



The A-test: assessment of functional recovery during early rehabilitation of patients in an orthopedic ward – content, criterion and construct validity

A-test: procena funkcionalnog oporavka tokom rane rehabilitacije bolesnika na ortopedskom odeljenju – validnost sadržaja, kriterijuma i konstrukcije

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Abstract

Background/Aim. The A-test was designed for assessment of functional recovery during early rehabilitation of patients in an orthopedic ward. This performance-based test consists of 10 items for assessing basic activities by a six level ordinal scale (0–5). Total scores can range from 0 to 50, i.e. from inability to perform any activity despite the help of therapists to complete independence and safety in performing all activities. The aim of this study was to examine the A-test validity. **Methods.** This prospective study was conducted in an orthopedic ward and included 120 patients [60 patients with hip osteoarthritis that underwent arthroplasty and 60 surgically treated patients with hip fracture (HF)] during early inpatient rehabilitation (1st–5th day). Validity was examined through 3 aspects: content validity – floor and ceiling effect, range, skewness; criterion validity – concurrent validity [correlation with the University of Iowa Level of Assistance Scale (ILAS) for patients with hip osteoarthritis, and with the Cumulated Ambulation Score (CAS) for patients with HF, Spearman rank correlation] and predictive validity [the New Mobility Score (NMS) 4 weeks after surgery, Mann-Whitney *U* test]; construct validity – 4 hypotheses: 1) on the fifth day of rehabilitation in patients underwent arthroplasty due to hip osteoarthritis, the A-test results will strongly correlate with those of ILAS, while the

correlation with the Harris hip score will be less strong; 2) in patients with HF, the A-test results will be significantly better in those with allowed weight bearing as compared to patients whom weight bearing is not allowed while walking; 3) results of the A-test will be significantly better in patients with hip osteoarthritis than in those with HF; 4) the A-test results will be significantly better in patients younger than 65 years than in those aged 65 years and older. **Results.** The obtained results were: low floor (1%) and ceiling (2%) effect, range 0–50, skewness 0.57, strong correlation with ILAS for the patients with hip osteoarthritis ($r = -0.97, p = 0.000$) and with CAS for the patients with hip fracture ($r = 0.91, p = 0.000$). The patients with the A-test score 35 and more on the fifth day of rehabilitation ($n = 46, Md = 4$) had significantly higher NMS rank 4 weeks after surgery than the patients with the A-test score less than 35 ($n = 59, Md = 2$), ($U = 379, z = -6.47, p = 0.000, r = 0.63$). All 4 hypotheses were confirmed. **Conclusion.** The A-test is simple and valid instrument for everyday evaluation of pace and degree of functional recovery during early rehabilitation of patients surgically treated in an orthopedic ward.

Key words:

hip prosthesis; orthopedic procedures; postoperative period; physical therapy; recovery of function; predictive value of the tests.

Apstrakt

Uvod/Cilj. A-test je dizajniran za procenu funkcionalnog oporavka bolesnika na ortopedskom odeljenju. Ovaj *performance-based* test sastoji se od 10 stavki za procenu 10 bazičnih aktivnosti uz pomoć šestostepene ordinalne skale (0–5). Ukupni skor je u opsegu od 0 do 50, tj. od nesposobnosti bolesnika da izvede bilo koju osnovnu aktivnost uprkos pomoći fizioterapeuta do potpune samostalnosti i sigurnosti

pri izvođenju svih osnovnih aktivnosti. Cilj ove studije bio je da se ispita validnost A-testa. **Metode.** Ova prospektivna studija sprovedena je na ortopedskom odeljenju i obuhvatila je 120 bolesnika (60 bolesnika sa osteoartritisom kuka kojima je učinjena artroplastika kuka i 60 hirurški lečenih bolesnika sa prelomom kuka) tokom rane rehabilitacije (1–5. dan). Validnost A-testa bila je ispitana kroz 3 aspekta: validnost sadržaja – efekat poda i plafona (*floor and ceiling effect*), opseg, asimetrija distribucije rezultata; validnost kriterijuma

– konkurentna validnost [korelacija sa skalom *The University of Iowa Level of Assistance Scale* (ILAS) za bolesnike sa osteoartritisom kuka i sa skalom *The Cumulated Ambulation Score* (CAS) za bolesnike sa prelomom kuka, Spearman-ova rank korelacija] i prediktivna validnost [*The New Mobility Score* (NMS) 4 nedelje nakon operacije, Mann-Whitney U-test]; validnost konstrukcije – ispitane su 4 hipoteze: 1) 5. dana rehabilitacije kod bolesnika kojima je urađena artroplastika zbog osteoartritisa kuka rezultati A-testa biće u jačoj korelaciji nego sa *Harris hip* skorom; 2) kod bolesnika sa prelomom kuka rezultati A-testa biće značajno bolji kod onih kojima je dozvoljen oslonac na operisanu nogu toikom hoda nego kod onih kojima to nije dozvoljeno; 3) rezultat A-testa biće značajno bolji kod bolesnika sa osteoartritisom kuka nego kod onih sa prelomom kuka; 4) rezultati A-testa biće značajno bolji kod bolesnika mlađih od 65 godina nego kod onih koji imaju ≥ 65 godina. **Rezultati.** Ustanovljen je ni-

zak pod (1%) i plafon (2%) efekt, opseg 0–50, koeficijent asimetrije 0,57, kao i snažna korelacija sa ILAS-om za bolesnike sa osteoartritisom kuka ($r = -0,97$, $p = 0,000$) i sa CAS-om za bolesnike sa prelomom kuka ($r = 0,91$, $p = 0,000$). Bolesnici koji su imali skor A-testa veći od 35, petog dana nakon operacije ($n = 46$, $Md = 4$) imali su značajno veći NMS skor 4 nedelje nakon operacije od bolesnika sa skorom A-testa manjim od 35 ($n = 59$, $Md = 2$), ($U = 379$, $z = -6,47$, $p = 0,000$, $r = 0,63$). Sve četiri hipoteze su potvrđene. **Zaključak.** A-test je jednostavan i validan instrument za svakodnevno praćenje brzine i stepena funkcionalnog oporavka tokom rane rehabilitacije hirurški lečenih ortopedskih bolesnika.

Ključne reči:

kuk, proteza; ortopedske procedure; postoperativni period; fizikalna terapija; funkcija, povratak; testovi, prognostička vrednost.

Introduction

Patients in an orthopedic ward are heterogeneous, and this is the situation in all general hospitals. Surgical treatment is followed by early rehabilitation which usually lasts a short time, only a few days¹. Adequate assessment of the functional recovery of patients in this period is important, not only for monitoring regaining functional ability, but also for an adequate (proper) dosage of physiotherapy and planning further rehabilitation. Simple instruments are needed to monitor the rehabilitation process, presenting the results of the work, and conducting clinical studies². However, there are but a few tests that cover this period of rehabilitation³.

A test that is the most adapted to the period of early rehabilitation is the University of Iowa Level of Assistance Scale (ILAS)^{4,5}. Its good to moderate validity, reliability and responsiveness were shown in the group of patients after hip and knee arthroplasty. The test assesses the four main activities through a seven-level ordinal scale (0–6) and walking speed. To calculate walking speed, stopwatch and path, length of exactly 13.4 m are required, which makes it complicated for everyday use, but also for clinical research. Thus, in an investigation of factors predictive of independence in transfers and ambulation after a hip fracture, only three basic functions of this test were used⁶.

A few years ago, a Danish-Swedish team designed and tested the Cumulated Ambulation Score (CAS). This test is used to evaluate functional recovery in the first days after the surgical treatment of hip fractures⁷⁻⁹. The CAS measures the three main activities: getting up and returning to bed, sitting down and standing up from a chair and walking. In evaluating each activity, a three-level ordinal scale is used (0–2). The CAS has a good reliability^{9,10} and is a valid predictor of postoperative morbidity, mortality and rehabilitation⁸. The CAS is simple and applicable in daily practice. Although simplicity is a feature that attracted us to this test, it seemed to us that the test is too easy and that patients will quickly and easily reach the maximum score.

While the validity and reliability of the ILAS were tested in patients with hip and knee arthroplasty, CAS was examined in patients surgically treated for hip fractures. These two populations make up the majority of patients in our Orthopedic Ward. We needed one general test that would be valid and reliable in both populations, and whose simplicity would allow us to easily apply it every day. Therefore, we designed a test that could help in functional recovery assessment of patients in the Orthopedic Ward.

Ten years ago, we designed a test for assessment 9 basic activities that a patient needs to regain in this period. The tenth item of the test is walking endurance. Activities are evaluated using the six-ordinal scale (0–5). Total scores can range from 0 to 50, i.e. from inability to perform any activity despite the help of therapists to complete independence and safety in performing all the activities. The test was called A-test (“A” like Activity or Assessment). The A-test was first used in the study to assess the effects of preoperative physical therapy and education of patients who were scheduled for hip arthroplasty¹⁰. Then we continued to use it in everyday practice in the Orthopedic Ward.

The aim of this study was to examine the validity of the A-test through the evaluation of the functional abilities of patients who had been surgically treated for hip fractures and osteoarthritis.

Methods

Subjects

This prospective study was conducted in the Clinic for Orthopedic Surgery and Traumatology (COST), Military Medical Academy, Belgrade, and included 120 patients: 60 patients with acute hip fracture of both sexes who were, before the injury, able to walk with or without aids and up and down stairs (help of another person was allowed for this activity). This study did not include patients with dementia, pathological hip fracture, bilateral hip fractures, concurrent fracture in any other part of the body, and patients to whom surgical treatment was contraindicated; 60 patients who un-

derwent hip arthroplasty due to osteoarthritis, without significant mental disability, who were, before the operation, able to walk with or without aids and up- and downstairs (help of another person was allowed for this activity).

Exclusion criteria during the study were the occurrence of intraoperative or postoperative complications that prevented or delayed the beginning of rehabilitation, lethal outcome immediately after surgery and incomplete collected data for individual patient.

Procedure

All the patients were treated surgically. The modality of treatment depended on the type of fracture: osteosynthesis with dynamic hip screw was applied in patients with intertrochanteric fracture, and arthroplasty was performed in patients with fractures of the femoral neck (partial arthroplasty for older than 70 and total arthroplasty for younger than 70). All the patients admitted for arthritis of the hip underwent arthroplasty.

After the surgery, all the patients had the same rehabilitation treatment involving early mobilization of the patients at the bedside (from the first postoperative day, unless it does not allow the general condition of the patients), progressive verticalization (in accordance with the possibilities of the patient), walking with aids on the flat as well as up- and downstairs, practicing the basic activities of daily living (using the toilet, sitting down in a chair). Daily physical therapy treatment lasted 30 minutes, and it was implemented every day, except at the weekend. The modality of surgery determined allowable weight bearing when walking.

On admission, from all patients data on comorbidity and used drugs, mental and functional status before injury (for the patients with hip fracture) or on admission for the patients with hip osteoarthritis walking distance, the ability to walk up- and downstairs, use of walking aids, carrying out basic and instrumental activities, as well as socio-epidemiological data (marital status, housing conditions) were collected. Assessment of mental status was made using the Serbian version of shortened mental test score¹¹, while the functional status before injury was assessed by the New mobility score (NMS)¹². Also, in the group of the patients with hip fracture assessment of general health status before arrival in hospital was done with Barthel index (BI)¹³. For the patients scheduled for hip arthroplasty, Harris hip score (HHS)¹⁴ and Oxford hip score (OHS)¹⁵ were used for estimation of osteoarthritis severity.

In the postoperative period, from the first day of rehabilitation until discharge, assessment of functional abilities of all patients was performed by the A-test, ILAS and CAS. In addition, the functional status of the patients who underwent arthroplasty due hip osteoarthritis was assessed with the HHS, as well as of the patients with surgically treated hip fracture with BI. In this report, we used only the results of the HHS gathered for the fifth day of rehabilitation.

By the protocol, postoperative complications that were slowed down the course of rehabilitation, the number of days of treatment and duration of hospitalization after surgery were recorded.

Finally, in order to investigate the predictive value of this test, four weeks after the surgery, the recovery of all the patients who underwent hip arthroplasty due hip osteoarthritis was assessed with the OHS, and for surgically treated patients with hip fracture assessment of recovery was done with BI. In addition, the functional status of all the patients was assessed with the NMS.

We conducted this research with the approval of the competent local Ethics Committee.

Measurement

The A-test is a performance-based test that assesses 10 activities necessary for everyday life that patients need to achieve in the first days after the surgery: turn to the side, from supine to sitting position, getting out of bed, go back to bed, standing, walking with aids, use of toilet and dining room chairs, walking up- and down stairs, walking endurance.

Depending on the success of performance, a patient is evaluated from 0 to 5 for each activity: score 5 – fully independent and secure; score 4 – completely independent but insecure (while performing activities, a patient needs the presence of another person, for example a family member); score 3 – activity performed with verbal suggestions of therapists; score 2 – requires adherence by a physiotherapist; score 1 – need full assistance of a physiotherapist; score 0 – activity is not achieved.

Walking endurance is graded in a slightly different way: score 5 – a patient walks more than 100 meters; score 4 – a patient walks from 50 to 100 meters; score 3 – a patient walks from 20 to 50 meters; score 2 – a patient walks from 5 to 20 meters; score 1 – a patient walks across the room (up to 5 meters); score 0 – activity is not achieved.

For ease of grading walking endurance, we had a landmark in the hospital: score 5 – several times cross hospital corridor, score 4 – once cross hospital corridor, score 3 – two times cross ward hallway, score 2 – once cross ward hallway, score 1 – the patient walks across the room, score 0 – activity is not achieved.

The maximum sum is 50, which means that a patient is independent and secure in the performance of all activities envisaged in the early rehabilitation. The test is simple, convenient, taking no additional time and no additional equipment.

Validity

Validity or the extent to which an instrument measures what it intends to measure was examined from several aspects.

Content validity

The A-test was designed in 2002 in order to adequately assess and present the results of early rehabilitation in orthopedic ward. The form and content of the A-test were proposed by the physiatrist, while a group of experts, consisting of 4 physical therapists, 3 psychiatrists and an orthopedic surgeon, supported the contents of the test with minor descriptions adjustments of each item. Initially, the A-test was used

for monitoring patients of interest for some studies. Since 2007 the A-test has been used in the routine practice of the rehabilitation team in the Orthopedic Ward. From January 2012 A-test has been an integral part of "Rehabilitation List" which is used for assessing the results of early rehabilitation of all patients in our hospital.

The A-test assesses the basic functions that a patient should regain during early rehabilitation in an orthopedic ward. Content validity is an extent to which an instrument contains items critical or appropriate to construct being measured². Content validity is present when instrument fits for intended use and adequately covers measured domain with its items. An instrument that demonstrates content validity uses the full range of test results with a small asymmetry in the distribution of results and has a low ceiling and floor effect. We thought that the A-test would have a satisfactory content validity if its results collected from the first to fifth day of early rehabilitation (as it usually lasts in COHT) ranged from 0 to 50, if the distribution was such that the skew values were less than 1.00, and if less than 15% of the result had the minimum or maximum total scores of the test².

We examined, per days of rehabilitation, what ceiling and floor effect of the A-test, ILAS and CAS was for all patients and separately for patients with hip osteoarthritis and patients with hip fracture. By this, we intended to verify whether all these tests can be applied to all patients, and whether and when their measurable domain ends.

Criterion validity

Concurrent validity and predictive validity were examined within criterion validity.

Concurrent validity refers to the ability of an instrument to assess the current state of a patient. The instrument is compared with the existing measurement tool (the criterion). Since the validity of the ILAS was confirmed in patients after hip and knee arthroplasty, we examined the correlation between the A-test and ILAS in patients with hip osteoarthritis who had underwent arthroplasty. On the other hand, the validity of the CAS has been demonstrated in patients with hip fracture, so we correlated the A-test results with results of the CAS in this patient group. The magnitude and direction of the association between the results were calculated using the Spearman's rank correlation. The value of rho between 0.10 and 0.29 pointed to weak, from 0.30 to 0.49 to moderate, and from 0.50 to 1.00 to strong correlation. Statistical analyses were performed using SPSS version 10.0.

Predictive validity refers to the ability of the instrument to predict the future condition of a patient. In order to examine it, all the patients were evaluated using the NMS 4 weeks after surgery. Further, the overall condition of the patients surgically treated due to hip fracture was assessed with the BI, and patients who underwent hip arthroplasty due to osteoarthritis completed the OHS. The results of the OHS were calculated on

http://www.orthopaedicscore.com/scorepages/oxford_hip_score.html, where the score range is from 0 to 48, a higher score indicating better function of the joint. Based on the A-test results

of the fifth rehabilitation day, the patients were divided into two groups. The patients with A-test score 35 and higher made up the first group. These patients performed most activities independently and the help of the physiotherapist was reduced to verbal suggestion for some activities. The patients with the score less than 35 formed the group II. The physiotherapist's help in performing some or all activities from the early rehabilitation program was required by these patients. In this way, we divided all the patients and particularly the patients with hip fractures and hip osteoarthritis. We analyzed whether the two groups differ in the results of NMS, BI and OHS 4 weeks after operation. The differences between the groups were tested using the Mann-Whitney *U*-test.

Construct validity

Construct validity is present when there is a relationship between the instrument and various hypotheses. In order to confirm the construct validity, we set up several hypotheses to examine the relationship between A-test and other measures and parameters of the observed population.

The first hypothesis was: on the fifth day of rehabilitation in the group of patients who underwent arthroplasty due to hip osteoarthritis, the A-test results will strongly correlate with the results of ILAS, while the correlation with the Harris hip score will be less strong. To test this hypothesis, we used Spearman's rank correlation.

The second hypothesis was: for patients with hip fracture, the A-test results will be significantly better in patients with allowed weight bearing as compared to patients whom weight bearing is not allowed while walking.

The third hypothesis was: the A-test results will be significantly better for patients with hip osteoarthritis compared to the A-test results of patients with hip fracture.

The fourth hypothesis was: the A-test results will be significantly better in patients younger than 65 years compared to patients aged 65 years and older.

We tested the results between the groups for the second, third and fourth hypothesis by Mann-Whitney *U*-test.

Results

Out of 120 patients included in the study, 15 patients (10 with hip fracture and 5 with osteoarthritis of the hip) were excluded during the study: 2 patients with intertrochanteric fracture were excluded due to poor operative stabilization of the fracture and orthopedic surgeon recommendations to rest after surgery, 2 patients with hip fracture were excluded due to cardiac disorders and recommendations of cardiologists to delay mobilization, 3 patients (2 with hip fracture and one with osteoarthritis) were excluded because of the debilitating diarrhea, severe electrolyte imbalances and extreme hypotension so physiatrist recommended postponing initiation of early rehabilitation, in 1 patient with hip fracture and with symptoms of pulmonary embolism, early rehabilitation was interrupted in the first days after surgery as recommended by pulmonologists, 4 patients died in the first days after surgery (3 patients with hip fracture and one with

osteoarthritis of the hip), 3 patients with osteoarthritis had no completely collected data (hospital discharge was performed before the seventh day after surgery).

We did not delay the start of early rehabilitation because of complications occurred in other patients such were: confusion, gastric complaints, hypotension, urinary tract infection, short-term diarrhea, the occurrence of pressure ulcers in the sacral region and on the feet, vomiting.

Demographic characteristics, comorbidity, mental and functional status before admission (for the patients with hip osteoarthritis) or injury (for the patients with hip fracture), hospital stay and duration of early rehabilitation are shown in Table 1. Due to the large influx of patients in the Orthopedic Ward, patients were discharged relatively quickly, so most patients in both populations had only 5 days of early rehabilitation.

Content validity

All A-test results obtained from first to fifth day of early rehabilitation (105 patients × 5 days of rehabilitation = 525 measurements) were in the maximum possible range from 0 to 50, skewness was 0.57, 1% of the results had a minimum total score and 2% had the maximum total scores, which fulfilled our criteria for good content validity.

The A-test and ILAS had low floor and ceiling effect observed for the whole population, from the first to the fifth day of rehabilitation (Table 2).

The result was similar when analyzed separately the total scores of patients with hip fracture and osteoarthritis. From the third day of rehabilitation, CAS has expressed ceiling effect observed in the results of the entire patient population (21% on the third day – 40% on the fifth day of rehabilitation). A similar result was observed in the group of patients with osteoarthritis from the second day of rehabilitation (22% on the second day – 64% on the fifth day of rehabilitation). But even for the patients with hip fracture, ceiling effect has been increased on the fifth day of rehabilitation, when almost approaching the given criterion of 15%.

Criterion validity

Concurrent validity

Analyzing all data collected during early rehabilitation of patients undergoing arthroplasty due to hip osteoarthritis (55 patients × 5 days of rehabilitation = 275 measurements with each test) we noticed a strong negative correlation between total scores of the A-test and ILAS ($r = -0.97$, $n = 275$, $p = 0.000$). The correlation is negative because the higher the

Table 1
Demographic characteristics, comorbidity, mental and functional status before admission injury, living environment, hospital stay and rehabilitation duration

Parameters	The group of patients with osteoarthritis of hip (n = 55) [mean ± SD; median (range) or number, percent]	The group of patients with hip fracture (n = 50) [mean ± SD; median (range) or number, percent]	p
Age (years)	65 ± 12; 53 (32–85)	75 ± 10; 76 (47–89)	0.000*
Female	32 (58%)	37 (74%)	0.088†
Number of comorbid diseases	1 ± 1; 1 (0–4)	2 ± 1; 2 (0–4)	0.005*
Number of used drugs	2 ± 2; 2 (0–8)	3 ± 2; 3 (0–9)	0.083*
Shortened mental test score (Serbian version)	10 ± 0; 10 (10–10)	9.84 ± 0.51; 10 (8–10)	0.017‡
New Mobility Score	7 ± 2; 6 (2–9)	7 ± 2; 9 (1–9)	0.009‡
Limited walking distance	41 (74.5%)	26 (52%)	0.016†
Aids when walking	28 (51%)	16 (32%)	0.050†
Up and down stairs with difficulty:	51 (93%)	32 (64%)	0.000†
Lives in the flat without elevator	18 (33%)	14 (28%)	
Lives alone	7 (13%)	10 (20%)	
Hospital stay (days)	7.44 ± 1.08, 7 (7–12)	8.52 ± 3.40, 7 (7–24)	0.035*
Rehabilitation (days)	5.25 ± 0.78, 5 (5–10)	6.20 ± 2.28, 5 (5–16)	0.007*
5 days of rehabilitation	46 (84%)	33 (66%)	

*t-test; †Pearson's Chi-Square; ‡Mann Whitney Test

Table 2
Floor and ceiling effect of the A-test, the University of Iowa Level of Assistance Scale (ILAS) and the Cumulated Ambulation Score (CAS)

Patients	Score	Day of rehabilitation														
		1 st	2 nd	3 rd	4 th	5 th	1 st	2 nd	3 rd	4 th	5 th					
All patients (n = 105)	Minimal (%)	3	1	1	1	0	0	1	2	3	3	12	3	2	3	1
	Maximal (%)	0	0	1	3	5	9	2	2	3	1	2	12	21	35	40
Patients with hip osteoarthritis (n = 55)	Minimal (%)	0	0	0	0	0	0	2	4	6	6	4	0	0	0	0
	Maximal (%)	0	0	2	6	9	4	0	0	0	0	4	22	36	60	64
Patients with hip fracture (n = 50)	Minimal (%)	6	2	2	2	0	0	0	0	0	0	22	6	4	6	2
	Maximal (%)	0	0	0	0	0	14	4	4	6	2	0	2	4	8	14

A-test the total scores indicate better functioning ability, which is reversed in the ILAS.

Also, all collected results of the A-test and CAS for patients after surgically treated hip fractures strongly correlated ($r = 0.91$, $n = 250$, $p = 0.000$).

Predictive validity

The patients with the A-test score 35 and more on the fifth day of rehabilitation ($n = 46$, $Md = 4$) had a significantly higher NMS rank 4 weeks after surgery than patients with the A-test score less than 35 ($n = 59$, $Md = 2$), ($U = 379$, $z = -6.47$, $p = 0.00$, $r = 0.63$).

In the group of patients who had been surgically treated due to hip osteoarthritis, patients with the A-test score 35 and more on the fifth day of rehabilitation ($n = 37$, $Md = 36$) had a significantly better OHS rank 4 weeks after the surgery than patients with the A-test score less than 35 ($n = 18$, $Md = 29$), ($U = 125$, $z = -3.74$, $p = 0.00$, $r = 0.51$).

Also, in the group of patients who had been surgically treated for hip fractures, Mann Whitney *U*-test revealed a significant difference in BI rank 4 weeks after the surgery in the patients with the A-test score 35 and higher ($n = 9$, $Md = 95$) compared with these with the A-test scores of less than 35 ($n = 41$, $Md = 80$) on the fifth day of rehabilitation, ($U = 19:50$, $z = -4.20$, $p = 0.00$, $r = 0.59$).

Construct validity

All four hypotheses were confirmed.

The first hypothesis: on the fifth day of rehabilitation in the group of patients with arthroplasty due to hip osteoarthritis, the A-test results strongly correlated with the results of ILAS ($\rho = -0.94$, $n = 55$, $p = 0.000$), while the correlation with the Harris hip score was moderate ($\rho = 0.49$, $n = 55$, $p = 0.000$).

The second hypothesis: on the fifth day of rehabilitation, in the group of patients with hip fracture, the A-test scores rank was significantly better in patients with allowed weight bearing ($n = 26$, $Md = 22$) as compared to patients whom weight bearing was not allowed while walking ($n = 24$; $Md = 7.5$) ($U = 112.00$, $z = -3.89$, $p = 0.000$, $r = 0.52$).

The third hypothesis: the A-test scores rank was significantly higher for patients with hip osteoarthritis compared to the A-test scores rank of patients with hip fracture during early rehabilitation (Table 3).

The fourth hypothesis: the A-test results were significantly better in the patients younger than 65 ($n = 33$, $Md = 44$) compared to the patients aged 65 and older ($n = 72$, $Md = 19.5$) ($U = 449.50$, $z = -5.10$, $p = 0.000$, $r = 0.50$).

Discussion

This study investigated the validity of the A-test in the assessment of functional recovery of patients treated surgically due to hip fracture and osteoarthritis in an orthopedic department. In the Orthopedic Ward, the patients with different clinical entities were managed, but two large groups of patients dominated: the patients with arthroplasty due to osteoarthritis of the hip and the patients treated surgically for hip fractures. It may be noted that these two groups of patients are quite different in premorbid characteristics. The patients with hip fracture were significantly older and with more associated diseases. They also had occasional mild mental difficulties before injury, mostly related to the recall of new information, while patients scheduled for arthroplasty had perfectly satisfactory mental state. The patients with hip fracture had good mobility before the injury, even better than the patients with osteoarthritis. However, their stay in hospital lasted longer after the surgery, and therefore early rehabilitation was longer. These two groups also differed in the degree and pace of recovery after the surgery. Despite these differences, both groups of patients experienced the same type of functional disability after surgery. Our test was based on the assessment of their ability. Could they indeed be assessed by the same instrument?

The floor and ceiling effects that are usually considered within content validity^{16,17}, provide part of the answer to this question. After analyzing the floor and ceiling effects of the A-test, ILAS and CAS results collected from the first to the fifth rehabilitation day, we can say that the content of the A-test and ILAS can cover a period of early rehabilitation in a heterogeneous patient population in an orthopedic ward. In patients with osteoarthritis of the hip, floor effect of the ILAS and ceiling effect of the A-test slightly higher than 5% appears on the fourth and the fifth day of rehabilitation. This indicates that these patients by the end of the fifth day of rehabilitation were ready for some more sophisticated tests. It can be noted that no patient in the group with hip fracture reached the maximum score during the first five days of rehabilitation. That would mean that the A-test could be used for assessing functional ability of these patients during further subacute rehabilitation. This area of the A-test application could be the subject of future research.

The CAS is primarily intended for assessment of the functional recovery of patients with hip fracture. Therefore, the expressed ceiling effect of the results of patients with hip osteoarthritis, already on the second day of rehabilitation, was not surprising. But for patients with hip fracture, ceiling

Table 3
The A-test scores from the first to the fifth day of rehabilitation – differences between patients with hip osteoarthritis and patients with hip fracture

Rehabilitation day	The group of patients with osteoarthritis of hip (n = 55) [mean ± SD, median (range)]	The group of patients with hip fracture (n = 50) [mean ± SD, median (range)]	Mann Whitney U-Test			
			U	z	p	r
1st	10 ± 9; 8 (1–42)	5 ± 5; 2 (0–17)	774.5	-3.880	0.000	0.379
2nd	22 ± 13; 18 (2–48)	10 ± 8; 7,5 (0–36)	549.0	-5.307	0.000	0.518
3rd	30 ± 13; 29 (7–50)	13 ± 10; 12 (0–43)	389.0	-6.630	0.000	0.647
4th	36 ± 12; 42 (11–50)	15 ± 13; 11 (0–47)	343.5	-6.622	0.000	0.646
5th	38 ± 12; 43 (12–50)	18 ± 14; 13,5 (1–47)	392.5	-6.308	0.000	0.615

effect also increased on the fifth day of rehabilitation, and almost reaches 15%. Therefore the application of this test remains limited to the elderly and frail patients with hip fractures with delayed recovery⁹.

Strong correlations between the A-test and ILAS and similar content validity provide a recommendation to use both tests in the early period of rehabilitation. The differences in structure between the A-test and ILAS significantly affect the feasibility of these two tests. The A-test includes more activities, but has a simpler scale. The scale is designed to remind on the grades that pupils receive during elementary and secondary school in the region. Also, the program of early rehabilitation is called "school of walking". The scoring is close to the patient and they can easily monitor their progress in the "school of walking". But in the case of the A-test, as performance-based test, it is important that the scale is not complex for the physiotherapist and does not affect the reproducibility of the results. However, what makes the ILAS difficult for everyday practice is not more complex scale, but the assessing and calculation of walking speed. To test and calculate the speed, a stopwatch, the path length of exactly 13.4 m and extra time are required. We marked the path in the hallway of the ward for research purposes. Patients with hip fracture often do not have sufficient duration when walking to get to the start of the track or to cross the entire path. There were no many complaints and observations of patients who participated in the survey for this item, but some patients sometimes simply were not willing to undergo this test.

Unlike the ILAS, during evaluation of the activities by the A-test, patients are unaware that their activities are assessed. Each activity of the A-test is an integral part of early rehabilitation program. And most importantly, the therapist, who conducts the assessment, has no additional obligation during the session. After treatment, the physiotherapist records the degree of autonomy which the patient has achieved for a particular activity from the early rehabilitation program in the A-test form. And for this activity the physiotherapist does not need more than a minute. And when the two tests have similar reliability and validity, this difference between the tests becomes very important¹⁸.

The predictive validity of our instrument is very important for planning further rehabilitation of patients and rational use of health facilities. This study showed that based on the A-test total score on the fifth day of rehabilitation, we can predict what the functional ability of patients 4 weeks after the surgery will be.

In addition, the A-test showed that it has satisfactory discriminative ability, convergent and divergent validity, which gives it a good recommendation for clinical use. The A-test and ILAS measure the same construct – patient's functional ability, and the HHS beside function, estimate pain and range of motion in the hip. Therefore we are not surprised that the A-test results strongly correlate with the results of the ILAS, while the correlation with the results of the HHS has a moderate magnitude on the fifth day of rehabilitation.

Although we tried to examine all the recommended aspects of validity^{2, 19-21}, what's missing in this study is Rasch analysis of the A-test. This will be our future task.

Conclusion

Early rehabilitation in an orthopedic ward usually lasts for a short time. However, it is an important period for the restoration of patient's functional capacity and determination of further objectives and modalities of rehabilitation. The lack of simple and easy tests for assessing functional recovery of heterogeneous population of patients in an orthopedic ward is noticeable. The results of this study show that the A-test could be a valid instrument for evaluation monitoring the pace and degree of functional recovery of surgically treated patients for hip fractures and osteoarthritis of the hip during early rehabilitation.

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