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Research Article

Factors Associated with Complex Regional Pain Syndrome in Patients with Surgically Treated Distal Radius Fracture

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Abstract

Background: Complex regional pain syndrome (CRPS) is an important common complication after surgical treatment for distal radius fracture. Recognition of the related factors is important to reduce the burden of the problem. Herein, the contributing factors for CRPS after distal radius fracture surgery are studied.
Methods: In this cross-sectional comparative study, 250 patients admitted to the orthopedics ward in Sina Hospital in Tehran, Iran, from 2017 to 2020, were enrolled. The contributing factors for CRPS after distal radius fracture surgery were determined in them.
Results: The CRPS was seen in 17 cases (6.8%). 9 percent of male and 1.9 percent of female patients were diagnosed with CRPS. This showed a significant difference in the Fisher test (P = 0.028). The mean pain severity by Visual Analogue Scale (VAS) was higher in CRPS cases, that showed a significant difference by the Mann-Whitney test (P = 0.001).
Conclusion: According to the obtained results, it may be concluded that CRPS was seen in seven percent of patients under surgery for distal radius fracture and was related to the male gender and higher pain severity.

Keywords: Risk Factors; Complex Regional Pain Syndrome; Wrist Fractures

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Background

Complex regional pain syndrome (CRPS) may be a neuropathic torment clutter characterized by the nearness of particular clinical highlights, counting allodynia, hyperalgesia, pseudomotor and vasomotor variations from the norm, and trophic changes (1). The torment experienced is unbalanced to the degree of tissue harm and last longer than the ordinary anticipated time for tissue mending. The pathophysiology is multifactorial and includes torment dysregulation within the thoughtful and central apprehensive frameworks, with likely hereditary, provocative, and mental commitments (2).

There are two subtypes: sort I, once in the past known as reflex thoughtful dystrophy, and sort II, once known as causalgia. Sort I occurs within the nonattendance of nerve injury, whereas sort II happens within the setting of known nerve injury. Clinically, they are undefined and take after a territorial instead of dermatomal or fringe nerve dissemination (3).

CRPS is subdivided into “warm” versus “cold” and sympathetically-maintained versus sympathetically-independent, which may influence diagnosis and treatment options (4). Clinically, they are vague and take after a territorial instead of a dermatomal or fringe nerve dispersion (5-7).

There are several etiologies for CRPS. Various degrees of tissue injury and trauma can induce CRPS. Another etiology is prolonged immobilization. Fracture is the most common type of limb injury which causes CRPS. Surgery is another common etiology. CRPS can occur after minor injuries such as sprain, strain, superficial wound, laceration, and abrasions (2).

Fracture: CRPS has been known to be commonly related to limb fractures. A huge multicenter planned study found that 48.5% of patients developed CRPS [International Association for the Study of Pain (IASP) criteria] after enduring a single break of the lower leg, wrist, scaphoid, or the fifth metatarsal. All patients remained symptomatic at 1-year follow-up. Rheumatoid joint pain and intra-articular lower leg fractures and dislocation were recognized as chance components for CRPS. In any case, no critical distinction for illness onset was famous between fractures of arms or legs (8). Another planned cohort found that CRPS was created within eight weeks after a trauma. Indications progressed in numerous patients at three months, but no noteworthy change was famous for almost a year (9). Some consider that patients who created CRPS after the break of the distal sweep were recognized by higher age, social or mental disorders, and psychiatric comorbidities as hazard factors (10, 11). However, another recent study did not discover any relationship between mental variables or misery indications and the advancement of CRPS (12).

Surgery: Like fractures, limited surgeries appear to be more commonly related to the advancement of CRPS as

well. In a review study of 390 patients who experienced foot and/or lower leg surgeries, 4.36% created CRPS (13). Surgical administration of fractures has been found to have the next hazard of CRPS (14). Carpal burrow surgeries were famous for having a 2% to 5%, and Dupuytren's contracture surgeries had a 4.5% to 40% chance of creating CRPS (13, 14).

Genetics: The effect of hereditary variables on the advancement of CRPS is vague. Human leukocyte antigen and tumor necrosis factor-alpha (TNF-α) polymorphism have been found to play a part in CRPS. These components can lead to a prior age of onset and more extreme side effects (15).

This study evaluated risk factors that cause CRPS after a distal radius fracture treatment.

Methods

This observational study was performed as a cross-sectional study in Sina Hospital of Tehran, Iran, on patients with distal radius fractures referred to the orthopedic ward from 2017 to 2020. The data collection method was convenience sampling and included 312 patients.

The data required for the study were obtained by checklists and patient's hospital records, which included age, gender, clinical indicators, risk factors, and pain intensity [Visual Analogue Scale (VAS)] of patients at the time of hospitalization.

Inclusion criteria for patients with hospitalized distal radius fractures included distal radius fractures following surgery in the operating room and age of 16 to 70 years, and exclusion criteria included concomitant fractures, vascular problems, compartment syndrome, history of conversion diseases, and age under 16 or over 70 years old. Informed consent was obtained before entering the study.

Patients with distal radius fracture were included in the study, and after confirmation of the fracture, at intervals of 24 hours, one month, and 6 months after the fracture, they were again visited and evaluated for pain and CRPS symptoms. Pain intensity was assessed by VAS criteria, and the diagnosis of CRPS was based on the criteria of the IASP. Data were analyzed by SPSS software (version 26, IBM Corporation, Armonk, NY, USA), and the significance level was 0.05.

Results

Out of 312 patients, 250 met the inclusion criteria, of which 20 (8%) had CRPS with a mean age of 40.6 years, and in other cases, CRPS was not observed; this group had a mean age of 42.34. Out of the total population, 19 (10.7%) were men, and only 1 (1.4%) was a woman with CRPS, with a statistically significant difference between them (P = 0.014).

Most people with CRPS had lower socioeconomic status (15 out of 20 patients) with a statistically significant difference (P = 0.018) according to the chi-square test results.

Depending on the type of fracture, 12 out of 20 patients had closed fractures, and 8 cases had open fractures, which had a significant difference (P = 0.01).

In the study of history of the disease in the study groups, only 2 people with a history of hypertension, 7 people with a mental disorder, 12 people with a history of smoking, and no cases of diabetes were observed.

As shown in table 1, the frequency distribution of CRPS in patients based on high-impact fracture mechanisms was statistically significant according to the chi-square test results (P = 0.001).

Table 1. Frequency distribution of complex regional pain syndrome (CRPS) in patients based on the fracture mechanism

		CRPS		
		Yes	No	Total
Mechanism of fracture	High impact	14 (16.1)	73 (83.9)	87 (100)
	Low impact	6 (3.7)	157 (96.3)	163 (100)
Total		20 (8.0)	230 (92.0)	250 (100)

Data are presented as number and percent.
CRPS: Complex regional pain syndrome

The frequency distribution of CRPS in patients based on the type of compression fracture was statistically significant according to the chi-square test results (P = 0.008) (Table 2).

Table 2. Frequency distribution of complex regional pain syndrome (CRPS) in patients by type of fracture

		CRPS		
		Yes	No	Total
Classification of fracture	Bending	1 (1.3)	74 (98.7)	75 (100)
	Shearing	5 (7.6)	61 (92.4)	66 (100)
	Compression	14 (16.9)	69 (83.1)	83 (100)
	Avulsion	0 (0)	8 (100)	8 (100)
	Combined	0 (0)	13 (100)	13 (100)
	Salter-Harris	0 (0)	5 (100)	5 (100)
Total		20 (8.0)	230 (92.0)	250 (100)

Data are presented as number and percent.
CRPS: Complex regional pain syndrome

As given in table 3, the frequency distribution of CRPS in patients based on pain intensity was statistically significant according to the results of the Mann-Whitney test (P = 0.001), and pain intensity in patients with CRPS was more significantly different (Figure 1).

Table 3. Frequency distribution of complex regional pain syndrome (CRPS) in patients based on pain intensity

	CRPS	N	Mean ± SD	Standard error of the mean
VAS	Yes	20	2.10 ± 1.07	0.240
	No	230	1.16 ± 1.09	0.072

CRPS: Complex regional pain syndrome

Discussion

CPRS is one of the most common problems in the postoperative phase in patients with distal radius fractures. By assessing the factors associated with the occurrence of CRPS in distal radius fractures, the occurrence of this complication can be prevented. On the other hand, if CRPS occurs by recognizing the related factors, it can be performed more accurately in the approach.

In this study, patients who underwent open reduction and internal fixation (ORIF) and closed reduction internal fixation (CRIF) surgery were evaluated for the incidence of CRPS. In the group for which ORIF was performed, the incidence of CRPS was statistically significant, which due to the severity of trauma, fracture type, and soft tissue damage caused by ORIF, CRPS can be justified. This can be included in our study with a selection bias because the surgeon did not use ORIF randomly, but underwent surgery based on surgical indication and fracture type.

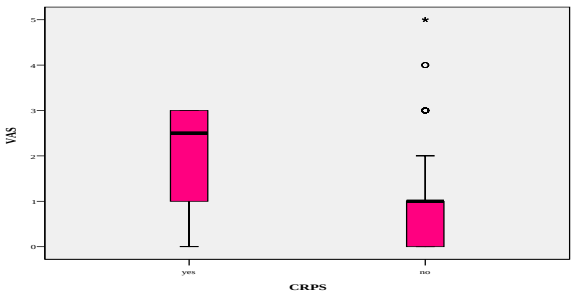

Figure 1. Frequency distribution of complex regional pain syndrome (CRPS) in patients based on pain intensity

Another variable that was examined in this study was the gender of patients; 9% of men and 1.4% of women had CRPS. Unlike other studies of men, in our study, it was more, given that our center is a referral center and the referred cases have suffered from high-energy trauma, and high-energy trauma has been more in men in the study population. Doing multi-hospital studies in the future can fix our input data flaws.

Smoking was higher in men who had CRPS. The same statistic for Iranian women has varied from 0.6% to 9.8%. This study may have exaggerated the incidence of CRPS. A study by Zale et al. in 2021, conducted in the United States in retrospective cohorts, examined 26 patients with CRPS in the post-distal radius fracture phase; two-thirds of whom were men (16).

Another variable that was qualitatively examined in our study, which is also associated with the incidence of CRPS, is the economic status of patients, which was higher in people with good economic status. A study by Ortiz-Romero et al. also examined the economic situation that exacerbated the risk of CRPS after distal radius fractures (14).

In our study, the type of fracture and the causative agent of the fracture were also evaluated. With soft and ligament injuries, along with the severity of trauma in these people, the incidence of CRPS can be justified.

In Roh et al. study in South Korea, 477 patients with distal radius fractures were identified, of whom 42 (8.8%) had CRPS. Fracture type and higher severity of injury were CRPS-related factors (15).

Another variable that was examined in our study was pain intensity based on VAS criteria, which in patients with CRPS in the first 24 hours after surgery had a statistically significant increase in the study of Zale et al. A retrospective cohort was performed, and the results were published in 2021 (16). By examining 26 patients with CRPS in the phase after distal radius fracture, it was found that there was a significant relationship with the severity of pain in patients based on VAS.

Conclusion

Overall, based on the results obtained in this cross-sectional study, it is shown that CRPS in patients with distal radius fracture in the postoperative phase is observed in 8 percent of cases. Male gender, economic factors, smoking, history of mental disorders, and more severe postoperative pain were associated risk factors. However, multicenter studies with a larger sample size and comparison of CRPS cases based on the results of other variables that were not examined in our study, such as more underlying diseases, osteoporosis, and patients' medical records, are recommended to achieve more documented results.

Conflict of Interest

The authors declare no conflict of interest in this study.

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