General Hospital Psychiatry 38 (2016) 15–20

Contents lists available at ScienceDirect

General Hospital Psychiatry

journal homepage: http://www.ghpjournal.com

Short-Form Mini Nutritional Assessment as a useful method of predicting the development of postoperative delirium in elderly patients undergoing orthopedic surgery☆

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ARTICLE INFO

Article history:
Received 15 May 2015
Revised 25 August 2015
Accepted 26 August 2015

Keywords:
Short-form Mini Nutritional Assessment
Delirium
Aged
Orthopedic surgery

ABSTRACT

Objective: Postoperative delirium (POD) is a major cause for concern among elderly patients undergoing surgery, often resulting in poor outcome. It is therefore important to predict and prevent POD. The aim of this study was to evaluate the Mini Nutritional Assessment Short-Form (MNA-SF) as a predictor of POD after orthopedic surgery. *Methods:* Elderly patients undergoing orthopedic surgery between April 2011 and March 2013 were included in the study ($n=544$; mean age, 74.24±7.92 years). The MNA-SF was used to evaluate preoperative nutritional status. Delirium was assessed daily after surgery using the confusion assessment method. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* criteria were used to confirm delirium diagnosis. Univariate and multivariate logistic regression analyses were performed to identify key factors associated with POD. *Results:* POD occurred in 52 patients (9.6%). According to the MNA-SF, 17.5% of subjects were at risk of undernutrition. Adjusting for all potential factors in the final model, age, male gender and lower Mini-Mental State Examination and higher Charlson Comorbidity Index scores were associated with significantly increased likelihood of POD. Subjects who were identified preoperatively as at risk of undernutrition were 2.85 times more likely to develop POD compared to normally nourished subjects (odds ratio: 2.85, 95% confidence interval: 1.19–6.87). *Conclusions:* These results suggest that the MNA-SF is a simple and effective tool that can be used to predict incident delirium in elderly patients after orthopedic surgery.

1. Introduction

The *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV-TR*) defines *delirium* or *acute confusional state* as a clinical neuropsychiatric syndrome characterized by acute and fluctuating disturbance of consciousness; reduced ability to focus, maintain or shift attention; and change in cognition secondary to a general medical condition [1, 2]. The reported incidence of delirium in hospitalized older patients ranges from 14% to 56% [3]. Postoperative delirium (POD) is a form of delirium that appears in patients undergoing surgical procedures and anesthesia, usually emerging 1 to 3 days after surgery [4]. POD incidence rates vary widely, depending on the patient population and type of surgery [5, 6]. For example, delirium is estimated to occur in 17% of patients after total joint replacement of the hip and knee and in 40 to 60% of patients after vascular surgery [5, 6]. In elderly patients (aged 60 years or over), the incidence of POD after orthopedic surgery ranges from 5 to 14.3% [7].

The causes of POD are complex. Multiple risk factors for POD have been documented, including cognitive and functional impairment, polypharmacy and multiple comorbidities [8, 9]. Malnutrition, as indicated by low-serum albumin level, has recently been regarded as a key risk factor for POD in surgical patients [8, 10–12]. Several studies have found that poor nutrition is associated with functional and cognitive

☆ Authors' contributions: CCS and CCL acquired the follow-up data, performed the main analysis and interpretation of data and wrote the main paper. CPH, LCK and LYT have been involved in study concept and design. CCL, CMY and HCJ initiated the study and obtained funding support. CCL and CPH supervised all stages of the project, supported and advised the data collection process and commented on drafts of the paper.

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http://dx.doi.org/10.1016/j.genhosppsych.2015.08.006
0163-8343/

impairment, dependency and increased risk of depression, all of which are documented risk factors for POD [8, 13, 14]. Most importantly, POD is reportedly associated with adverse surgical outcomes, including prolonged hospital stays, delayed functional recovery, future institutionalization and higher mortality rate [15–17]. As the aging population expands, an increasing number of elderly patients require surgical procedures. Adequate preoperative nutritional evaluation of these patients is vital because of the high prevalence of malnutrition in the elderly and the detrimental impact of malnutrition on postoperative recovery [12].

The Mini Nutritional Assessment (MNA) questionnaire (the full MNA) is an established nutritional screening tool used to identify subjects with malnutrition or at risk of malnutrition. It consists of 18 items and covers four parameters: anthropometry, dietary assessment, global assessment and self-evaluation [18]. However, completing this questionnaire is time consuming, requiring 10 to 15 min. To simplify the clinical evaluation, the MNA Short-Form (MNA-SF), consisting of the first six items of the full MNA, was developed and validated [19, 20]. In general, MNA-SF scores correlate well with scores on the full MNA [18, 19]. Several studies have been conducted using the MNA or MNA-SF to predict different physical conditions or outcomes, such as pressure ulcers [21], risk of falling [22] and functional disability [13].

We hypothesize that malnourished surgical patients are particularly susceptible to detrimental effects of surgical procedures and, therefore, at greater risk of developing POD. To date, the MNA-SF has not been tested for its ability to predict POD. Therefore, the aim of this study is to determine the usefulness of the MNA-SF in predicting the development of POD in the Chinese elderly population.

2. Methods

2.1. Study design

This prospective cohort study was conducted in a medical center in southern Taiwan. Patients aged 60 years and older who were scheduled for acute or elective orthopedic surgeries were recruited between April 2011 and March 2013. Written informed consent was obtained from all subjects with adequate understanding of the study. Patients were excluded in the following cases: (a) a medical condition that prevented the patient from completing the comprehensive assessment; (b) inability of the patient to provide informed consent; (c) delirium occurring before study enrollment or surgery; and (d) incomplete data. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Kaohsiung Veterans General Hospital.

2.2. Preoperative clinical assessment

All participants were assessed by trained research nurses before surgery and within the first 24 h after hospital admission from outpatient clinics or the emergency department. Demographic and general clinical details were recorded, including age, gender, years of education, type of admission (from outpatient clinics for elective surgery or from the emergency department for acute surgery) and type of surgery (spinal, hip or knee). Cognitive function was assessed at the time of admission using the Mini-Mental State Examination (MMSE) [24]. Depressive symptoms were assessed using the 15-item Geriatric Depression Scale (GDS-15; score range, 0–15: scores≥5 indicate clinically significant depressive symptoms) [23]. Functional status was evaluated using the Barthel Index (score range, 0–100: 0 = *completely dependent*, 100 = *completely independent*) and the Instrumental Activities of Daily Living (IADLs) scale (score range, 0–8: 0 = *completely independent*, 8 = *completely dependent*) [25, 26]. Alcohol use was assessed using the CAGE questionnaire [27]. The CAGE questionnaire, the name of which is acronym of its four questions. They are as following: 1. Have you ever felt you needed to Cut down on your drinking? 2. Have people Annoyed you by criticizing your drinking? 3. Have you ever felt Guilty about drinking? 4. Have you ever felt you needed a drink first thing in the morning (Eye-opener) to steady your nerves or to get rid of a hangover? Two "yes" responses indicate that the possibility of alcoholism. Comorbidities were assessed using the Charlson Comorbidity Index (CCI) [28]. Polypharmacy was defined as the concurrent use of four or more prescription drugs for 2 or more weeks. Patients were considered to be dehydrated if the ratio of blood urea nitrogen (BUN) to creatinine was 18 or greater [29]. Visual acuity and hearing ability were tested using the Snellen eye chart and the whispered voice test, respectively [30]. The Visual Analogue Scale (VAS) was used to assess pain intensity (score range, 1–10: 1 = *no pain*; 10 = *severe pain*).

Nutritional status was assessed by the MNA-SF [19, 20]. The MNA-SF consists of six questions on food intake, weight loss, mobility, psychological stress or acute disease, presence of dementia or depression and body mass index (BMI). Scores range from 0 to 14. Scores of 0–11 points indicate that the patient is at risk of undernutrition; scores of 12–14 points indicate that the patient is well nourished [19, 20].

2.3. Intraoperative and postoperative assessments

Intraoperative variables were recorded, including use of general anesthesia (yes/no), blood transfusion (yes/no) and lowest mean arterial pressure (mmHg) during surgery. Patient-controlled analgesia (PCA) following surgery was also recorded for variable analysis.

The confusion assessment method was used daily by the primary care nurses in the orthopedic wards to screen patients for delirium after surgery [31]. A senior psychiatrist confirmed diagnosis of delirium using *DSM-IV-TR* criteria. The Delirium Rating Scale-revised-98 (DRS-R-98) was used to evaluate the severity of delirium. The DRS-R-98 is a clinician-rated and reliable assessment tool consisting of 13 items, each of which is scored from 0 to 3 points (0 = *low severity*; 3 = *high severity*; total score range, 0–39) [32].

2.4. Statistical analyses

Data were analyzed using Statistical Product and Service Solutions (SPSS) statistical analysis software (Version 18). Patient demographics and clinical characteristics are presented as mean±standard deviation (S.D.) for continuous variables and as percentages for categorical variables. Dichotomous and ordinal variables were compared between subjects with and without POD using the chi-square test or Fisher's Exact Test. The Mann–Whitney *U* test and Student's *t* test were used to compare continuous characteristics between patients who developed POD and those who did not. Univariate analyses were conducted to examine relationships between demographics, clinical variables and incidence of POD. Variables were chosen because of their documented association with POD [5, 8, 10, 33–36].

For multivariate analyses, variables were entered into a multiple logistic regression model to identify the most significant risk factors for developing POD after orthopedic surgery. Variable selection was made if: (a) a putative risk factor was significant at $P<0.05$ in univariate analyses or (b) its removal changed the multivariate model by more than 10% of the variance based on the pseudo-R^2 value. If two variables showed a correlation greater than 0.6, then one of them was omitted. All results were two tailed; results were considered statistically significant if $P<0.05$.

3. Results

A total of 544 patients (mean age, 74.24±7.92 years) met the inclusion criteria. Of these, 43.6% were male, 11.7% lived alone and 11.2% were admitted from the emergency department (Table 1). According to the MNA-SF, 17.5% of subjects were at risk of undernutrition (MNA-SF score of 0–11), and 82.5% were normally nourished (MNA-SF score of 12–14). The numbers of patients who underwent spinal surgery, surgery for hip fracture and surgery for knee fracture were 167 (30.7%), 177