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USING THE CLINICAL FRAILTY SCALE TO PREDICT THE LENGTH OF STAY IN OTOLARYNGOLOGY UNIT IN TAIWAN

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ABSTRACT

Frailty was a common syndrome in geriatric clinic and general internal medical wards. Some authors had identified the Clinical Frailty Scale (CFS) as a predictor of length of stay in the acute medicine unit. However, the role of the Clinical Frailty Scale in the length of stay in otolaryngology unit had not been well studied. The objective of this study was to find out the correlation of the CFS in elderly patients admitted to otolaryngology unit and their length of stay. A retrospective medical chart review of 203 elderly patients admitted to the otolaryngology ward from January, 2014 to December, 2018 was performed. These patients were hospitalized for treating otorhinolaryngological (ENT) disease or for otorhinolaryngological surgery except for those of ENT- related malignancies at Kaohsiung Municipal United Hospital (KMUH). Patients' demographics, CFS scores, Charlson comorbidities Index (CCI), and length of stay (LOS) were recorded. All the participants were divided into three groups: non-frail (CFS 1- 4), mild-to-moderately frail (CFS 5- 6), and severely frail (CFS7- 8). Severely frail group had longer lengths of stay (mean= 8.76±0.97 days), comparing to mild-to-moderate frail group (mean=6.25±0.72 days), and non-frail group (mean= 3.93±0.38 days, p=0.000). For the length of stay stratified by each individual CFS score, it was significant that patients with higher CFS scores had longer lengths of stay (p=.000). The group with higher CFS scores had higher CCI when compared with non-frail group (6.76±1.35 for severely frail, vs. 5.41±1.10 for mild-to- moderately frail vs. 3.02±0.95 for non-frail, p=0. 000). The use of the CFS for assessment of the elderly patients could help the otolaryngologist to predict the length of stay in

otolaryngology unit in Taiwan.

Key words: Clinical Frailty Scale, Frailty, Length Of Stay, Otolaryngology Unit

INTRODUCTION

When Taiwan started National Health Insurance in 1995, the aged population (65 years and over) was only 7.6% (Dingtao Qi, 2016). But according to the announcement of Taiwan's Ministry of the Interior, Taiwan had officially reached the standard of an "aged society" as Taiwanese people over 65 years old accounted for 14.05% of the country's total population at the end of March, 2018. Among this population, frailty was a common physical change in the elderly. Frailty was more prevalent in Taiwan- urban (33.1%) and Taiwan- rural (38.1%) compared to Hong Kong (16. 6%, $p < 0.05$) and was higher in women (22.6–49.7%) than in men (10.5–27.5%, $p < 0.05$) (Ruby Yu, Wan- Chi Wu, Jason Leung, Susan C. Hu, & Jean Woo, 2017).

Frailty is more like the aging of body organs and is a morbid, unhealthy aging with an increased risk of hospitalization, falls, incident disability, delirium, mortality and complications during hospitalization (Qian- Li Xue, 2011, Eeles E, et al., 2012, Gill T, et al., 2010, Joosten E, et al., 2014, Fried L, et al., 2001). For older individuals with physical frailty, there were increasing possibility of intervening illness and fall-related injury which caused new or worsening disability (Gill T, et al., 2010). Therefore, the length of stay of the frail elderly could be longer (Gill T, et al., 2010, Joosten E, et al., 2014).

There were a variety of frailty scales, including the frailty phenotype, the frailty index (Cesari M, et al., 2014), the Edmonton Frail Scale (Rolfson, D. B., 2006), Multidimensional Frailty Score (Kim SW, et al., 2014), which had been proposed. But concerning the definition of frailty, there was no single golden criteria which was ubiquitous and generally accepted (Rockwood K, et al., 2005). Frailty had impact on prognosis and was a predictive role in many diseases.

The CSHA Clinical Frailty Scale (CFS) was first developed by Kenneth Rockwood at 2005. The CFS was highly correlated ($r = 0.80$) with the Frailty Index (Rockwood K, et al., 2005). There were linear correlations between the scores of CFS and the probability of survival, avoidance of institutional care. That study showed the CFS was an effective measure of frailty and could predict death and the need for an institution (Rockwood K, et al., 2005). The Clinical Frailty Scale was reliable and comparable to the Frailty Phenotype in identifying frailty in community-dwelling older adults with the advantage of being easy to administer in clinical settings (Islam A, et al., 2014). Besides, the CFS for frailty was a strong predictor of adverse outcomes, such as in-hospital mortality, new nursing home placement and length of hospital stay, in older people hospitalized with acute

illness (Basic D, Shanley C., 2015). An increased awareness of its impact may alert clinicians to screen for frailty. The CFS was simple and practical for physicians in assessing related risks of frailty. If the CFS was 5 or more, the patient was frail.

About frailty, different evaluation models depended on different needs. The use of the Edmonton Frailty Scale (EFS) for the level of frailty was not a useful predictor of rehabilitation and discharge outcomes for older people in subacute care by some exploratory study (Haley MN, Wells YD, & Holland AE, 2014). There were studies used chart reviews to retrospectively explore the value of CFS for length of stay and other related health outcomes (Basic D, 2015, Murali- Krishnan R, et al., 2015). Little is known, however, about the impacts of frailty evaluated by the CFS among older patients on the length of stay in otolaryngology unit. Therefore, the main purpose of this study was to determine the predictive ability of the CFS for the length of stay of elderly patients in otorhinolaryngology ward.

MATERIALS AND METHODS

Study Design and Participants

Antai Medical Care Cooperation Antai- Tian- Sheng memorial Hospital Institutional Review Board reviewed and approved the study prior to its initiation (TSMH IRB No. / Protocol No.: 19- 047- B). Exemption of informed consent of study participants was granted by the IRB because participant data were protected and deidentified. A retrospective medical chart review of all patients from the senior author (WK T) was performed. All participants were admitted to the ENT unit at KMUH, Kaohsiung, Taiwan, from January, 2014 to December, 2018. Inclusion criteria for the project were: being admitted to the ENT unit at KMUH for surgery or non-surgery treatment, aged 65 or older, with or without any chronic health condition. These patients were all treated with disorders related to otorhinolaryngological field with or without performing surgery.

Exclusion criteria were used to select appropriate patients and to minimize bias and eliminate confounding factors. Of the patients identified, those who had or were suspected had ENT-related malignancies with or without radiation therapy or chemotherapy were excluded.

Data Collection

The Demographic and Core medical data were all collected from hospital records of all patients including age, sex, Charlson comorbidities Index (CCI), Study of Osteoporotic Fracture (SOF) index (Ensrud KE, et al., 2008), diagnoses for admission, No. of medications, social situation (from home or from Long-Term Care), number of falls in past 12 months, and sports-days per week (SDW). The SDWs were counted if over-30-minute exercise each time per day was reached. The activities of daily function were measured by the Barthel index. The Lawton Instrumental Activities of Daily Living Scale (IADL) was used to assess independent living skills (Lawton & Brody, 1969). Information was confirmed by a qualified otolaryngologist with face-to-face assessments with

the patients and family members.

The CFS scores were judged by a geriatrician well-trained in scoring with the CFS. Assessments took place within 24 hours of the admission, through chart review and face-to-face assessments with patients and families, to determine their baseline CFS prior to admission. The CFS was assigned from 1 (very fit) to 9 (terminally ill).

Outcomes collected included length of stay (LOS), Charlson Comorbidity Index (CCI), transfer to subacute medicine unit or other units, entry into institutional care, and in-hospital mortality. Data were obtained from electronic medical records available for each participant.

Statistical Analysis

All the descriptive statistics divided into 3 groups by CFS frailty level were evaluated via one-way ANOVA or Pearson chi-squared test. The three categories of frailty were based on the CFS scores: CFS 1–4 non-frail, 5–6 mild-to-moderately frail, 7–8 severely frail. Patients with CFS 9 were excluded from the data base because by definition they are approaching the end of life rather than frail. The mean length of stay between CFS categories was compared using one-way ANOVA and ANCOVA which adjusted for age and sex. All statistical analyses were performed using SPSS (IBM SPSS version 20). Significance level was set at $p < .05$.

RESULTS

Table 1 listed the demographic and clinical characteristics of all included participants. It was stratified by three CFS frailty categories. Mean age was = 74.92±8.0; range 65 to 96, and 50. 25% were female. The CFS scores assigned ranged from 1 (very fit) to 8 (very severely frail), with a mean ± SD of the CFS of 3.27 ± 1. 83. All the data stratified by the CFS categories resulted in 154 patients with CFS 1–4 (non-frail), 32 patients with CFS 5–6 (mild-to-moderately frail), and 17 patients with CFS 7–8 (severely frail).

The patients in higher CFS strata had higher CCI and No. of medications at baseline (*p*=. 000). The sex ratio of the three groups showed no significant difference (*p*=. 08). Those with higher CFS were more likely require assistance or be dependent with IADLs and ADLs (*p*=. 000). The patients in higher frailty strata also tended to be older significantly (*p*=. 000) and had more history of fall in the past years (*p*=. 000). Those in lower frailty strata had more sports-days per week (SDW) significantly (*p*=.000).

Table 2 listed the length of stay stratified by each individual CFS score. The mean length of stay of the total sample was 4. 70 days (SD = 1. 58, range 3 to 11). It was significant that patients with higher CFS scores had longer lengths of stay (*p*=. 000).

As shown in Table 3 which listed the association between frailty categories stratified as non-frail, mild-to-moderately frail, severely frail, and

TABLE 1. Demographics and clinical characteristics according to frailty status at admission

Characteristic	*Frailty Groups*				*p Value*
	Total Sample n=203	*CFS 1- 4 n=154 (75. 9%)*	*CFS 5- 6 n=32 (15. 8%)*	*CFS 7- 8 n=17 (8. 4%)*	
Age, mean (±SD)	74. 92 (±8. 00)	72. 40 (±6. 73)	80. 19 (±5. 36)	87. 76 (±5.18)	*p*=. 000[b]
Females, n (%)	102 (50. 25)	76 (49. 35%)	16 (50. 0%)	10 (58. 8%)	*p*=. 08[c]
No. of medications, mean (±SD)	1. 53 (±1. 83)	0. 72 (±1. 02)	3. 63 (±1. 29)	4. 88 (±1. 45)	*p*=. 000[b]
CCI, mean (±SD)	3. 71 (±1. 62)	3. 02 (±0. 95)	5. 41 (±1. 10)	6. 76 (±1. 35)	*p*=. 000[b]
CFS, mean (±SD)	3. 27 (±1. 83)	2. 38 (±0. 84)	5. 31 (±0. 47)	7. 47 (±0. 51)	*p*=. 000[b]
SOF, mean (±SD)	1. 05 (±1. 12)	0. 54 (±0. 69)	2. 47 (±0. 62)	3. 00 (±0. 69)	*p*=. 000[b]
History of falls in past year, n (%)	34 (16. 75%)	13 (8. 44%)	12 (37. 50%)	9 (52. 94%)	*p*=. 000[b]
Baseline dependence or assistance for IADLs[a], (n%)	68 (33. 50%)	31 (20. 13%)	23 (71. 88%)	17 (100%)	*p*=. 000[c]
Baseline dependence or assistance for ADLs[a], (n%)	55 (27. 09%)	16 (10. 39%)	22 (68. 75%)	17 (100%)	*p*=. 000[c]
Sports- day per week (SDW)	3. 34 (±2. 50)	4. 19 (±2. 50)	0. 94 (±2. 12)	0. 12 (±0. 49)	*p*=. 000[b]
From LTC, n (%)	9 (4. 43%)	2 (1. 30%)	4 (12. 50%)	3 (17. 65%)	*p*=. 000[c]

Abbreviation: CCI, Charlson Comorbidity Index, SOF: Study of Osteoporotic Fracture Criteria for Frailty

[a]Dependency in ADL or IADLS was defined as haveing at least one deficit in the Barthel Index and Lawton IADL scales, respectively

[b] ANOVA

[c]χ^2 test

TABLE 2. Description of the Length of Stay stratified by individual CFS scoring

CFS	*N*	*Length of Stay (SD)*	*p Value*
1	15	3. 40 (0. 51)	*p*=. 000[a]
2	86	3. 99 (0. 29)	
3	32	3. 91 (0. 39)	
4	21	4. 10 (0. 30)	
5	22	6. 14 (0. 77)	
6	10	6. 50 (0. 53)	
7	9	8. 22 (0. 83)	
8	8	9. 38 (0. 74)	
1- 8	203	4. 70 (1. 58)	

CFS = clinical frailty scale, N = number of patients, SD = standard deviation.

[a]ANOVA

TABLE 3. Association between frailty categories stratified as non-frail, mild-to-moderately frail, and severely frail, and length of stay before and after adjusting for age & sex

Outcome Variable (mean(±SD))	*Sample Stratified by Frailty Status*			*p Value*
Total sample (n=203)	*CFS 1- 4 non- frail (n=154)*	*CFS 5- 6 mild-to-moderately frail (n=32)*	*CFS 7- 8 severely frail (n=17)*	
Length of stay	*mean (±SD)*	*mean (±SD)*	*mean (±SD)*	
4.70 (±1.58)	3.93 (±0.38) [a]	6.25 (±0.72) [a]	8.76 (±0. 97) [a]	0. 000[a]
Length of stay	*mean (95%C.I.)*	*mean (95%C.I.)*	*mean (95%C.I.)*	
4.70 (±1.58)	3.97(3.89-4.06)[b]	6.02(5.70-6.33)[b]	8.45(7.79-9.12)[b]	0. 000[b]

[a]ANOVA

[b]ANCOVA: adjusted for AGE & SEX

length of stay before and after adjusting for age & sex. Severe frailty (CFS 7–8) was associated with longer lengths of stay (mean 8.76 days, SD = 0. 97) compared to mild-to-moderate frailty (mean 6.25 days, SD =0.72) and non-frailty (mean 3.93 days, SD = 0.38, *p* =. 000, Welch's test for unequal variances). After adjusting for age and sex, severe frailty (CFS 7–8) was associated with longer lengths of stay (mean 8.45 days, 95%C.I., 7.79- 9.12) compared to mild-to- moderate frailty (mean 6.02 days, 95% C.I., 5.70- 6.33) and non-frailty(mean 3.97 days, 95%C.I., 3.89-4.06). The association was still significant(*p*=. 000).

In the 203 patients, the stepwise regression was used to assess the predictive factors (AGE, CCI, CFS, SOF, SDW) for the dependent variable LOS (Table 4). This models was significant (*p*=. 000) and had adjusted R^2 0.792. The significantly predictive factor for Length of stay (LOS) was CFS(*p*=. 000).

TABLE 4. Predicting Length of Stay (LOS) from AGE, CCI, CFS, SOF, SDW via Stepwise Regression

The Stepwise regression equation is LOS[a] = 2. 180+0. 769 CFS[b]					
Predictor	*B Coef*	*SE Coef*	*Beta*	*t*	*p*
Constant * * *	2.183	0.104		21.067	0.000
CFS * * *	0.769	0.028	0.891	27.790	0.000
S= 0. 000	R^2 = 0.793	R^2(adj) = 0.792			
excluded variables					
Age			0.046	1.061	0.290
CCI			0.101	1.926	0.056
SOF			-0.022	- 0.378	0.706
SDW			-0.009	- 0.225	0.822

Abbreviation: CCI, Charlson Comorbidity Index. CFS: clinical frailty scale, SOF: Study of Osteoporotic Fracture Criteria for frailty. SDW: Sports- Day per week. LOS: Length of Stay
a. dependent variable: LOS
b. significantly predictive variable: CFS

Among the three CFS categories, readmission rates were 1 (0. 65%) for non-frail patients vs. 2 (6. 25%) for mild-to- moderately frail patients vs. 5 (29. 41%) for severely frail patients (*p*= 0. 464). Other outcomes included death during admission (1 patient with CFS = 8) due to sepsis with DM poor control. Besides, there were one patient with CFS = 7 transferred to general internal medicine ward due to hyperglycemia and another patient with CFS = 5 transferred to Neurosurgical ward for surgery due to brain metastasis of breast carcinoma.

DISCUSSION

The purpose of the analysis was to explore the usefulness of the Clinical Frailty Scale for predicting the length of stay of older patients in otolaryngology unit in Taiwan. It was significant that the patients with higher CFS scores had longer lengths of stay stratified by each

individual CFS. Similarly, severe frailty (CFS 7–8) was associated with longer lengths of stay compared to mild-to-moderate frailty and non-frailty significantly. Stepwise regression showed that the significant predictive factor for Length of Stay (LOS) was the CFS. Therefore, using the Clinical Frailty Scale to predict the length of stay of elderly patients in otolaryngology unit was feasible.

Majority of the patients belonged to the non-frailty group *(*75.9%) compared to mild- to- moderate frailty *(*15.8%) and severe frailty *(*8.4%). This could be due to majority of the causes for otorhinolaryngological admissions via acute medical unit or ENT outpatient department were of pharyngo-esophageal origins. Besides, part of the ENT patients were hospitalized for surgery. These patients who were ready to undergo operation were relatively healthy. Therefore, the reasons for hospitalization of ENT patients may be clinical relevant and need to be further explored.

This research was a continuation of the spirit of many studies in the past. For example, a study highlighted the association of Canadian Study of Health and Aging Clinical Frailty Scale with length of hospital stay, 30-day mortality and 1 year mortality after percutaneous coronary intervention (Murali- Krishnan R, et al., 2015). Another study showed that the CFS was an independent predictor of in-patient mortality, transfer to Geriatric ward and LOS ≥ 10 days. (Juma S, Taabazuing MM, Montero- Odasso M, 2016).

The difference in mean length of stay of 3.97 in non-frail patients and 8.45 days in severely frail patients after adjusting for age & sex was clinically and economically vigilant for patients, physicians and families. Although the differences in our research were smaller than those in the acute medical unit in Canada (Juma S, 2016), such differences could still lead to more in-hospital complications and more health-care budgets.

We must point out some restrictions on our research. With no governmental subsidies and limited samples, it was difficult for us to do further research and detect stronger associations. Besides, the patients were admitted with a variety of diagnosis and diseases, but we did not investigate the associations between diagnosis for admission and length of stay. Although we sampled in the otolaryngology ward where frailty was less prevalent and patients were more heterogeneous, but our study include a comprehensive evaluation of frailty status performed by a qualified and well-trained geriatrician was still effective and validated.

In the Taiwan Society of Otorhinolaryngology Head and Neck Surgery, few doctors would pay attention to the clinical application of the CFS. But since 2010, the inpatient reimbursement system of Taiwan had changed to partial implementation of diagnosis related groups (Tw- DRG). Decision in hospital management adopted the reimbursement system that help contain costs. The efficient assessment method for patients would help the physicians to improve the bed turnover rate and length of stay. Therefore, we were looking forward to shortening the length of stay and avoid complications from hospitalization by understanding how the CFS scores were assigned.

CONCLUSIONS

The CFS was an easy-to-perform and time-efficient evaluation method (Juma S, 2016). The role of Clinical Frailty Scale for the elderly in the length of stay in otolaryngology unit had not been well explored before. This study showed CFS could help the otolaryngologist to predict length of stay and revealed the practical and clinical applicability of the CFS to detect those elderly at risk of longer length of stay in otolaryngology unit in Taiwan. Because the otolaryngology ward includes two types of patients: the patients need for surgery, and the patients need for non-surgery treatment. Instantly understanding the frailty severity early on during admission or in outpatient department may allow the otolaryngologists to stratify the patients into their level of risk for frailty-related outcomes, reschedule or cancel operations, plan treatments and consult general physicians for general medical care to prevent further complications and decrease length of stay (Juma S, 2016, Pashikanti L, 2012, Li-Chun Wu, 2008).

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AVAILABILITY OF DATA AND MATERIAL

All of the data and materials were available.

CONFLICT OF INTEREST DISCLOSURES

The authors declared that no conflicts of interest existed.

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