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Protocol Paper

Comparison of five indices for prediction of adverse outcomes in hospitalised Mexican older adults: A cohort study

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ABSTRACT

The aim of this prospective study was to investigate the ability of five indices of risk stratification to predict functional decline and prolonged length of stay (LOS) in older Mexicans hospitalized in the acute care setting. A total of 254 patients aged ≥60 years were followed up. Risk indices were constructed from baseline data collected during the first 48 h of ward admission, and included: Frailty Index (FI), Hospital Admission Risk Profile (HARP), Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie (SHERPA), Acute Physiology and Chronic Health Evaluation II (APACHE II) and Charlson's Co-morbidity Index (CCI). Area Under Receiver Operating Characteristic ($_{au}$ROC) curves was used to compare the ability of risk indices to predict adverse outcome, with outcomes of interest being prolonged LOS, and functional decline, the latter defined as ≥10% drop in Barthel Index score across hospitalization. Mean (SD) FI score was 0.31 (0.14). Effective in predicting long LOS were FI, SHERPA and APACHE II; effective in predicting functional decline were SHERPA and HARP. Indices generally showed high specificity values (most were >80%), although all indices lacked adequate sensitivity values for outcome prediction (<80%). Geriatricians could use information from FI, SHERPA, APACHE II, HARP to guide patient management decisions. However, given that all indices lacked accuracy of prediction, results should be interpreted with caution.

1. Introduction

Over the last five decades, human lifespan has more than doubled in many societies, resulting in the rapid increase in both the number and proportion of older people (Gutierrez-Robledo, 2002). This expansion of the older population has had a profound impact on hospital use, particularly in developing countries with a shortage of specialized resources for the care of older people (Gutierrez-Robledo, 2002). To optimize patient care and treatment in a busy hospital setting, it is important to be able to risk-stratify patients at increased risk of adverse outcomes (de Saint-Hubert, Jamart, Boland, Swine, & Cornette, 2010).

Several indices are used in the hospital setting to identify those patients who are at increased risk of adverse outcomes. Functional decline indices include the Hospital Admission Risk Profile (HARP) (Sager, Rudberg et al., 1996) and the Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie (SHERPA); (Cornette et al., 2006) co-morbidity indices include Charlson's Co-morbidity Index (CCI); and disease severity indices include the Acute Physiology and Chronic Health Evaluation II (APACHE II) (Knaus, Draper, Wagner, & Zimmerman, 1985) index. An alternate way to predict adverse outcomes in older people is by using a frailty classification. Frailty is considered to be a medical syndrome characterized by reduced physiologic reserve that increases vulnerability for adverse outcomes, including increased dependency and mortality (Morley et al., 2013). There are a number of ways to identify frailty, however the Frailty Index (FI) developed by Rockwood and Mitnitski (Rockwood, Mitnitski, & MacKnight, 2002; Rockwood et al., 1999) accounts for the multifaceted nature of frailty, incorporating not only the physical components of frailty, but also accounting for cognition and the psychosocial aspects of frailty. The FI has been found to be predictive of adverse hospital outcomes in several recent studies

Abbreviations: FI, Frailty Index from Comprehensive Geriatric Assessment; HARP, Hospital Admission Risk Profile; SHERA, Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie; APACHE II, Acute Physiology and Chronic Health Evaluation II.

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(Dent, Chapman, Howell, Piantadosi, & Visvanathan, 2014; Evans, Sayers, Mitnitski, & Rockwood, 2014; Pilotto et al., 2012; Singh et al., 2012).

Whilst several studies have compared risk stratification indices on their ability to prediction functional decline in hospitalised older people (Sutton, Grimmer-Somers, & Jeffries, 2008), it is not yet clearly known how the FI compares to other outcome prediction indices in the hospital setting. Therefore, the aim of this study was to determine the effectiveness of the FI to predict adverse outcomes in hospitalised older people in Mexico, and to compare the effectiveness to that of mortality and functional decline indices used in the hospital setting. Outcomes of interest were functional decline and long length of hospital stay (LOS).

2. Material and methods

2.1. Setting and design

An acute care cohort study was performed in two hospitals of Mexico City. The study was originally planned to determine the effectiveness of a geriatric unit compared to the usual care provided in internal medicine ward; description of the cohort is available elsewhere (Pérez-Zepeda et al., 2012). In brief, all patients at least 60 years of age who were admitted during a two-year period (2007–2009) to one of three acute care units (two internal medicine wards and one geriatric unit) were screened for the fulfillment of the selection criteria (see fig. 1). The inclusion criteria were the presence of at least one geriatric problem (falls, slow walking speed, fatigue, sorrow, depression, memory deficit or difficulty with instrumental activities or bathing), as assessed at the first visit after admission using a simple dichotomous question (e.g., "Have you had any falls in the last six months?", answer = yes or no). Proxies were used to corroborate these questions where needed. Excluded from the study were patients who were: unable to communicate, referred from the intensive care unit, under mechanical ventilation, receiving parenteral nutrition or exhibiting altered consciousness.

2.2. Measurements

After obtaining informed consent, patients were interviewed by one of four nurses trained and standardized in study data collection procedures. Information collected from patient interview included: patient function, mood and quality of life status, and socio-demographic characteristics. The baseline interview was done in the first 48 h of admission to the ward. A final interview was performed prior to discharge date by a nurse blinded to the baseline assessment results.

Health-related variables were poor health self-perception, quality of life, and clinical data extracted from medical records. Health self-perception was evaluated as excellent, very good, good, bad or very bad using a Likert scale question. Quality of life was measured with the visual analog scale of the European Quality of Life (VAS EuroQoL), in which patients rate their quality of life on a 0-to-100-point scale, with the highest score indicating the best possible score. All indices were based on measurements collected at hospital admission, from interviews, with the exception of the FI which was derived from medical records.

A validated Spanish version of the Barthel Index was used to assess Activities of Daily Living (ADL), with scores ranging from 0 to 100 (Cid-Ruzafa and Damián-Moren, 1997). For instrumental ADLs, a validated Spanish version of the Lawton and Brody IADL scale was used (Vergara et al., 2012).

2.3. Indices

The Frailty Index of cumulative deficits designed by Rockwood and Mitnitski (Rockwood et al., 1999, 2002) is a continuous variable indicating frailty severity. It is computed by summing a list of health deficits, and then dividing by the number of health deficits. The final FI values are a number between 0 and 1. Variables in our study were predominantly selected from the Comprehensive Geriatric Assessment (CGA) (exceptions included grip strength) (see Appendix A). In our study, we had 40 health deficits; selected by using the FI construction principles set by Searle, Mitnitski, Gahbauer, Gill, & Rockwood (2008) (see Appendix A). All health deficits chosen did not plateau with age (Searle et al., 2008). FI values ≥ 0.25 were classified as frail, in accordance with previous literature (Rockwood, Andrew, & Mitnitski, 2007; Singh et al., 2012; Theou, Brothers, Mitnitski, & Rockwood, 2013) thus any patient with $\geq$10 deficits out of a possible 40 deficits was classified as frail in our study. Scores > 0.4 were classified as severe frailty as per a previous study on geriatric inpatients (Singh et al., 2012).

HARP is a commonly used weighted functional decline index, originally validated for use in patients hospitalised with an acute illness (Sager, Rudberg et al., 1996). Physical examination of the patient is not required. HAPP was scored as per its original scoring system, which included age (scored 0–2 points), the first 21 questions from the MMSE (scored 0–1 point) and IADL (scored 0–2 points) (Sager, Rudberg et al., 1996). Scores were then summed, and functional decline risk classified as low (scores 0–1), intermediate (scores 2–3) and high (scores 4–5) (Sager, Rudberg et al., 1996). HARP was initially designed for use in patients admitted to hospital with an acute illness and it does not require a physical examination of the patient (de Saint-Hubert et al., 2010; Sager, Rudberg et al., 1996).

SHERPA is a weighted functional decline index designed for acute hospital admission in older people (Cornette et al., 2006). Like the HARP, patient examination is not required to complete the SHERPA (de Saint-Hubert et al., 2010). SHERPA components include falls in the previous year (yes = 2, no = 0), the first 21 questions of the MMSE ($<$15 = 2points; $\geq$15 = 0 points), bad self-perceived health (yes = 1.5 points; no = 0 points, age ($>$84 = 1 point, 75–84 = 1.5 points, $<$75 = 0 points) and IADL (scores of 0–2 = 3 points), scores 3–4 = 2 points, score of 5 = 1 point and scores 6–7 = 0 points) (Cornette et al., 2006). Component scores were summed to calculate the final SHERPA score. Functional decline risk was classified as low (scores 0–3), mild (scores 2–3), moderate (scores 5–6) and high (scores $>$ 6) (Cornette et al., 2006).

APACHE II is designed to rank the severity of a disease during the first 24 h of hospital admission, and uses 12 routinely collected variables: age, laboratory values (sodium, creatinine, potassium (serum), haematocrit, white blood cell count), vital signs (heart rate, mean arterial pressure, respiratory rate, temperature, pH) and clinical items (Glascow coma score) (Knaus et al., 1985). A cut-off point of $>$16 was used to indicate high disease burden, as per previous literature guidelines (Knaus et al., 1985).

CCI is a weighted co-morbidity index which evaluates the presence of 19 conditions (Charlson et al., 1987). The maximum possible CCI score is 37 (Charlson et al., 1987). Low and high CCI scores were classified as scores $<$5 and $\geq$5 respectively as per previous research (Dent et al., 2014).

2.4. Outcomes

Two outcomes were studied: functional decline over hospitalization and long length of hospital stay (LOS). Functional decline was defined as a drop in BI score $\geq$ 10% from the admission score. Patients who died during hospital were not included in the