

Brief communication (Original)

Early interdisciplinary intensive rehabilitation significantly improves the quality of life of stroke survivors: a multi-center study

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Background: Interdisciplinary and intensive stroke rehabilitation programs have been shown to be positively correlated with improved functional outcomes. However, data regarding their combined use on the quality of life (QOL) of stroke survivors appears scant.

Objective: To evaluate whether interdisciplinary intensive rehabilitation programs for stroke survivors can improve their health-related QOL (HRQOL) scores and whether the timing of the interdisciplinary intensive rehabilitation has a significant effect on HRQOL scores.

Materials and Methods: This was a multi-center, prospective study. Patients were retrospectively selected from the Thai Stroke Rehabilitation Registry database. Three hundred seventy-six stroke patients from nine main tertiary hospitals in Thailand who had received acute stroke rehabilitation were screened between March and December 2006. Two hundred seven patients completed World Health Organization Quality of Life scale abbreviated Thai version (WHOQOL-BREF-Thai) questionnaires and were divided into two groups based on the time after onset of stroke to start interdisciplinary intensive rehabilitation: sub-acute (<1 month) and chronic (≥1 month). WHOQOL-BREF-Thai questionnaires were composed of four domains (physical health, psychological well being, social relationships and environment satisfaction), which were administered to the patients before and after interdisciplinary intensive rehabilitation to assess QOL.

Results: After interdisciplinary intensive rehabilitation, patients from both groups showed significant improvement in their quality of life in all domains, sex life and family relationships. However, patients from the sub-acute group had more significant improvement in their environment domain, family relationships and overall WHOQOL scores than those in the chronic group.

Conclusion: Early interdisciplinary intensive stroke rehabilitation can significantly improve environment domain, family relationships and overall WHOQOL of stroke patients.

Keywords: Interdisciplinary intensive rehabilitation, quality of life, stroke

Stroke is one of the most costly diseases found worldwide [1, 2] resulting in long-term mental and physical disabilities [1, 3], which significantly impact the quality of life (QOL) for both the survivors and their caregivers. In Western countries, approximately 15%–30% of stroke survivors are permanently disabled. To help the patient regain motor functions, rehabilitation has been used and has been shown to

be very effective [4, 5]. Early [2, 6, 7] rehabilitation has shown to improve significantly the physical and functional outcomes and improve quality of life for stroke survivors. In Thailand, an appropriate stroke rehabilitation program is started as soon as the patient's condition has been stabilized according to the international stroke guidelines [6, 7]. Similarly, interdisciplinary rehabilitation has also been shown to be equally effective and a combination of both early and interdisciplinary stroke rehabilitation has been shown to be positively correlated with improved functional outcomes [8]. Likewise, intensive stroke rehabilitation has shown that it also could improve

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functional outcomes [9-11]. However, to our knowledge there are no data regarding the combined use of interdisciplinary and intensive stroke programs on the QOL of stroke survivors.

Health Related QOL (HRQOL) is often used to assess the patient's QOL that has been modified by any impairment in functional state, perceptions and social opportunities by disease, injury, treatment or policy [12]. Its multidimensional aspect allows it to accurately measure the patient's QOL for the following domains: physical, functional, mental and social (psychological), and perceptions of situations (environment). For the physical domain, the individual's mobility and dependency in activities of daily living (ADL) are assessed. For the psychological domain, the patients' feelings and perceptions, and how they feel about their health status is assessed. This is important because stroke sequela are becoming more common as survival in stroke patients and the aging population increase. In these patients, not only does their physical role change after onset of stroke, but they also commonly suffer from mood disorders, cognitive impairment, and decreased social interactions. Through its ability to associate the patient's social support and health-promoting behaviors with the patient's stroke severity, HRQOL scores can be used as a secondary tool for evaluating stroke QOL.

Studies that have used HRQOL have shown that there were multiple factors associated with poorer HRQOL scores in stroke survivors such as age [13, 14], sex [13, 15], ADL [13, 14], social support [16], depression, institutionalization [14], and diabetes. Despite this, to our knowledge there are no studies evaluating the ability of HRQOL scores to assess the effects of interdisciplinary intensive rehabilitation program after the onset of clinical stroke. Thus, we evaluated whether interdisciplinary intensive rehabilitation program can improve HRQOL scores among stroke survivors and whether the timing of this treatment is important.

Materials and methods

Patients

This was a prospective, uncontrolled observational, and nonrandomized multicenter study. Stroke patients were retrospectively selected from the Thai Stroke Rehabilitation Registry (TSRR) database between March and December 2006. Only stroke patients older than 18 years were recruited in to the study. Diagnosis

of stroke was confirmed by either brain CT or MRI findings consistent with clinical presentations. Patients with severe medical conditions such as cognitive impairment (TMSE <24), uncontrolled heart disease, schizophrenia or multiple disabilities were excluded from the study. Patients who had previously participated in a comprehensive rehabilitation program after having a stroke were also excluded. All of the patients with documented conventional rehabilitation after onset of stroke and have met the inclusion criteria were stratified into two groups based on the time of onset-admission interval (OAI) into the interdisciplinary rehabilitation ward or center: sub-acute (less than 1 month) and chronic stroke survivors (1 month). This cut-off was based on previous studies that have used 30 days to separate the patients that were admitted early from those that were admitted late [2]. All patients were assessed before and after interdisciplinary intensive rehabilitation. Interdisciplinary intensive stroke rehabilitation was administered to all patients at the rehabilitation wards or centers. In brief, the intensive stroke rehabilitation program was individualized for each stroke survivor according to their needs, physical capabilities, and tolerance by the interdisciplinary team composed of multiple professional specialists including physiatrists, nurses, physiotherapists, occupational therapists, speech language pathologists and social workers. Each session lasted for 3-6 hours and was conducted 5 days per week. Goals were appropriately set by the rehabilitation team for each patient. The rehabilitation program was composed of a combination of various techniques including neurodevelopmental and task-oriented techniques. The interdisciplinary intensive rehabilitation program was stopped when the patients reached their goals or if their Barthel Index (BI) scores were stable for 2 consecutive weeks. However, if the patient became ill or developed any serious complications that needed treatment at another department or hospital, the patient would be immediately transferred and the patient's outcome data would not be collected. For these patients, their data were not analyzed and were labeled as incomplete.

We enrolled participants into the study after all sites received ethical approval for human research from their respective Institutional Review Board (IRB). This study was conducted in accordance with the ethical standards of the responsible committee on human experimentation of each site involved and complied with the guidelines of World Medical

Association Declaration of Helsinki 1975, as revised in 1983. This study was approved by the committee on research ethics at the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand. Informed consent was obtained in writing from each patient after the procedures were fully explained and before entering the study.

Sites

The study was conducted in seven teaching hospitals, one National Rehabilitation Center and one Neurological Institute. Four of the teaching hospitals were in Bangkok and its suburbs. Other teaching hospitals were located in the north and northeast parts of Thailand, Chiang Mai, Khon Kaen while the other was located in Songkhla. Both the National Rehabilitation Center and the Neurological Institute were located in Bangkok. All nine sites used the same interdisciplinary intensive rehabilitation program for both groups, which were conducted at the interdisciplinary rehabilitation ward or centers.

Instruments used

The World Health Organization Quality of Life scale abbreviated Thai version [17] (WHOQOL-BREF-Thai), a 26-item self-report assessment of stroke outcome that includes perceived objective questionnaire and self-report subjective questionnaire, was used to measure QOL in 4 domains; (1) physical health, (2) psychological well being, (3) social relationships, and (4) environment satisfaction. Higher scores indicated higher QOL. Reliability and validity of the questionnaire has already been established in a stroke population [18]. The questionnaire was found to be sufficiently sensitive to capture changes in the patient's QOL across all domains at each time point [18]. Questions pertaining to physical health and well being, psychological health and well being, social relations and environment were evaluated on a 5-point Likert scale ranging from 1 (e.g. very poor, very dissatisfied, not at all, an extreme amount or always) to 5 (e.g. very good, very satisfied, an extreme amount, not at all or never). The questionnaires were given to the patients before and after the interdisciplinary intensive stroke rehabilitation program.

Since the BI was commonly used to assess stroke outcomes, therefore it was used to measure the functional status of the patients [19]. BI was also used in an early rehabilitation study and was able to successfully detect functional improvement accurately

[20]. The BI was scored before and after interdisciplinary intensive rehabilitation by the rehabilitation nurse.

Impairment-based assessment such as the Brunnstrom stage of recovery, a six-stage-evaluation tool, was used to assess physical recovery of the upper extremity (arm), hand and lower extremity (leg) functions [21]. This assessment was done by the investigator.

Patient's mood and depression was assessed by rehabilitation nurse using the Hospital Anxiety and Depression scale (HADS) [22]. All assessments were done before and after interdisciplinary intensive stroke rehabilitation program.

Statistical analysis

Standard statistical methodology was used to analyze the results. All analysis was conducted using SPSS version 17 (SPSS, Chicago, IL, USA). Demographic data was analyzed using mean and standard deviations. A Student *t* test was used for normal distributions. A Mann–Whitney *U* test was used for abnormal distribution data. For quantitative data, percentage and a χ^2 test were used. Changes in QOL, BI, anxiety and depression scores before and after treatment data were analyzed using a paired *t* test or Wilcoxon signed-rank test. When both groups were compared to each other, the difference between the pre- and post-treatment scores was calculated using a Mann–Whitney *U* test. A $p < 0.05$ was considered statistically significant.

Results

Three hundred and seventy-six stroke patients who have completed the conventional stroke rehabilitation program were screened from 9 main tertiary hospitals, but only 327 met the inclusion criteria (**Figure 1**). Fifteen subjects (4%) refused to participate in the study. Eleven patients (2.9%) were not cooperative with the study's guidelines. A total of 23 participants (6.1%) were excluded because of medical conditions: unable to follow commands ($n = 10$; 2.7%), unable to sit for more than 30 minutes ($n = 5$; 1.3%) and had unstable medical condition ($n = 8$; 2.1%). Another 46 patients (1.4%) were excluded because they were illegible for the interdisciplinary intensive rehabilitation program. From 281 patients, only 207 patients had completed the WHOQOL-BREF-THAI questionnaires and were later stratified into 2 groups based on the time of OAI:

sub-acute (<1 month) and chronic (≥ 1 month) stroke survivors.

Demographic data of the 207 patients are shown in **Table 1**. There were no significant differences between the groups for sex, age, or education. Risk factors such as hypertension, diabetes mellitus, dyslipidemia, cardiac disease, transient ischemic attack, and previous stroke were comparable between the groups. Types of strokes between both groups were also comparable.

Both groups showed significant improvement for all aspects of WHOQOL-BREF-Thai: physical health ($p < 0.001$), psychological wellbeing ($p < 0.001$), social relationships ($p < 0.001$), and environment satisfaction ($p < 0.001$) domains, sex life ($p < 0.001$), and family relationships ($p < 0.001$) (**Table 2**). However, only the environment satisfaction domain, family relationships and overall

QOL scores showed more significant improvement in the sub-acute group than the chronic group.

As for the Brunnstrom stage of recovery, patients from both groups before interdisciplinary intensive rehabilitation had comparable scores (**Table 3**). After interdisciplinary intensive rehabilitation, they showed significant improvement in their Brunnstrom stages ($p < 0.001$). However the sub-acute group had a more significant improvement in their Brunnstrom stage for the arm when compared to the chronic group ($p = 0.012$). Patients from both groups significantly improved in their BI, HADS after rehabilitation ($p < 0.001$). An increasing trend in the BI appeared to show that the patients from the sub-acute group significantly benefited from the interdisciplinary intensive rehabilitation ($p = 0.007$) as shown in **Table 4**.

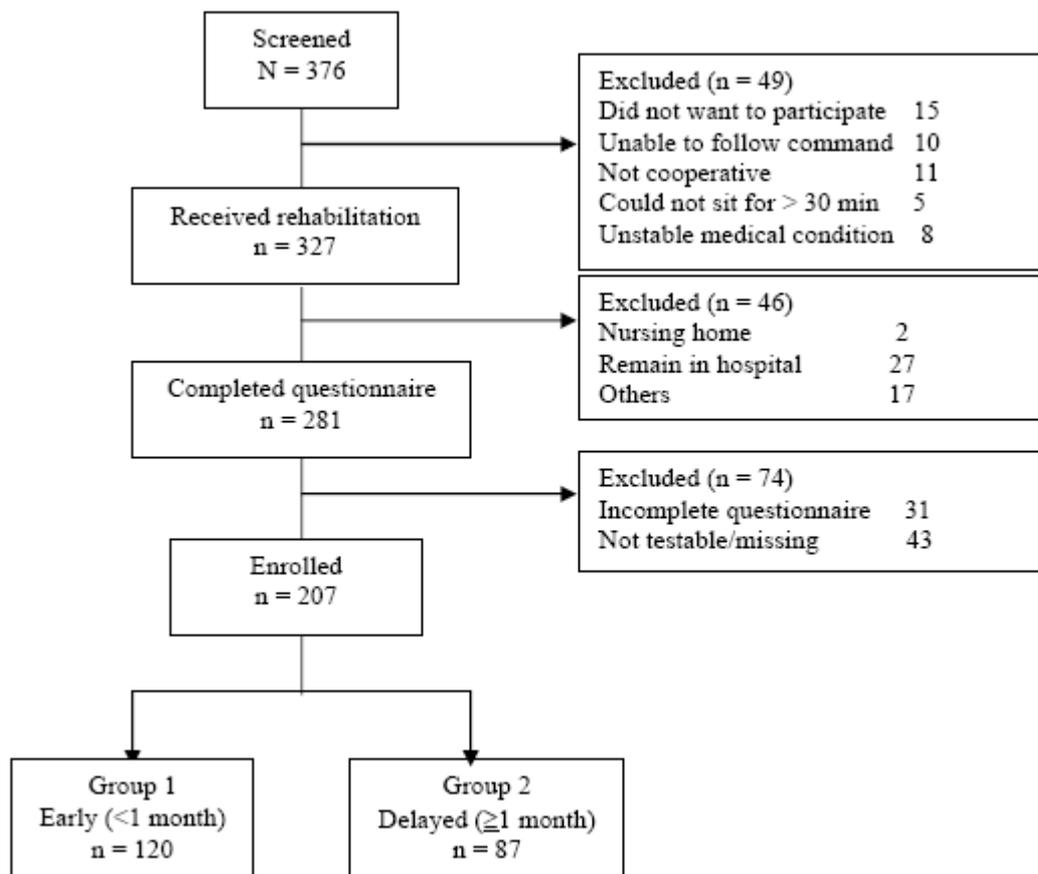


Figure 1. Patient flow chart

Table 1. Demographic data

	<1 month	≥1 month	<i>p</i>
Sex			0.464
Male	67 (55.83)	53 (60.92)	
Female	53 (44.17)	34 (39.08)	
Age			0.614
Mean (SD)	61.45 (13.0)	62.34 (12.0)	
Education			0.268
None	6 (5)	5 (5.75)	
Primary school	66 (55)	39 (44.83)	
Secondary school	15 (12.50)	17 (19.54)	
Diploma	7 (5.83)	5 (5.75)	
Bachelor or more	22 (18.33)	21 (24.14)	
Others	4 (3.33)	0 (0)	
Risk factors			
Hypertension	92 (76.67)	62 (71.26)	0.379
Diabetes mellitus	34 (28.33)	27 (31.03)	0.674
Hypercholesterolemia	63 (52.50)	46 (52.90)	0.958
Cardiac disease	20 (16.67)	20 (22.99)	0.256
Transient ischemic attack	2 (1.67)	1 (1.15)	1.000
Previous stroke	11 (9.17)	13 (14.94)	0.200
Types of stroke			0.272
Infarction	91 (75.83)	60 (68.97)	
Hemorrhage	29 (24.17)	27 (31.03)	

Table 2. Results for Brunnstrom stage of recovery

	Pre rehab	Post rehab	<i>p</i>	Difference	<i>p</i>
Arm					
<1 month	2.96 (1.75)	3.68 (1.71)	<0.001*	0.72 (0.96)	
≥1 month	2.91 (1.58)	3.33 (1.6)	<0.001*	0.42 (0.68)	0.012**
Hand					
<1 month	2.80 (1.83)	3.50 (1.84)	<0.001*	0.70 (1.03)	
≥1 month	2.68 (1.63)	3.20 (1.66)	<0.001*	0.52 (0.87)	0.163**
Leg					
<1 month	3.23 (1.48)	4.13 (1.38)	<0.001*	0.91 (1.04)	
≥1 month	2.85 (1.29)	3.55 (1.4)	<0.001*	0.70 (0.85)	0.151**

*Wilcoxon Signed Ranks test, **Mann–Whitney *U* test

Table 3. Functional and psychological evaluation

	Pre rehab	Post rehab	<i>p</i>	Difference	<i>p</i>
Barthel index					
<1 month	7.82 (3.59)	14.44 (4.35)	<0.001*	6.62 (3.5)	
≥1 month	8.69 (4.82)	14.02 (4.26)	<0.001*	5.34 (3.74)	0.007**
Anxiety score					
<1 month	7.57 (3.61)	5.50 (3.15)	<0.001*	-2.07 (2.97)	
≥1 month	7.58 (4.11)	5.99 (3.18)	<0.001*	-1.59 (3.41)	0.516**
Depression score					
<1 month	8.61 (4.27)	6.79 (3.81)	<0.001*	-1.82 (2.92)	
≥1 month	9.01 (4.02)	6.95 (3.80)	<0.001*	-2.06 (3.95)	0.528**

*Wilcoxon Signed Ranks test, **Mann–Whitney *U* test

Table 4. Scores for quality of life

	Pre rehab	Post rehab	<i>p</i>	Difference	<i>p</i>
Physical health					
<1 month	18.26 (3.76)	22.05 (3.68)	<0.001*	3.79 (4.37)	
≥1 month	18.29 (3.71)	21.24 (3.61)	<0.001*	2.95 (4.70)	0.161***
Psychological well being					
<1 month	18.28 (3.80)	21.03 (3.43)	<0.001*	2.74 (4.10)	
≥1 month	18.08 (3.75)	19.91 (3.60)	<0.001**	1.83 (4.27)	0.210***
Social relationship					
<1 month	9.53 (2.14)	10.13 (2.02)	<0.001*	0.61 (1.70)	
≥1 month	8.62 (2.33)	9.38 (2.02)	<0.001*	0.76 (2.38)	0.233***
Environment satisfaction					
<1 month	24.18 (4.26)	26.90 (4.07)	<0.001*	2.72 (4.05)	
≥1 month	24.75 (4.16)	25.69 (3.95)	<0.066*	0.94 (4.84)	0.004***
QOL q1					
<1 month	2.41 (1.03)	3.30 (0.88)	<0.001*	0.89 (1.21)	
≥1 month	2.60 (1.02)	3.18 (0.77)	<0.001*	0.59 (1.04)	0.042***
QOL q26					
<1 month	2.94 (0.91)	3.44 (0.80)	<0.001*	0.50 (0.92)	
≥1 month	2.89 (0.81)	3.38 (0.70)	<0.001*	0.49 (0.76)	0.922***
QOL total					
<1 month	70.25 (11.64)	80.11 (10.55)	<0.001**	9.86 (11.38)	
≥1 month	69.74 (10.51)	76.22 (10.29)	<0.001**	6.48 (12.57)	0.045****

*Wilcoxon Signed Ranks test, **Paired *t* test, ***Mann-Whitney *U* test, ****Unpaired *t* test

Discussion

The benefits of interdisciplinary stroke rehabilitation are irrefutable [8]. Several randomized clinical trials using interdisciplinary stroke rehabilitation showed that it was able to improve functional outcome, QOL, and reduce costs when compared with multidisciplinary stroke rehabilitation [8, 23-25]. Furthermore, rehabilitation has been shown to lessen disability and improve physical and social function among chronic stroke survivors [4]. This is even more prominent in functional gain and shorter lengths of stay when moderately and severely impaired stroke patients start rehabilitation as early [26], at 20 days after onset of clinical stroke [20], or within 30 days [5]. In another report, earlier initiation of rehabilitation and intensity or aggressiveness of a challenging specific therapy activity also yielded better outcomes [11], even among severe stroke patients [5, 11].

However, no one has investigated the use of the combination of interdisciplinary and intensive rehabilitation programs. Moreover, no one has evaluated the use of HRQOL in assessing the effects of interdisciplinary intensive rehabilitation. We chose to use HRQOL because it has been shown to

effectively assess the QOL of stroke survivors [4, 27, 28].

In our study, significant improvement was detected in both the sub-acute and chronic groups after interdisciplinary intensive rehabilitation for all aspects of WHOQOL assessed: physical health, psychological well being, social relationship, and environment satisfaction, the Brunstrom stage of recovery, BI and HADS. Our interdisciplinary approach allowed us to provide our stroke survivors a more personalized and holistic medicine that may explain why both the sub-acute and chronic groups showed improvements in all aspects of WHOQOL.

Yet when the results of the sub-acute and chronic groups were compared, the sub-acute group showed more significant improvement for the Brunstrom stage of recovery for the arm ($p = 0.012$), and functional recovery from the BI ($p = 0.007$). Aside from that, more significant improvement was also seen in the environment satisfaction and overall quality of life perception (WHOQOL question 1 and total QOL) in the sub-acute group. These results are consistent with other studies that have shown significant improvement in the physical and functional recovery after rehabilitation [4, 10, 24, 25].

Our study encountered some limitations. First, our patients are not representative of the entire stroke population because those with severe medical conditions were excluded. Second, the data was collected only at two time points: before and after interdisciplinary intensive rehabilitation. Perhaps if we collected data from other time points and had a longer follow-up period of more than one year, it is possible that we might be able to detect other factors previously not reported. Third, resources for interdisciplinary intensive rehabilitation are limited because in Thailand, this service is available only in teaching hospitals, one National Rehabilitation Center, one Neurological Institute, and tertiary hospitals. Therefore after the results of the interdisciplinary intensive program were obtained, the ethical thing would be to offer the program to all stroke survivors in the registry. However, the problem encountered was that many of the stroke survivors lived in rural areas or far away from the institutions that offered such a program and when they were able to come, it was more than 1 month after stroke. This situation has been reported elsewhere where it has been shown that several severe stroke patients were admitted later than one month because of other more serious and frequent medical complications [2, 29], and lack of readiness to engage in a rehabilitation program [5]. Even though all stroke survivors have had the conventional rehabilitation, it is clear that this is not sufficient and additional rehabilitation with an interdisciplinary and intensive aspects are needed. This is especially true for patients who have delayed the start of their rehabilitation beyond 30 days after onset of clinical stroke. It has been shown that survivors of severe stroke can have substantial functional improvement with rehabilitation but compared with their peers who have had early rehabilitation, the outcome is poorer because the brain is less primed for recovery and more time is required in order to achieve the same level of improvement as seen with those in the early treatment group [5]. Lastly, this study was unable to detect any sexual dysfunction, which was a common complaint among stroke survivors in Western countries [30]. This was attributed to cultural differences where in Asia, the topic of sex is barely discussed openly and the discomfort from both the assessor and patient may have contributed to this. Aside from these limitations, the findings from this study indicated that an interdisciplinary intensive rehabilitation program could improve the QOL in sub-acute and chronic stroke

survivors, but that early interdisciplinary intensive rehabilitation was preferred.

Recommendations for future study include collecting data from more than one time point, having a longer follow-up period to determine the efficacy of the interdisciplinary intensive rehabilitation program after discharge. Furthermore, we need to investigate whether our results are applicable to other developing countries within the Southeast Asia region with similar cultures and beliefs if WHOQOL-BREF is consistently used.

In conclusion, early interdisciplinary intensive rehabilitation can significantly improve the Brunnstrom stage for the arm, BI, environment domain, family relationships, and overall WHOQOL scores in sub-acute stroke survivors. Therefore, we highly recommend early interdisciplinary intensive rehabilitation for stroke survivors who are physically, cognitively, and mentally ready.

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