Zastosowanie wybranych testów korytarzowych w ocenie funkcji chodu dzieci i młodzieży z mózgowym porażeniem dziecięcym

The use of selected walk tests for gait assessment in children and adolescents with cerebral palsy

Mariusz Pawłowski¹, Jakub S. Gąsior¹, Marcin Bonikowski², Marek Dąbrowski¹

¹ Klinika Kardiologii Oddziału Fizjoterapii, II Wydział Lekarski, Warszawski Uniwersytet Medyczny

² Oddział Rehabilitacji Narządu Ruchu, Mazowieckie Centrum Neuropsychiatrii w Zagórzku k. Warszawy

STRESZCZENIE

Wstęp. Główne zaburzenia funkcji chodu obserwowane w grupie pacjentów z mózgowym porażeniem dziecięcym (MPD) to zmniejszenie prędkości i wytrzymałości chodu oraz brak jego stabilności. Jedną z popularnych, nielaboratoryjnych metod oceny chodu oraz efektywności leczenia usprawniającego nastawionego na poprawę wybranych jego parametrów są testy korytarzowe. Celem pracy było przedstawienie najbardziej rozpowszechnionych testów korytarzowych stosowanych w grupie pacjentów z MPD. **Metoda.** Najczęściej stosowane testy korytarzowe zidentyfikowane zostały przy użyciu medycznych baz danych EMBASE, PubMed, Cochrane i PEDro. **Testy korytarzowe.** Istnieje wiele testów korytarzowych, a wybór odpowiedniego powinien być związany z celami programu leczenia usprawniającego. Sześciominutowy test korytarzowy służy do oceny wytrzymałości i jest to odległość, jaką badana osoba może pokonać podczas swobodnego 6-minutowego marszu. Dziesięciometrowy test korytarzowy wykorzystywany jest do oceny prędkości chodu poprzez pomiar czasu, w którym badany pokonuje 10-metrowy odcinek. Test Wstań i idź ocenia mobilność i ryzyko upadku wynikające z problemów związanych z zaburzeniami stabilności podczas chodu. **Podsumowanie.** Ocena wyników i efektów leczenia nastawionego na poprawę funkcji chodu powinna być istotną częścią procesu usprawniania. Testy korytarzowe są proste do wykorzystania w praktyce klinicznej ze względu na brak kosztów oraz sprzętu niezbędnego do ich wykonania. **Wnioski.** Testy korytarzowe są proste i łatwe do przeprowadzenia, w związku z czym powinny być powszechnie przeprowadzane w praktyce klinicznej jako forma oceny funkcji chodu w grupie pacjentów z MPD.

Słowa kluczowe: chód, testy korytarzowe

ABSTRACT

Introduction. The core features of declined walking ability observed in patients with cerebral palsy (CP) is a reduction in speed and endurance and deficits in postural balance during walking. One of the most popular methods in clinical practice for non-laboratory assessment of gait dysfunction and checking effectiveness of a walking programs in group of patients with CP are walk tests. Aim of the study was to present the most popular walk tests used in group of patients with CP. **Method.** Relevant articles for this paper were identified by searching the EMBASE, PubMed, Cochrane and PEDro electronic databases. **Walk tests.** There are many walk test available and the choice of the adequate one should be related to the objectives of rehabilitation program. The 6-minute walk test evaluates endurance and it is the distance a person can walk at an unhurried, self-determined pace in 6 minutes. 10- meter walk test assesses speed of walking evaluated by the time it takes for a child to cover 10- meter section, measured in seconds. Timed Up and Go test assesses mobility and risk of falling due to balance or gait problems. **Summary.** Evaluation of the results and effects of gait treatment should be an essential part of the rehabilitation process. Walk tests are feasible to use in the clinical settings due to the lack of costs and equipment necessary for their implementation. **Conclusions.** Walk tests are simple and easy to administer therefore they should be commonly used in clinical practice in gait assessment of patients with CP.

Key words: gait, walk tests

INTRODUCTION

Abnormal motor behavior observed in children with cerebral palsy (CP) usually causes activity limitation [1] and can have detrimental effect on gait parameters in children with walking abilities [2, 3]. Some of the main features of declined walking ability in CP individuals are decreased speed, reduced endurance and deficits in postural balance during walking [4–8].

Thus, it should not be surprising, that one of the main objectives of treatment process and rehabilitation programs in group of patients with CP is the improvement of selected gait attributes including speed, endurance and balance [9, 10].

Prior to determining an intervention strategy, multidisciplinary treatment team has to decide on an appropriate outcome measures [11].

Although kinetic, kinematic and electromyographic quantitative analysis (instrumented gait analysis – IGA) is the gold standard in gait assessment, its complexity, and great knowledge requirement render its use complicated and difficult. Moreover, gait analysis systems are expensive and not generally available worldwide [12–14].

One of the most popular methods considered as a cost effective alternate for IGA in regular clinical practice for non-laboratory assessment of a walking programs in group of children with CP are observation gait scales and walk tests [6, 15].

Despite their frequent use and popularity, to our knowledge, walk tests are not commonly used as a standard clinic procedure in Poland. If the clinicians would like to make judgments about the patients progress in walking abilities and exchange experiences in this field, introduction and dissemination of these tests is required.

Therefore the aim of the study was to shortly discuss the most popular walk tests used in a group of patients with CP.

METHOD

Relevant articles for our review were identified by searching the EMBASE, PubMed, Cochrane and PEDro electronic databases. Published studies about walk tests for children with CP were identified using the following keywords: cerebral palsy and walk tests. Authors of this report decided to present the most commonly used, recommended, required no training for supervisors and available free of charge tests in the assessment of gait function in cerebral palsy (Table I).

WALK TESTS

Walk tests used in gait assessment of patients with cerebral palsy should be simple and easy to administer. It is important for clinicians to understand and follow standard procedures of testing to assess gait function properly in unified way to avoid mistakes.

There are many walk tests available, and the choice of adequate one should be related to the objectives of rehabilitation programs.

ENDURANCE ASSESSMENT IN 6-MINUTE WALK TEST (6MWT)

The 6-minute walk test (6MWT) is used to measure the distance which a person can walk at an unhurried, self-determined pace in 6 minutes. Test is simple, low tech, and well established. It has been found to be a reliable and valid measure of sub maximal exercise capacity and endurance in healthy children [16–18]. Reliability, validity, and usefulness of the 6MWT in children with CP was also proved [6, 19]. There are specific guidelines developed by the American Thoracic Society (ATS) for the unified use of 6MWT [17, 20]. Corridors dedicated for 6MWT should measure ± 30 meters (100 feet). Every 3 meter (± 10 feet) distance should be marked. The path that patient will follow should be clearly marked as well as the turnaround points (with a cone). More specific recommendations and instruction are presented in ATS statement, of which the supervisor of 6MWT should be aware [20].

Before the test, the patient should rest on a chair in a sitting position for 10 minutes. During this time, therapist should give loud and clear instructions on how the test will be conducted, and what is the patient going to do. Warm-up period before the test should not be performed. The supervisor of trial should provide the patient with necessary information like:

- test will be performed once,
- during testing, do not run,
- legs should be set before the start line,
- if you feel tired you can stop, rest and then continue the trail,
- test ends when you run out of time.

During test, individuals should wear walking aids that are customary for them. 6MWT requires practically no exercise equipment. If the weather permits, the test may be performed outdoors [21]. Significant improvement observed in 6MWT performed in community environment in comparison to physical therapy gym suggested that the 6MWT can be done in CP patients in community using GPS [22]. Study showed reproducibility, responsibility and concurrent validity of test in this steady-state conditions. The use of a treadmill for 6-minute walk testing is not recommended because patients can have problem with pacing themselves and, what is more, results are not exchangeable with walk tests performed in corridor [20].

According to most experts' opinions, based on validity and usefulness measurements, 6MWT can be used in experimental studies. Only 6% of researchers found 6MWT as not useful or valid for research [23].

SPEED ASSESSMENT IN 10-METER WALK TEST (10MWT)

Ten-meter walk test (10MWT) represents the minimum distance required for functional ambulation. The main aim of the test is to measure gait speed [6, 24] but there are studies showing that 10MWT is positively correlated with functional capacity and balance [24].

Test evaluates the time it takes for a individual to overcome 10-meter section measured in seconds. Participants run test in three trials. The first attempt is to ensure the adequate understanding of the instructions before performing two timed trials. The start line and end line should be marked with adhesive tape as proposed by Wolf et al. and Watson [24, 25]. Patients can use any walking aid that is customary for him or her. Total covered distance is divided by the time it took the individual to walk the distance.

Test supervisor should provide patient with necessary information as: “test will be performed twice”, “during testing, do not run”, “legs should be set before the start line”. The 10MWT can be performed at self selected velocity or as fast as possible. It is important to document chosen velocity (preferred vs. fast) [26].

Excellent test-retest reliability of 10MWT was confirmed for children and young adults with neuromuscular disease [27] and for normally developing young subjects [25]. Convergent validity was found to be in excellent correlation between the 10MWT and TUG and between 10MWT and 6MWT [28, 29].

BALANCE PROBLEMS DURING GAIT – TIMED UP & GO TEST (TUG)

Balance control is important for independency expressed by competence in the performance of most functional skills. Timed Up & Go test assesses mobility and risk of falling due to balance or gait problems [30].

The TUG test has been used, over time, in various types of diseases [31–33]. Although, little information was available about the use of the test in young people with disabilities, including children with CP [34]. By now, TUG has spread as an outcome measure in adults and children with CP [35, 36]. Since 2005, Williams et al. adapted test to the needs of the functional assessment of children with CP [34]. TUG was constructed to measure ability to stand, walk and sit down [34]. This examination assesses complex relation between balance and movement comprising tasks like planning, initiating and executing moves [36]. Results showed that TUG is a simple, valid and reliable measurement test [35, 37, 38].

During the TUG test, time taken for a person to stand up from a standard armchair, walk 3 meters, turn 180°, and walk back to the chair and sit down is recorded [34, 39, 40]. Williams et al. proposed to perform two trials in children with CP, recording the lowest achieved score [34].

Timed Up and Go test demonstrates good within-session and between-sessions reliability among normally developed children and in youths with CP, as well as moderate to good levels of association with other clinical measures among children with CP [34, 41]. TUG test has excellent inter-rater reliability [34] and was found to be related to the index of sway on the Pediatric Clinical Test of Sensory Interaction in Balance and the mobility functional skills and caregiver assistance sections of the Pediatric Evaluation of Disability Inventory in children with disabilities [40, 41].

Table 1. Summary of selected walk tests used in cerebral palsy.

Test	Equipment required	Duration of testing	ICF* domain
10 MWT	Stopwatch	± 5 min	Activity
6 MWT	Stopwatch, cone, measuring tape	± 10 min	Activity
TUG	Stopwatch, cone, chair with armrests	± 5 min	Activity

ICF – International Classification of Functioning

SUMMARY

Based on the clinical experience of authors of this report and the results of many studies concerning and using walk tests in children, adolescents and adults with CP, it can be stated that this kind of assessment of gait function is feasible in the clinical and research settings in group of patients with cerebral palsy. It is important to emphasize that these tests are low cost, little time-consuming, safe and practically no equipment is required.

Evaluation of the results and effects of gait treatment should be an essential part of the rehabilitation process. Results are the aftermath of actions that relate specifically to the taken therapeutic actions. Measurement of outcomes relating to therapeutic interventions can be the answer for basic questions that should concern rehabilitation team members, whether the taken action is effective and what effect is a consequence of this action. These questions are the principle for making decisions based on facts. The necessity to conduct a thorough evaluation of results is very important also because of the regular introduction of a large number of therapeutic interventions that can affect the gait treatment progress. The relative benefits of some interventions may have a marginal effect on expected function, so that a detailed analysis and comparative evaluation of its effectiveness should be prepared.

Treatment of gait problems is expensive, and in group of patients with CP may be required for a long period of time [42]. Therefore, the decision to take a specific action, which is based on short-term assessment, may have long-term economic consequences. Moreover, time for therapeutic interventions including assessment is often limited. That is why selection of one or several walk tests for gait assessment in group of patients with CP is an important process not only in clinical medicine, but also in research.

CONCLUSIONS

Widespread use of the walk tests is required in the evaluation of gait function of children with cerebral palsy and should be implemented in clinical practice.

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Correspondence:

Mariusz Pawłowski, Klinika Kardiologii Oddziału Fizjoterapii II WL Warszawskiego Uniwersytetu Medycznego, Szpital Bielański, 01-809 Warszawa, ul. Ceglowska 80, e-mail: pawlowskimariusz@o2.pl