Validation of a record-based frailty assessment according to the Multidimensional Prognostic Index

Troels Kjærskov Hansen

Aarhus University Hospital

December 27th, 2018

Validation of a record-based frailty assessment according to the Multidimensional Prognostic Index

Background

Various phenotype and cumulative frailty assessment tools have been developed and compared in research (1). For use in an in-hospital setting, a cumulative and graded frailty assessment method is preferred in order to identify subgroups of patients at risk of adverse events during discharge and transition to primary care. Comprehensive Geriatric Assessment (CGA) is the gold standard to assess frailty (2). Most medical wards have limited access to specialized geriatric team support capable of performing CGA. Thus in these wards there is a need for a CGA based instrument to identify the frail patients and to quantify the level of frailty. The Multidimensional Prognostic Index (MPI) (3,4) is based on CGA and is a comprehensive cumulative deficit frailty assessment tool validated in a Danish geriatric department (5). MPI is fully applicable in the everyday clinical work and supplies useful information to clinicians. It can predict readmission and death (5), and it is well-suited to assess the degree of frailty (1,6). Enabling identification of patients at risk of adverse events facilitates targeting of the interventions in order to improve patient outcomes. The MPI is a bedside assessment. However, in observational record-based research the patient is not accessible for the researcher. To assess and identify hospitalized frail patients retrospectively for clinical research, a valid record-based frailty assessment method is needed.

Objectives

The aim of this study is to compare the accuracy of a record-based MPI assessment with a bedside performed MPI assessment in order to use the record-based MPI when access to bedside MPI is impossible.

Hypothesis

There is a high correlation (≥ 70%) between the bedside MPI sum score and the record-based MPI sum score in 75+ year older hospitalized patients.

Materials and methods

This validation study is performed in a paired design with comparison of the bedside MPI compared to a record-based MPI of the same hospitalized patient at the same day.

Source of data

Bedside MPI:

The MPI screening tool for bedside use has been modified and validated as described by Gregersen et al. (5). The original MPI tool (3) consists of a combined score of eight items: co-habitation status, number of drugs used, activities of daily living (ADL) and instrumental activities of daily living (I-ADL), cognitive status, risk of pressure sores, morbidity and nutritional risk. In this study, the bedside MPI will be calculated using the following eight items: co-habitation status, number of drugs used, ADL and I-ADL by Functional Recovery Score (FRS), cognitive status by Short Portable Mental Status Questionnaire (SPMSQ), risk of pressure sores by Exton Smith Scale (ESS), morbidity by Cumulative Illness Rating Scale Geriatrics (CIRS-G), and nutritional risk by the Mini Nutritional Assessment Short Form (MNA-SF). All items except the CIRS-G will be assessed by a Research Assistant.

Record-based MPI:

The Danish civil registration register, the hospital medical record used in Central Denmark Region, and the community nurse medical chart are all linked in the Columna Clinical information system (Systematic) used in all hospitals in Central Denmark Region. Information on all eight MPI items needed to calculate the sum score with the exception of SPMSQ and BMI in the MNA-SF can be assessed through the clinical information system and without direct bedside access to the patient. The record-based MPI screening tool has been customized to these minor limitations (See Appendix A: Record-based MPI sum score and frailty level).

Fifty unique patients are needed in this validation study. They will all be assessed by both a record-based MPI performed by two independent raters (a Research Assistant and a PhD student), and by bedside MPI performed by a skilled physiotherapist or occupational therapist (see Fig. 1: Record-based and bedside MPI-screening). All raters will be blinded to the screening results. Enrollment to the MPI screening is performed during daytime on weekdays by the Research Assistant. The CIRS-G used in both methods will be calculated by the Research Assistant prior to the record based MPI-screening. The record-based MPI screening will be performed before the bedside MPI screening, using only the medical record information accessible at the time of screening

as described in Appendix A. The inclusion takes place from December 4th, 2018 until the total of 50 patients has been reached. The inclusion will be paused during weekends and holidays.

Patients

The study group comprises medical patients acutely admitted to the Department of Cardiology (DC), and the Department of Infectious Diseases (DID), Aarhus University Hospital (AUH). Participants can only be included once.

- **Inclusion criteria:**
  - Aged 75 years or older
  - Living within the municipality of Aarhus
- **Exclusion criteria:**
  - Included in any other kind of follow-up schemes
  - Already included in this study
  - Declared terminally ill or undergoing palliative care at admission
  - Admitted from one specific temporary nursing home with geriatric medical assistance (Vikærgården)
  - Discharge or transfer to another department, including hospice
  - The patient does not want to participate in the MPI-screening process

Statistical analysis

Reasonable precision for estimates of reliability requires at least 50 study participants (7). The bedside MPI serves as a gold standard and will be held up against the record-based MPI. The relative difference between the two measurements' sumscores is calculated as an Intraclass Correlation Coefficient (ICC). It is recommended that the ICC exceeds 70% in order to be regarded as acceptable (8). This method is controlled by calculating the correlation between the difference and the average by using the Pearson's statistics. Assumption of independence is examined in a Bland-Altman plot and normal distribution of the differences will be checked in a QQ plot. Limits of agreement are prediction intervals for the difference and will be presented in a figure. The within-subject random variation (standard error of measurement) and the systematic change of the mean will be calculated. Also, the inter-rater reliability of two raters using the record-based MPI will be examined in the same way. We will examine how consistent the results are for the each of the eight different items and for the construct within the measures. The internal consistency is analyzed by Cronbach's Alpha. Researchers have proposed that the minimum item-total correlation should be 0.20 (9). Data are registered in REDCap and exported to STATA version 15 for the statistical calculations.

Perspectives

This study may prove that retrospective, record-based MPI frailty assessment is a valid way to assess frailty for scientific use, compared to bedside performed MPI, thereby enabling retrospective inclusion of control group patients in larger scale studies.

Ethics

The study has been approved as a quality development project by the Regional Research Ethics Committee, Central Denmark Region (journal no. 197/2017), thereby no patient consent form is needed, and further referral to the committee not required. No patient will receive less than usual care, no extra treatment or examination will be applied, and no patient will be exposed to any additional risk because of the study. Participants may decline participation at any point. The project, which is a part of the national rate adjustment pool-project "Early post-discharge follow-up of the frail elderly – a intersectoral effort" in the Central Denmark Region, is approved by the Danish Data Protection Agency (journal no. 2012-58-006).

APPENDIX A: Record-based MPI sum score and frailty level

The bedside-assessment of MPI frailty level has been validated and slightly modified, and is performed as described by Gregersen et al. (5). The record-based MPI is a little further revised, since some information is not directly achievable or even unachievable in the medical records. The record-based assessment is made using the medical record information obtained from the municipality nurses and home care staff at admission and information provided by physiotherapists, nurses, occupational therapists, home care staff, municipality nurses, social workers and doctors during admission. In case of divergent information, the most recent information is considered right. In case of lack of information on the separate items, values are estimated based on the overall impression after reading the medical record.

Co-habitation status: is always provided
Number of drugs: is always obtainable
FRS-ADL: some values are estimated based on the overall impression after reading the medical record. If no information at all is obtainable from the medical record, the patient is considered self-sufficient.
FRS-I-ADL: some values are estimated based on the overall impression after reading the medical record. If no information at all is obtainable from the medical record, the patient is considered self-sufficient.
SPMSQ: Since no testing can be performed, the SPMSQ is by default 5, unless the patient has been diagnosed with any degree of dementia.
ESS: if no information is obtainable, the patient is considered alert, mobilized and continent.
CIRS-G: is always obtainable
MNA-SF: is modified with regards to neuropsychological problems and with regards to Body Mass Index (BMI) as described below, since the information is often unavailable or indistinctly described in the medical record.

Modified SPMSQ:

Default (no testing possible)	5 points
Diagnosed dementia	10 points

Modified MNA-SF:

	Point
A Has food intake declined over the past three months due to loss of appetite, digestive problems, chewing or swallowing difficulties? 0 = Severe decrease in food intake 1 = Moderate decrease in food intake 2 = No decrease in food intake	
B Weight loss during the last 3 months? 0 = Weight loss greater than 3 kg (6.6 pounds) 1 = Does not know 2 = Weight loss between 1 and 3 kg (2.2 and 6.6 pounds) 3 = No weight loss	
C Mobility 0 = Bed or chair bound 1 = Able to get out of bed/chair, but does not go out 2 = Goes out	
D Psychological stress or acute disease	0 (all hospitalized patients)
E Neuropsychological problems: 0 = Severe dementia or depression (diagnosed dementia, mild or severe; or diagnosed with depression, moderate or severe; or treated with anti-depressants) 1 = Mild dementia (diagnosed with mild cognitive impairment or diagnosed dementia of mild stage; diagnosed mild depression (not treated with anti-depressants); described some degree of cognitive impairment, but undiagnosed 2 = No psychological problems	
F Estimated BMI 0 point if BMI <19, or if patient is described as underweight, cachectic, malnourished or as suffering from sarcopenia or atrophy of the muscles. 1 point if BMI between 19 and 21, or if state of nutrition is not described. 2 points if BMI between 21 and 23, or described as of	

normal weight or well nourished. **3 points if BMI above 23 or described as overweight or obese.**	
Score: (max 14 points) 12-14 points: Normal nutritional status 8-11 points: At risk of malnutrition 0-7 points: Malnourished	

Record-based MPI sum score conversion table:

	low (=0)	moderate (=0,5)	severe (=1)
Co-habitation	With relative	institution	alone
Number of drugs	0-3	4-7	8 or more
FRS (ADL)	77-60	59-37	36-0
FRS (I-ADL) (modified)	19-13	12-9	8-0
SPMSQ (always 5 or 10)	X	5	10
ESS	16-13	12-9	8-4
CIRS-G	0	1-2	3 or more
MNA-SF (modified)	12-14	8-11	0-7
SUBTOTAL	0	(0-4)	(0-8)
TOTAL	X	X	(0-8)
Record based MPI sum score = TOTAL divided by 8	X	X	(0-1)

Sum score to MPI frailty level conversion table:

Sum score	0,0-0,33	0,33 – 0,66	0,66 – 1,0
Frailty level	1	2	3

FIG. 1: Record-based and bedside MPI-screening

Department of Cardiology (DC), and the Department of Infectious Diseases (DID), Aarhus University Hospital (AUH)

All consecutively discharged, acutely admitted patients aged +75 years of age

↓

Living within Aarhus Municipality

↓

Receiving daily care, or

CCI ≥ 1

↓

Daily list of patients

↓

CIRS-G

↓

Record-based MPI made by PhD student and by Research Assistant (both blinded)

↓

Bedside MPI made by physiotherapist or occupational therapist (blinded to the above assessment)

↓

Inclusion and frailty assessment continues until at total number of 50 patients has been reached.

References

(1) Dent E, Kowal P, Hoogendijk EO. Frailty measurement in research and clinical practice: A review. Eur J Intern Med 2016 2016/06;31:3-10.

(2) Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet 2013 /;381(9868):752-762.

(3) Volpato S, Bazzano S, Fontana A, Ferrucci L, Pilotto A. Multidimensional Prognostic Index predicts mortality and length of stay during hospitalization in the older patients: a multicenter prospective study. J Gerontol A Biol Sci Med Sci 2015 2015/03;70(3):325-331.

(4) Pilotto A, Ferrucci L, Franceschi M, D'Ambrosio LP, Scarcelli C, Cascavilla L, et al. Development and validation of a multidimensional prognostic index for one-year mortality from comprehensive geriatric assessment in hospitalized older patients. Rejuvenation Res 2008 2008/02;11(1):151-161.

(5) Gregersen M, Hansen TK, Jørgensen BB, Damsgaard EM. Validation of a modified Multidimensional Prognostic Index obtained at discharge in older Danish geriatric patients to predict acute readmission and mortality. 2018 Unpublished data.

(6) Warnier RMJ, van Rossum E, van Velthuijsen E, Mulder WJ, Schols JMGA, Kempen GIJM. Validity, reliability and feasibility of tools to identify frail older patients in inpatient hospital care: A systematic review. J Nutr Health Aging 2016 2016/02;20(2):218-230.

(7) Hopkins WG. Measures of reliability in sports medicine and science. Sports Med 2000 2000/;30(1):1-15.

(8) de Vet HCW, Terwee CB, Knol DL, Bouter LM. When to use agreement versus reliability measures. J Clin Epidemiol 2006 /;59(10):1033-1039.

(9) Terwee CB, Bot SDM, de Boer MR, van der Windt DAWM, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007 /;60(1):34-42.