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The overlapping of geriatric syndromes not medical multimorbidities is a better predictor for depression and disability in hospitalized older people

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ABSTRACT

Introduction: Geriatric syndromes, multimorbidity, and disability are closely interrelated concepts. The presence of different geriatric syndromes and medical comorbidities has major impacts on health and well-being. The medical comorbidities are usually well evaluated and recorded during the initial assessment of hospitalized older adults, while the geriatric syndromes usually remain overlooked. The impact of geriatric syndromes on depression and functional disability needs evaluation.

Aim: To determine the impact of geriatric syndromes and medical multimorbidities on predicting functional disability and depression in hospitalized older adults.

Methods: 189 hospitalized elderlies were recruited for the study. Each participant underwent comprehensive geriatric assessment to determine medical comorbidities, geriatric syndromes and factors associated with depression and functional disability.

Results: The prevalence of functional disability among participants was 39.68% while 28.57% of the participants had depression. The geriatric syndromes accumulation score but not the age adjusted Charlson comorbidity index (CCI) was able to predict depression and functional disability. In the adjusted model for age, gender, and CCI, the increased number of coexisting geriatric syndromes increased the risk of depression and functional disability [OR: 1.817 (95% confidence interval 1.338-2.793), OR: 1.936 (95% confidence interval 1.338-2.793)].

Conclusions: The geriatric syndromes usually occur simultaneously. The presence of coexisting geriatric syndromes increased the risk of depression and functional disability.

Keywords: functional disability, geriatric syndromes, depression, multimorbidities, Charlson comorbidity index, geriatric

INTRODUCTION: BACKGROUND

Geriatric syndromes, multimorbidity, and disability are closely interrelated concepts. Some researchers consider disability and multimorbidity as geriatric syndromes; whereas others describe them as distinct clinical conditions that commonly overlap in the same patient [1].

The term “geriatric syndromes” refers to multifactorial health conditions due to multisystem accumulated age-related deficits leading to increased vulnerability of older adults [2]. Although the concept of the geriatric syndromes is highly embraced by geriatricians, it remains poorly defined [2]. The term is generally used to describe incontinence, falls, functional decline, dementia, malnutrition, sensory deficits, and delirium. These syndromes are commonly associated with poor outcomes, as functional disability and acquisition of new syndromes [3]. Disability refers to the gap between the elder’s abilities and environmental requirements; it is defined by the limitations in the ability to perform activities of daily living (ADL), or the ability to function independently in terms of basic ADL or instrumental ADL [4].

Persons with multimorbidity are at twice the risk of depressive disorder compared to those without multimorbidity [5]. Moreover, multimorbidity increases the likelihood of functional disability [6]. Similarly, the increased numbers of overlapped geriatric syndromes are linked to functional decline [7,8]. However, data is lacking regarding the impact of overlapped geriatric syndromes on depression, moreover; comparing the impact of overlapped geriatric syndromes and medical multimorbidities on predicting functional disability and depression among hospitalized older people needs to be evaluated.

The aim of this study was to explore the impact of overlapped geriatric syndromes and medical multimorbidities on predicting functional disability and depression in hospitalized older adults.

METHODS

Study Design and Population

This is a cross-sectional study including 189 elderly (≥60 years) admitted to the geriatric department of Ain Shams University Hospital, Cairo, Egypt, between June 2018 and May 2019. We excluded those who refused to participate in the study. All participants were subjected to multidisciplinary comprehensive geriatric assessment (CGA).

Clinical Assessment

1. A detailed socio-demographic data, medical history taking, and physical examination were performed.
2. **Self-report health survey questionnaire** was used to diagnose urinary incontinence, falls, significant visual impairment (markedly affected patient's quality of life), significant hearing impairment (markedly affected patient's quality of life), previous episodes of delirium, and dizziness.
3. **Functional disability** was defined according to [9], where any degree of assistance in the basic ADL was considered as disability (interpreted as ADL score below six by Katz index) [10].
4. **Geriatric syndromes accumulation score** was operationalized as the total count of geriatric conditions obtained by multidisciplinary CGA. It included the number of existing geriatric conditions including urinary incontinence, falls, malnutrition, visual impairment, hearing impairment, cognitive impairment, resolved delirium, and dizziness. It included the geriatric conditions using indicator covariates to denote whether the condition is present (the indicator equals 1 if the condition is present, 0 otherwise), it did not attach weights to each syndrome making it a simple score requiring no complex calculations and can be easily obtained from medical records.
5. **Multimorbidity** was defined as the presence of at least two chronic diseases at the same time. The weighted prognostic burden of comorbidities was measured by the age adjusted Charlson comorbidity index (aCCI). It contains 19 items including (diabetes with diabetic complications, congestive heart failure, peripheral vascular disease, chronic pulmonary disease, mild and severe liver disease, hemiplegia, renal disease, leukemia, lymphoma, metastatic tumor, and acquired immunodeficiency syndrome) [11].
6. **Depression** was assessed using the Arabic geriatric depression scale-15 (GDS), with scores ≥5 indicate the presence of depression [12].
7. **Malnutrition** was diagnosed if mini nutritional assessment (MNA) score is <17/30. MNA assesses 18 items (anthropometric variables, general parameters, dietary parameters, and self-perception of health and nutrition) [13].
8. **Cognitive impairment** was diagnosed using the Arabic version of the mini mental state examination (MMSE). It detects deficits in the domains of orientation, registration, calculation, recall, language, and copying design. The scores are adjusted to age and educational levels [14].
9. Detailed clinical, neuropsychological assessment, and diagnostic investigations were performed as required, this was supplemented by medical record reviewing to confirm the diagnosis of medical disorders and geriatric syndromes.

Ethical Consideration

The approval of the Research Review Board of the Geriatrics and Gerontology Department, Faculty of Medicine, Ain Shams University was obtained before undertaking the research. Informed verbal consent was obtained from all participants after being informed about the study, it was documented in the presence of a next of kin and a nurse.

Statistical Methods

1. The collected data were coded, tabulated, revised, and analyzed using SPSS package 22. For the receiver operating characteristic (ROC) curves and regression analysis, we used MedCalc statistical software version 18.9.1 (MedCalc software bvba, Ostend, Belgium; https://www.medcalc.org; 2018).
2. Quantitative variables were presented in the form of means and standard deviation. Qualitative variables were presented in the form of frequency tables (numbers and percentages). The comparison between quantitative variables was done by Student t test and the comparison between qualitative variables was carried out using Pearson's $\chi 2$ test.
3. ROC curves were plotted. The area under each ROC curve was calculated to assess the ability of the assessed score to predict recorded outcomes.
4. Multivariable logistic regression analysis was used to study the association of geriatric syndromes score and CCI with depression and disability. Odds ratios (ORs) with 95% confidence intervals (CI) were presented. p-value <0.05 was considered statistically significant.

RESULTS

The demographic and clinical characteristics of the participants are presented in (**Table 1**).

Regarding medical comorbidities, hypertension and musculoskeletal disorders were significantly more prevalent among women (women vs men: 54.7% vs 43.6%; p-value=0.03, 56.8% vs 30.9%; <0.001, respectively). Chronic obstructive

Table 1. Clinical characteristics stratified according to gender

		Males (N=94)	Females (N=95)	p-value
Age		68.54±7.11	68.84±7.60	0.78
Marital status	Single	1 (1.1%)	2 (2.1%)	<0.0001*
	Married	81 (86.2%)	34 (35.8%)	
	Widow	12 (12.8%)	56 (59.9%)	
	Divorced	0 (0%)	3 (3.2%)	

Table 1 (Continued). Clinical characteristics stratified according to gender

		Males (N=94)	Females (N=95)	p-value
Smoking	Current	28 (29.8%)	1 (1.1%)	<0.0001*
	Ex-smoker	46 (48.9%)	2 (2.1%)	
	Non-smoker	20 (21.3%)	92 (96.8%)	
Living arrangement	Alone	12 (12.8%)	3 (3.2%)	0.015*
	With family members	82 (87.2%)	92 (96.8%)	
Medical conditions				
DM		38 (40.4%)	47 (49.5%)	0.21
HTN		41 (43.6%)	52 (54.7%)	0.03*
IHD		30 (31.9%)	32 (33.7%)	0.79
PVD		2 (2.1%)	2 (2.1%)	0.991
CVS		18 (19.1%)	19 (20.0%)	0.883
Heart failure		19 (20.2%)	19 (20.0%)	0.971
Arrhythmia		10 (10.6%)	17 (17.9%)	0.154
COPD		43 (45.7%)	8 (8.4%)	<0.0001*
Bronchial asthma		5 (5.3%)	12 (12.6%)	0.079
Anemia		9 (9.6%)	15 (15.8%)	0.199
CLD		33 (35.1%)	25 (26.3%)	0.190
CKD		10 (10.6%)	11 (11.6%)	0.837
Gastritis		18 (19.1%)	19 (20.0%)	0.883
Parkinsonism		4 (4.3%)	0 (0%)	0.042*
Musculoskeletal disorders		29 (30.9%)	54 (56.8%)	<0.0001*
Malignancy		9 (9.6%)	3 (3.2%)	0.07
The aCCI		6.32±1.81	5.64±1.68	0.008*
Previous delirium		8 (8.5%)	10 (10.5%)	0.637
Cognitive impairment		19 (20.2%)	14 (14.7%)	0.321
Significant hearing impairment		4 (4.3%)	2 (2.1%)	0.399
Significant visual impairment		15 (16.0%)	20 (21.1%)	0.367
Dizziness		16 (17.0%)	11 (11.6%)	0.285
Falls		13 (13.8%)	15 (15.8%)	0.705
Malnutrition		20 (21.3%)	16 (16.8%)	0.438
Urinary incontinence		28 (29.8%)	27 (28.4%)	0.836
Geriatric syndromes accumulation score		1.30±1.09	1.21±1.13	0.54
Disability		37 (39.4%)	38 (40.0%)	0.929
Depression		31 (33.0%)	23 (24.2%)	0.182

Table 2. Sensitivity, specificity, area under the curve (AUC), positive predictive value (PPV), negative predictive value (NPV) of the aCCI, geriatric syndromes accumulation score in predicting depression, and functional disability

	AUC	p-value	Sensitivity	Specificity
Depression				
Geriatric syndromes accumulation score >1	0.679	<0.0001	57.41%	72.59%
Age adjusted Charlson comorbidity index >5	0.558	0.2064	61.11%	49.63%
Disability				
Geriatric syndromes accumulation score ≥1	0.701	<0.0001	88.00%	39.47%
Age adjusted Charlson comorbidity index >7	0.518	0.6780	26.67%	85.09%

pulmonary disease (COPD) and parkinsonism were more prevalent among men (men vs women: 45.7% vs 8.4%; p-value <0.001, 4.3% vs 0%; <0.042, respectively). The aCCI was higher among males (men vs women: 6.32±1.81 vs 5.63±1.68, p-value=0.008).

There was no significant difference between both genders regarding neither the prevalence of common geriatric syndromes nor the geriatric syndromes accumulation score. 39.68% and 28.57% of the participants had functional disability and depression, respectively.

By using ROC analysis, the geriatric syndromes accumulation score but not the aCCI was able to predict depression and functional disability (depression: AUC: 0.679 vs 0.558, p-value <0.001 vs 0.206; functional disabilities: AUC: 0.701 vs 0.518, p-value <0.001 vs 0.678, respectively) (**Table 2**, **Figure 1**, and **Figure 2**).

In the adjusted model for age, gender, and CCI, the increased number of coexisting geriatric syndromes increased the risk of depression and functional disability [OR: 1.817 (95% CI 1.338-2.793), OR: 1.936 (95% CI 1.338-2.793), respectively, p-value <0.001 for both] (**Table 3**).

DISCUSSION

This study demonstrated that functional disability and depression were common among hospitalized elderly. 39.68% and 28.57% of the participants had functional disability and depression, respectively. Although, the presence of different geriatric syndromes has a major impact on health and well-being, they remain overlooked during the initial assessment of hospitalized older adults. This is not the case with medical comorbidities, that are usually assessed and reported in standardized approaches evaluating both the disease and treatment burdens.

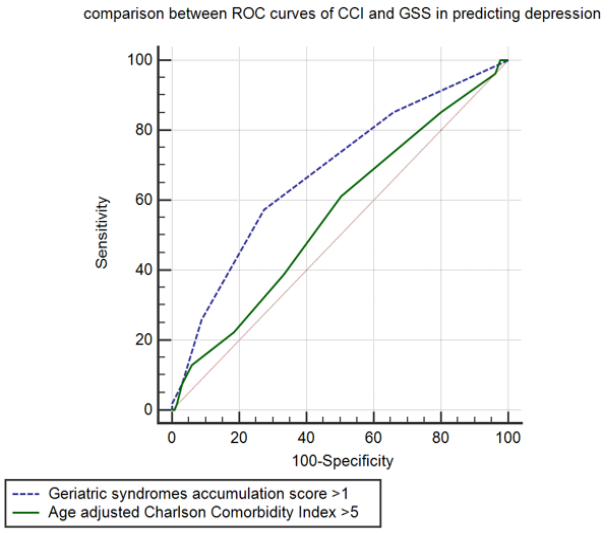

Figure 1. ROC analysis for predicting depression using aCCI and GSS

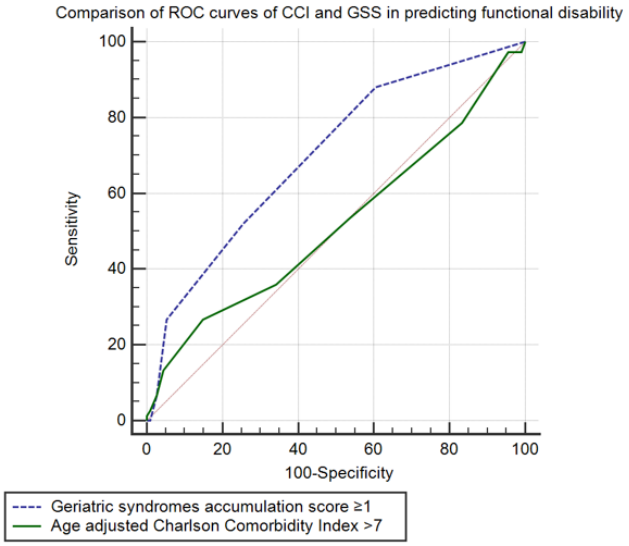

Figure 2. ROC analysis for predicting functional disability using aCCI and GSS

Table 3. Adjusted OR & 95% CI for the accumulated effect of geriatric syndromes & CCI on depression & disability

	Coefficient	Odds ratio	95% CI	p-value
Predictors of depression				
Age	-0.029	0.972	0.924 to 1.022	0.260
CCI	0.114	1.121	0.916 to 1.372	0.267
GSS	0.597	1.817	1.338 to 2.467	<0.001
Male gender	0.343	1.410	0.711 to 2.793	0.325
Constant	-0.635			0.698
Predictors of disability				
Age	0.051	1.053	1.005 to 1.102	0.031
CCI	-0.032	0.969	0.798 to 1.176	0.748
GSS	0.661	1.936	1.429 to 2.624	<0.001
Male gender	-0.063	0.940	0.492 to 1.791	0.849
Constant	-4.589			0.003

Note. **GSS-Geriatric syndromes accumulation score** is the total count of geriatric conditions (urinary incontinence, falls, malnutrition, significant visual impairment, significant hearing impairment, cognitive impairment, resolved delirium, and dizziness).
aCCI-The age adjusted Charlson comorbidity index is the weighted prognostic score of 19 items including (diabetes with diabetic complications, congestive heart failure, peripheral vascular disease, chronic pulmonary disease, mild and severe liver disease, hemiplegia, renal disease, leukemia, lymphoma, metastatic tumor, and acquired immunodeficiency syndrome).

There are many medical comorbidity measures e.g., the CCI, the agency for healthcare research and quality's comorbidity index (AHRQCI) [15], and the chronic disease score (CDS) [16]. The CCI remains the most commonly used index in health outcomes prediction analysis [17].

The aCCI is an example of a summary score which attach weights to each condition, and then sum the weights of those conditions, it was initially developed to assess mortality, then other outcomes as length of hospital stay, critical care admission, and mechanical ventilation were evaluated in multiple medical and surgical conditions [18, 19]. Yet, its utility in predicting the risk of depression and functional disability in hospitalized elderly is lacking.

Currently, there is no summary score for measuring geriatric syndromes. Thus, the current study used a statistical model which included the geriatric conditions using indicator covariates to denote whether the condition is present (the indicator equals 1 if the condition is present, 0 otherwise).

In the current study, the prevalence of specific geriatric syndromes varied greatly from about 3.17% for severe hearing impairment to 39.68% for functional disability. However, the true prevalence is likely to be higher, as assessment of most of the geriatric syndromes in the current study was based on self-reporting which can be affected by patients' cognitive status and affect.

The findings of this study demonstrate a significant relationship between the proposed *geriatric syndromes accumulation score* and the risk of depression and functional disability after adjustment for age, gender, and aCCI. This finding is in line with previous findings in literature, which demonstrated that the presence of any of the geriatric syndromes was associated with poor outcomes, as functional disability and acquisition of other geriatric syndromes [3]. These findings suggested that, geriatric syndromes were combinations of interacting multiple conditions sharing similar risk factors and pathophysiologic mechanisms [8]. Thus, the prevention of common geriatric syndromes may be a useful strategy to prevent other syndromes preventing the downward spiral of accumulated deficits leading to frailty.

Although, previous reports suggested strong association between medical multimorbidity and depression and physical disability [5, 6], the current study failed to reproduce similar results. This difference may be due to the use of summary score as aCCI instead of the statistical models previously used.

One major strength of this study is using simple statistical model of the proposed geriatric syndromes accumulation score to predict depression and functional disability among hospitalized elderly, however; frailty and sleep disorder were not evaluated in the current study because their diagnosis is usually based on expert assessment which lacks in most non specialized settings. Other limitations of the current study include being a cross-sectional study cannot prove a causal relationship between the overlapping geriatric syndromes and depression or functional disability.

CONCLUSIONS

The geriatric syndromes usually occur simultaneously. The presence of coexisting geriatric syndromes increased the risk of depression and functional disability. Comprehensive assessments and management of geriatric syndromes may help to prevent or at least delay the development of other syndromes such as depression and functional disabilities.

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Declaration of interest: No conflict of interest is declared by authors.

Ethical statement: Informed consent was taken from each participant. The study methodology was reviewed and approved by the Research Review Boards of the Geriatric and gerontology department, Faculty of medicine, Ain Shams University.

Data availability: The data of this study is open to public access at the web page: https://data.mendeley.com/datasets/vykznkxvpk/1

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