

# The Complex Regional Pain Syndrome after Fractures of Distal Radius

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## ABSTRACT

**Objectives:** The present study aims to determine frequency of Complex regional pain syndrome (CRPS) after distal radius fractures on the basis of clinical examination findings and classify into stages and to find out association of CRPS with age, genders, and risk factors.

**Study Design:** Prospective cross sectional study

**Place and Duration of Study:** This research work was conducted at the Department of Orthopaedics, Creek General Hospital Korangi Karachi, Pakistan from January 2013 to April 2014.

**Materials and Methods:** This is a prospective cross sectional study of 150 cases. Follow up of patients is undertaken in out-patient department for a minimum 4 months period following injury. The percentage of patients with CRPS was identified according to IASP Diagnostic Criteria based on history and physical examination.<sup>1,2,3,4</sup> Patients were studied prospectively to ascertain the incidence, natural history and the degree of morbidity induced by CRPS.

**Results:** Mean $\pm$  SD age was  $45.6 \pm 14.2$  years (*Range = 18 – 75 years*). There were 88 (58.7%) males and 62 (41.3%) females with Male: Female = 1: 0.7. CRPS was found in 20 (13.3%) cases. Out of 20 CRPS patients 12 (60%) were female, out of 20 CRPS patients 12 (60%) had age 40 – 59 years and 8 (40%) had age  $>59$  years. Out of 20 CRPS patients 14 (70%) were diagnosed in stage 1.

**Conclusion:** The incidence of CRPS after distal radius fracture in this study is 13.3%. Proportion of CRPS was high in females and in old patients. Most of the patients of CRPS were diagnosed in stage 1. Diabetes mellitus, hypertension, stroke, carpal tunnel syndrome and myocardial infarction were the risk factors found in patients diagnosed with CRPS. CRPS is an under diagnosed entity. More work needs to be done on CRPS as many areas of research remains.

**Key Words:** Complex regional pain syndrome; Sudeck's dystrophy; Reflex sympathetic dystrophy; IASP.

## INTRODUCTION

Complex regional pain syndrome (CRPS), formerly known as Sudeck's dystrophy or reflex sympathetic dystrophy, is a painful disorder with clinical features that include pain, sensory and vasomotor disturbances, trophic changes and impaired motor function.<sup>1</sup> The disease course varies from relatively mild and self-limiting to chronic disease with a high impact on daily functioning and quality of life.<sup>2</sup> Usually, symptoms appear in one extremity after even a relatively mild trauma, for example a fracture, contusion or surgery.<sup>3</sup>

Complex regional pain syndrome (CRPS) is a perplexing condition characterized by local neurogenic inflammation out of proportion to injury affecting the limbs, without nerve injury (CRPS I or reflex sympathetic dystrophy [RSD]) or with obvious nerve lesions (CRPS II or causalgia).<sup>4-9</sup> It consists of pain and related sensory abnormalities, abnormal blood flow and sweating, abnormalities in the motor system and changes in the structure of both superficial and deep tissues (trophic changes).<sup>7-12</sup> Psychological and social problems such as anxiety, depression, fear avoidance (of painful movements) and loss of employment may develop. Both the affected body part and the patient as

a whole may become "dysfunctional" in CRPS. Other terms commonly used to describe CRPS are algodystrophy, shoulder-hand syndrome and sudeck's atrophy.<sup>5,6,8,10</sup> The inciting injury may be a sprain, dislocation, fracture or post-surgery.<sup>4,7,13,14</sup> The syndrome may also be associated with medical conditions such as diabetic neuropathy, multiple sclerosis, stroke, myocardial infarction and cancerous infiltration of a nerve plexus.<sup>7,9</sup> The reported incidence of CRPS after wrist fractures is 7-35%.<sup>4,7,15,16</sup> CRPS appeared equally distributed in every age group, except in children under 10 as widely reported in literature. It is not a diagnosis of exclusion, because International Association for the Study of Pain (IASP) has formulated a Diagnostic Criteria for CRPS.<sup>4,5,6</sup> The diagnosis of CRPS is possible as soon as one week after fracture by history and physical exam.

Treatment is crucial within the first three to six months when the disease responds best. Otherwise the syndrome may progress producing a lifetime chronic pain, permanent functional impairment, resistance to treatment and resultant emotional distress.<sup>8</sup> Management of CRPS is based on the bio-psychosocial model of pain and should involve a multidisciplinary team. Keystones include the provision

of effective analgesia, allowing the affected region to be mobilized (physical therapy) and returned to normal function as soon as possible, the "use it or lose it principle". Psychological, social and occupational rehabilitation should also be provided. The study will be helpful in identifying early screening of CRPS patients to avoid delayed complications involving no risk and benefit to patient.

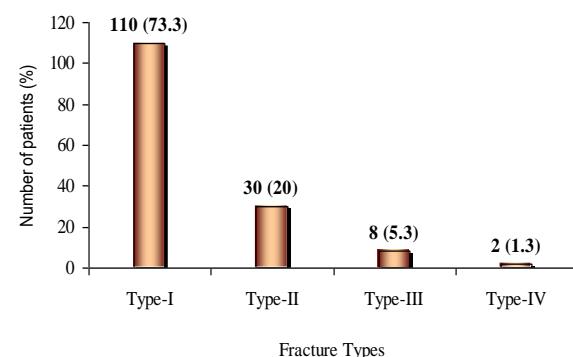
## MATERIALS AND METHODS

This research work was conducted at the department of Orthopaedic surgery, Creek General Hospital Korangi, Karachi from January 2013 to April 2014. This is a cross sectional done on 150 patients sustained close distal radius fractures. All patients with fractures of distal radius were clerked at Orthopedics clinic and Accident & Emergency, a full history and physical examination was done. Patients were recruited after taking the informed consent. The patients who were excluded from the study included presentation after one week of fracture, multiple fractures, disability of affected limb prior to fracture, pathological fracture and patient suffering from psychiatric illness. Pre-reduction and post-reduction roentgenograms of affected wrist were taken. Fracture patterns were categorized according to Fernandez classification.<sup>17</sup> All relevant features including patient's bio data, clinical and radiological findings at presentation and follow up visits were recorded on proforma. Follow up of patients was undertaken in out patient department for a minimum of 4 months period following injury. The percentage of patients with CRPS was identified according to IASP Diagnostic Criteria based on history and physical examination.<sup>1,2,3,4</sup> Patients were studied prospectively to ascertain the incidence, natural history and the degree of morbidity induced by CRPS.

The data was entered and analyzed by SPSS 12. Frequencies and percentages were calculated for all qualitative/categorical data including sex, age groups, mechanism of injury, risk factors, types of fracture, history of surgery, sign and symptoms of CPRS, pain visual analog scale (PVAS) and the ratio of CRPS among the total screened patients was presented by their frequency and percentage. Chi-square test for proportions was used for compare the proportion of sign and symptoms (between day-1 and 16 weeks). Mean $\pm$  SD was computed for age and PVAS. Student's t-test was used to compare the mean of PVAS (between day-1 and 16 weeks). The results were considered statistically significant at  $p < 0.05$ .

## RESULTS

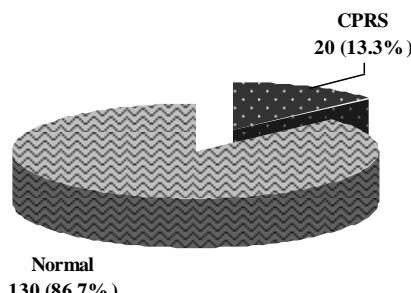
This study was conducted on 150 patients with fractures of distal radius. Mean $\pm$  SD age was  $45.6 \pm 14.2$  years (Range = 18 – 75 years), age of 68(48) cases was 40 – 59 years, 48 (33.3%) cases had age 20 - 39 years while 30 (16%) cases had age  $> 59$  years.



**Figure No.1: Types of Fracture n = 150**

**Keys:**

- Type-I = Metaphyseal bending fracture
- Type-II = Shearing fracture
- Type-III = Compression of the articular surface without fragmentation
- Type-IV = Avulsion fracture or radiocarpal fracture dislocation
- Type-V= Combined injury with significant soft tissue involvement



**Figure No.2: Proportion of Patients with Complex Regional Pain Syndrome (CRPS) n = 150**

Key: CRPS = Complex Regional Pain Syndrome

Among these 150 patients, 88 (58.7%) were males and 62 (41.3%) were females with Male: Female = 1: 0.7. According to the presenting complaint, all patients came with Pain and swelling.

Out of 150 patients, 88 (58.7%) patients had history of fall in different modes while 62 (41.3%) came with history of road traffic accident.

According to Fernandez classification of fracture patterns, there were 110 (73.3%) patients of type-I fracture, followed by 30 (20%) patients of type-II, 8 (5.3%) patients of type-III and 2 (1.3%) patients of type IV. (Figure-1)

Out of 150 patients, only 12 (8%) patients had a history of previous surgery.

The percentage of patients with Complex Regional Pain Syndrome (CRPS) was identified according to IASP diagnostic criteria based on history and physical examination. CPRS was found in 20 (13.3%) cases. (Figure-2)

Swelling was the most common finding in all 150 (100%) patients at day-one, followed by altered temperature of limb skin in 136 (90.7%) patients, color changes of limb in 132 (88%) patients. All these symptoms were decreased significantly after sixteen weeks, found in only 18 (12%) patients (P-value <

0.0001). While sweating changes was seen in 24 (16%) patients at day-one and after sixteen week found in 20 (13.3%) patients (P-value = 0.546). Table-1

Mean  $\pm$  SD of score on Pain Visual Analog Scale (PVAS) was  $5.89 \pm 0.61$  at day one and after sixteen weeks the score was significantly decreased up to  $1.2 \pm 2.26$ . (P-Value  $< 0.0001$ ). Score greater than 6 was seen in 40 (26.7%) cases at day-1, after sixteen weeks this proportion of patients was reduced to 20 (13.3%). Table-2

Out of 20 CRPS patients, stage one was seen in 14 (70%) and stage two was seen in 6 (30%) patients. Table-3.

**Table No.1: Sign and Symptoms of Complex Regional Pain Syndrome n = 150**

Signs & Symptoms	Day one	16 Weeks	P-Values*
Swelling	150 (100%)	18 (12%)	< 0.0001
Altered Temperature of Limb Skin	136 (90.7%)	18 (12%)	< 0.0001
Color Changes of Limb	132 (88%)	18 (12%)	< 0.0001
Sweating Changes	24 (16%)	20 (13.3%)	0.546
Motor	146 (97.3%)	18 (12%)	< 0.0001
Dystrophic	18 (12%)	18 (12%)	1

\* By Chi-Square test for proportions

**Table No.2: Pain Visual Analog Scale n = 150**

PVAS	At Day One	At 16 weeks
$\leq 6$	110	130
$> 6$	40	20
Mean $\pm$ SD	$5.89 \pm 0.61$	$1.2 \pm 2.26$
P-Value	$< 0.0001$	

**Table No.3: Stages of Complex Regional Pain Syndrome (CRPS) n = 20**

Stages	Number of Patients	Percentages
First	14	70%
Second	6	30%
Third	0	0

Hypertension (HTN) with Diabetes mellitus (DM) was the most common risk factor of CRPS. They were present in 4 (20%) patients, HTN was present in 3 (15%) and DM was present in 2 (10%) patients, HTN with previous history of myocardial infarction (MI) was seen in 2 (10%) patients, HTN with DM and stroke combined was seen in 1 (5%) and Carpal tunnel syndrome (CTS) proved by electromyography and nerve conduction study was seen in 1 (5%) patient.

Proportion of CRPS was high in females, out of 20 CRPS patients 12 (60%) were female and 8 (40%) were male patients.

Proportion of CRPS was high in old patients, out of 20 CRPS patients 12 (60%) had age 40 – 59 years and 8 (40%) had age  $> 59$  years.

## DISCUSSION

Complex regional pain syndrome is a severe complication in orthopedic surgery. Trauma patients; undergoing conservative management or orthopedic procedures frequently develop complex regional pain syndrome, particularly the hand or forearm. It is characterized by the presence of regional pain and sensory changes followed predominantly by traumatic noxious event. Pain is associated with edema abnormal skin color, skin temperature alteration, and abnormal sudomotor activity. In post-traumatic patients, the clinical examination still is preferred to establish the diagnosis of complex regional pain syndrome. First, possible differential diagnosis must be excluded. Next the clinical criteria of definition should be checked and documented, if possible with the help of verifying procedures. Like most medical conditions, early diagnosis and treatment of CRPS increase the likelihood of a successful outcome.

The incidence of CRPS after fractures of the distal radius found in this study is 13.3%. This incidence of CRPS agrees with the incidences of 16.4% in 140 patients at the Mayo Clinic<sup>8</sup> during a span of 2 yr. This is in disagreement with other studies, 0.9% - 7%, found in previous studies, and in disagreement with higher incidences, 15–37% (Atkins et al. Bickerstaff and Kanis, Cooney et al., de Bruijn, Field and Atkins, Hove)<sup>18,19</sup>. The incidence of CRPS seems to be dependent on the criteria used in different studies. However, the diagnostic criteria used in those studies differ considerably from the studies with the lower incidences.

The proportion of signs and symptoms after day one was very high; swelling was seen in 100%, followed by altered temperature of limb skin in 90.7%, color changes of limb in 88%. All these symptoms were decreased significantly after sixteen weeks, the proportion of patients complaining of swelling, altered temperature of limb skin, and color changes of limb had fallen to 88%. While sweating changes was seen in 16% at day-one and after sixteen week found in 13.3%. Bickerstaff DR, and Kanis JA reported the same results.<sup>20</sup>

The highest incidence rate of 60% in our study was observed in the age group of  $> 59$  years with mean age at diagnosis was  $66.5 \pm 5.3$  years. The similar results were seen in an international study. This age peak is higher than is generally expected and observed in some non-population-based investigations (Veldman et al., 1993). However, other clinical studies showed high average ages of patients, in line with our observation (Atkins et al., 1990; Field and Atkins, 1997; Zollinger et al., 1999). It could be suggested that the increasing

incidence of CRPS with age is due to a higher occurrence of fractures at older age. However, the same age distribution pattern was observed in the group of patients with another precipitating event other than a fracture.

Out of 20 CRPS patients 14 were diagnosed in stage 1 and 6 were diagnosed in stage 2. Most of the cases were picked early.

Hypertension, diabetes mellitus, stroke, history of myocardial infarction and carpal tunnel syndrome were the risk factors found in patients diagnosed with CRPS. Many of these have been associated with CRPS in previous studies.

From our findings, it can be concluded that the majority of the CRPS cases in females occur in the postmenopausal stage of life. This was noted before by Zollinger and colleagues (Zollinger et al., 1999).

The age and sex distribution pattern suggests that hormonal etiological factors may be involved in the pathogenesis of CRPS.

## CONCLUSION

Incidence of CRPS after distal radius fracture found in this study is 13.3%. At day one swelling was the most common symptom followed by altered temperature of limb skin and color changes. After 16 weeks sweating changes was in 13.3% patients followed by swelling, altered temperature of limb skin, motor changes and dystrophic changes at 12%. Hypertension, stroke, previous history of myocardial infarction, diabetes mellitus and carpal tunnel syndrome were the risk factors found in patients diagnosed with CRPS. Proportion of CRPS was high in females and in old patients. Most of the cases diagnosed with CRPS were in stage 1. CRPS is a neglected disorder and is far more common than appreciated. The problem may be an under recognized one. We observed that persons with persistent post traumatic pain and swelling eventually diagnosed with CRPS undergo unnecessary test resulting in inappropriate or delayed treatment. Early diagnosis of CRPS is essential as treatment in early stage is beneficial whereas, if the disease progresses to an advanced stage treatment is mainly ineffective. Awareness about the condition is the only way it can be diagnosed early. Diagnosis of CRPS raises many questions regarding its etiology, underlying mechanisms, contributing and perpetuating factors. More studies should be done on CRPS as several areas of research remain the risk factors, the clinical management of CRPS, the difference in patient's susceptibility to develop CRPS, the criteria themselves, etc.

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