

Review Article

Surgical management and outcomes of self-inflicted zone V wrist injuries: a narrative review

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ABSTRACT

Self-inflicted wrist injuries involving flexor tendon zone V represent a complex subset of hand trauma with important surgical, functional, and psychosocial implications. These injuries frequently involve simultaneous damage to tendons, nerves, and vascular structures, often resulting in substantial long-term disability. Despite their clinical relevance, the available literature remains fragmented, with no universally accepted definition of “spaghetti wrist” and no standardized management framework. This narrative review synthesizes current evidence on epidemiology, injury patterns, classification systems, clinical assessment, operative management, rehabilitation, complications, and prognosis in self-inflicted zone V wrist injuries. A structured literature search was conducted in PubMed/MEDLINE, Scopus, and Google Scholar for studies published between January 2005 and January 2025 in English or Spanish. Eligible publications included retrospective and prospective cohort studies, case series, case reports, and review articles addressing self-inflicted wrist injuries involving zone V. Extracted data included epidemiological characteristics, mechanisms of injury, classification systems, assessment tools, surgical and non-surgical management strategies, rehabilitation protocols, and functional outcomes. Findings were synthesized qualitatively, with emphasis on recurring themes, areas of consensus, and persistent gaps in knowledge. Available evidence indicates that these injuries predominantly affect young adults, frequently men, and are commonly associated with psychiatric comorbidity. Injury patterns typically involve the dominant hand inflicting damage on the non-dominant wrist and are characterized by multistructural involvement. Flexor tendons are almost universally affected, while neurovascular injury varies in severity and consistently emerges as the strongest predictor of long-term functional impairment. Outcome heterogeneity remains substantial, reflecting differences in injury definitions, operative techniques, rehabilitation protocols, and outcome measures. Psychiatric factors further influence recurrence risk, adherence to therapy, and return-to-work outcomes. Self-inflicted zone V wrist injuries remain a challenging and heterogeneous clinical entity. Although advances in microsurgical reconstruction and rehabilitation have improved recovery, prognosis remains guarded, particularly in patients with nerve or combined neurovascular injury. Standardized definitions, consistent outcome reporting, and integration of surgical, rehabilitative, and psychiatric care are essential to improve comparability across studies and optimize patient outcomes.

Keywords: Self-inflicted wrist injury, Zone V laceration, Spaghetti wrist, Flexor tendon injury, Neurovascular repair, Hand trauma, Suicide attempt, Rehabilitation protocols, Functional outcomes, Patient-reported outcomes

INTRODUCTION

Self-inflicted injuries to the volar wrist represent a challenging subset of upper extremity trauma frequently encountered in emergency and trauma settings. These injuries often involve multiple anatomical structures within a relatively confined space, including flexor tendons, major nerves, and vascular components of the distal forearm. As a result, even seemingly superficial lacerations can lead to complex patterns of damage with significant functional consequences if not appropriately recognized and managed.¹⁻³

In particular, injuries occurring in flexor tendon zone V, located in the distal forearm proximal to the transverse carpal ligament, are commonly associated with the so-called “spaghetti wrist” pattern, characterized by simultaneous disruption of multiple tendons and neurovascular structures. Such injuries present important diagnostic and therapeutic challenges for trauma surgeons and hand specialists, as accurate identification of the involved structures and timely surgical intervention are critical to optimizing functional recovery.⁴⁻⁶

Self-inflicted wrist injuries are frequently associated with psychiatric conditions, emotional distress, or acute crises, which may influence both the mechanism of injury and the patient’s postoperative course. Previous studies have highlighted the complex interplay between psychological factors, injury patterns, and long-term outcomes, emphasizing the need for a multidisciplinary approach to management.⁷⁻⁹

From a surgical perspective, zone V injuries require systematic exploration and repair strategies due to the high likelihood of multiple tendon and nerve lesions. Failure to recognize associated injuries may lead to persistent functional deficits, including impaired finger flexion, sensory loss, and reduced grip strength. Therefore, a structured operative approach, combined with appropriate postoperative rehabilitation, is essential to restore hand function and minimize long-term disability.¹⁰⁻¹²

Despite the clinical importance of these injuries, the literature addressing self-inflicted zone V wrist trauma remains heterogeneous, with variations in reported mechanisms, patterns of injury, and operative management strategies. A clearer synthesis of the available evidence may help guide trauma surgeons in the evaluation and treatment of these complex injuries.

The aim of this review is to examine the mechanisms, anatomical considerations, surgical management strategies, and prognostic factors associated with self-inflicted injuries to the volar wrist in flexor tendon zone V, with particular emphasis on their implications for trauma and hand surgeons. While previous narrative reviews have summarized the epidemiology and general clinical features of self-inflicted wrist injuries, fewer

studies have focused specifically on surgical decision-making, postoperative complications, and rehabilitation strategies in complex multistructural zone V injuries. This review aims to provide a clinically oriented synthesis emphasizing management principles and complication profiles relevant for surgical practice.

REVIEW OF THE LITERATURE

This article was designed as a narrative review to synthesize the available evidence regarding the clinical presentation, operative management, and outcomes of self-inflicted wrist injuries involving flexor tendon zone V. A narrative review format was selected because the literature on this topic is heterogeneous, ranging from retrospective cohort studies and case series to individual case reports and expert reviews, which makes the application of a strict systematic review methodology challenging.

Unlike systematic reviews that follow structured frameworks such as PRISMA, narrative reviews provide greater flexibility for integrating diverse types of evidence. This approach allows for a broader exploration of epidemiology, classification systems, clinical presentation, operative management, rehabilitation strategies, and reported outcomes. The present review aimed to identify recurring patterns, summarize areas of agreement, and highlight knowledge gaps that may inform future research, without attempting to establish definitive treatment protocols.

A comprehensive literature search was conducted in PubMed/MEDLINE, Scopus, and Google Scholar. The search was restricted to studies published between January 2005 and January 2025. Articles published in English or Spanish were considered eligible in order to maximize the inclusion of relevant international and regional evidence. Eligible publication types included original research articles, retrospective or prospective cohort studies, case series, case reports, and review articles.

The search strategy combined Medical Subject Headings (MeSH) and free-text terms related to self-inflicted wrist injuries. Keywords included “self-inflicted wrist injury,” “zone V laceration,” “zone V flexor tendon injury,” “spaghetti wrist,” “full house syndrome,” “wrist cutting,” “wrist laceration,” “suicide attempt hand injury,” “intentional wrist injury,” “volar forearm laceration,” “flexor tendon repair zone V,” “nerve and vessel injuries wrist,” and “hand function after wrist injury.” Boolean operators (AND/OR) were used to optimize search sensitivity. Example search strings included (“self-inflicted” OR “suicide attempt” OR “intentional injury”) AND (“wrist laceration” OR “zone V”); (“spaghetti wrist” OR “full house syndrome”) AND (“flexor tendon” OR “nerve injury” OR “arterial injury”); and (“volar forearm laceration”) AND (“surgical management” OR “rehabilitation”). Reference lists of included studies were

also manually reviewed to identify additional relevant publications not captured through the electronic search.

Studies were considered eligible if they addressed self-inflicted wrist injuries, with particular attention to those involving zone V, and reported on at least one of the following domains: epidemiology, classification, clinical assessment, surgical or non-surgical management, rehabilitation, complications, or functional outcomes. When available, data regarding reoperations and validated functional outcome measures, including Noaman's criteria, the Disabilities of the Arm, Shoulder and Hand (DASH) score, and Total Active Motion (TAM), were also extracted.

Exclusion criteria were applied to maintain the clinical focus of the review. Publications not available in full text, as well as non-peer-reviewed materials such as preprints, conference abstracts, editorials, or letters without clinical data, were excluded. Studies limited to non-human, cadaveric, biomechanical, or imaging-only data without clinical outcomes were also excluded. Articles addressing exclusively accidental wrist injuries, or trauma outside zone V without subgroup analysis, were omitted. In cases of overlapping cohorts, the most comprehensive or most recent report was retained.

Study selection was performed in two stages. First, titles and abstracts retrieved from the database search were screened for relevance to self-inflicted wrist injuries, particularly those involving zone V. Articles that did not meet the inclusion criteria, were duplicates, or were clearly unrelated to the topic were excluded at this stage. Second, the full texts of potentially eligible studies were reviewed in detail. Publications lacking sufficient clinical or methodological information, or not specifically addressing zone V injuries, were excluded. Reference lists of included studies were also reviewed manually to identify additional eligible articles.

Disagreements regarding study inclusion were resolved through discussion among the reviewers until consensus was reached. Although formal inter-rater agreement measures such as Cohen's kappa were not calculated, all inclusion and exclusion decisions made collaboratively to enhance transparency and minimize bias.

Relevant information from each included study was extracted narratively. Data items of interest included epidemiological characteristics, demographic features, mechanisms of injury, definitions and classification systems, clinical assessment strategies, operative and non-operative management approaches, rehabilitation protocols, complications, prognostic factors, and reported functional outcomes.

Given the heterogeneity of study designs, patient populations, and outcome reporting, no formal statistical pooling or meta-analysis was performed. Findings were synthesized qualitatively, with emphasis on recurring themes, areas of consensus, and divergences across

studies. Potential sources of bias, including publication bias, selective reporting, and heterogeneity in study design, were acknowledged as inherent limitations of the narrative review methodology. Particular attention was given to identifying knowledge gaps and inconsistencies relevant to the surgical management and prognosis of self-inflicted zone V wrist injuries.

EPIDEMIOLOGY AND PATIENT PROFILE

Self-inflicted wrist injuries constitute a significant proportion of self-harm presentations in emergency and trauma settings. Large multicenter data from England indicate that approximately 19.6% of hospital presentations for self-harm involve cutting or stabbing mechanisms, with nearly 70% of these injuries affecting the arm or wrist.^{6,7} These findings highlight the wrist as a frequent anatomical target in intentional self-harm, reflecting both its accessibility and its cultural association with suicidal behavior. Importantly, the anatomical location of injury may also carry prognostic implications, as wrist lacerations have been associated with increased risk of subsequent suicide attempts.⁶

Surgical series provide a more detailed characterization of the patient population presenting with severe volar wrist injuries. Wang et al reported that zone V lacerations most frequently affect young adults and demonstrate a predominance among male patients. A consistent pattern involves injury to the non-dominant wrist inflicted by the dominant hand, a mechanism repeatedly described in intentional wrist trauma.⁹ Psychiatric comorbidities are commonly documented in this population, emphasizing that these injuries should be approached as both surgical emergencies and manifestations of underlying psychological distress.

Demographic characteristics may also influence clinical outcomes. In a systematic review of zone V flexor tendon injuries, Cardoz Lobo et al observed that most patients fall between 20 and 40 years of age and often present with multistructural damage involving tendons and neurovascular elements.⁵ Across studies, the number of injured structures and the presence of nerve lesions consistently emerge as important prognostic indicators. Nevertheless, considerable heterogeneity in outcome reporting limits direct comparisons across demographic subgroups.

Overall, the available evidence suggests that self-inflicted zone V injuries predominantly affect young adult patients and frequently involve multistructural damage in the volar wrist. While epidemiological datasets provide a broad context, surgical series and systematic reviews offer a more refined clinical profile of this complex patient population.^{5,7,10}

MECHANISMS AND INJURY PATTERNS

Intentional wrist lacerations exhibit characteristic mechanisms and injury patterns that distinguish them

from accidental trauma. Deep volar lacerations associated with suicide attempts commonly involve multiple anatomical structures simultaneously, including flexor tendons, major nerves, and vascular elements.² In contrast, accidental injuries tend to be more superficial and are less frequently associated with complex multistructural damage.

Several clinical series have demonstrated consistent biomechanical patterns in self-inflicted injuries. Jeong et al reported that most patients sustain injuries to the non-dominant wrist using the dominant hand and that sharp instruments are the most common mechanism.⁴ This pattern has been reproduced across different populations and highlights the reproducibility of injury mechanics in intentional trauma.

The concept of “spaghetti wrist” represents the extreme end of this injury spectrum. Noaman described these injuries as complex volar wrist lacerations involving simultaneous disruption of multiple tendons, nerves, and arteries.⁴ Subsequent clinical series confirmed that these

injuries often involve more than three structures and require comprehensive surgical exploration.⁸ Ersen et al reported that patients presenting after suicide attempts frequently demonstrate multistructural injuries requiring urgent operative management.⁷

More recent analyses provide additional anatomical insight. Kim et al observed that flexor tendons are the structures most consistently involved in self-inflicted wrist injuries, followed by median and ulnar nerves and the radial and ulnar arteries.¹⁰ These injuries tend to occur at predictable distances from the wrist crease, suggesting recurrent anatomical patterns in the mechanism of injury.

Collectively, the literature indicates that self-inflicted zone V injuries are characterized by deep volar lacerations, dominant-to-non-dominant injury patterns, and a high prevalence of multistructural involvement affecting tendons and neurovascular structures.^{2,4,5,8,10}

Key clinical differences between accidental and self-inflicted wrist lacerations are summarized in Table 1.

Table 1: Comparative clinical profile of accidental vs. self-inflicted Zone V wrist injuries.

Domains	Accidental injuries	Self-inflicted injuries (Zone V)	Clinical implication	References
Mechanism	Unintentional, variable trauma	Intentional cutting/stabbing	Predictable injury patterns	2 and 4
Injury depth	Often superficial	Typically deep volar lacerations	Higher surgical complexity	2
Structural involvement	Usually isolated (≤ 2 structures)	Multistructural (≥ 3 structures common)	Requires systematic exploration	5 and 11
Tendon involvement	Variable	Near-universal flexor tendon injury	Functional impairment risk	5 and 8
Neurovascular injury	Less frequent	High prevalence (median/ulnar nerves, arteries)	Prognostic determinant	5 and 11
Laterality pattern	Random	Dominant $\rightarrow$ non-dominant wrist	Behavioral pattern recognition	4 and 8
Demographics	Heterogeneous	Young males (20–40 yrs)	Target population	8 and 11
Psychiatric association	Rare	Frequent ($\approx 60\text{--}70\%$)	Requires multidisciplinary care	4 and 8
Functional outcome	Generally favorable	Variable, often limited	Long-term disability risk	2 and 5

DEFINITIONS AND CLASSIFICATION OF COMPLEX VOLAR WRIST INJURIES

Despite decades of clinical experience, terminology used to describe severe volar wrist injuries remains inconsistent. The term “spaghetti wrist” was originally introduced to describe extensive lacerations in which multiple tendon ends protrude from the wound, resembling strands of spaghetti.⁵ However, the literature lacks consensus regarding the minimum number of injured structures required for this diagnosis.

Different authors have proposed varying thresholds. Some definitions require involvement of at least three anatomical structures, typically including tendons and at

least one neurovascular element, whereas others extend the definition to injuries involving ten or more structures.^{4,5,10,11} This variability reflects the wide spectrum of injury severity encountered in clinical practice.

Functional outcome assessment has also been heterogeneous. Noaman’s criteria remain among the most frequently cited evaluation frameworks and incorporate tendon function, motor recovery of median and ulnar nerves, sensory outcomes, deformity, and range of motion.⁴ Although comprehensive, the complexity of this system has limited its widespread use.

Systematic reviews confirm this lack of standardization. Cardoz Lobo et al identified multiple outcome measures used across studies of zone V injuries, including Total Active Motion (TAM), Disabilities of the Arm, Shoulder and Hand (DASH), and author-specific scoring systems.⁵ Such variability complicates comparison of clinical outcomes and limits the development of standardized management guidelines.

More recent work has attempted to expand the conceptual framework of spaghetti wrist injuries. Wang et al proposed that severe volar forearm lacerations proximal to the wrist crease may share similar mechanisms and clinical implications, suggesting that the traditional definition may underestimate the spectrum of injury patterns.⁹ Likewise, Kim et al documented cases involving up to ten injured structures, reinforcing the complexity of these lesions.¹⁰

Overall, the literature demonstrates that both definitions and outcome measures remain inconsistent, underscoring the need for standardized classification systems to facilitate clinical research and comparison across studies.^{6,12} Table 2 summarizes the major definitions and classification approaches proposed for “spaghetti wrist” injuries.

CLINICAL ASSESSMENT AND DIAGNOSTIC EVALUATION

Accurate evaluation of zone V wrist injuries is essential for determining injury severity and planning surgical management. Initial assessment focuses on a systematic neurovascular examination, including evaluation of distal perfusion, capillary refill, and arterial integrity. Allen’s test may be useful when vascular compromise is suspected.^{11,12}

Motor assessment of the flexor tendons is performed through isolated finger flexion tests, while sensory function is evaluated using light touch and two-point discrimination in the median and ulnar nerve territories. Although these bedside assessments remain fundamental, their reliability may be limited in the acute trauma setting due to pain, swelling, and limited patient cooperation.^{5,8}

Outcome assessment after repair has also evolved. Noaman’s criteria represent one of the most comprehensive frameworks, integrating tendon function, nerve recovery, deformity, and range of motion.⁴ However, simpler functional tools such as the Disabilities of the Arm, Shoulder and Hand (DASH) score and Total Active Motion (TAM) are frequently used in clinical studies.⁶

Nerve injury plays a critical role in determining long-term outcomes. Jaquet et al demonstrated that median and

ulnar nerve lesions significantly affect functional recovery after zone V injuries.¹³ Similarly, systematic reviews have highlighted the inconsistency of outcome reporting across studies, which complicates synthesis of available evidence.¹⁴

Consequently, contemporary literature advocates combining detailed clinical examination with standardized functional outcome measures to improve prognostic accuracy and comparability across studies. Commonly used functional outcome measures and their limitations are summarized in Table 3.

OPERATIVE MANAGEMENT OF ZONE V INJURIES

Management of self-inflicted zone V injuries requires meticulous surgical exploration and repair of all injured structures. Because these injuries frequently involve multiple tendons, nerves, and vessels, comprehensive operative assessment is essential.

Flexor tendon repair is typically performed using multi-strand core suture techniques, often reinforced with epitendinous sutures to enhance repair strength and facilitate tendon gliding.^{5,8} Concurrent repair of neurovascular structures is usually performed in the same operative session. Median and ulnar nerves are generally repaired using epineural techniques, while vascular injuries involving the radial or ulnar arteries may require primary anastomosis or interposition grafting depending on defect length.^{10,11}

The timing of surgical intervention remains debated. Many authors advocate repair within the first 24 hours to minimize tendon retraction and facilitate anatomical reconstruction.⁶ However, delayed reconstruction may be considered in selected cases, particularly when contamination, soft tissue compromise, or psychiatric instability complicate immediate intervention.¹²

Longitudinal studies highlight the importance of comprehensive reconstruction. Combined tendon and nerve injuries have been associated with poorer functional outcomes compared to isolated tendon injuries, emphasizing the importance of addressing all injured structures during initial surgery.¹³⁻¹⁵

Despite advances in surgical technique, significant variability persists in operative strategies and postoperative protocols. High-quality comparative studies remain limited, and standardized treatment algorithms have yet to be established. Areas of consensus and ongoing debate in operative and perioperative management are summarized in Table 4.

Table 2: Conceptual evolution and limitations of “spaghetti wrist” definitions.

Conceptual elements	Early definition	Contemporary interpretation	Key limitation	References
Core definition	≥3 structures injured	Spectrum of multistructural injuries	Arbitrary threshold	4 and 5
Anatomical scope	Wrist only	Includes proximal volar forearm	Lack of consensus	9 and 10
Severity classification	Binary (yes/no spaghetti wrist)	Gradual spectrum (3-10+ structures)	Poor stratification	10
Outcome linkage	Implicit severity	Direct prognostic relevance	Inconsistent use	5
Clinical utility	Descriptive term	Decision-making framework	Not standardized	6 and 12

Table 3: Functional outcome domains and assessment tools in Zone V injuries.

Domain assessed	Tool	Strength	Limitation	References
Tendon function	TAM	Simple, reproducible	No nerve assessment	6 and 14
Global disability	DASH	Patient-centered	Non-specific	6 and 14
Multistructural evaluation	Noaman criteria	Comprehensive	Complex, low adoption	5 and 8
Motor recovery	MRC scale	Standardized	Limited scope	13
Sensory recovery	2PD / monofilament	Clinically relevant	High variability	8 and 13

Table 4: Key surgical decision points in zone V self-inflicted wrist injuries.

Steps	Recommended approach	Controversy	Clinical impact	References
Timing	Early (<24h)	Delayed in selected cases	Affects outcomes	6 and 12
Tendon repair	Multi-strand core + epitendinous	Technique variability	Strength vs glide	5 and 8
Nerve repair	Epineural repair	Grafts vs direct repair	Sensory recovery	10 and 13
Vascular repair	Repair if compromised	One artery sufficient?	Ischemia prevention	10 and 11
Exploration	Extensile approach	Selective exploration	Missed injuries risk	13

Table 5: Summary of functional outcomes after zone V wrist injury repair.

Outcome domains	General trend	Key determinant	Clinical implication	References
Tendon recovery	Generally good	Repair technique	Functional restoration possible	8 and 15
Sensory recovery	Often incomplete	Nerve injury	Major limitation	13
Range of motion	Improved with early rehab	Mobilization protocol	Trade-off with rupture risk	15
Return to work	Variable	Psychosocial factors	Not purely surgical	33
Patient perception	Worse than clinical scores	Residual deficits	PROs needed	16-18

REHABILITATION AND FUNCTIONAL RECOVERY

Postoperative rehabilitation is a critical determinant of functional recovery following zone V injuries. Successful outcomes depend not only on surgical repair but also on carefully structured rehabilitation protocols designed to balance protection of repairs with restoration of motion.

Early controlled mobilization has been widely advocated to improve tendon gliding and reduce adhesion formation.⁶ A meta-analysis by Xu et al demonstrated that early mobilization protocols are associated with improved range of motion and functional outcomes, although they may increase the risk of tendon rupture in complex injuries.¹⁵

Conversely, prolonged immobilization may reduce rupture risk but often results in stiffness and delayed recovery.¹⁴ Determining the optimal rehabilitation protocol therefore requires individualized assessment based on injury severity and repair stability.

Clinical outcomes reported in the literature vary considerably. Yazdanshenas et al observed satisfactory tendon recovery in most patients but persistent sensory deficits in cases involving nerve injury.⁸ Jaquet et al confirmed that neurovascular involvement is one of the most important determinants of long-term disability.¹³

Recent prospective cohorts have also emphasized the importance of patient-reported outcomes. Rosales et al demonstrated significant improvements in grip strength and active motion at one year following flexor tendon

repair.¹⁴ However, studies incorporating patient-reported outcome measures suggest that objective clinical scores may underestimate residual disability.¹⁶⁻¹⁸

Reported functional outcomes across key cohorts and reviews are summarized in Table 5

COMPLICATIONS AND PROGNOSTIC FACTORS

Complications remain common following zone V injuries and significantly influence long-term prognosis. Tendon adhesions, joint stiffness, and persistent sensory deficits represent the most frequently reported adverse outcomes.^{8,13} Large cohort studies have identified several risk factors for poor recovery. Jia et al reported that multistructural injuries, delayed rehabilitation, and concomitant nerve damage are major predictors of tendon

adhesions.¹⁹ Similarly, Tessier et al documented persistent complication rates after flexor tendon repair even in specialized centers.¹⁸

Neurovascular injury appears to be the strongest determinant of long-term prognosis. Patients with isolated tendon injuries generally achieve better functional recovery than those with combined tendon and nerve lesions.^{20,21} Although surgical techniques and rehabilitation protocols have improved substantially over the past decades, outcome variability remains considerable. Future research should focus on prospective multicenter studies using standardized outcome measures to better define prognostic factors and optimize management strategies. Table 6 summarizes the most commonly reported complications and associated predictors.

Table 6: Complications and prognostic impact in zone V wrist injuries.

Complications	Frequency	Main predictors	Impact on outcome	References
Tendon adhesions	High (20-40%)	Delayed rehab, complexity	ROM limitation	8 and 19
Rupture	Moderate (5-15%)	Early overload	Reoperation	19
Sensory deficit	Common	Nerve injury	Long-term disability	13
Joint stiffness	Frequent	Immobilization	Functional limitation	21
Reoperation	10-20%	Adhesions, rupture	Prolonged recovery	19
Infection	Low-moderate	Contamination	Complication cascade	19

PROPOSED CLINICAL MANAGEMENT ALGORITHM FOR ZONE V SELF-INFLICTED WRIST INJURIES

Complex volar wrist lacerations involving flexor tendon zone V frequently present as multistructural injuries requiring rapid evaluation and coordinated surgical management. Given the variability in injury patterns and the absence of standardized treatment protocols, several authors have emphasized the need for structured clinical approaches to guide assessment and operative planning.

Initial evaluation should follow the principles of trauma assessment, prioritizing hemodynamic stability and rapid identification of vascular compromise. Examination of distal perfusion, capillary refill, and arterial integrity is essential, particularly when radial or ulnar artery injury is suspected. In cases of active bleeding or evidence of vascular insufficiency, urgent surgical exploration is generally indicated.

Once vascular stability is confirmed, a systematic neurotendinous examination should be performed. Assessment includes isolated testing of finger flexion to evaluate flexor tendon integrity, together with sensory examination in the territories of the median and ulnar nerves. Although these bedside tests remain fundamental, their reliability may be limited in the acute trauma setting

due to pain, swelling, or limited patient cooperation.^{5,8} Operative management typically involves comprehensive exploration of the volar wrist through extensile exposure to identify all injured structures. Because multistructural involvement is common in spaghetti wrist injuries, surgical repair should prioritize restoration of vascular continuity when compromised, followed by tendon repair and microsurgical nerve repair when indicated.^{10,11} Several studies emphasize that failure to identify associated nerve injuries during the initial procedure may significantly compromise functional outcomes.¹³

Following surgical reconstruction, postoperative management focuses on protection of repairs while promoting early functional recovery. Early controlled mobilization protocols are generally favored when repair stability permits, as they may reduce adhesion formation and improve tendon gliding.^{6,16} However, rehabilitation strategies must be individualized according to injury severity and the number of repaired structures.

Finally, psychiatric evaluation and follow-up are essential components of care in patients with self-inflicted injuries. Integration of psychological support alongside surgical management has been recommended to address underlying mental health conditions and reduce the risk of recurrent self-harm.¹² Although high-level comparative evidence remains limited, integrating these steps into a

structured clinical pathway may improve coordination of care and facilitate more consistent management of complex zone V wrist injuries. The proposed clinical

pathway integrating initial assessment, operative priorities, and postoperative rehabilitation strategies for complex zone V wrist injuries is illustrated in Figure 1.

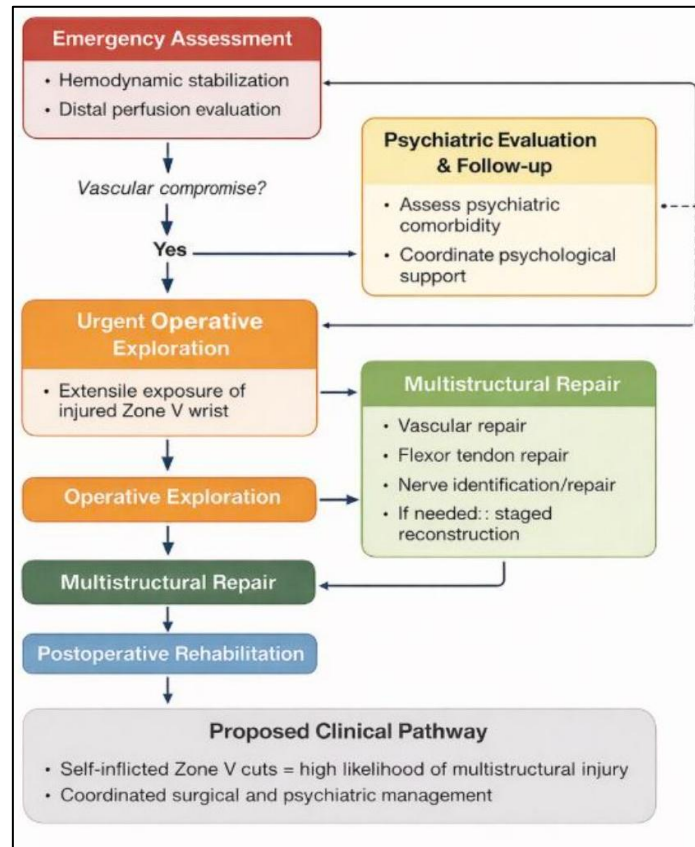


Figure 1: Proposed clinical management pathway for self-inflicted zone V wrist injuries.

This figure illustrates a proposed clinical management pathway for self-inflicted wrist injuries involving flexor tendon zone V. Initial evaluation focuses on emergency assessment, including hemodynamic stabilization and distal perfusion evaluation, with prompt identification of vascular compromise. In cases of suspected vascular injury, urgent operative exploration is indicated.

Surgical management consists of extensile exposure of the injured volar wrist, followed by comprehensive multistructural repair, including vascular reconstruction, flexor tendon repair, and identification and repair of nerve injuries. Staged reconstruction may be considered in selected cases.

Postoperative care emphasizes structured rehabilitation to optimize functional recovery. Given the strong association with psychiatric comorbidities, psychiatric evaluation and follow-up are integrated into the clinical pathway to address underlying mental health conditions and reduce the risk of recurrence.

Overall, this pathway highlights the importance of a coordinated, multidisciplinary approach combining surgical, rehabilitative, and psychiatric management.

DISCUSSION

This narrative review summarizes the available literature on self-inflicted volar wrist injuries involving flexor tendon zone V, with particular emphasis on their surgical management and clinical outcomes. These injuries frequently involve multiple tendons, nerves, and vascular structures, making them among the most complex lesions encountered in hand trauma. Although advances in microsurgical repair and rehabilitation protocols have improved functional recovery, outcomes remain heterogeneous. This variability reflects differences in injury patterns, timing of surgical intervention, rehabilitation strategies, and the frequent coexistence of psychiatric comorbidities.

Definitions and conceptual challenges

One of the persistent challenges in the literature is the lack of a universally accepted definition of “spaghetti wrist.” While several authors define the condition as injury to at least three structures at the volar wrist, others adopt broader criteria including up to ten anatomical elements.^{5,11} Puckett emphasized that outcome interpretation is highly dependent on the definition

applied, as stricter definitions tend to include more severe injuries and therefore report higher complication rates.²² Historical analyses such as that by Eliot illustrate how the concept has evolved from a descriptive term for multistructural wrist lacerations to a more anatomically inclusive classification.²³ This definitional variability complicates comparison between studies and contributes to inconsistencies in reported surgical outcomes.

Surgical management and advances in repair techniques

Modern management of zone V injuries relies on meticulous surgical exploration and multistructural repair. Advances in microsurgical techniques have improved the reliability of vascular and nerve reconstruction; however, postoperative complications remain relatively common. Altigan et al and Groth reported rupture rates after flexor tendon repair ranging from 5% to 12%, even in specialized centers.^{24,25} Howell similarly demonstrated that improvements in suture configuration and tendon repair techniques have not completely eliminated the risk of repair failure.²⁶ Nerve repair outcomes remain particularly variable. Groth showed that although microsurgical epineural repair restores structural continuity, complete sensory recovery is achieved in only a proportion of patients, with residual deficits reported in up to 40% of cases.²⁵ These findings highlight that successful surgical reconstruction depends not only on technical precision but also on biological factors influencing nerve regeneration and tendon healing.

Rehabilitation protocols and functional recovery

Postoperative rehabilitation represents a critical determinant of functional recovery after multistructural wrist injuries. Early controlled mobilization protocols have been widely adopted in modern hand surgery, as they may improve tendon gliding and reduce adhesion formation. Howell and Peck reported significantly greater total active motion in patients undergoing early mobilization protocols (TAM 210-230°) compared with immobilization strategies (TAM 160-180°).²⁶⁻³⁰ Similar findings were reported by Buhkari et al although these authors also noted a reoperation rate of approximately 12% related to tendon rupture or persistent adhesions.³⁰ Saini et al emphasized that adherence to structured rehabilitation programs is essential for optimal outcomes, yet compliance may be compromised in patients with psychiatric comorbidities or limited social support.²⁸ Consequently, rehabilitation protocols must be individualized according to injury severity, repair stability, and patient-specific factors.³¹

Prognostic factors and long-term outcomes

Several prognostic factors have been identified that influence long-term functional recovery after zone V injuries. Among these, nerve involvement appears to be

the most significant determinant of outcome. Opsteegh demonstrated that patients with combined tendon and nerve injuries exhibited significantly worse DASH scores compared with those with isolated tendon injuries.^{30,31} Long-term follow-up studies also suggest that complete functional recovery is not always achieved. Soomro and Kakhi reported satisfactory functional outcomes in only 62% of patients, with persistent sensory deficits representing the most common cause of dissatisfaction.³² In addition to surgical factors, socioeconomic and psychosocial variables may influence recovery. Ozgen et al observed that only 55% of patients returned to work within one year after injury, with psychiatric comorbidity and social instability acting as major barriers to reintegration.^{31,33,34} These findings reinforce the importance of evaluating outcomes from both functional and psychosocial perspectives.³⁴

Psychiatric and multidisciplinary considerations

Self-inflicted wrist injuries represent not only a surgical challenge but also a complex mental health issue. Jeong et al reported recurrence of wrist-cutting behavior in up to 20% of patients who did not receive structured psychiatric follow-up.³ Similarly, Chin et al emphasized that self-inflicted wrist injuries frequently occur in the context of untreated psychiatric disorders, including depression and personality disorders.³³ Such models aim not only to restore hand function but also to reduce the risk of recurrent self-harm and improve overall patient outcomes.

Knowledge gaps and future directions

Despite advances in surgical techniques and rehabilitation strategies, the available evidence remains limited. Most studies are retrospective, single-center investigations with relatively small sample sizes. Moreover, substantial heterogeneity exists in injury definitions, surgical techniques, rehabilitation protocols, and outcome reporting methods. Some studies rely on objective measures such as TAM, while others emphasize patient-reported outcomes or composite scoring systems such as Noaman's criteria. Future research should prioritize multicenter prospective studies that incorporate standardized definitions, uniform outcome measures, and long-term follow-up. In addition, greater integration of patient-reported outcomes and psychosocial assessments may help provide a more comprehensive understanding of recovery after complex zone V wrist injuries.

CONCLUSION

Self-inflicted volar wrist injuries involving flexor tendon zone V represent complex multistructural lesions that require prompt recognition and coordinated surgical management. Although advances in microsurgical techniques and rehabilitation protocols have improved functional outcomes, significant variability persists due to differences in injury severity, nerve involvement, and

patient-related factors. Early surgical exploration, meticulous repair of tendons, nerves, and vascular structures, and structured postoperative rehabilitation remain central to optimizing recovery. In addition, the frequent association with psychiatric comorbidities underscores the importance of integrating mental health evaluation into the management pathway. Future multicenter studies with standardized definitions and outcome measures are needed to improve comparability across studies and guide evidence-based management of these challenging injuries.

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