

Functional impairment of the extremities in patients who got over Complex Regional Pain Syndrome

ANDRZEJ ŻYLUK

Department of General and Hand Surgery, Pomeranian Medical University in Szczecin, Szczecin, Poland

Corresponding author: Prof. Andrzej Żyluk, M.D. Ph.D.

Department of General and Hand Surgery
Pomeranian Medical University in Szczecin
ul. Unii Lubelskiej 1, 71-252 Szczecin, Poland
Phone/Fax: +48 91 425 31 96; E-mail: azyluk@hotmail.com

Abstract: Complex regional pain syndrome (CRPS) is a descriptive term for a complex of symptoms and signs, including pain, swelling and vasomotor disturbances. The disease causes also functional impairment of the affected extremity and limitation in daily activities. Even after effective treatment, the condition frequently leaves residual symptoms and impairment of the limb.

The objective of this study was assessment of the level of functional impairment in patients who got over CRPS.

Materials and Methods: Fifty-two patients, 45 women (86%) and 7 men (14%) in a mean age of 57 years who were got over CRPS were asked to fill 2 questionnaires for assessment of function of their upper limbs in daily living. The questionnaires included the Raadboud Skills Questionnaire (the RASQ) and the Disability of Arm, Shoulder and Hand (the DASH).

Results of this study show statistically significant differences in functional impairment of the limbs between the groups with different recovery status and duration of CRPS: the patients with longer lasting disease and those, who did not feel recovered showed greater functional impairment of their limbs than remaining patients.

Conclusion: These results suggest that, in spite of a satisfactory outcome of treatment, significant long-term sequelae of the disease impair function of the affected limbs and reduce quality of life in a proportion of patients.

Keywords: Complex regional pain syndrome, functional impairment, outcome measures, questionnaires.

Submitted: 01-Sep-2024; **Accepted in the final form:** 25-Oct-2024; **Published:** 26-Dec-2024.



Introduction

Complex regional pain syndrome (CRPS) is a descriptive term for a complex of symptoms and signs, including pain at rest or at the slightest movement, swelling, vasomotor instability (changes of colour, temperature and sweating) and is accompanied by severe functional impairment of the affected hand or whole extremity (Figs 1, 2). It is usually caused by trauma or surgery and is characterized by presence of these symptoms and signs which are more severe than would normally be expected for the degree of trauma of the precipitating event (which can sometimes be very minor) and extend beyond the area involved by the initial trauma [1–3]. The clinical presentations of CRPS vary between patients. CRPS is not confined to the hand and upper extremity. Involvement of the foot, knee and hip have been described and generally (although very infrequently) it can occur anywhere in the body. CRPS in upper extremity most commonly occurs after trauma or surgery, but it can occur after a stroke, heart disease or spontaneously [1, 2].



Fig. 1. Typical “guarding” position of the upper extremity in patient with acute CRPS. Note swelling and “shining” skin in the affected hand.

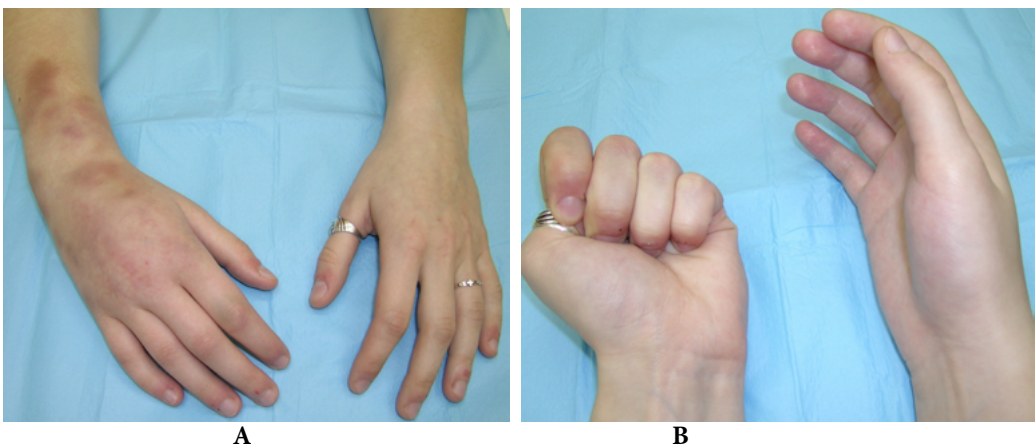


Fig. 2. Chronic CRPS involving right hand of the patient. (A) Note paleness of the skin and trophic changes in form of cyanotic spots. (B) Note stiffness of the fingers.

In most cases CRPS resolves within a year, but some symptoms may persist longer, i.e. pain remains in 13% of patients over 1 year after diagnosis [4–7]. Longer-term retrospective studies report the persistence of symptoms for between 22% and 64% of patients even 3 years after diagnosis [4, 5]. Unremitting symptoms (sequele) of CRPS are associated with disability, poor psychological health and reduced quality of life [8–10].

The trajectory of chronic, long-lasting CRPS is not straightforward and signs and symptoms can fluctuate over time. While many of the initial florid, presenting features of CRPS may disappear, patients may remain far from their premorbid health state [11, 12]. Moreover, when symptoms tend to persist, the reduction of clinical signs may cause that the patient barely meets diagnostic criteria of the disease. In this scenario declaration of the efficacy of therapeutic interventions, as well as recovery from CRPS may be difficult.

The objective of this study was assessment of the level of functional impairment in patients who got over Complex Regional Pain Syndrome.

Materials and Methods

A total of 156 patients were identified in the authors' institutional CRPS Register. The patients were registered over a period of 14 years (1998–2012). A set of two questionnaires were sent to these patients: the Raadboud Skills Questionnaire (the RASQ) and the Disability of Arm, Shoulder and Hand (the DASH). The package sent to the patients contained also the informed consent in participation in this study and a brief instruction how to fill each questionnaire.

Brief description of questionnaires

The RASQ questionnaire is a disease specific instrument introduced in 1999 in the Netherlands, consisting of 45 items, with 3 distinct domains: (a) personal care/hygiene, (b) domestic activities and (c) other activities (recreation, work) [13]. The answers of RASQ are scored according to Likert 1–5 scale: 1 — Normal (as is usual for me); 2 — With a bit more effort; 3 — With clearly more effort (can use my hand a bit); 4 — With a lot of effort (important adjustments); 5 — I do not do it any more alone; 9 Not applicable item. The not applicable item is not considered in the total score. The results are given in scores of individual items ranged 1–5 and assigned to particular domains. Lower scores indicate better function of the extremity, whereas greater scores show poorer function (greater impairment). In general the RASQ items ask about daily activities more detailed and concern more activities than the DASH. The RASQ have also not items concerning pain experience.

The DASH questionnaire is a 30-items test (instrument) designed to self-assessment of function of the upper extremity. Particular items of the test ask about various aspects of limitation in daily activity of the patient caused by the disease or injury. Twenty-three items concern function of the extremity, whereas 7 concern pain, and pain-related phenomena associated with the activities. Each item is scored in the Likert scale (from 1 to 5), where 1 indicates no pain or unrestricted ability to perform given task, whereas 5 indicates constant, severe pain or inability to perform given task. After adding all individual scores, the sum (the raw score, range 30–150) is next converted to a final score (range 0–100). Lower scores indicate better function of the extremity, whereas greater scores show poorer function (greater impairment).

The patients were asked to complete the questionnaires. Additionally, the patients were asked to respond the question if they feel recovered from the CRPS. All returned questionnaires were analysed.

Statistical analysis

The statistical significance of differences of variables between subgroups of patients was examined with the U Mann–Whitney test for non-normal distribution of variables. For analysis of the correlation between the RASQ and the DASH scores, the Spearman rank test was used. A confidence level of 0.05 was assumed as indicating statistical significance.

Results

The questionnaires was sent to 156 patients and a total of 52 (33%) questionnaires returned. Thus, the study group consisted of 52 patients, 45 women (86%) and 7 men (14%) in a mean age 57 years (range 24–77). All patients had upper extremity involved and additionally, 3 patients had the disease localized in the lower limb. Duration of CRPS was a mean of 4.5 years (range 0.5–14); Table 1 shows disease duration in particular time intervals.

Table 1. Duration of CRPS in 52 patients in the study.

Duration of CRPS	Number of patients	%
<1 year	9	17%
1–3 years	15	29%
3–10 years	18	35%
>10 years	10	19%
Total	52	100%

Results of analysis of the RASQ scores

Results of analysis of the RASQ questionnaires are shown in Tables 2–4. The mean total score for the whole test was 2.5 and scores for particular activities did not differ significantly one from another (Table 2). Mean scores were distributed around half of the scale (2.4–2.5 points) what indicated that activities were performed with a bit more effort or with clearly more effort than normal. It concerned all three subscales.

Results of the RASQ scores in patients with different duration of CRPS (Table 3) showed statistically significant differences. The patients with duration of the disease 1–3 years had statistically significantly greater scores in each of the domains, comparing to patients in other groups (U Mann–Whitney test, $p = 0.01$). Differences of scores between other subgroups were not statistically significant.

Results of the RASQ scores in patients with different recovery status (Table 4) showed statistically significant differences. The patients who declared full recovery had RASQ scores statistically significantly lower than those with “partial” or “no-recovery” status (U Mann–Whitney test, $p = 0.007$). Likewise, the differences between scores of “partially recovered” vs “non-recovered” patients were statistically significant ($p = 0.03$).

We also recorded which items were most frequently marked as not applicable. And so, performing occupation was declared as not applicable by 28 (54%), participating in sport by 27 (52%), transportation on a bicycle by 24 (46%), transportation in a car by 22 (42%), doing needlework, knitting by 22 (42%), and to fold and iron the washing by 20 patients (38%).

Table 2. Results of the RASQ in the study group.

The RASQ domains	Mean score	Number of answers “not applicable”
Personal hygiene	2.4	20 (2%)
Domestic activities	2.5	109 (12%)
Other activities	2.5	158 (23%)
Total score	2.5	287 (12%)

Table 3. Results of the RASQ in patients with different duration of CRPS.

Duration of CRPS	Total score	Personal hygiene	Domestic activities	Other activities
<1 year	1.7	1.6	1.7	1.8
1–3 years	2.8	3.0	3.2	2.7
3–10 years	2.1	2.2	2.3	2.1
>10 years	2.1	2.1	2.2	2.2

Table 4. Results of the RASQ in patients with different recovery status.

Recovery status	Total score	Personal hygiene	Domestic activities	Other activities
Fully recovered n = 6	1.4	1.4	1.6	1.5
Partially recovered n = 29	2.2	2.2	2.3	2.2
Not recovered n = 17	2.7	3.0	3.2	2.6

Results of analysis of the DASH scores

A mean DASH score for the whole group was 26 (range 7–76), indicating mild/moderate functional impairment.

Results of the DASH scores in patients with different duration of CRPS (Table 5) showed statistically significant differences between subgroups with CRPS duration 1–3 years and >10 years vs those with CRPS duration <1 year and 3–10 years (U Mann–Whitney test, $p = 0.03$). Differences in DASH scores between other subgroups were not significant.

Table 5. Results of the DASH in patients with different duration of CRPS.

Duration of CRPS	The DASH score	
	Mean	Range
<1 year	21	13–44
1–3 years	32	7–76
3–10 years	19	10–65
>10 years	31	12–67

Results of the DASH scores in patients with different recovery status (Table 6) showed statistically significant differences between all three subgroups (U Mann–Whitney test, $p < 0.005$). The patients who declared full recovery had normal function of the affected extremity (a mean DASH score 14), those who felt partially recovered had mildly impaired function (a mean DASH score 28), whereas those who felt non-recovers had moderate/serious impairment (a mean DASH score 40).

Table 6. Results of the DASH in patients with different recovery status.

Recovery status	The DASH score	
	Mean	Range
Fully recovered n = 6	14	7–23
Partially recovered n = 29	28	7–65
Not recovered n = 17	40	7–76

The correlation between the RASQ and the DASH scores

Analysis of the correlation between the RASQ and the DASH scores showed statistically significant, but weak correlation (the Spearman rank test, $p = 0.02$; $r = 0.4–0.6$).

Discussion

CRPS is believed to be a self-limiting condition [3, 4]. However, in many cases the condition leaves long-term, sometimes disabling sequelae. Pain, autonomic disturbances and impaired function of the hand may persist even years after resolution of the acute episode of CRPS. In this study, level of impairment of the extremity as a result of CRPS was assessed using two different questionnaires: the disease specific RASQ and the more generic DASH. Results of measurements show that duration of CRPS had significant impact on function of the affected extremity: the longer duration, the greater impairment. However, when assessed with the RASQ, the greatest impairment was shown in patients with the disease lasting from 1 to 3 years, whereas the slightest in patients with the disease lasting less than 1 year. When assessed with the DASH, the greatest impairment was shown in patients with the disease lasting from 1 to 3 years, and more than 10 years, whereas the slightest impairment in patients with the disease lasting less than 1 year, and between 3 and 10 years. These differences can be explained by different specificity of either questionnaire in measurement of dysfunction. As it was mentioned earlier, the RASQ items ask about daily activities more detailed and concern more activities than the DASH. In contrast, the DASH contain items concerning pain experience, whereas the RASQ does not. Both questionnaires showed similar accuracy in measurement of impairment related to declared recovery status: the patients who felt recovered had statistically significant lower scores comparing to those who felt partially- or non-recovered. Our study showed also good correlation between used questionnaires in assessment of the level of impairment as a consequence of CRPS.

Participants of this study were asked to describe what would lead them to consider themselves recovered from CRPS. Responses showed that the patient-reported impacts of CRPS fall across the breadth of WHO categories, with the largest number relating to: activities of daily living,

bodily functions and structures (including symptoms and pain), external factors (including medication use) and participation in specific activities such as housework or shopping. These findings support prior studies suggesting interference with many aspects of life including self-care, work and mobility [9, 14]. When participants selected and ranked, the factors that they felt were most important to their belief of recovery included (in priority order): liberation from CRPS pain and discomfort, improvement of mobility and reduction of the need of medication. Regarding the intensity of CRPS pain, it was not surprising that this was patients' highest priority. However, the frequency with which the factor: "generalised pain and discomfort" was identified by all subgroups was unanticipated.

Among the many publications on CRPS there are only few which analyse the long-term sequelae. The results of the treatment are usually assessed at 1 year after its completion, since in longer follow-up, further improvement is believed to be unrelated to the previous therapy, but is rather result of spontaneous disappearance of symptoms [3, 8]. Field *et al.*, reported the results of a long-term follow-up of 55 patients after Colles' fracture: 14 patients (26%) were found to have at least one sign or symptom of CRPS ten years later. Tender fingers and vasomotor instability were the features that persisted most frequently in this study. In all patients, the affected hand was weaker than in contralateral side, but the degree of weakness was not studied [8].

Fialka *et al.*, analysed the presence of symptoms in the lower limb in 17 patients three years after the onset of the disease. Fifteen patients still complained of pain of the foot and nine patients considered this to be severe. Ten patients had reduced range of movement in the ankle joint, three had swelling of the foot. Mean strength of the quadriceps muscle was lower than that of the unaffected limb [15].

Bickerstaff and Kanis reported the results of a one year follow-up of 77 patients with CRPS of the hand who were left without treatment. At final assessment 65% were found to have stiff fingers, 29% vasomotor disturbances, 18% tender fingers, 14% some variant of pain and 12% swelling. Mean grip strength was 45% of the normal hand [3].

Veldman and Goris analysed long-term complication of CRPS in group of 1137 patients. This is the largest published study and presented sequelae are more distinct than published before. Chronic oedema, dystrophic changes of skin and skin infections were noticed in 13 cases. Severe contracture of the hand or foot were found in 18 patients and subcutaneous haematomas in 32. The authors did not mention pain, but this is assumed it was present in all cases as well as tenderness of the fingers. In some of these cases the severity of trophic changes, joint contractures and unbearable pain in the affected limb was the cause of amputation [16].

Bean *et al.* (2016), reported results of the study on extent of recovery of 59 patients in the first 12 months after of developing CRPS [6]. All the patients met the Budapest criteria of confident diagnosis of CRPS and all received treatment-as-usual over a study period. The following variables were measured at baseline, at 6 and at 12 months: severity scores (symptoms and signs of CRPS), pain level, disability, work status and psychological functioning. The authors found that rates of almost all signs and symptoms of CRPS reduced significantly over 1 year. Reductions in symptom severity were clinically relevant and were greatest in the first 6 months and plateaued thereafter. However, at 1 year, 25% of patients continued to meet the Budapest research criteria for CRPS and only 3 patients (5%) were symptom-free at 12 months. These results show that only few cases of CRPS resolve completely within 12 months of onset. Improvements were generally greater in the first 6 months, and suggest that it may be worth exploring early interventions to prevent long-term disability in CRPS (Bean *et al.* 2016) [6].

Llewellyn *et al.* (2018) reported results of a multi-centre, retrospective study to define recovery from the CRPS patients' perspective and better understand their priorities for treatment approaches [17]. A total of 347 patients, 80% women, 20% men participated in Round 1 study, of this number 316 (91%) declared non-recovery. The dominant themes were: activities of daily living; bodily functions; external factors; participation and personal factors. In Round 2 of this study, the patients were asked what are their priorities in feeling recovered from CRPS. The top five priority statements in Round 2 ($n = 252$) were: "No longer having..." (1) CRPS-related pain, (2) generalised pain and discomfort, (3) restricted range of movement, (4) need for medication, (5) stiffness in the affected limb. With very few exceptions, these priorities were consistent, irrespective of patient demographics or geography. Symptoms affecting daily activities were among those most frequently reported [17].

Problems of the hand function persisting for a long time after treatment of CRPS indicate impairment of normal physiological mechanisms in the affected extremity. Results of present study suggest that, in spite of a satisfactory outcome of treatment, significant long-term sequelae of the disease impair function of the hand and reduce quality of life in a proportion of patients. In conclusion, results of this study show statistically significant differences in functional impairment as measured by the RASQ and the DASH between the groups with different recovery status and duration of CRPS. Statistically significant correlation was noted between the disease specific (the RASQ) and more generic questionnaire (the DASH).

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