

Factors that Affect the Quality of Life at 3 Years Post-Stroke

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Background and Purpose: Elucidating the factors that predict the quality of life (QOL) in stroke patients is important. However, the residual sensory symptoms that are common in stroke patients have not usually been included as factors that influence the QOL. The purpose of the present study was to elucidate the factors that predict the QOL of chronic-stage patients with special attention to residual sensory symptoms.

Methods: We examined 214 patients who had experienced a first-time stroke during the subacute (i.e., approximately 3 months poststroke) stage; 151 patients from this group were followed up by telephone interview during the chronic (i.e., approximately 3 years poststroke) stage. Physical disabilities, including motor dysfunction, sensory symptoms that included central poststroke pain (CPSP, described using a standardized questionnaire with a visual analogue scale), activities of daily living (ADL, measured by the Barthel index score), as well as the presence of depression (using the DSM IV criteria), were assessed during both the subacute and chronic stages. Economic and job statuses during the chronic stage were also assessed. QOL ratings were determined by the World Health Organization QOL scale.

Results: The following factors at 3 months poststroke were related to low QOL at 3 years poststroke: dependency in ADL, motor dysfunction, depression, and CPSP. At 3 years poststroke, dependency in ADL, depression, CPSP, poor economic status, and unemployment were all factors that were related to low QOL. Multiple regression analysis showed that dependency in ADL (19%), presence of CPSP (12%), and poor economic status (10%) were important explanatory factors for overall QOL. In the analysis of QOL subdomains, the most important explanatory factors were CPSP for both physical and psychological domains, dependency in ADL for both independence and social-relationships domains, economic status for the environmental domain, and female sex for the spiritual domain.

Conclusions: We conclude that dependency in ADL, depression, low socioeconomic status, and the presence of CPSP either at 3 months or 3 years poststroke are factors that are related to a low QOL at 3 years poststroke. The recognition of these factors may allow strategies to be developed to improve the QOL for stroke patients. *J Clin Neurol 2(1):34-41, 2006*

Key Words : Depression, Central poststroke pain, Cerebrovascular disease, Quality of life

INTRODUCTION

Stroke is a leading cause of death and frequently

reduces patient quality of life (QOL) even with survival. Several factors may influence the QOL, including motor impairment,^{1,2} dependency in activities of daily living (ADL),^{2,3} the presence of depression,^{1,3-6} functional

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health,⁷ severity of neurological deficits,⁷ aphasia,⁷ and the location of stroke.⁸

However, most previous studies have not included the residual sensory symptoms that are experienced by approximately half of stroke patients.⁹ Since 1-8% of these patients have painful sensory symptoms (central poststroke pain, CPSP),^{10,11} which are often distressing and refractory to treatment,^{11,12} these symptoms may adversely affect the QOL of these patients. Therefore, we attempted to examine the factors that may affect the QOL of stroke patients, including residual sensory symptoms. Because CPSP may not be present during the acute stage but may develop a few months after stroke onset,¹³ we examined patients during the subacute stage of stroke and followed them 3 years poststroke to determine factors predictive of QOL.

MATERIALS AND METHODS

1. Methods

The subjects included consecutive patients who visited the outpatient clinic of one of the authors (J.S.K.) between 2-5 months poststroke (mean, 3 months) at the Asan Medical Center between April 1999 and June 2000. We included only those patients with first-time stroke whose CT/MRI showed lesions compatible with their neurological symptoms. We excluded patients (1) with strokes due to miscellaneous causes (e.g., aneurysmal rupture, arteriovenous malformation, vasculitis, anticoagulation overuse, or moyo-moya disease), (2) with a transient ischemic attack without progression to stroke, (3) who had communication problems due to severe aphasia, dementia, or dysarthria so as not to provide a reliable interview, (4) who had a previous history of depression that was diagnosed by a medical doctor, (5) who declined to participate, and (6) who were younger than 40 years or older than 80 years of age since age may itself affect QOL.

A detailed neurological examination was performed by one of the authors (J.S.K.). Motor impairment was graded using the I-V Medical Research Council motor scale as severe (\leq III/V), mild (IV/V), or not impaired.

Immediately afterwards, a structured interview was conducted by the other author (S.C.K.) that included: (1) performance of ADL, recorded with the use of the modified Barthel index score; (2) the level of education, expressed as the number of years of schooling; and (3) the presence of poststroke depression, assessed using the DSM-IV major criteria.¹⁴

We also assessed the degree of sensory symptoms using a visual analogue scale (VAS) in which patients reported the degree of symptoms from 0 (lowest) to 10 (highest). A patient's maximal sensory symptoms of greater than 5 were arbitrarily defined as CPSP, whereas those less than or equal to 5 were categorized as moderate paresthesia. Musculoskeletal or joint pain was not considered a sensory symptom. To characterize the sensory complaints, a standardized questionnaire was used.¹⁵ After the modification of the McGill-Melzack pain questionnaire,¹⁶ patients were asked to choose the descriptions that best (and next best) characterized their sensory symptoms, such as burning, cold, numbness, heavy, pricking, lancinating, squeezing, and throbbing.

At approximately 3 years (i.e., ranging from 26 to 39 months) poststroke, a telephone interview was conducted by S.C.K. The presence of moderate paresthesia, CPSP, depression, Barthel index score, the current economic and employment statuses, and QOL were assessed. Current economic status was divided into high (monthly income $>$ 2 million Korean won), moderate (1-2 million won), and poor ($<$ 1 million won).¹⁷ To measure the QOL, we used a multidimensional, multilingual, and generic QOL instrument that was developed by the World Health Organization (WHO) for cross-cultural use in health care. In this instrument, pain and sensory functions are included collectively as one of the items in the physical domain. This instrument has been justified for use in patients with chronic pain.¹⁸

The questionnaire consisted of 6 main subdomains with a total of 29 items: physical aspects of QOL (5 items), psychological aspects of QOL (5 items), level of independence (6 items), social relationships (3 items), environment (9 items), and spirituality (1 item). Subjects responded to the 29 questions on a 5-point Likert scale, ranging from "the highest QOL" (score of 5) to "the lowest QOL" (score of 1). Scores for the negative

questions were reversed in order to yield mean QOL scores, where a higher score represented a better QOL. Subdomain item responses were used in calculating subdomain mean scores, thus comprising an overall QOL score. WHO QOL assessment (WHOQOL) has been shown to have high validity and reliability in studies of various neurological diseases.^{19,20}

2. Statistics

The data were analyzed using descriptive statistics, Student's t-tests, and ANOVA with the SAS statistical package. Parametric statistics were used since the data were normally distributed. Factors that could significantly influence QOL were identified by multiple regression analysis. By employing stepwise regression analysis, all variables were investigated to screen for those factors that were related to changes in QOL. Those factors that did not meet a 0.15 significance level were excluded.

RESULTS

1. Demographic details

Of the 214 patients included in the first interview, 43 patients could not be reached by phone at 3 years poststroke after three attempts. Nine patients had died and 11 patients refused to participate. Thus, 151 (70.6%) of the original 214 patients finally participated in the phone interview. Eleven of the 20 patients who had either died or declined to participate in the study had recurrent stroke. However, none of the 151 patients who finished the second follow-up at 3 years poststroke had a recurrent stroke.

Out of the 151 interviewees, 92 were men and 59 were women. One hundred and twenty (79%) patients had cerebral infarctions and 31 (21%) had intracerebral hemorrhage. Their ages ranged from 42 to 77 (mean, 63) years. The mean duration of education was 10.7 years. Ninety-three patients (62%) had a history of hypertension, 37 (25%) patients had diabetes mellitus, 10 (7%) patients had ischemic heart disease, and 32 (21%)

were current cigarette smokers. Ninety-nine patients (66%) had supratentorial lesions and 52 (34%) had infratentorial lesions. The lesions were located in the right in 73 (48%) patients and in the left in 78 (52%) patients.

2. Patient characteristics

At 3 months poststroke, of the 151 patients who participated in both the first and second interviews, 20 patients had depression. Seventy-six (50%) patients had motor impairment, of which 34 had severe deficits. The mean BI score was 96 and 37 (25%) patients had scores less than 96. Thirty-seven patients had sensory symptoms, 25 patients had moderate paresthesia, and 12 patients had CPSP. The characteristics of CPSP were described as numbness and burning by three patients; numbness and cold by two patients; numbness and squeezing by two patients; cold and burning by two patients; cold, numbness, and burning by one patient; numbness and aching by one patient; and numbness alone by one patient.

At 3 years poststroke, 7 out of 20 depressed patients continued to be depressed while the rest reported that their depression had improved. Of 12 patients with CPSP, only 3 patients reported that their CPSP had decreased in intensity below the VAS score of 5, whereas 4 out of 25 patients with moderate paresthesia reported that their sensory symptoms increased in severity to greater than a VAS score of 5, finally yielding 13 CPSP patients at 3 years poststroke. Of the 76 patients who had motor impairment at 3 months poststroke, 45 patients stated that their symptoms had not improved at 3 years poststroke. However, motor dysfunction at 3 years poststroke was not included in the subsequent analysis because assessing this based on a telephone interview alone may be unreliable. The mean BI score was 97.0 (SD=11.4), with 41 (27%) patients having BI scores less than 97.

3. Factors at the subacute stage predicting the QOL at 3 years poststroke

As indicated in Table 1, QOL levels were not related

Table 1. Quality of life (QOL) scores at 3 years poststroke in relation to patient characteristic (n=151)

Patient characteristics / clinical factors		Mean QOL score (SD)		
		n	at 3 years	p
Age	<63 years	73	3.30 (0.33)	ns
	≥63 years	78	3.33 (0.45)	
Sex	Female	59	3.31 (0.35)	ns
	Male	92	3.31 (0.44)	
Education	<11 years	81	3.26 (0.44)	ns
	≥11 years	70	3.38 (0.31)	
Marital status	Married	127	3.33 (0.42)	ns
	Single	24	3.30 (0.49)	
Lesion location	Supratentorial	99	3.37 (0.42)	ns
	Infratentorial	52	3.23 (0.33)	
Lesion laterality	Right	73	3.32 (0.44)	ns
	Left	78	3.31 (0.45)	
Stroke subtype	CI	120	3.34 (0.35)	ns
	ICH	31	3.29 (0.49)	
Hypertension	Yes	97	3.28 (0.35)	ns
	No	54	3.35 (0.42)	
Diabetes mellitus	Yes	37	3.22 (0.45)	ns
	No	114	3.33 (0.31)	
At 3 months				
Barthel index	<96	37	3.05 (0.43)	<0.01
	≥96	117	3.58 (0.46)	
Motor impairment	None	75	3.55 (0.43)	<0.01
	Mild	42	3.32 (0.44)	
	Severe*	34	2.87 (0.51)	
Depression	None	131	3.45 (0.47)	<0.01
	Present	20	2.97 (0.21)	
CPSP	None	113	3.48 (0.46)	<0.01
	Paresthesi	25	3.38 (0.35)	
	Present*	12	2.91 (0.45)	
At 3 years				
Barthel index	<97	41	3.16 (0.53)	<0.01
	≥97	110	3.51 (0.41)	
Depression	None	144	3.49 (0.47)	<0.01
	Present	7	2.89 (0.21)	
CPSP	None	113	3.48 (0.46)	<0.05
	Paresthesia	24	3.36 (0.37)	
	Present*	13	2.93 (0.47)	
Economic status	Poor	12	3.05 (0.68)	<0.01
	Moderate	48	3.22 (0.44)	
	High*	91	3.56 (0.4)	
Employment status	Unemployed	114	3.34 (0.48)	<0.01
	Employed	37	3.65 (0.33)	

ns, not significant; CI, cerebral infarction; ICH, intracerebral hemorrhage; CPSP, central poststroke pain.

*significant compared to the other two conditions (Scheffe post-hoc test)

to gender, age, level of education, marital status, presence of risk factors such as hypertension and diabetes mellitus, lesion laterality, lesion location, or

stroke subtype. We found that the presence of depression ($p<0.01$), CPSP ($p<0.01$), dependency in ADL ($p<0.01$), and motor impairment ($p<0.01$) at 3 months poststroke

Table 2. Forward step-wise regression model explaining QOL at 3 years poststroke (n=151)

Variable	Coefficient (SE)	<i>p</i>	R ²
Overall QOL			
ADL	0.33 (0.08)	<0.01	19%
CPSP	-6.96 (1.3)	<0.01	12%
Economic status	6.7 (1.3)	<0.01	10%
Employment status	5.48 (1.99)	<0.05	5%
Depression	-9.3 (4.0)	<0.05	4%
Physical domain			
CPSP	-2.61 (0.34)	<0.01	27%
ADL	1.01 (0.38)	<0.01	7%
Depression	-0.72 (0.35)	<0.05	2%
Economic status	0.68 (0.35)	ns	2%
Psychological domain			
CPSP	-1.98 (0.41)	<0.01	13%
ADL	0.08 (0.02)	<0.01	8%
Economic status	1.15 (0.42)	<0.01	5%
Depression	-3.25 (1.24)	<0.05	3%
Sex	1.12 (0.58)	ns	2%
Employment status	1.56 (0.67)	ns	2%
Age	0.07 (0.03)	ns	1%
Level-of-independence domain			
ADL	0.14 (0.02)	<0.01	24%
Employment status	1.99 (0.55)	<0.01	7%
Depression	-3.18 (1.13)	<0.01	4%
CPSP	-0.82 (0.38)	<0.05	2%
Social-relationships domain			
ADL	0.05 (0.02)	<0.01	15%
Employment status	0.76 (0.26)	<0.01	6%
Economic status	1.25 (0.37)	<0.01	5%
CPSP	-0.43 (0.25)	ns	2%
Environment domain			
Economic status	3.36 (0.53)	<0.01	21%
Employment status	2.16 (0.81)	<0.05	6%
ADL	0.07 (0.03)	<0.05	3%
CPSP	-1.23 (0.53)	<0.05	3%
Spiritual domain			
Gender	0.96 (0.32)	<0.01	6%

ADL, activities of daily living; SE, standard error

were significantly associated with a low QOL score at 3 years poststroke. Patients with severe motor impairment had a lower QOL score than those with mild or no motor impairment ($p<0.01$), whereas patients with CPSP showed a lower QOL score than either those with moderate paresthesia or those without sensory symptoms ($p<0.01$).

4. Factors related to QOL at 3 years post-stroke

The factors studied at 3 years poststroke are also listed in Table 1. The QOL scores were significantly lower in patients with dependency in ADL ($p<0.05$), depression ($p<0.01$), CPSP ($p<0.01$), poor economic status ($p<0.01$), and unemployment ($p<0.01$). One-way ANOVA with a Scheffe post-hoc test revealed that the QOL score was significantly lower for those patients with a poor economic status than for those with either a high or moderate economic status ($p<0.05$). Patients with CPSP had a lower QOL score than either those with moderate paresthesia or those without sensory symptoms ($p<0.01$).

5. Factors at 3 years poststroke related to overall and various subdomains of QOL

Table 2 lists the results of multiple regression analysis for the level of QOL and that of the six subdomains. After exclusion of variables, such as lesion location, lesion laterality, and stroke subtype that did not meet a 0.15 significance level, 50% of the total variation of QOL scores was explained by the model. Dependency in ADL, presence of CPSP, and economic status were strong predictors of overall QOL scores at 3 years poststroke, explaining 19%, 12%, and 10% of the variation in the QOL scores, respectively, whereas unemployment and depression were found to be less important predictors, explaining 5% and 4% of the variation in the QOL scores, respectively. The factors related to each QOL subdomain are listed in Table 2.

DISCUSSION

We found that motor dysfunction, dependency in

ADL, presence of depression, and CPSP at 3 months poststroke predict the QOL at 3 years poststroke. Economical and occupational factors were also related to low QOL scores. Age, gender, level of education, laterality of lesions, lesion location, and stroke subtype were not factors that were related to QOL.

The importance of motor dysfunction and dependency in ADL as factors related to low QOL scores has also been elucidated in previous studies.^{1,2,7,21} Dependency in ADL was also a strong explanatory factor in all subdomains except for the spiritual subdomain. We also found that the presence of depression, either at the subacute or chronic stage, was related to a low QOL score at 3 years poststroke, which is consistent with the findings of previous studies.^{1-6,21,22} However, in multiple regression analysis, depression was only responsible for a 4% variation in overall QOL scores. As shown in a previous report on Korean patients,¹⁴ the incidence of poststroke depression in our patients was low compared with Western studies. The reasons for these findings may include different criteria for depression and an exclusion of previously depressed patients. In addition, almost all of our patients lived their poststroke lives at home with either their spouses or children, an environment that is favorable for depressed patients.^{23,24}

We found that the QOL at 3 years poststroke was not different between patients with supratentorial strokes and those with infratentorial lesions. This finding agrees with the results of van Straten et al,²⁵ but not with those of others,^{2,8} who reported that supratentorial lesions were associated with a low QOL score. This difference might be due to the fact that patients with either cognitive or speech disturbances were excluded in both our study and the study of van Straten et al. These symptoms are associated with supratentorial lesions and are related to a low QOL score.⁷ We also found that economic and employment statuses were determinant factors for QOL during the chronic stage of stroke, which was consistent with a finding in a previous Korean study.²⁶ A stepwise regression analysis showed that both economic and employment factors were determinants of overall QOL levels and were predictive factors in five out of the six subdomains. These results suggest that a long duration of illness, high medication costs, and possibly a lack of

available social services for these patients had negative impacts on QOL.

Interestingly, the presence of CPSP significantly and adversely affected QOL, an observation rarely emphasized in earlier studies. In our series, as many as 25% of stroke patients had paresthesia. Although there is no comprehensive definition of CPSP, we designated symptoms with scores greater than grade 5 on the VAS as CPSP.¹⁵ Our results illustrate that CPSP at both 3 months and 3 years poststroke is an important factor that determines overall QOL and is also an explanatory factor in four of the six QOL subdomains 3 years after stroke.

CPSP has been reported as a troublesome sequela in patients who have strokes that occur anywhere in the somatosensory tract.^{10,12,27-29} Our results suggest that patients with CPSP experience not only physical discomfort from the pain but also low QOL related to both psychological and environmental dimensions. These findings are consistent with those of a previous study¹⁸ in which pain and subsequent discomfort made a significant impact not only on QOL in general but also on five of its six subdomains. The author also stated that negative feelings were closely associated with reports of pain and discomfort. In our population, patients with CPSP often expressed frustration with painful paresthesia due to its persistent nature and resistance to treatment. Unbearable sensations such as numbness, burning, and coldness could certainly be disruptive to daily living, and thus negatively affect QOL.

In our study, we tried to exclude musculoskeletal pain or pain induced by peripheral neuropathy through careful history taking and through examination at 3-months poststroke. However, the inclusion of these pains may have been possible in some patients at 3 years poststroke when only a telephone interview was performed, which is one of the limitations of our study. It is also feasible that patients with CPSP were overrepresented since our hospital is a tertiary center. However, while previous authors have reported that the incidence of CPSP ranges from 1-8%,^{10,11} the incidence of CPSP in our patients was 8% at 3 months poststroke and 9% at 3 years poststroke. Taking into consideration that CPSP often develops months or even years after stroke onset and

that some patients were on pain-relieving medications, the incidence of CPSP in our patients does not appear to be exceptionally high.

One of the limitations of our study was the use of the telephone interview during the 3-year follow up, which could have prompted inaccurate responses and introduced observer bias. This limitation, however, is unlikely because the relationship that we had developed with these patients during the subacute stage allowed us to conduct effective telephone interviews regarding various data, including CPSP and depression. Moreover, previous studies have reported that a telephone interview was preferable to a postal questionnaire with regard to data completeness.³⁰⁻³² Second, because most of our subjects lived in Seoul, where many people move frequently for a variety of reasons, we were unable to reach 20% of the original interviewees by phone after 3 years.

Finally, our findings may not be applicable to stroke patients in general because we excluded patients with cognitive or speech problems, reported to have some impact on QOL in stroke patients.^{1,7,8} Moreover, our patients were those who visited the outpatient clinic and severely disabled patients might have been therefore underrepresented.

Despite these limitations, our data suggest that CPSP is one of the important factors affecting the QOL of stroke patients. Further research is required to treat CPSP and to eventually improve the QOL in stroke victims.

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