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Changes in nutritional status and associated factors in a geriatric post-hip fracture assessment

Abstract

Aim: To examine changes in nutritional status and to identify factors associated with poor nutritional status in a comprehensive geriatric assessment after hip fracture.

Methods: Nutritional status according to the Mini Nutritional Assessment Short Form (MNA-SF) was assessed in 585 hip fracture patients aged 65 years and over at baseline and six months postoperatively at our geriatric outpatient clinic. Poor nutritional status was defined as being malnourished or at risk of malnutrition according to the MNA-SF. Logistic regression analyses were used.

Results: At baseline 39% and at follow-up 59% of patients had poor nutritional status. After adjusting for age, higher age, American Society of Anesthesiologists (ASA) -grade 3, taking 4-10 medications, prefracture diagnosis of memory disorder, non-independent mobility, not living in own home and poor nutritional status at baseline were prognostic factors for poor nutritional status. In the geriatric assessment, MMSE<24, difficulties in basic activities of daily living, depressive mood, longer time on Timed Up and Go (TUG) and weakened grip strength were associated with poor nutritional status. In multivariate analyses, prefracture memory disorder, MNA-SF at baseline and depressive mood, TUG and grip strength in the outpatient assessment continued to be associated with poor nutritional status at follow-up.

Conclusions: Cognition and mood require attention in the nutritional care of hip fracture patients. The strong association of poor nutritional status with impaired mobility and grip strength implies an association between protein-energy malnutrition and sarcopenia. Both muscle strength and nutrition need to be addressed in comprehensive hip fracture care and rehabilitation.

Keywords: nutrition, hip fracture, comprehensive geriatric assessment, frailty

1. Introduction

The prevalence of malnutrition is very high in older populations. This has been demonstrated in many healthcare settings, hospitals and among community dwelling older people [1-4]. The incidence of hip fracture is currently high and expected to increase, especially in women, due to population aging [5]. Malnutrition is one significant risk factor for falls and fractures [6]. Food intake is often insufficient during recovery from the hip fracture operation, impairing the nutritional status further [7]. Patients with protein-energy malnutrition have a higher postoperative complication rate, which means longer expensive hospital stay, and also higher morbidity and mortality [4,7-9]. Altogether individuals with malnutrition are more likely to experience poor quality of life [1,10]. Identifying patients likely to benefit from nutritional support could reduce morbidity and mortality and also save costs.

Nutritional screening is important in order to identify at-risk patients. There is no gold standard for assessing nutritional status. The short form of the Mini Nutritional Assessment (MNA-SF) is one of the most frequently used nutritional instruments to assess nutritional status in older hip fracture patients. Both malnutrition and risk of malnutrition as assessed by the MNA-SF have recently been proven to predict major negative outcomes in older hip fracture population [3].

So far only very few studies have examined changes in nutritional status in older populations over time [11,12]. To the best of our knowledge, no population-based observational studies have been presented following up changes in nutritional status in older hip fracture patients. The aim of the present study was to follow up nutritional status as measured by the MNA-SF [13] from the time of the hip fracture to the comprehensive geriatric outpatient assessment, to which all the hip fracture patients in our hospital were invited, according to our local care pathway, 4-6 months after the fracture. In particular, we aimed to identify prefracture prognostic indicators of poor nutritional status and factors associated with poor nutritional status as assessed at the outpatient clinic.

2. Material and methods

2.1. Study population and design

The study includes all 1,025 consecutive patients aged over 65 who suffered their first hip fracture between January 2010 and December 2014. Pathological fractures were excluded. Of the patients 88% were operated on within 48 hours of admission to our hospital. The mean length of stay in the hospital was six days. Seinäjoki Central Hospital, Finland is the only hospital in the Southern

Ostrobothnia region providing acute surgical care. The population of the hospital district is approximately 200,000 and all hip fractures are treated there.

The nurses on the orthopaedic ward were instructed to give daily nutritional supplements rich in energy (300 kcal) and protein (20 g) twice a day to all hip fracture patients in addition to meals (breakfast, lunch, dinner and evening snack) enriched with energy and protein. It was recommended to continue this in the primary care hospitals where patients were transferred for rehabilitation.

2.2. Data collection

The baseline data were collected during the perioperative hospital stay mainly by a single geriatric nurse interviewing the patients or their representatives and by extracting it from hospital records. In addition, data were collected during the visit to the geriatric outpatient clinic in the comprehensive assessment in a median time of six months (Inter Quartile Range [IQR] 4-6 months) after the fracture. A physiotherapist`s examination preceded the geriatric assessment. All the patients or their caregivers gave informed consent and the study design was approved by the ethics committee of our hospital district. The dates of death for mortality follow-up were extracted from the electronic patient files. The mortality data were complete.

2.3. Variables

In order to assess the nutritional status MNA-SF was used in the perioperative period on the orthopaedic ward and again at the outpatient clinic. To measure the body mass index (BMI), the patients' height and weight were monitored as reported by the patients or caregivers or extracted from the patient files and, if not available, as estimated by the nurses on the orthopaedic ward. At the outpatient clinic the patients were measured and weighed. The MNA-SF consists of six sections: appetite or eating problems, recent weight loss, mobility impairment, acute illness/stress, dementia or depression and BMI. Its scores are 0-7 points malnourished, 8-11 points at risk of malnutrition and 12-14 points normal nutritional status [13]. For the purposes of our study, poor nutritional status was defined as being at risk of malnutrition or being malnourished according to the MNA-SF.

The preoperative American Society of Anesthesiologists (ASA) risk scores were used to assess general health at the time of the fracture. There are five classes: 1) healthy person, 2) mild systemic disease, 3) severe systemic disease, 4) severe systemic disease that is a constant threat to life and 5) a moribund person who is not expected to survive without the operation [14]. The ASA scores were categorized into three groups: 1-2, 3 or 4-5.

A possible diagnosis of memory disorder was elicited at the time of the fracture and defined as a clinical diagnosis confirmed by a specialist in geriatric medicine or in neurology.

The baseline independent mobility was defined as being able to move independently without personal assistance. Living in an institution was defined as residing in a health centre hospital or residential care home providing 24-hour care.

In the comprehensive geriatric assessment (CGA), the Geriatric Depression Scale (GDS-15) was used to measure the individual`s mood [15]. The GDS-15 consists of 15 questions with higher scores indicating more symptoms of depression, a cut-off score of six meaning depressive mood. Cognition was assessed by the Mini Mental State Examination (MMSE), where a score of less than 24 points out of 30 was considered to indicate cognitive impairment [16]. Difficulties in the basic activities of daily living (ADLs) were defined as having difficulties in at least one out of the six basic activities of daily living [17] and difficulties in instrumental activities of daily living (IADL) one out of the eight IADLs [18]. The patients` regular medications were categorized as less than 4, 4-10 or more than 10 regular daily medications.

Physical functioning tests were conducted by a physiotherapist. Grip strength was measured using the Jamar Dynamometer on both the right and left hands. In men, grip strength less than 26 kg and in women less than 16 kg in the stronger hand was defined as weakened [19]. The Timed Up and Go test (TUG) requires patients to stand up from a chair, walk a short distance, turn around, return and sit down again [20]. It assesses both mobility and fall risk. In addition to measuring the median time, the performance on the TUG was categorized as normal (1 point), slightly abnormal (2-4 points) or markedly abnormal (5 points) as evaluated by mainly the same physiotherapist. Three or more points mean risk of falling. The Elderly Mobility Scale (EMS) was used to evaluate an individual`s mobility problems in seven functional activities including bed mobility, transfers and bodily reaction to perturbation, speed of going from sitting to standing and walking speed [21]. The tasks give 0-4 points, total 20. Scores over 14 are taken to mean independent in basic ADLs.

2.4. Statistical analysis

Distributions of the basic characteristics at baseline between the well-nourished, those at risk of malnutrition and the malnourished are described in Table 1. Differences in the distribution of age, gender, ASA scores, BMI, MNA, type of hip fracture, regular medications and length of stay in hospital, mobility and living arrangements between groups were analysed by independent samples Kruskall-Wallis test or Pearson chi-square test. Due to the skew distributions, continuous variables were described by medians, with ranges and modelled by non-parametric tests.

Age-adjusted prognostic factors of poor nutritional status at baseline and in the CGA after six months' follow-up were calculated by logistic regression. The results were shown as prevalence odds ratios (POR) or incidence odds ratios (IOR) with 95% confidence intervals (CI). Finally, multivariate analyses including all the factors examined as enter and forward and backward stepwise models were conducted.

Statistical analyses were performed with IBM SPSS Statistics for Windows, version 20.0.0 (IBM Corp. Released 2011, Amonk, NY). The p-value < 0.05 was considered statistically significant.

3. Results

Before the exclusions 493 (51%) out of 958 patients had normal nutritional status, 388 (41%) were at risk of malnutrition and 77 (8%) were malnourished. The MNA scores were missing in 67 cases, mainly due to inconsistent data during initiation of nutritional assessment. After six months' follow-up, the MNA points scores were missing due to non-attendance in 191 cases and 182 patients had died, so the final sample size was 585 (Figure 1). After six months 63 (11%) patients had better nutritional status and in 205 (35%) patients the nutritional status had deteriorated (Figure 1). Of the 585 patients, 227 (39%) were at risk of malnutrition or malnourished according to MNA-SF at baseline and 346 (59%) at follow-up (Table 2). At baseline the median of points in MNA-SF was 13 (IQR and Range 12-14) in normal nutritional status and 10 (IQR 8-11, Range 2-11) in poor nutritional status, and after follow-up 12 (IQR 10-13, Range 2-14) in normal nutritional status and 10 (IQR 8-11, Range 1-14) in poor nutritional status. The change in normal nutritional status was Md -1 (IQR -3 -0; range -11-2) and in poor nutritional status Md 0 (IQR -2-2; range -8-8).

Compared to the attendees of the geriatric outpatient assessment, the non-attendees and deceased were older; they had higher ASA scores, were taking more regular medications and had lower BMI and MNA scores (Supplementary Table). In the baseline age-adjusted univariate analyses (Table 2) all the domains except the type of fracture and the time to the operation were associated with poor nutritional status. The baseline prognostic indicators of poor nutritional status at follow-up were high age, ASA score 3, diagnosis of memory disorder, non-independent mobility, living in an institution, taking more than four regular medicines per day and poor nutritional status at baseline.

The factors associated in the aged-adjusted univariate analyses with poor nutrition in the CGA were cognitive impairment, depressive mood, basic ADLs and IADLs, abnormal result in the TUG-test (either as time or as categorized by the examining physiotherapist) and weakened grip strength (Table 3). When using the multivariate analysis by enter model, diagnosis of memory disorder OR 2.45 (95% CI 1.23-4.87), MNA at baseline OR 2.10 (95% CI 1.25-3.51), GDS-15 OR 2.38 (95% CI 1.20-4.70), TUG time OR 1.04 (95% CI 1.01-1.07) and grip strength OR 2.00 (95% CI 1.25-3.21) at follow-up continued to be associated with poor nutritional status. The forward and backward stepwise models gave the same results.

4. Discussion

The findings of our study demonstrate that poor nutritional status is very common among older hip fracture patients, which concurs with the literature [2-4,9]. The observations could be explained by patients' poor appetite after the trauma and operation and less than recommended dietary intake [7]. There was a clear deterioration in nutritional status between the time of the fracture and follow-up. Nutritional status improved in only few patients during the rehabilitation period. Even patients with normal nutritional status were prone to develop risk of malnutrition. Deterioration of nutritional status has previously been reported in hospitalized older patient populations [22], and bed rest is a well-known cause of loss of skeletal muscle [23]. The negative findings may reflect the poor rehabilitation outcomes of older hip fracture patients that have been reported in numerous studies [24]. Moreover, perioperative medical complications and dementia has been found to restrict nutritional intake [25]. Even in the present study, poor nutritional status was predicted by prefracture diagnosis of memory disorder. The patients whose nutritional status deteriorated were older and had higher comorbidity scores and more cognitive impairment and depressive mood. These findings are in accord with previous reports [4,9,25,26].

About two thirds of the patients with poor nutritional status had difficulties in the basic ADLs and IADLs. Similar results have been published before [2]. Over half of the patients had abnormal results on the in TUG test and weakened grip strength. In an earlier study hand grip strength has been found to correlate with nutritional status [27,28].

Physical function, gait speed and cognition have been the most commonly used criteria for identifying components of frailty [29]. Sarcopenia has been defined as progressive loss of skeletal muscle mass, strength and power and is considered a significant component of frailty [30]. In our study in the multivariate analysis, longer time on the TUG test, weakened grip strength, memory disorder, depressive mood and poor nutrition at baseline were independent prognostic indicators of poor nutritional status at follow-up. Bollwein and colleagues reported a similar association between frailty syndrome and poor nutritional status [31].It has to be noted that physical performance, cognition and mood are in fact domains that are included as parameters in the MNA-SF and this may have in part affected the associations of these domains with poor nutritional status. Nevertheless, the observations do emphasize the significance for a comprehensive approach to nutritional care. Patients with cognitive impairment and memory disorders need specific attention and taking care of the patients' mood is also a priority. The association between poor nutritional status and impaired mobility and weakened grip strength suggests an association between protein-energy malnutrition and sarcopenia. This underlines the importance of exercises aimed at improving muscle strength in combination with effective nutritional care.

The strengths of our study include a large and representative study population, prospective and consecutive design, and the use of well-known and standardized instruments in the comprehensive geriatric assessment. Due to the good coverage of our systematic data collection, basic baseline information and mortality dates were available even for patients who did not attend the outpatient clinic. The data were collected mainly by a single geriatric nurse and the tests of physical functioning by mainly the same physiotherapist, which strengthens the reliability of the data. Patients were not excluded from the investigation on the basis of any comorbidity, for example having a memory disorder or living in an institution.

There are number of limitations to our study. First, hip fracture patients' weight and height are difficult to measure in the perioperative period because of pain. On the other hand height and weight were estimated again at the outpatient clinic and at that time the patients were also measured. These two BMI results were very near each other, which means that the estimates were fairly accurate. It is worth noting that measuring the height as a part of the BMI may be unreliable, especially in older frail female patients, due to possible shortening of the spine attributed to vertebral fractures [32]. On the other hand muscle mass decreases as people age. Thus aging affects BMI less than weight and height [33].

The second limitation was that exception of nutritional status, the rest of the domains of the CGA were not examined at the time of the fracture, and thus it was not possible to examine changes in these domains between baseline and follow-up. Third, follow-up data were available on 57% of the original hip fracture cohort. According to our analyses, patients in poorest health had either died or were not able to attend the outpatient clinic. This may impair the reliability of the data introducing a possibility of a selection bias, where the number of undernourished people is likely to be underestimated. Finally, the present study was a real-life observational and non-interventional study and thus, in spite of the instructions given to the nurses regarding nutritional care and supplementation, the effect of these practices on the outcomes could not be examined.

5. Conclusions

It is very important to pay attention to hip fracture patients' nutritional status with supplements and energy and protein-rich meals during the acute phase of hip fracture care and in the course of rehabilitation. Malnutrition predisposes to muscle weakness, additional illnesses and falls. Age, comorbid conditions, prefracture functional and mental abilities, and nutritional status have an impact on the outcome regarding ambulation, activities of daily living and quality of life. Comprehensive geriatric care by means of orthogeriatric management and multidisciplinary geriatric rehabilitation - both based on the gold standard of CGA - need to be implemented more actively to improve the outcomes of geriatric fracture patients and also to save costs. Nutritional assessment and interventions constitute an essential component of the CGA. It is likely that the same principles also apply to other frail acutely ill hospitalized patients in different medical specialities.

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LEGEND

Figure 1. Flow chart of nutritional status according to MNA-SF in the study population.

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Table 1. Distribution of predictor variables at baseline according to the MNA-SF (N=958)

	Normal (n=493)		At risk of malnutrition (n=388)		Malnourished (n=77)		p
Age, Md (IQR, Range)	83	(76-87; 65-98)	85	(73-95; 65-103)	85	(74-90; 65-99)	<0.001
Male, n (%)	150	(30)	82	(21)	22	(29)	0.006
BMI, Md (IQR)	26.4	(22.5-40.7)	24.2	(22-35.3)	20.3	(17.4-27.2)	<0.001
MNA-SF before hip-fracture, Md (Range)	13	(12-14)	10	(8-11)	6	(2-7)	<0.001
Fracture type, n (%)							0.679
Neck of femur	304	(62)	238	(61)	44	(57)	
Intertrochanteric	157	(32)	127	(33)	27	(35)	
Subtrochanteric	30	(6)	23	(6)	6	(8)	
ASA, n (%)							<0.001
1-2	100	(21)	34	(9)	3	(4)	
3	315	(65)	237	(61)	48	(64)	
4-5	71	(14)	115	(30)	24	(32)	
Missing	7		2		2		
Number of regularly taken medications, n (%)							<0.001
<4	121	(25)	48	(12)	10	(13)	
4-10	297	(60)	247	(64)	52	(67)	
over 10	72	(15)	93	(24)	15	(20)	
Diagnosis of memory disorder, n (%)	82	(16)	158	(41)	29	(38)	<0.001
Independent mobility, n (%)	367	(75)	128	(33)	18	(23)	<0.001
Living in own home, n (%)	409	(84)	216	(56)	46	(60)	<0.001
Time to operation < 24 h, n (%)	220	(45)	145	(38)	32	(43)	0.185
Hospital stay, n (%)							0.797
1-3 days	30	(6)	25	(7)	6	(8)	
4-5 days	230	(47)	200	(52)	37	(49)	
6-7 days	158	(31)	106	(28)	22	(29)	
over 7 days	67	(14)	51	(13)	10	(13)	
Missing	8		6		2		

Md=Median; IQR=Interquartile range. Differences (p-value) between groups were tested by Independent samples Kruskall-Wallis test or Pearson chi-square test.

Table 2. Age-adjusted indicators of poor nutritional status (at risk of malnutrition or malnourished) at baseline among hip-fracture patients (N=585).

		Poor nutrition at baseline [n=227 (39%)]					Poor nutrition at 6 months follow-up [n=346 (59%)]				
	N	n	(%)	p	POR	(95% CI)	n	(%)	p	IOR	(95% CI)
Age	585	227	(39)		**1.04**	**(1.01-1.06)**	346	(59)		**1.05**	**(1.03-1.08)**
Sex				0.005					0.050		
Male	443	41	(29)		1.00		74	(52)		1.00	
Female	142	186	(42)		**1.63**	**(1.07-2.47)**	272	(61)		1.28	(0.86-1.89)
Fracture type				0.421					0.126		
Neck of femur	373	139	(37)		1.00		211	(57)		1.00	
Intertrochanteric	182	74	(41)		1.08	(0.75-1.56)	119	(65)		1.34	(0.92-1.94)
Subtrochanteric	29	14	(48)		1.52	(0.71-3.26)	16	(55)		0.88	(0.41-1.93)
ASA				0.001					0.009		
1-2	114	27	(24)		1.00		52	(46)		1.00	
3	374	152	(41)		**1.97**	(1.21-3.23)	231	(62)		**1.60**	(1.03-2.48)
4-5	90	45	(50)		**2.77**	(1.50-5.14)	59	(66)		1.76	(0.97-3.19)
Not known	7	3	(43)		2.22	(0.46-10.7)	4	(57)		1.39	(0.29-6.65)
Regular medications				0.008					0.007		
<4	140	41	(29)		1.00		67	(48)		1.00	
4-10	360	144	(40)		**1.57**	(1.03-2.40)	227	(63)		**1.81**	(1.21-2.71)
over 10	85	42	(49)		**2.29**	(1.30-4.02)	52	(61)		1.64	(0.94-2.86)
Diagnosis of memory disoder				<0.001					<0.001		
No	431	131	(30)		1.00		213	(49)		1.00	
Yes	152	94	(62)		**3.60**	(2.44-5.31)	131	(86)		**6.18**	(3.74-10.2)
Missing	2	2	(100)				2	(100)			
Mobility*				<0.001					<0.001		
Independent	389	99	(25)		1.00		183	(47)		1.00	
Non-independent	195	128	(66)		**5.36**	(3.66-4.84)	162	(83)		**5.06**	(3.29-7.77)
Living				<0.001					<0.001		
Home	460	152	(33)		1.00		240	(52)		1.00	
Institution	122	73	(60)		**2.83**	(1.87-4.29)	104	(85)		**4.89**	(2.86-8.36)
Not known	3	2	(67)		3.85	(0.35-42.8)	2	(67)		1.68	(0.15-18.7)
Time to operation				0.316					0.787		
<24 h	258	92	(36)		1.00		149	(58)		1.00	
> 24 h	321	132	(41)		1.21	(0.86-1.71)	193	(60)		1.04	(0.74-1.46)
Not known	6	3	(50)		1.75	(0.34-9.05)	4	(67)		1.42	(0.25-8.19)
MNA before hip-fracture									<0.001		
Normal	358						162	(45)		1.00	
At risk of malnutrition	194						153	(79)		**4.32**	(2.88-6.49)
Malnourished	33						31	(94)		**17.6**	(4.14-75.1)

Age-adjusted univariate analyses were performed by logistic regression results shown by prevalence odds ratios (POR) or by incidence odds ratios (IOR) with 95% Confidence Intervals (CI). Statistically significant (p<0.05) odds ratios were **bolded**. * One missing case, normal nutrition.

Table 3. Age-adjusted indicators of poor nutritional status (at risk of malnutrition or malnourished) after 6 months follow-up among hip-fracture patients (N=585).

		Poor nutrition at 6 months follow-up [n=346 (59%)]				
	N	n	(%)	POR	(95% CI)	P
MMSE						
Normal (24-30)	204	78	(38)	1.00		
<24	362	250	(69)	**3.22**	**(2.22-4.68)**	<0.001
Not known	19	18	(95)	**26.5**	**(3.46-203.4)**	0.002
IADL						
No difficulties (8)	91	25	(28)	1.00		
Difficulties (0-7)	486	316	(65)	**4.20**	(2.52-7.00)	<0.001
Not known	8	5	(62)	4.24	(0.93-19.3)	0.062
Basic ADL						
No difficulties (6)	195	69	(35)	1.00		
Difficulties (0-5)	382	272	(71)	**4.10**	(2.81-5.97)	<0.001
Not known	6	5	(62)	3.12	(0.71-13.6)	0.130
GDS-15						
No depression (0-6)	463	246	(53)	1.00		
Depressed (> 6)	96	75	(78)	**2.94**	**(1.74-4.96)**	<0.001
Not known	26	25	(96)	**20.5**	**(2.74-153)**	0.003
EMS	554			0.77	(0.72-0.82)	<0.001
TUG time	489			**1.07**	**(1.05-1.09)**	<0.001
TUG						
Normal (1-2)	164	62	(38)	1.00		
Moderately abnormal (3-4)	269	146	(54)	**1.83**	**(1.22-2.73)**	0.003
Markedly abnormal (5)	41	38	(93)	**18.7**	**(5.52-63.5)**	<0.001
Not known	109	100	(92)	**16.3**	**(7.66-34.8)**	<0.001
Grip strenght, better hand						
Normal (men ≥26 kg, women ≥16 kg)	253	126	(50)	1.00		
Weakened (men<26 kg, women<16 kg)	332	220	(66)	**1.81**	**(1.28-2.54)**	0.001

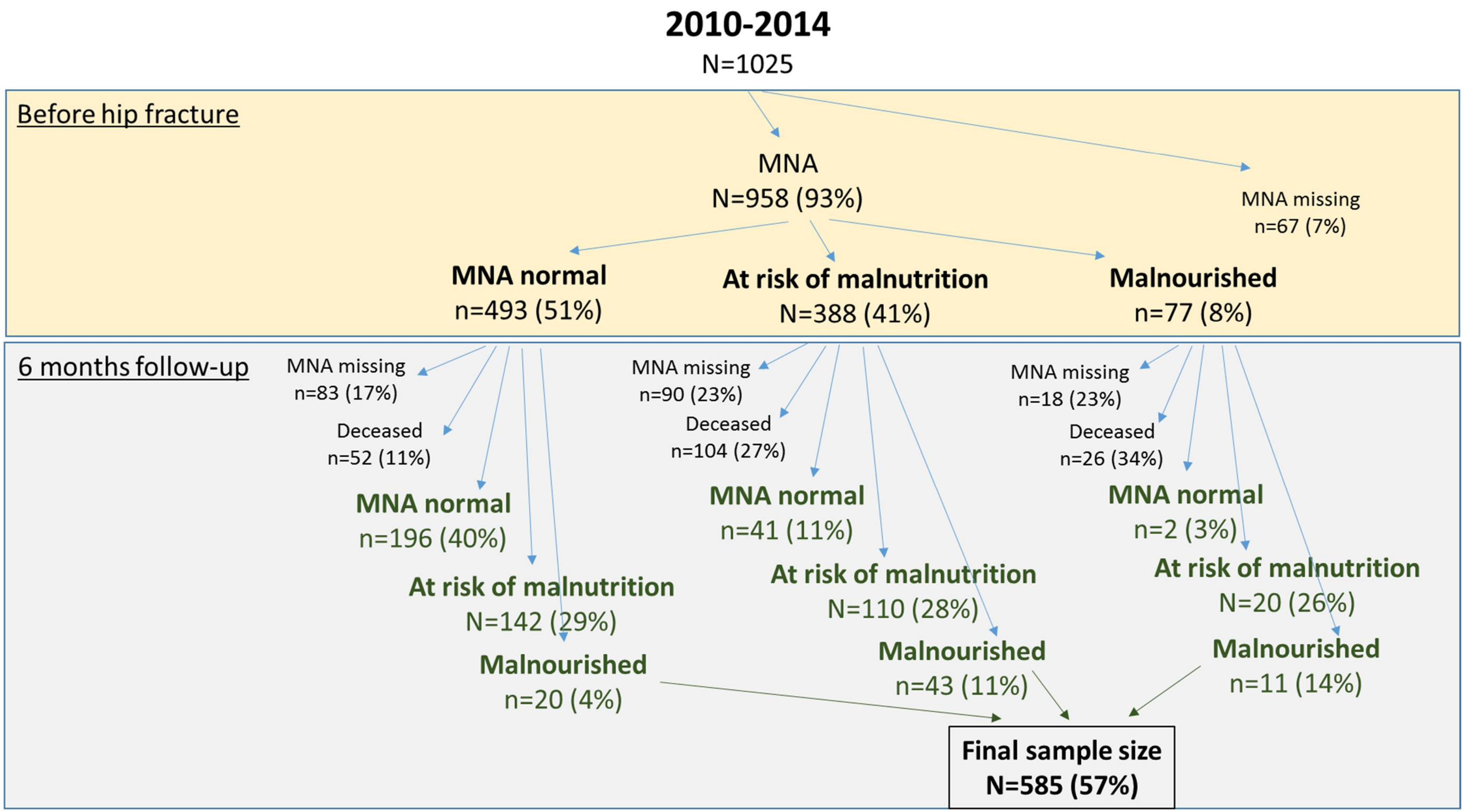
Age-adjusted univariate analyses were performed by logistic regression results shown by prevalence odds ratios (POR) or by incidence odds ratios (IOR) with 95% Confidence Intervals (CI).

Supplementary Table. Attendees vs. non-attendees (N=958) at 6-month follow-up.

	Attendees (n=585)		Non-attendees (n=191)		Deceased n=182)		p
Age, Md (IQR, Range)	83	(77-87; 65-99)	85	(81-90; 65-99)	87	(83-91; 67-103)	<0.001
Male, n (%)	142	(24)	55	(29)	59	(32)	0.073
BMI, Md (IQR)	25.8	(22.9-29.1)	23.7	(21.2-27.0)	24.5	(21.5-27.7)	<0.001
MNA-SF before hip-fracture, Md (IQR, Range)	12	(10-13; 2-14)	11	(9-12; 4-14	10	(9-12; 4-14)	<0.001
Fracture type, n (%)							0.068
Neck of femur	374	(64)	105	(55)	110	(60)	
Intertrochanteric	182	(31)	67	(35)	62	(34)	
Subtrochanteric	29	(5)	19	(10)	10	(6)	
ASA, n (%)							<0.001
1-2	114	(20)	21	(11)	4	(2)	
3	374	(64)	128	(67)	98	(54)	
4-5	90	(15)	42	(22)	77	(42)	
missing	7	(1)	0	(0)	3	(2)	
Number of regularly taken medications, n (%)							<0.001
<4	140	(24)	31	(16)	8	(4)	
4-10	360	(62)	119	(62)	117	(65)	
over 10	85	(15)	41	(22)	56	(31)	
Diagnosis of memory disorder, n (%)	152	(26)	59	(31)	59	(32)	0.318
Independent mobility, n (%)	390	(64)	80	(42)	45	(25)	<0.001
Living in own home, n (%)	463	(79)	124	(65)	86	(47)	<0.001
Time to operation < 24 h, n (%)	258	(44)	77	(40)	61	(34)	0.092
Hospital stay, n (%)							<0.001
1-3 days	44	(7)	8	(4)	9	(5)	
4-5 days	292	(50)	111	(58)	66	(36)	
6-7 days	181	(31)	49	(26)	56	(31)	
over 7 days	68	(12)	23	(12)	36	(20)	
missing	0	(0)	0	(0)	15	(8)	
MNA-SF before hip fracture, n (%)							<0.001
Normal	358	(61)	83	(44)	52	(29)	
At risk of malnutrition	194	(33)	90	(47)	104	(57)	
Malnourished	33	(6)	18	(9)	26	(14)	

Md=Median; IQR=Interquartile range. Differences (p-value) between groups were tested by independent samples Kruskall-Wallis test, Pearson chi-square test or Fisher's exact test.

Figure 1



2010-2014
N=1025
Before hip fracture
MNA
N=958 (93%)
MNA missing
n=67 (7%)
MNA normal
n=493 (51%)
At risk of malnutrition
N=388 (41%)
Malnourished
n=77 (8%)
6 months follow-up
MNA missing
n=83 (17%)
Deceased
n=52 (11%)
MNA normal
n=196 (40%)
At risk of malnutrition
N=142 (29%)
Malnourished
n=20 (4%)
MNA missing
n=90 (23%)
Deceased
n=104 (27%)
MNA normal
n=41 (11%)
At risk of malnutrition
N=110 (28%)
Malnourished
n=43 (11%)
MNA missing
n=18 (23%)
Deceased
n=26 (34%)
MNA normal
n=2 (3%)
At risk of malnutrition
N=20 (26%)
Malnourished
n=11 (14%)
Final sample size
N=585 (57%)