



## Clinical Study

## Quality of Life after Brain Injury (QOLIBRI) Overall Scale for patients after aneurysmal subarachnoid hemorrhage



George Kwok Chu Wong<sup>a,\*</sup>, Sandy Wai Lam<sup>a</sup>, Karine Ngai<sup>a</sup>, Adrian Wong<sup>c</sup>, Vincent Mok<sup>b</sup>, Wai Sang Poon<sup>a</sup>

<sup>a</sup> Division of Neurosurgery, Department of Surgery, Prince of Wales Hospital, The Chinese University of Hong Kong, 30–32 Ngan Shing Street, Shatin, New Territories, Hong Kong, China

<sup>b</sup> Division of Neurology, Department of Medicine and Therapeutics, Prince of Wales Hospital, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong, China

<sup>c</sup> Department of Psychological Studies, The Hong Kong Institute of Education, Tai Po, New Territories, Hong Kong, China

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## ABSTRACT

The Quality of Life after Brain Injury Overall Scale (QOLIBRI-OS) is a recently developed instrument that provides a brief summary measure of health-related quality of life (HRQoL) in domains typically affected by brain injury. This study examined the application of the six item QOLIBRI-OS in patients after aneurysmal subarachnoid hemorrhage (aSAH). Hong Kong Chinese aSAH patients were evaluated prospectively within the chronic phase of 1 year after aSAH in this multi-center observational study. Cronbach's  $\alpha$  was 0.88, and correlations were satisfactory for all six items. QOLIBRI-OS demonstrated good criterion validity with other 1 year outcome assessments. In conclusion, QOLIBRI-OS can be used as a brief index for disease-specific HRQoL assessment after aSAH. Further validation in another population of aSAH patients is recommended.

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## 1. Introduction

Although aneurysmal subarachnoid hemorrhage (aSAH) accounts for only 3–5% of all strokes, a high degree of morbidity has been reported in these relatively young patients [1–5]. To overcome the shortcomings in unidimensional aSAH outcome assessments, a disease-specific health-related quality of life scale (HRQoL) should be considered. The Quality of Life after Brain Injury (QOLIBRI) assessment has been developed as a descriptive system for HRQoL in brain injury patients. QOLIBRI is a patient-reported outcome instrument consisting of a 37 item scale with six sub-scales covering the areas of physical condition, cognition, emotion, function in daily life, personal and social life, and current situation and future prospects [6,7]. In initial studies of traumatic brain injury patients in different countries, QOLIBRI was found to be valid and reliable [8].

To reduce patient burden, the Quality of Life after Brain Injury Overall Scale (QOLIBRI-OS) is a recently developed six item scale that provides a brief summary measure of HRQoL in QOLIBRI domains [9]. The QOLIBRI-OS has also been validated for traumatic brain injury and hemorrhage patients [9].

We designed the current study to investigate whether QOLIBRI-OS is also suitable as a HRQoL scale for aSAH patients.

## 2. Methods

This prospective, observational four-center study was carried out in Hong Kong. It is registered with [ClinicalTrials.gov](http://ClinicalTrials.gov) of the USA National Institutes of Health (NCT01038193) and was approved by the Joint Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee and local Ethics Committees of participating centers. The study conformed to the Declaration of Helsinki, and written informed consent was obtained from all the participants or their next of kin.

The patient inclusion criteria were as follows: (1) spontaneous subarachnoid hemorrhage resulting from an angiographically confirmed intracranial aneurysm; (2) hospital admission within 96 hours of the ictus; (3) aged between 21 and 75 years; (4) Chinese (Cantonese) speaking; and (5) willing and able to provide informed consent (or availability of a person authorized to do so). The exclusion criteria were as follows: (1) previous cerebrovascular or neurological disease other than an unruptured intracranial aneurysm; (2) neurosurgery prior to the ictus; and (3) inability to cooperate in assessments (unable to obey commands) or aphasic.

## 2.1. Assessments

Outcome assessments were conducted 1 year after ictus (chronic phase) by one of two research assistants (psychology graduates) trained by a post-doctoral research psychologist.

\* Corresponding author. Tel.: +85 2 2632 2624; fax: +85 2 2637 7974.

E-mail address: [georgewong@surgery.cuhk.edu.hk](mailto:georgewong@surgery.cuhk.edu.hk) (G.K.C. Wong).

### 2.1.1. QOLIBRI-OS

The Chinese version of QOLIBRI-OS consists of six items with one item selected from each domain of QOLIBRI (physical condition, cognition, emotions, function in daily life, personal and social life, and current situation and future prospects) [9]. Responses to each item were scored 1 (“not at all”) to 5 (“very”), and the sum of all items was converted to a percentage, with 0% representing the lowest score and 100% the best score.

### 2.1.2. Montreal Cognitive Assessment

The Montreal Cognitive Assessment (MoCA) is a one page, 30 point test that includes six subtest domains of visuospatial/executive functions, naming, attention, abstraction, recall, and orientation [10–12]. One point is added for participants with fewer than 12 years of education.

### 2.1.3. Modified Rankin Scale

The modified Rankin Scale (mRS) is a valid and clinically relevant instrument that is used to assess recovery (levels of disability and dependence) after stroke [13]. The mRS score ranges from 0 (no symptoms) to 6 (death). An unfavorable mRS outcome in survivors is defined as a mRS score of 3–5 (moderate to severe disability).

### 2.1.4. Chinese Lawton Instrumental Activities of Daily Living Scale

The Chinese Lawton Instrumental Activities of Daily Living Scale (IADL) is an appropriate instrument for assessing independent living skills [14,15]. Items that are assessed include the ability to use the telephone, go shopping, prepare food, do housekeeping and laundry, secure transportation, be responsible for medications, and handle finances. An unfavorable IADL outcome in survivors is defined as an IADL score <15 [15].

### 2.1.5. Geriatric Depressive Scale

Post-stroke depressive symptoms were assessed using the validated Chinese version of the 15 item version of the Geriatric Depressive Scale (GDS) [16,17].

### 2.1.6. Short Form-36

Short Form-36 (SF-36) is a 36 item generic general health questionnaire that yields scores on eight health subscales relating to physical health and social and mental well-being [18,19]. The Chinese version has previously been validated, and population-based norms are available [20,21]. The HRQoL assessment was omitted if the patient was unable to follow commands or to comprehend and answer the questions correctly. The scores of the various scales are combined to form physical health and mental health component scores. The procedures for scoring and the computation of the scale and component scores of SF-36 have been described previously using norms for the Hong Kong population [22].

## 2.2. Statistical analysis

Statistical analyses were performed with the Statistical Package for the Social Sciences version 18.0 (SPSS Inc., Chicago, IL, USA) and MedCalc version 12.2.1.0 (MedCalc Software, Ostend, Belgium). Results are reported as the number (and percentage) of patients or mean  $\pm$  standard deviation unless otherwise specified. A difference with a  $p$  value of <0.05 (with Bonferroni correction for multiple comparisons) was regarded as statistically significant (two-tailed test).

Correlations between QOLIBRI-OS items were assessed using Spearman's rank order correlation to assess whether individual items measured different constructs. For internal consistency, a Cronbach's  $\alpha$  coefficient of  $\geq 0.70$  was required [23]. QOLIBRI-OS items were assessed for criterion validity by whether other 1 year

outcome assessments were different between QOLIBRI-OS dichotomized into above and below 50% using unpaired Student's  $t$ -tests and chi-squared test for linear-by-linear association as appropriate.

## 3. Results

Sixty-four aSAH patients were recruited into the current study. The patient characteristics are described in Table 1.

Cronbach's  $\alpha$  was 0.88, which is excellent for a six item scale. All items made a positive contribution to Cronbach's  $\alpha$ . The item scale correlations were satisfactory for all six items (0.55 to 0.76). Inter-item correlations were statistically significant (Spearman's rank order correlation coefficients, 0.39 to 0.73) (Table 2).

For criterion validity, QOLIBRI-OS dichotomized into above and below 50%, and showed significant difference in mRS, GDS, SF-36 physical and mental health scores (Table 3). There was also a trend towards a significant difference in IADL and MoCA scores.

## 4. Discussion

Our results indicated that QOLIBRI-OS is a suitable disease-specific HRQoL assessment for aSAH patients with good internal consistency and criterion validity. This scale could be employed for assessment in clinics or as part of the assessment battery for clinical research.

In a previous validation for traumatic brain injury patients, neurological outcome was assessed by the Extended Glasgow Outcome Scale [8]. In the current validation we employed the mRS, which has been more commonly reported for stroke studies. HRQoL in traumatic brain injury patients was associated with general health, social isolation, and labor force participation, which were not assessed in this aSAH validation study [24]. Nevertheless, we believe that these measures would have similar psychometric properties for aSAH patients and should be equally applicable in aSAH patients.

**Table 1**  
Demographic characteristics of aneurysmal subarachnoid hemorrhage patients

	aSAH patient (n = 64)
Age, years ( $\pm$ SD)	54 $\pm$ 9
Sex, female	44 (69%)
Admission WFNS Grade	
5	33 (52%)
4	17 (27%)
3	3 (5%)
2	8 (13%)
1	3 (5%)
Admission Fisher Grade	
1	0 (0%)
2	1 (2%)
3	31 (48%)
4	32 (50%)
Smoker	17 (27%)
Hypertension	26 (41%)
Aneurysm location	
Anterior circulation	54 (84%)
Posterior circulation	10 (16%)
Aneurysm treatment	
Coiling	35 (55%)
Clipping	26 (41%)
Delayed cerebral infarction	31 (48%)
Chronic hydrocephalus requiring shunt	11 (17%)

aSAH = aneurysm subarachnoid hemorrhage, SD = standard deviation, WFNS = World Federation of Neurosurgical Societies.

**Table 2**

Quality of Life after Brain Injury Overall Scale item correlations in aneurysmal subarachnoid hemorrhage patients

	Physical status	Mental status	Emotion	Function in daily life	Social status	Prospects
Physical status						
Mental status	<b>0.54</b>					
Emotion	<b>0.52</b>	<b>0.42</b>				
Function in daily life	<b>0.51</b>	<b>0.47</b>	<b>0.45</b>			
Social status	<b>0.49</b>	<b>0.39</b>	<b>0.41</b>	<b>0.59</b>		
Prospects	<b>0.59</b>	<b>0.43</b>	<b>0.37</b>	<b>0.56</b>	<b>0.73</b>	

Bold =  $p < 0.05$  after Bonferroni correction for multiple comparisons.**Table 3**

Quality of Life after Brain Injury Overall Scale and other 1 year outcome assessments in aneurysmal subarachnoid hemorrhage patients

	QOLIBRI-OS $\geq 50$ (n = 37)	QOLIBRI-OS < 50 (n = 27)	p value
mRS score			0.033
0	12 (36%)	4 (13%)	
1	5 (15%)	5 (16%)	
2	13 (39%)	14 (45%)	
3	2 (6%)	6 (19%)	
4	0 (0%)	2 (7%)	
5	1 (3%)	0 (0%)	
IADL	17 $\pm$ 3	15 $\pm$ 4	0.066
GDS	6 $\pm$ 6	13 $\pm$ 9	0.004
MoCA	24 $\pm$ 5	22 $\pm$ 6	0.097
SF-36			
PH	48 $\pm$ 13	37 $\pm$ 14	0.004
MH	53 $\pm$ 12	41 $\pm$ 18	0.006

GDS = Geriatric Depression Scale, IADL = Chinese Lawton's Instrumental Activity of Daily Living, MH = Mental Health Summary Score, MoCA = Montreal Cognitive Assessment, mRS = modified Rankin Scale, PH = Physical Health Summary Score, QOLIBRI-OS = Quality of Life after Brain Injury Overall Scale, SF-36 = Short Form-36.

SF-36 is one of the generic HRQoL measures applied in various field of medicine. One advantage of generic HRQoL measures is that it allows comparisons across different disease entities. However, specific areas of disease-related dysfunction may not be optimally captured. QOLIBRI-OS was specifically designed for brain injury patients. We found that QOLIBRI-OS was also suitable for application in aSAH patients.

There are a number of limitations in the current study. First, the study did not compare QOLIBRI-OS with other disease-specific HRQoL measures for aSAH. Second, test-retest reliability was not assessed in aSAH patients although it has been confirmed in traumatic brain injury patients [9]. Third, the feasibility of surrogate assessments or different modes of administration (mail questionnaire, face-to-face, and telephone interview) were not compared. Fourth, the results may not be valid for other forms of hemorrhagic stroke. Finally, replication in another aSAH patient population as well as using other language versions is recommended.

## 5. Conclusion

QOLIBRI-OS demonstrated good internal consistency and criterion validity for application in aSAH patients. The QOLIBRI-OS can be used as a brief index for disease-specific HRQoL assessment after aSAH. Further validation in another population of aSAH patients is recommended.

## Conflicts of interest/disclosures

The authors declare that they have no financial or other conflicts of interest in relation to this research and its publication.

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