An evaluation of the usefulness of Comprehensive Geriatric Assessment in patients after a fracture within the proximal femoral epiphysis while staying at a nursing home – a pilot study

Wioletta Dziubek [ID], Joanna Kowalska [ID]

Faculty of Physiotherapy, Wroclaw University of Health and Sport Sciences, Poland

Abstract

Introduction. The aim of this study was to evaluate the usefulness of Comprehensive Geriatric Assessment (CGA) in patients after a fracture within the proximal femoral epiphysis, staying at a nursing home (NH).
Methods. The study was conducted at a NH centre on 15 people after a fracture within the proximal femoral epiphysis (mean aged 76.9 ± 10.8). The CGA assessment was performed twice: before and after a 12 week stay at the centre. Physiotherapy was carried out five times a week for one hour (Monday to Friday).
Results. The analysis showed a significant improvement in the Activities of Daily Living scale (ADL). In the case of the physical condition of the patients, the physiotherapy led to significant improvements, predominantly in the gait and balance of the patients. Significant correlations, at the start and end of the study, were found between the ADL and Tinetti scale.
Conclusions. There was a significant relationship found between the functional status and physical health of the patients undergoing physiotherapy staying at the NH. The systematic 3-month physiotherapy significantly improved the functional and physical condition of elderly patients. CGA can be a tool for evaluating the efficacy of the rehabilitation process of elderly patients staying at a NH. The results are a pilot study, but confirm that CGA can and should be routinely used in geriatric centres in Poland.
Key words: Comprehensive Geriatric Assessment (CGA), elderly patients, nursing home

Introduction

Over the past decades, there has been a rapid development in medical science and an accompanying improvement in the quality of life. This has contributed to a significant increase in life expectancy. This is important, as elderly people represent a growing proportion of the population in Western European countries, including Poland [1, 2].

The ageing processes contribute to the formation of a clear impairment of motor skills, manifesting itself as incapacity in old age. This is accompanied by the reduced efficiency of the analysers: visual, auditory and proprioception. A large decrease in basic motor skills, such as strength, speed, flexibility, agility and strength can also be seen [3].

Furthermore, once over the age of about 65, there is a reduction in the supply of energy substrates to the muscles, which is caused by a sparse network of capillaries. Some authors report that, between the age of 30 and 80, the human upper limb muscle strength may fall to 30%, and that of the lower limbs to 40% [4, 5]. Additionally, with age, we observe a reduction in static and dynamic strength, as well as a progressive impairment of the motor and postural functions, on which the efficiency of postural stability depends. The main symptoms of postural instability are balance disorders, which result in falls – often tragic [6, 7].

In people over 65 years of age, apart from changes affecting the musculoskeletal system, there are also changes in the mental sphere, which are often disorders of the cognitive function as well as depressive disorders. This is due to the weakening of the brain functions, which results from the progressive loss of neurons, lost connections between dendrites, decreases in cerebral blood flow and changes in the functioning of enzymes and receptors [7, 8]. Particular cognitive functions may be affected in varying degrees. As time progresses, there is a decrease in the intellectual and emotional states and hence a loss of independent functioning. Both cognitive function disorders and depressive disorders are additional factors adversely affecting the quality of life and functional status of the elderly. They also hinder the care, rehabilitation and the return to independence among those patients coping with the disease and its effects [9, 10]. They are often the reason for a patient's prolonged stay at a rehabilitation centre [11]. As a result of all these negative developments in elderly people, one ought to conduct a detailed individual analysis of such people before commencing physiotherapy. This would involve adapting workouts to the current conditions and capabilities of the patients, to set realistic goals in terms of the therapy and to monitor them throughout the rehabilitation period.

In addition to the standard assessment methods adopted in rehabilitation, such as specifying muscle tension, mobility of joints and the strength of such patients, one should also evaluate their performance in daily living activities. Their deterioration negatively affects their quality of life and burdens their families with more responsibilities. Even the most accurate clinical trials do not fully illustrate the functional status of an elderly patient, which raises many doubts as to the selection of the tests and scales monitoring the efficacy of physiotherapy in the elderly.

It seems that Comprehensive Geriatric Assessment (CGA) should be a good tool in measuring these issues, as well as in the assessment of nutritional status and the risks of pres-

sure ulcers. Consequently, "CGA is a multidimensional inter-disciplinary diagnostic process focused on determining a frail person's medical, psychological and functional capability in order to develop an integrated and coordinated plan for treatment and long-term follow-up" [12, 13]. All the information resulting from the tests and scales form a precise description of the patient. It also allows the planning of comprehensive physiotherapy and rehabilitation as well as monitoring and controlling the results of any interventions [14].

Therefore, the aim of this study was to evaluate the usefulness of CGA in patients staying at a NH in Wroclaw, and to answer the question concerning whether CGA is a tool that demonstrates the efficacy of the rehabilitation performed. An additional aim was to explore the relationships between the functional state and the physical and mental health of the patient, and to check whether systematic 3-month physiotherapies can change the functional, physical and mental state of NH patients.

Subjects and methods

The study was conducted in Wroclaw at a NH with a rehabilitation domain. It is a long-term care centre, where the stay may last between a month and several months. The aim of the hospitalization was to improve the health and physical functioning of the patients, so that they could function at home, either independently or with help from their family. The study took place between September 2019 and January 2020. Written consent was obtained from the patients to conduct the study.

The study group consisted of patients after a fracture within the proximal femoral epiphysis, at least three months after surgery, satisfying the following inclusion criteria: age over 60 years, patient's consent to participate in the study, satisfactory level of cognitive function (Mini-Mental State Examination (MMSE) > 15) [15, 16]. According to the authors, such a number of points guarantees an understanding of the instructions given by the therapist. Criteria for exclusion from the study included: severe loss of vision or hearing preventing the performance of the tests, limitations in activities related to movement (e.g. locomotion), neurological disorders and cardio-respiratory system diseases that make it impossible to conduct the tests, dizziness, polypharmacy, depression, and the patient's refusal at every stage of the study.

The group consisted of 29 patients. During the project, 7 patients achieved an unsatisfactory result in the MMSE (MMSE < 15) test and a further 7 patients left the centre without a chance to finalize the study.

The results of 15 patients, including 12 women (80%) and 3 men (20%), aged 60 to 88 years (mean 76.9 ± 10.8) were analysed. Mean body weight was 72.9 (± 13.9) and mean BMI score was 28.5 (± 4.2). The largest group were single people – 61% (39% had spouses) and people with primary education or vocational training (63%). The patients were subject to a systematic and individualized physiotherapy, at a specified time and frequency (60 minutes a day, Monday to Friday).

Physiotherapy was carried out five times a week for one hour. The classes were conducted by a physiotherapist employed by the NH. The rehabilitation process carried out in the gym included: active and resistance exercises for the upper and lower limbs and the trunk, contralateral and ipsilateral exercises, and breathing exercises with the use of various gymnastic equipment. Additionally, learning to get up and down as well as to walk on flat terrain and stairs was conducted.

The CGA assessment was performed twice: a preliminary examination up to 5 days after admission to the centre, and a final examination after a 12 week stay at the centre. The CGA included the following scales: MMSE (Mini-Mental State Examination), ADL (Activities of Daily Living), IADL (Instrumental Activities of Daily Living), MNA (Mini Nutritional Assessment), GDS (Geriatric Depression Scale), Norton Scale and Tinetti Test.

The MMSE is a widely-used screening test that is used to assess cognitive function: orientation in time and place, memory, attention and numeracy, language functions and visual-spatial orientation. A result of 30–27 points was adopted as standard [17].

The ADL scale was developed by Katz. It assesses the ability to perform basic activities of daily living, such as: eating, using the toilet, bathing, dressing and undressing, ability to move about, and holding of stools and urine. The greater the number of points (max. 6), the better the patient's functional status [18].

The IADL scale, created by Lawton, assesses the ability to perform complex activities of daily living, such as using the phone, going shopping, preparing a meal, being able to reach places that are more remote than within normal walking distance, ability to perform basic household chores (cleaning, minor repairs), self-taking of medicines and money management. The maximum number of points that one can attain is 24 [19].

The MNA scale consists of anthropometric measurements (lower leg and upper arm circumference), body height (measured with an anthropometer), body weight (measured with portable medical scales) and questions related to the assessment of well-being (physical activity, self-assessment of mental status, taking of medications), as well as questions about diet. A patient can obtain a maximum of 30 points, while a score below 17 points indicates malnutrition [20, 21].

The Norton scale assesses the risk of developing pressure ulcers. Additionally, it explores the physical and mental condition, physical activity, ability to move around as well as the holding of stools and urine. The patient can obtain a maximum of 20 points. A score over 14 points suggests no risk of developing pressure ulcers, while below 14 is associated with an increased risk of its occurrence [22–24].

The GDS scale is a widely used screening scale for self-assessment of well-being and quality of life in elderly people. A short version contains 15 questions where the patient answers "yes" or "no". The assessment concerns the last two weeks immediately prior to the survey. The assessment concerns the subjective satisfaction with quality of life, mood and feelings of happiness or lack thereof. A score between 0–5 points indicates no depression, 6 points and above indicates depression with an increasing severity [25, 26].

The Tinetti scale (POMA, Performance Oriented Mobility Assessment) assesses the risk of falling. In the first section dedicated to balance it assesses activities like: balance in a sitting position, balance after getting up from a chair and standing up, 360° rotation around its axis and also sitting down. The second part concerns walking: how does it begin, what is the length and height of the step, how is its symmetry. It also assesses the work of the torso and the way in which the patient sets their feet during walking. A patient can obtain a maximum of 16 points in the first part and 12 points in the second part, which gives a total score of 28 points. A score below 26 indicates a problem with mobility and a result below 19 indicates that the risk of falling increases 5-fold compared to someone who received a maximum number of points. This scale is the most widely used tool for analysing balance and

mobility. It has been considered a gold standard in the assessment of balance and walking in elderly people [27, 28].

The initial and final tests were performed by a trained physiotherapist who did not conduct physiotherapy with the patients included in the study.

Statistical analysis

The Shapiro–Wilk test was used to check the distribution of quantitative variables, which showed normality. Descriptive statistics were calculated. For quantitative variables, the mean was used as a measure of the central tendency, while the standard deviation as a measure of dispersion. For the variables on the ordinal scale, the median and the interquartile range (IQR) were used. An assessment of the statistical significance of changes in the analysed parameters as a result of therapy was performed using the Student's *t*-test for dependent measures for quantitative variables and Wilcoxon's Signed-Rank Test for ordinal variables. Due to the small size of the patients a Spearman's ρ rank-order correlation coefficient was used in the analysis of correlation. Multi-way tables with a Chi-square test were used to analyse qualitative variables. Statistical significance was predicated at $p < 0.05$. Calculations were performed using Statistica 13.1 from StatSoft [29].

Ethical approval

This research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Bioethics Committee of the Wroclaw University of Health and Sport Sciences, Poland (approval No.: 15/2020).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

The analysis of results showed an improvement in functional status after 3 months of regular physiotherapy. A significant improvement was observed in basic activities of daily living (ADL scale), the change being statistically significant ($p < 0.05$). The percentage of patients showing significantly better functional status had increased (from 40% to 60% of respondents) and the proportion of moderately disabled patients had decreased. The improvement in complex daily activities (IADL) was relatively smaller and could not be considered statistically significant (Table 1).

Table 1. ADL and IADL parameters before and after physiotherapy

Scale	Time	Median	IQR	Wilcoxon's *t*-test	
				Z	p
ADL	Before physiotherapy	4	4	2.02	0.0431*
	After physiotherapy	5	4		
IADL	Before physiotherapy	16	4	1.52	0.1282
	After physiotherapy	17	4		

ADL – Activity of Daily Living assessment,
IADL – Instrumental Activity of Daily Living assessment
IQR – inter quartile range
* $p < 0.05$

In the case of the physical condition (assessed using the Tinetti gait and balance scale, the risk of pressure ulcers scale and the nutritional status scale) physiotherapy performed led to significant improvements, predominantly in gait and balance, and evaluated using the Tinetti scale. Before the therapy, combined Tinetti scale results for all respondents indicated problems with balance associated with a high fall risk (score < 19 points). The numerical value of the combined results had increased after the therapy and thus reduced the risk of falling. After 3 months of physiotherapy, the combined score exceeded 18 points in 7 cases. A greater improvement after 3 months of therapy occurred in the part of the Tinetti scale concerning balance, and it was a statistically significant improvement. The improvement in gait was significantly lower, and the change in mean value cannot be regarded as statistically significant ($p > 0.05$). The combined results of the assessment of balance and gait had significantly improved after 3 months in relation to the initial state (Table 2).

Regular 3-month physiotherapy also significantly reduced the risk of pressure ulcers. The number of patients in whom the risk of pressure ulcers was not present (Norton scale score > 14 points) increased after the treatment from 11 (73%) to 14 (93%). A reduction in the risk of pressure ulcers after the treatment was highly significant in statistical terms ($p < 0.01$) (Table 2).

Next the results of the MNA scale were analysed. The mean score of the MNA scale was low, both before and after therapy, indicating a state of malnutrition (Table 2). This result is not coherent with the subjects' body weight and BMI values. The range of variations in the BMI indicates a presence of excessive body weight in the case of some patients (BMI > 25 kg/m^2). However, the patients' body weight changed after 3-months of therapy, and with it the value of the BMI. The number of patients with normal body weight increased and number with obesity decreased. These changes were statistically significant ($p = 0.043$, $p = 0.037$) (Table 3, 4).

Before physiotherapy, as many as 33% of the people were obese, 53% were overweight and only 13% were normal. After 3 months of physiotherapy, obesity decreased to 13%, and the amount with normal BMI increased to 20%. The relationship is statistically significant (Table 4).

In evaluating the mental (emotional) state, the GDS scale was used. The therapy only slightly changed the mental state of the patients. Before therapy, most patients showed no depression (10 patients, representing 67% of the patients, GDS < 6), while after the therapy the number of people without depression increased to 11 (73%). The mean point score of the assessment of depression according to GDS decreased after the treatment by a mere 0.5 points, which was not statistically significant (Table 2).

Due to the small size of the study group, the Spearman ρ-rank correlation coefficient was used. When independent of the shape of the distribution of correlated features, it reduces the impact of outliers on the result (the value of the correlation coefficient).

The relationship between functional status of the patients and their physical and mental health were also analysed. Clear and significant correlations in the initial and final study were found only between the ADL scale and the Tinetti scale, i.e. between the assessment of basic daily activities and the assessment of balance and gait ($p = 0.0022$; $p = 0.0027$). The other correlations were statistically insignificant and difficult to interpret due to the high probability of their randomness (Table 5).

Table 2. Distribution parameters of the balance and gait assessments, pressure ulcer risk assessment, nutritional assessment and geriatric depression assessment before and after physiotherapy

Scale	Time	Median	IQR	Wilcoxon's *t*-test	
				Z	p
Tinetti balance	Before physiotherapy	7	4.00	3.06	0.0022*
	After physiotherapy	9	5.00		
Tinetti gait	Before physiotherapy	7	4.00	1.35	0.1763
	After physiotherapy	8	4.00		
Tinetti gait and balance	Before physiotherapy	13	6.00	3.01	0.0027*
	After physiotherapy	17	9.00		
Norton	Before physiotherapy	15	2.00	2.63	0.0086*
	After physiotherapy	16	3.00		
MNA	Before physiotherapy	24.50	3.00	2.29	0.0219*
	After physiotherapy	21.00	4.00		
GDS	Before physiotherapy	2.00	7.00	0.97	0.3329
	After physiotherapy	2.00	8.00		

Tinetti – balance and gait assessments, Norton – Pressure Ulcer Risk Assessment Scale, MNA – Mini Nutritional Assessment Scale
GDS – Geriatric Depression Scale, IQR – inter quartile range; * $p < 0.05$

Table 3. Body mass and BMI before and after physiotherapy

Characteristics	Time	Mean	SD	Student's *t*-test	
				Z	p
Body mass (kg)	Before physiotherapy	72.87	13.99	2.02	0.0426*
	After physiotherapy	71.03	13.11		
BMI (kg/m²)	Before physiotherapy	28.34	4.17	2.31	0.0366*
	After physiotherapy	27.66	4.08		

BMI – body mass index; * $p < 0.05$

Table 4. Detailed analysis of BMI before and after physiotherapy

Time	BMI norm (18–25 kg/m²)		BMI overweight (25–30 kg/m²)		BMI obesity (BMI > 30 kg/m²)		p χ^2 test
	N	%	N	%	N	%	
Before physiotherapy	2	13.33%	8	53.33%	5	33.33%	0.0090*
After physiotherapy	3	20.00%	10	66.67%	2	13.33%	

BMI – body mass index; * $p < 0.05$

Table 5. Spearman ρ correlations between the assessment of the functional status of patients (ADL and IADL scales) and the assessment of state of health (Tinetti, Norton and MNA scales) and mental state (GDS scale) before and after the therapy

Scale (total points)	ADL before	ADL after	IADL before	IADL after
Tinetti balance	0.62*	0.57*	−0.34	−0.11
Tinetti gait	0.66*	0.69*	−0.57*	−0.23
Tinetti balance and gait	0.69*	0.59*	−0.52*	−0.13
Norton	0.43	0.45	0.24	0.51
MNA	0.14	0.03	0.69*	0.37
GDS	−0.04	−0.26	0.11	−0.35

ADL Scale – Activity of Daily Living assessment, IADL Scale – Instrumental Activity of Daily Living assessment
Tinetti – balance and gait assessments, Norton – Pressure Ulcer Risk Assessment Scale
MNA – Mini Nutritional Assessment Scale, GDS – Geriatric Depression Scale; * $p < 0.05$

Discussion

While analysing issues concerning the ageing process, it is important to take into account changes occurring in the bodies of the elderly. Undoubtedly, the process of ageing itself is irreversible, inevitable and affects everyone. The age at which involution becomes clearly visible is not the same in all people, and the changes that take place determine their physical capacity, appearance and mental state. It is therefore very important to use appropriate scales in order to determine the functional, physical and mental status of the elderly [30].

The CGA is increasingly being adopted by geriatric wards. Further, long-term care centres, including NH, should adopt at least some elements of CGA while performing assessments of elderly patients in their rehabilitation wards [31].

In this paper we examined the efficacy of a 3-month rehabilitation carried out using scales included in CGA. The results indicate that CGA has proved to be an effective tool in assessing the efficacy of the rehabilitation processes, in terms of changes to the activity-functionality state (ADL and IADL) as well as the physical state (Tinetti, Norton scale). For the remaining scales (MNA, GDS), their suitability to assess therapy efficacy has not been demonstrated. Perhaps it is connected with the small sample size of the study group, as with a small group size, single cases can completely distort the picture. It is also worth noting that the majority of patients studied here did not have mood disorders, and therefore it is difficult to talk about a change in the GDS scale after the treatment. Nonetheless, the results of these scales make it necessary to modify the course of individual rehabilitation, which ultimately increases efficacy and improves the functional status in elderly patients.

The CGA Toolkit for Primary Care Practitioners (2019) by the British Geriatrics Society found that for mild or subliminal symptoms of depression, psychosocial interventions, such as increasing social contact and exercise, can be effective in working with patients [32].

Studies by other authors also confirm the suitability of scales relating to basic and complex activities of daily living in the rehabilitation of the elderly [19, 33].

Nykanen et al. [34], in using the MNA scale, showed that there is a relationship between the level of basic and complex everyday life activities and nutritional status. Patients who received more points from the functional scales showed a lower risk of malnutrition. A relationship between good functional status that translated into improved nutritional status was also significant [34].

After 3 months of physiotherapy, a reduction in the risk of developing pressure ulcers was observed in patients who studied at a NH, which confirms the efficacy of the therapy. Therefore, the preliminary studies carried out indicate the suitability and practical application of the Norton scale in hospital units. The research conducted by Cierzniakowska et al. [35] with the use of the Norton scale in patients at a surgical unit confirms these results. All patients who received a greater number of points in terms of the physical status, psychological status, mobility skills as well as holding of stools and urine did not have pressure ulcers. However, in the remaining respondents who received significantly lower scores to questions on the scale, pressure ulcers did occur [35].

The Tinetti test was also found to be significant. All patients after a period of rehabilitation received more points; therefore, the risk of falls was reduced and the patient's independence increased. This was also confirmed by the results of the correlation analysis carried out by Borowicz and Wieczorkowska-Tobis [36], who performed their work using the Tinetti scale in geriatric patients staying at a rehabilitation ward. They found that those who received scores less than 26 points had problems with gait and balance. However, after a 3-week rehabilitation a statistically significant improvement was observed in gait and balance, as well as in the independence of respondents [36].

The work by Welsh et al. [37] indicates that a well-conducted CGA can provide effective health care to various groups of patients. If CGA is included in the service model, it can help to minimize the damage and the direct the work of various specialists (physician, physiotherapists, psychologists) [37].

A 2017 Cochrane review found that CGA can lead to a modest increase in costs, and that the evidence of cost-effectiveness is weak due to imprecision and inconsistency between the studies. More research is needed that provides cost estimates that are specific to different care sectors [13]. Nord et al. [38] came to similar conclusions, indicating that CGA in primary care can reduce the need for inpatient days for the high-risk elderly population. This can make a huge difference in dealing with the increasing prevalence of weakness and multiple diseases [38].

In summary: The CGA evaluates particular problems in the functioning of elderly persons. It is a thorough assessment on the basis of which we can determine the needs of patients as well as providing them with appropriate treatment, programming and individual rehabilitation. This has to do with the improved quality of life in elderly patients. It provides medical staff, including physiotherapists, with current information on the patient's functional, physical and mental status, as well as on the efficacy of the physiotherapy.

It is worth mentioning that CGA is very easy to use because it requires no special equipment or strictly defined premises where such tests can be performed. In addition, scales are arranged in a clear and comprehensible way for both the researcher and the respondent. Further, the economic value is considerably important as well. In the 2004–2006 period, the costs of treatment were compared between two randomly selected groups of more than 2,000 elderly people. The first group consisted of individuals who were hospitalized in three internal medicine wards where CGA had not been used. The other group consisted of people from three geriatric units that had used CGA. The annual costs incurred by the National Health Fund in the first group were more than 25% higher compared to the second group [39].

Pilotto et al. [40] indicate that accurate and calibrated CGA-based prognostic tools can help in making clinical decisions in both diagnosis and physiotherapy of the elderly. More research is needed to determine the usefulness of CGA in tailoring appropriate interventions and improving the clinical outcomes in the elderly [40].

This is tremendously meaningful in an under subsidized health care system with limited budgets for patients staying at the NH.

The results form part of a pilot study, but they do confirm that CGA can and should be routinely used in geriatric and rehabilitation centres in Poland. This encourages further research, including the enlargement of the study group as well as the promotion of CGA as an effective, comprehensive tool in assessing the efficacy of geriatric physiotherapy.

Limitations

The limitations of this study comprise the limited number of participants. The recruitment of a larger group of volunteers was disrupted by the outbreak of the Covid-19 pandemic and the introduction of restrictions.

Another limitation of the study was the lack of a control group. We did not manage to achieve this because all the NH patients were covered by the rehabilitation program at the time when the research was carried out. Therefore, we did not have access to NH patients who did not receive physical therapy. After that time, the Covid-19 pandemic began, and we were unable to continue the study.

Conclusions

1. In the study group, there was a significant relationship between the functional status and physical health of NH patients undergoing physiotherapy.

2. Systematic 3-month physiotherapy significantly improves the functional and physical condition of elderly patients.

3. The CGA is a tool that can be used for evaluating the efficacy of NH rehabilitation of elderly patients.

Acknowledgments

Disclosure statement
The authors has any financial interest or received any financial benefit from this research.

No author has any financial interest or received any financial benefit from this research.

Conflict of interest
The authors state no conflict of interest.

References

1. Dziuban A. Social image of old age and perception of one's own body in the process of aging. Literature review [in Polish]. Gerontol Pol. 2010;18(3):140–147.
2. The Lancet Editorial. Global elderly care in crisis. Lancet. 2014;383(9921):927; doi: 10.1016/S0140-6736(14)60463-3.
3. Gladman JRF. The international classification of functioning, disability and health and its value to rehabilitation and geriatric medicine. J Chin Med Assoc. 2008;71(6):275–278; doi: 10.1016/S1726-4901(08)70122-9.
4. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, et al. Sarcopenia. European consensus on definition and diagnosis. Age Ageing. 2010;39(4):412–423; doi: 10.1093/ageing/afq034.
5. van Kan AG. Epidemiology and consequences of sarcopenia. J Nutr Health Aging. 2009;13(8):708–712; doi: 10.1007/s12603-009-0201-z.
6. Granacher U, Lacroix A, Muehlbauer T, Roettger K, Golhofer A. Effects of core instability strength training on trunk muscle strength, spinal mobility, dynamic balance and functional mobility in older adults. Gerontology. 2013;59(2):105–113; doi: 10.1159/000343152.
7. McGough EL, Logsdon RG, Kelly VE, Teri L. Functional mobility limitations and falls in assisted living residents with dementia: physical performance assessment and quantitative gait analysis. J Geriatr Phys Ther. 2013;36(2):78–86; doi: 10.1519/JPT.0b013e318268de7f.
8. Katch VL, McArdle WD, Katch FI. Essentials of Exercise Physiology. 4th ed. Lippincott Williams and Wilkins, Wolters Kluwer business; 2011:595–630.
9. Ghisla MK, Cossi S, Timpini A, Baroni F, Facchi E, Marengoni A. Predictors of successful rehabilitation in geriatric patients: subgroup analysis of patients with cognitive impairment. Aging Clin Exp Res. 2007;19(5):417–423; doi: 10.1007/BF03324724.
10. Szczepańska-Gieracha J, Kowalska J, Malicka I, Rymaszewska J. Cognitive impairment, depressive symptoms and the efficacy of physiotherapy in elderly people undergoing rehabilitation in a Nursing Home Facility. Adv Clin Exp Med. 2010;19(6):755–764.
11. Kowalska J, Szczepańska-Gieracha J, Piątek J. Cognitive and emotional disturbances and length of stay of elderly people in a nursing home facility [in Polish]. Psychogeriatr Pol. 2010;7(2):61–70.
12. Wilkinson I., Harper A. Comprehensive geriatric assessment, rehabilitation and discharge planning. Medicine. 2021;49(1):10–16; doi: 10.1016/j.mpmed.2020.10.013.
13. Ellis G, Gardner M, Tsiachristas A, Langhorne P, Burke O, Harwood RH, et al. Comprehensive geriatric assessment for older adults admitted to hospital. Cochrane Database Syst Rev. 2017;12;9(9):CD006211; doi: 10.1002/14651858.CD006211.pub3.
14. Rose D, Jones C, Lucchese N. Predicting the ability of falls in community-residing older adults using the 8- foot up & go: a new measure of functional mobility. J Aging Phys Act. 2002;10(1):466–475; doi: 10.1123/japa.10.4.466.
15. McGivney SA, Mulvihill M, Taylor B. Validating the GDS depression screen in the nursing home. J Am Geriatr Soc. 1994;42(5):490–492; doi: 10.1111/j.1532-5415.1994.tb04969.x.
16. Snowdon J, Lane F. Use of the Geriatric Depression Scale by nurses. Aging Ment Health. 1999;3(3):227–234; doi.org/10.1080/13607869956181; doi.org/10.1080/13607869956181.
17. Folstein MF, Folstein SE, McHugh PR. "Mini-Mental State": a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–198; doi: 10.1016/0022-3956(75)90026-6.
18. Sosnowski M, Chmara-Pawlińska R. An assessment of functions of ADL Index and MMSE in patients with various demention syndroms of different origin [in Polish]. Med Rodz. 2002;5:176–178.
19. Lawton MP, Brody EM. Assessment of older people: self- maintaining and instrumental activities of daily living. Gerontologist. 1969;9(3):179–186.
20. Guigoz Y. The Mini-Nutritional Assessment (MNA®) review of the literature – what does it tell us? J Nutr Health Aging. 2006;10(6):466–487.
21. Rogowski Ł, Kusztal M, Gołębiowski T, Bulińska K, Zembroń-Łacny A, et al. Nutritional assessment of patients with end-stage renal disease using the MNA scale. Adv Clin Exp Med. 2018;27(8):1117–1123; doi: 10.17219/acem/75604.
22. Norton D. Norton revised risk score. Nurs Times. 1987;83:6–21.
23. Szewczyk TM, Cwajda J, Cierzniakowska K, Stodolska A, Ślusarz R. Pressure ulcers risk assessment tools [in Polish]. Przew Lek. 2005;8(1):92–97.
24. Van Marum RJ, Germs P, Ribbe MW. Norton's decubitus risk score in a nursing home. Tijdschr Gerontol Geriatr. 1992;23(2):48–53.
25. Evans M, Mottram P. Diagnosis of depression in elderly patients. Adv Psychiatr Treat. 2000;6(1):49–56; doi: 10.1192/apt.6.1.49.
26. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer VO. Development and validation of geriatric depression screening scale. J Psychiatr Res. 1982–1983;17(1):37–49; doi: 10.1016/0022-3956(82)90033-4.
27. Köpke S, Meyer G. The Tinetti Test: Babylon in geriatric assessment. Z Gerontol Geriatr. 2006;39(4):288–291; doi: 10.1007/s00391-006-0398-y.

28. Tinetti M.E. Performance-oriented assessment of mobility problems in elderly patients. J Am Geriatr Soc. 1986; 34:119–126; doi: 10.1111/j.1532-5415.1986.tb05480.x.

29. Ferguson GA, Takane Y. Statistical Analysis in Psychology and Education [in Polish]. Warszawa: PWN; 2009.

30. Heller T, Sorensen A. Promoting healthy aging in adults with developmental disabilities. Dev Disabil Res Rev. 2013;18(1):22–30; doi: 10.1002/ddrr.1125.

31. Rams P, Szejna A, Braczkowski R, Wantuła T. Comprehensive geriatric assessment as a multidirectional diagnostic process in the elderly [in Polish]. Rehabil Prakt. 2011;2(5):14–17.

32. The British Geriatrics Society. The Comprehensive Geriatric Assessment Toolkit for Primary Care Practitioners. 2019, 20.

33. Nourhashémi F, Andrieu S, Gillette-Guyonnet S, Vellas B, Albarède JL, Grandjean H. Instrumental activities of daily living as a potential marker of frailty: a study of 7364 community-dwelling elderly women. J Gerontol A Biol Sci Med Sci. 2001;56(7):448–453; doi: 10.1093/gerona/56.7.m448.

34. Nykanen I, Lönnroos E, Kautiainen H, Sulkava R, Hartikainen S. Nutritional screening in a population-based cohort of community-dwelling older people. Eur J Public Health. 2013;23(3):405–409; doi: 10.1093/eurpub/cks026.

35. Cierzniakowska K, Szewczyk T, Łabuńska A, Michalak S, Popow A, Jawień A. The Doreen Norton scale for assessing risk of pressure ulcers [in Polish]. Leczenie Ran. 2011;8(1):7–13.

36. Borowicz A, Wieczorkowska-Tobis K. Assessment of the risk of falling in the elderly in a rehabilitation ward [in Polish]. Geriatria. 2011;5:13–18.

37. Welsh TJ, Gordon AL, Gladman JR. Comprehensive geriatric assessment – a guide for the non-specialist. Int J Clin Pract. 2014;68(3):290–293; doi: 10.1111/ijcp.12313.

38. Nord M, Lyth J, Alwin J, Marcusson J. Costs and effects of comprehensive geriatric assessment in primary care for older adults with high risk for hospitalisation. BMC Geriatr. 2021;21:263; doi: 10.1186/s12877-021-02166-1.

39. Garrard JW, Cox NJ, Dodds RM, Roberts HC, Sayer AA. Comprehensive geriatric assessment in primary care: a systematic review. Aging Clin Exp Res. 2020;32(2): 197–205; doi: 10.1007/s40520-019-01183-w.

40. Pilotto A, Cella A, Pilotto A, Daragjati J, Veronese N, Musacchio C, et al. Three decades of comprehensive geriatric assessment: evidence coming from different healthcare settings and specific clinical conditions. J Am Med Dir Assoc. 2017;18(2):192.e1–192.e11; doi: 10.1016/j.jamda.2016.11.004.