Diagnostic Test of a Scoring System for Frailty Syndrome in the Elderly According to Cardiovascular Health Study, Study of Osteoporotic Fracture and Comprehensive Geriatric Assessment Based Frailty Index Compared with Frailty Index 40 Items

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ABSTRAK

Tujuan: *untuk mendapatkan rekomendasi alat ukur sindrom frailty yang mudah diterapkan dalam praktik klinik sehari-hari di Indonesia.* ***Metode:*** *penelitian merupakan studi potong lintang dengan pendekatan uji diagnostik yang dilakukan pada pasien di poliklinik Geriatri Rumah Sakit Cipto Mangunkusumo berusia ≥60 tahun, periode waktu Mei-Juni 2013. Setiap subjek dilakukan penilaian frailty menggunakan sistem skor CHS, SOF, FI-CGA dan FI-40. Dilakukan penilaian sensitivitas, spesifisitas, NDP, NDN, RK+, dan RK- masing-masing sistem skor CHS, SOF dan FI-CGA terhadap FI-40.* ***Hasil:*** *proporsi individu frail, pre-frail, dan fit berdasarkan indeks frailty 40 item berturut-turut adalah 25,3%, 71%, dan 3,7%. Untuk membedakan individu frail dengan tidak frail, skor CHS memiliki sensitivitas 41,2%, spesifisitas 95%, NDP 73,7%, NDN 82,7%, RK + 8,41 dan RK - 0,62. Skor SOF memiliki nilai sensitivitas 17,6%, spesifisitas 99,5%, NDP 92,3%, NDN 78,1%, RK + 35,2, dan RK - 0,83. Sedangkan skor FICGA memiliki sensitivitas 8,8%, spesifisitas 100%, NDP 100%, NDN 76,4%, RK + infinite, dan RK - 0,91.* ***Kesimpulan:*** *tidak ada sistem skor yang dapat digunakan sebagai alat skrining yang baik untuk sindrom frailty tetapi masing-masing sistem skor dapat digunakan sebagai alat diagnostik yang baik untuk sindrom frailty.*

Kata kunci: *pasien usia lanjut, sindrom frailty, CHS index, SOF index, FI-CGA, FI-40.*

ABSTRACT

Aim: *to get a recommendation on the best frailty syndrome diagnostic tools, that will be able to be practiced on a daily setting in Indonesia.* ***Methods:*** *this is a cross-sectional study with diagnostic test approach, conducted to patients in the Geriatric Outpatient Clinic of Cipto Mangunkusumo National Referral Hospital on May-June 2013. Each subject underwent a frailty evaluation using CHS, SOF, FI-CGA and FI-40 scoring systems. Then, we calculate the sensitivity, specificity, PPV, NPV, LR+ and LR- of each scoring system compared to FI-40.* ***Results:*** *the proportion of frail, pre-frail and fit according to FI-40 are 25.3%, 71% and 3.7% respectively. In terms of differentiation frail to non-frail, CHS had 41.2% sensitivity, 95% specificity, PPV 73.7%, NPV 82.7%, LR+ 8.41 and LR- 0.62. SOF scoring system had 17.6% sensitivity, 99.5% specificity, PPV 92.3%, NPV 78.1%, LR+ 35.2 and LR- 0.83. Furthermore FI-CGA had 8.8% sensitivity, 100% specificity, PPV 100%, NPV 76.4%,*

LR+ ∞ and LR- 0.91. ***Conclusion:*** *There is no better scoring system that could be implemented to screen for frailty syndrome other than FI-40 items. However, other scoring systems could be used as a good diagnostic tool for the syndrome.*

Key words: *elderly patient, frailty syndrome, CHS index, SOF index, FI-CGA, FI-40.*

INTRODUCTION

The elderly is vulnerable to stress which could arise internally or externally, leading to a state of frailty because of decreasing functional capacity, complications in maintaining homeostasis and multi-organ failure. This elevated sensitivity could be called the frailty syndrome, and it is considered as an intermediary state between full independence and dependency or death.[1-2] This is a very dynamic process that could be intervened to prevent elderly individuals become frail or to improve the ones already afflicted to became fitter. This consideration makes the syndrome needs to be recognized early in the process to gain maximal benefit for the individuals.[3]

There are two main systems to define the syndrome, phenotypic (i.e. CHS and SOF) and deficit accumulation (i.e. Frailty Index 40 items).[4,5] A systematic review by de Vries in 2010 showed that deficit accumulation approach according to Rockwood et al, which used multiple prognostic items to evaluate frailty (minimum of 40), deemed the most appropriate method to predict mortality and hospitalization of frailty syndrome. This scoring system (FI-40 items) has been validated in two large populations in Canada and China, these two study showed a very tight correlation between the index's score and mortality rate.[6,7] Other cohort studies have also shown that FI-40 gave the best correlation to predict mortality and morbidity when compared to other approach in diagnosing frailty. However, the large number of variables to evaluate made this scoring system cumbersome to implement in daily practice.[8]

The phenotypic approach (CHS and SOF scoring systems) or simplified deficit accumulation system (FI-CGA) is easier to be done in daily practice.[8] However, considering the difference in the characteristics of elderly in each geographical location, there will also be variations in validity and reliability of the diagnostic methods.[9] Therefore, we need a validation and reliability test before we could use the diagnostic tests in question.

Until now there was no frailty syndrome diagnostic test that has been evaluated for its validity and reliability. This research was conducted to gain a recommendation for a set of frailty diagnostic tools which is easy to be applied in daily practice by comparing each diagnostic performance.

METHODS

This was a cross-sectional diagnostic study. Subjects were elderly (>60 years old) patients at the Geriatric Outpatient Clinic of Cipto Mangunkusumo National Referral Hospital Jakarta. The study took place between May to June 2013 and the data was obtained by means of questionnaires and also direct measurements of several variables described below.

We included all patients of the geriatric clinic and only excluded those who declined to participate or with a cognitive impairment and/or in the acute phase of disease. We gathered data about socio-demographic, anthropometric, nutritional status, comorbid and medications, frailty status and also functional status (ADL, I-ADL, AMT, MNA, GDS, handheld dynamometer, functional reach, timed up and go test, 15 feet walking test and chair sit stand test).

Collected data then analyzed by SPSS 20 to count sensitivity, specificity, PPV, NPV, +LR and –LR. The study was designed to determine the following results:

- Sensitivity, specificity, PPV, NPV, +LR and –LR of CHS compared to FI-40 item
- Sensitivity, specificity, PPV, NPV, +LR and –LR of SOF compared to FI-40 item
- Sensitivity, specificity, PPV, NPV, +LR and –LR of FI-CGA compared to FI-40 item.

This study already has passed the ethical

clearance from Faculty of Medicine Universitas Indonesia-Cipto Mangunkusumo Hospital, numbered 273/H2.F1/ETIK/2013 by 6th of May 2013. All of the data collected from medical records will be confidential and destroyed afterwards to maintain anonymity of subjects.

RESULTS

We managed to enroll 269 elderly patients; with the proportion of frail, pre-frail and fit respectively were 25.3%; 71% and 3.7%. The majority of our study subjects were female (60.6%); aged 60-87 years old with a median of 72 years old; most lived with their spouse/family (91.4%); lived with a good standard of living (81.4%) and also with higher education (46.8%).

The majority of our study subjects had good nutrition status (80.3%), overweight or obese (69.9%) and admitted that they have a sub-optimal health condition (52.8%). Independency according to Barthel and Lawton Index showed most still maintain their independence (72.5%; and 63.6%) with a median of 20 (range 4-20) and 8 (range 1-8).

The most frequent comorbid in our subjects were endocrine-metabolic (90.3%), sight and/or hearing deficits (88.5%) and hypertension (82.2%). Evaluated for the accumulation of deficit according to CIRS (Cumulative Illness Rating Scale, max score 40), most of the individuals had a high level of comorbid (scored 10 or more; 72.9%) with the median of 12 (range 2-24).

The Diagnostic Ability of Each Frailty Scoring Systems

To evaluate the diagnostic abilities of each frailty scoring systems compared to FI-40 items; we conducted calculation with the help of 2x2 tables. The complete results could be viewed in the **Table 1**, where the non-frail group was defined as fit and pre-frail patients. We also count for the inter-rater variability on 12 subjects, the Kappa measurement was 1 (95% CI 1.000-1.000).

DISCUSSION

Our subjects' characteristics were slightly different from another study that was comparing diagnostic abilities among frailty indexes. We have more subjects with higher level of education and most lived with their families, while in the other studies most patient had middle education level (42.9%) and the majority lived alone or in a nursing home (53.8%).[10] Population data in Indonesia also showed only 2.3% (n=414.933 from 18,008,586 individuals) of elderly old, are with higher education (2010 National Census, Central Statistical Bureau). On the other hand, recent prospective studies in the western countries showed that more than 40% of their subjects finished their studies in universities.[4,11]

The difference was mainly because our patients mostly came from state pensioners, so that it was understandable that most will be with a higher education level. Our Asian culture also stressed highly on familial and filial bond, so most of our elderly people will be living with their own extended family.

Our study showed a higher proportion of frail individuals compared with a Canadian study conducted by Song (25.3% vs. 22.7%). This was a small difference considering that we used an outpatient based subjects compared with the population based of the other study.[10] Most of our subjects also had good nutrition status and also overweight or obese, in similar condition with other studies whether in developing or developed countries.[12-14]

Table 1. Comparison of diagnostic abilities of each scoring systems in distinguishing frail and non-frail

	Frailty Index 40 item					
	Sensitivity % (CI 95%)	**Specificity % (CI 95%)**	**PPV % (CI 95%)**	**NPV % (CI 95%)**	**RK+ % (CI 95%)**	**RK- % (CI 95%)**
CHS	41.2 (29-53)	95 (92-98)	73.7 (60-88)	82.7 (78-88)	8.41 (4.25-16.14)	0.62 (0.51-0.76)
SOF	17.6 (9-27)	99.5 (99-100)	78.1 (78-100)	35.2 (73-83)	35.2 (4.7-67.77)	0.83 (0.74-0.92)
FI-CGA	8.8 (2-16)	100 (100-100)	100 (100-100)	76.4 (71-82)	∞	0.91 (0.85-0.98)

Comparison of Diagnostic Performance of Each Scoring Systems Compared to FI-40 Item

Referring to **Table 1**, we could see that the other scoring systems have a low sensitivity (8.8-41.2%). Thus, there are no scoring systems that could be used to replace FI-40 items. Low sensitivity of CHS, SOF and FI-CGA to diagnose frailty could be caused by the difference in variable constructions. Frailty index 40 item was constructed using frailty predictors variables gained from a cohort study, so it could provide a strong prediction on morbidity and mortality (Pearson r=0.992 for females and 0.955 for males).[15,16] On the other side, approach done by CHS and SOF scoring systems were based on pathophysiologic approach and clinical consensus[7,17-19] so their connection with FI-40 items looked weak. The effort to construct FI-CGA by combining deficit accumulation and phenotypic approach also has failed, because of the same consensus based item construct.[20,21]

Data from **Table 1** showed that each scoring systems maintained a very high specificity (95-100%), this means that each systems could reliably used to diagnose frailty. This was also supported with high score in PPV and +LR to provide higher accuracy in diagnosis. The phenotypic approach used by CHS and SOF also contributed to this result, where the systems was constructed by using signs and symptoms of manifested frailty syndrome with sarcopenia, negative energy balance, loss of strength and tolerance to stress.[7,17,19] On the other hand, FI-CGA, due to some similarity in the way it was constructed will have a better correlation with FI-40.[20,21]

Recommendations on the Use of Frailty Scoring Systems

The result of this study showed that SOF, CHS and FI-CGA diagnose frailty later than FI-40. This causes risk in the implementation of these systems, there will be a lot of frail individuals missed to be diagnosed or screened. However, with a high specificity and abilities to recognize each component of the syndrome, CHS and FI-CGA will be good candidate for following up examinations in individuals have been diagnosed with frailty using the FI-40. Interventions could then be tailored according to the affected domains assessed by CHS and FI-CGA. High PPV also means that SOF, CHS and FI-CGA could be used to diagnosed individuals with a high suspicion of frailty. According to the

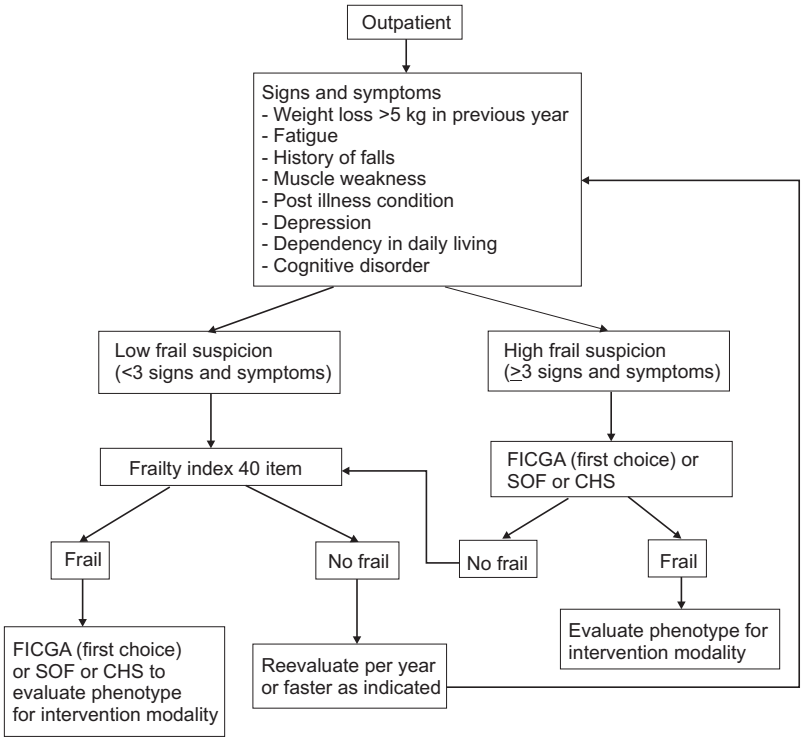

Figure 1. Recommendation for the implementation of the frailty scoring systems

result of this study, we make a recommendation for the implementation of each scoring systems in daily clinical practice (**Figure 1**).

CONCLUSION

No scoring system could be used to replace FI-40 to screen for frailty syndrome, but the others could be utilized for a good diagnostic tool for the syndrome.

AFFILIATION STATEMENT

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