biomechanical effects of angulated boxer's fractures. *J Hand Surg Am*. 1999;24(4):835-844.
7. Faraj AA, Davis TR. Percutaneous intramedullary fixation of metacarpal shaft fractures. *J Hand Surg Br*. 1999;24(1):76-79.
8. van Aaken J, Fusetti C, Luchina S, et al. Fifth metacarpal neck fractures treated with soft wrap/buddy taping compared to reduction and casting: results of a prospective, multicenter, randomized trial. *Arch Orthop Trauma Surg*. 2016;136(1):135-142. [doi:10.1007/s00402-015-2361-0](https://doi.org/10.1007/s00402-015-2361-0)
9. 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. [doi:10.1007/s00402-003-0580-2](https://doi.org/10.1007/s00402-003-0580-2)
10. Westbrook AP, Davis TRC, Armstrong D, Burke FD. The clinical significance of malunion of fractures of the neck and shaft of the little finger metacarpal. *J Hand Surg Eur Vol*. 2008;33(6):732-739. [doi:10.1177/1753193408092497](https://doi.org/10.1177/1753193408092497)
11. 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. [doi:10.1308/003588410x12628812458176](https://doi.org/10.1308/003588410x12628812458176)
12. Hunter JM, Cowen NJ. Fifth metacarpal fractures in a compensation clinic population. A report on one hundred and thirty-three cases. *J Bone Joint Surg Am*. 1970;52(6):1159-1165.
13. Ford DJ, Ali MS, Steel WM. Fractures of the fifth metacarpal neck: is reduction or immobilisation necessary? *J Hand Surg Br*. 1989;14(2):165-167.
14. Bloem JJ. The treatment and prognosis of uncomplicated dislocated fractures of the metacarpals and phalanges. *Arch Chir Neerl*. 1971;23(1):55-65.
15. Leung YL, Beredjiklian PK, Monaghan BA, Bozentka DJ. Radiographic assessment of small finger metacarpal neck fractures. *J Hand Surg Am*. 2002;27(3):443-448.
16. Lamraski G, Monsaert A, De Maeseneer M, Haentjens P. Reliability and validity of plain radiographs to assess angulation of small finger metacarpal neck fractures: human cadaveric study. *J Orthop Res*. 2006;24(1):37-45. [doi:10.1002/jor.20025](https://doi.org/10.1002/jor.20025)
17. Sletten IN, Nordsletten L, Hjorthaug GA, Hellund JC, Holme I, Kvernmo HD. Assessment of volar angulation and shortening in 5th metacarpal neck fractures: an inter- and intra-observer validity and reliability study. *J Hand Surg Eur Vol*. 2013;38(6):658-666. [doi:10.1177/1753193412461582](https://doi.org/10.1177/1753193412461582)
18. Padegimas EM, Warrender WJ, Jones CM, Ilyas AM. Metacarpal Neck Fractures: A Review of Surgical Indications and Techniques. *Arch Trauma Res*. 2016;5(3):e32933. [doi:10.5812/atr.32933](https://doi.org/10.5812/atr.32933)
19. Schädel-Höpfner M, Wild M, Windolf J, Linhart W. Antegrade intramedullary splinting or percutaneous retrograde crossed pinning for displaced neck fractures of the fifth metacarpal? *Arch Orthop Trauma Surg*. 2007;127(6):435-440. [doi:10.1007/s00402-006-0254-y](https://doi.org/10.1007/s00402-006-0254-y)
20. 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. [doi:10.1142/s0218810412500098](https://doi.org/10.1142/s0218810412500098)
21. 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. [doi:10.1002/14651858.cd003210.pub3](https://doi.org/10.1002/14651858.cd003210.pub3)

22. Hofmeister EP, Kim J, Shin AY. Comparison of 2 methods of immobilization of fifth metacarpal neck fractures: a prospective randomized study. *J Hand Surg Am.* 2008;33(8):1362-1368. [doi:10.1016/j.jhsa.2008.04.010](https://doi.org/10.1016/j.jhsa.2008.04.010)

23. Cepni SK, Aykut S, Bekmezci T, Kilic A. A minimally invasive fixation technique for selected patients with fifth metacarpal neck fracture. *Injury.* 2016;47(6):1270-1275. [doi:10.1016/j.injury.2016.01.034](https://doi.org/10.1016/j.injury.2016.01.034)

24. Pace GI, Gendelberg D, Taylor KF. The Effect of Closed Reduction of Small Finger Metacarpal Neck Fractures on the Ultimate Angular Deformity. *J Hand Surg Am.* 2015;40(8):1582-1585. [doi:10.1016/j.jhsa.2015.05.013](https://doi.org/10.1016/j.jhsa.2015.05.013)

25. Lowdon IM. Fractures of the metacarpal neck of the little finger. *Injury.* 1986;17(3):189-192. [doi:10.1016/0020-1383\(86\)90332-3](https://doi.org/10.1016/0020-1383(86)90332-3)