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# PROBIRNI ALATI U DJEČJOJ FIZIKALNOJ MEDICINI

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Uvod: Rana identifikacija djece s povećanim rizikom za neurorazvojna odstupanja, uključujući cerebralnu paralizu, ključna je za pravodobno započinjanje intervencije u razdoblju najveće neuroplastičnosti. Probirni alati omogućuju brzo prepoznavanje djece koja zahtijevaju daljnju dijagnostičku obradu ili praćenje. Uspješan test probira posjeduje vrlo visoke stope specifičnosti i osjetljivosti, odnosno njegova primjena rezultira minimalnim stopama lažno pozitivnih ili lažno negativnih rezultata, te se u kontekstu neurorazvojnih poremećaja preporučuju vrijednosti osjetljivosti testa iznad 80%, a specifičnosti iznad 90%.1 Negativna prediktivna vrijednost (NPV) testa pokazuje vjerojatnost da pojedinac s negativnim probirnim testom uistinu nema traženi poremećaj, dok pozitivna prediktivna vrijednost (PPV) ukazuje na vjerojatnost da pojedinac s pozitivnim rezultatom testa uistinu ima traženi poremećaj. NPV i PPV ovise o specifičnosti i osjetljivosti testa, ali i o prevalenciji traženog poremećaja u populaciji. U kontekstu šireg populacijskog probira važnije je da korišteni test posjeduje visoku negativnu prediktivnu vrijednost, odnosno da minimalizira lažno negativne rezultate, tim više što postoje i dokazi koji govore u prilog tome da čak i djeca s lažno pozitivnim rezultatom probira (tzv. „overreferring“) mogu imati koristi od programa rane intervencije.1 Primjenjujući Wilsonove i Jungnerove kriterije za probirne testove, postavljene još 1960-ih godina (traženi poremećaj je važan zdravstveni problem, poremećaj ima prepoznatljivu ranu latentnu ili ranu simptomatsku fazu, test je prihvatljiv populaciji, postoje ustanove za liječenje itd.), možemo zaključiti da je poželjno vršiti probir djece na kliničke entitete poput teških neurorazvojnih odstupanja ili cerebralne paralize. Cerebralna paraliza (CP) klinički je entitet kojim se označava skupina neprogresivnih, motoričkih poremećaja uzrokovanih razvojnim poremećajem ili oštećenjem mozga u ranom stadiju razvoja i predstavlja uzrok težih neuromotornih odstupanja u dječjoj dobi, s prevalencijom oko 2-3/1000 živorođene djece.2 Neurorazvojno odstupanje/kašnjenje odnosi se na kašnjenje u stjecanju razvojnih prekretnica pri kojem su refleksi i živčani sustav djeteta nedovoljno razvijeni ili nezreli u određenoj fazi razvoja,3 te se klasificira kao vrlo blago, blago, umjereno i teško odstupanje.4 Rasprava: S obzirom na prirodu cerebralne paralize i neurorazvojnih odstupanja, probirni testovi su mahom klinički, a provode se od strane educiranog stručnjaka. Probirni testovi koje smo izdvojili po učinjenom pregledu literature mogu se primijeniti u svakodnevnom kliničkom radu dječjeg fizijatra zbog svoje jednostavnosti, kratkog trajanja i dobre prediktivne vrijednosti za ranu identifikaciju neurorazvojnih odstupanja. Među najčešće korištenim i validiranim probirnim

alatima izdvajaju se opća procjena spontanih pokreta (General Movements Assessment, GMA), kratka Hammersmith neurološka procjena dojenčadi (Brief Hammersmith Infant Neurological Examination, Brief-HINE), Standardized Infant NeuroDevelopmental Assessment (SINDA) te probirna procjena funkcije šake dojenčadi (screening Hand Assessment for Infants, s-HAI). Opća procjena spontanih pokreta (GMA) neinvazivna je metoda procjene kvalitete spontanih motoričkih obrazaca dojenčadi, s posebnim naglaskom na tzv. pokrete uvijanja i vrpoljenja (engl. *writhing, fidgeting*).5 Test se primjenjuje od rođenja djeteta (uključujući nedonoščad) do otprilike 20. tjedna postterminske dobi, a sama procjena temelji se na kratkoj videoanalizi koja traje nekoliko minuta. GMA ima vrlo visoku negativnu prediktivnu vrijednost, koja se u validacijskim studijama kreće iznad 95%, dok je pozitivna prediktivna vrijednost za cerebralnu paralizu u razdoblju pokreta vrpoljenja najčešće između 85 i 98%. Zbog visoke osjetljivosti i rane primjenjivosti, GMA se smatra zlatnim standardom u ranom probiru visokorizične dojenčadi. Kratka Hammersmith neurološka procjena dojenčadi (Brief-HINE) strukturirana je neurološka procjena motoričkih funkcija, posture, refleksa i tonusa, namijenjena dojenčadi u dobi od 3 do 12 mjeseci.6 Trajanje testa iznosi oko 5 minuta. Studije pokazuju visoku negativnu prediktivnu vrijednost (80–90%), dok je pozitivna prediktivna vrijednost umjerena do visoka, ovisno o graničnim vrijednostima i dobi djeteta. Brief-HINE je osobito korisna kao brza procjena u svakodnevnoj ambulanti. SINDA je standardizirani probirni test za dojenčad u dobi od 6 tjedana do 12 mjeseci, koji procjenjuje neurološke znakove, kvalitetu spontanog kretanja i razvojne domene. Provođenje testa traje oko 10-15 minuta. SINDA pokazuje visoku osjetljivost za ranu identifikaciju neurorazvojnih poremećaja, s negativnom prediktivnom vrijednošću oko 90%, dok se pozitivna prediktivna vrijednost za cerebralnu paralizu i globalna razvojna odstupanja kreće između 70 i 90%.7 Probirna procjena funkcije šake dojenčadi (s-HAI) usmjerena je na procjenu fine motorike i funkcionalne uporabe šake u dojenčadi u dobi od 3 do 12 mjeseci. Test je brz, traje 5–10 minuta, te je posebno osjetljiv za ranu detekciju unilateralnih motoričkih odstupanja. Negativna prediktivna vrijednost je visoka, dok je pozitivna prediktivna vrijednost umjerena, osobito kod djece s rizikom za hemiparezu.8 Kako je već spomenuto, probirni test ne pruža dijagnozu i interpretacija i primjena ovise o selektiranoj populaciji. Negativan probirni test pruža kliničaru relativnu sigurnost da u danom trenutku dijete ne treba daljnju potvrdnu dijagnostiku ili praćenje, dok pozitivni probirni test ukazuje na to da su takvi postupci potrebni. Ovisno o anamnezi i fizikalnom pregledu djeteta, takvi postupci mogu uključivati neuroradiološku, laboratorijsku, konzilijarnu ili drugu obradu (primjerice, MRI, UZV, mjerenje kreatin kinaze, upućivanje neuropedijatru, pedijatru genetičaru itd.), ili vršenje daljnjih potvrdnih testova u svrhu dijagnostike ili praćenja (npr. potpuni Hammersmith test, test po Nevenki Čuturić, test neuromotoričkih sposobnosti prema Matijević, test Münchenske dijagnostike itd.).4 Zaključak: Suvremeni probirni testovi u dječjoj rehabilitaciji omogućuju ranu, brzu i klinički primjenjivu identifikaciju djece s povećanim rizikom za cerebralnu paralizu ili neurorazvojne motoričke poremećaje. Alati poput GMA-e, Brief-HINE, SINDA-e i s-HAI-ja odlikuju se kratkim trajanjem,

jednostavnom primjenom i visokom negativnom prediktivnom vrijednošću. Dječji fizijatar, u suradnji s neuropedijatrom, fizioterapeutom i drugim članovima rehabilitacijskog tima ima ključnu ulogu u interpretaciji nalaza probira te u pravodobnom usmjeravanju djece s povećanim rizikom za cerebralnu paralizu ili neurorazvojne motoričke poremećaje. U trenu potvrde kriterija visokog rizika za cerebralnu paralizu ili odstupanja, intervencija treba početi što je ranije moguće, dok traje kritično vrijeme neuroplastičnosti.9 Takav koordinirani pristup omogućuje ranije započinjanje ciljane intervencije i optimizaciju dugoročnih funkcionalnih ishoda.

**ključne riječi**

probir, cerebralna paraliza, neuromotoričko odstupanje

## SCREENING TOOLS IN PEDIATRIC PHYSICAL MEDICINE

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Introduction: Early identification of children at increased risk for neurodevelopmental disorders, including cerebral palsy, is crucial for the timely initiation of intervention during the period of greatest neuroplasticity. Screening tools enable rapid identification of children who require further diagnostic evaluation or monitoring. An effective screening test demonstrates high specificity and sensitivity, meaning that its application results in minimal rates of false-positive and false-negative outcomes. In the context of neurodevelopmental disorders, sensitivity values above 80% and specificity values above 90% are recommended.[1] The negative predictive value (NPV) of a test indicates the probability that an individual with a negative screening result truly does not have the condition being assessed, whereas the positive predictive value (PPV) indicates the probability that an individual with a positive test result truly has the condition. NPV and PPV depend not only on test sensitivity and specificity but also on the prevalence of the condition in the population. In the context of large-scale population screening, high negative predictive value is particularly important, as it minimizes false-negative results. This is especially relevant given evidence suggesting that even children with false-positive screening results (so-called "overreferrals") may benefit from early intervention programs.[1] Applying the Wilson and Jungner criteria for screening tests, established in the 1960s (the condition represents an important health problem, it has a recognizable latent or early symptomatic stage, the test is acceptable to the population, treatment facilities are available, etc.), it can be concluded that screening for clinical entities such as severe neurodevelopmental disorders or cerebral palsy is desirable. Cerebral palsy (CP) is a clinical entity referring to a group of non-progressive motor disorders caused by a developmental disturbance or injury to the brain occurring in early stages of development. It represents a major cause of severe neuromotor impairment in childhood, with a prevalence of approximately 2–3 per 1,000 live births.[2] Neurodevelopmental disorder/delay refers to delayed acquisition of developmental milestones,

in which a child's reflexes and nervous system are insufficiently developed or immature at a given stage of development.[3] Such delays are classified as very mild, mild, moderate, or severe.[4] Discussion: Given the nature of cerebral palsy and neurodevelopmental disorders, screening tests are predominantly clinical and are administered by trained professionals. The screening tools identified through literature review can be applied in everyday clinical practice due to their simplicity, short administration time, and good predictive value for the early identification of neurodevelopmental disorders. Among the most commonly used and validated screening tools are the General Movements Assessment (GMA), the Brief Hammersmith Infant Neurological Examination (Brief-HINE), the Standardized Infant NeuroDevelopmental Assessment (SINDA), and the screening Hand Assessment for Infants (s-HAI). The General Movements Assessment (GMA) is a non-invasive method for evaluating the quality of spontaneous motor patterns in infants, with particular emphasis on writhing and fidgety movements.[5] The assessment is applicable from birth (including preterm infants) up to approximately 20 weeks post-term age and is based on a short video analysis lasting several minutes. GMA demonstrates a very high negative predictive value, exceeding 95% in validation studies, while its positive predictive value for cerebral palsy during the fidgety movement period most commonly ranges between 85% and 98%. Due to its high sensitivity and early applicability, GMA is considered the gold standard for the early screening of high-risk infants. The Brief Hammersmith Infant Neurological Examination (Brief-HINE) is a structured neurological assessment of motor function, posture, reflexes, and muscle tone, intended for infants aged 3 to 12 months.[6] The assessment takes approximately 5 minutes to administer. Studies report a high negative predictive value (80–90%), while the positive predictive value is moderate to high, depending on cutoff values and the infant's age. Brief-HINE is particularly useful as a rapid assessment tool in routine outpatient settings. SINDA is a standardized screening test for infants aged 6 weeks to 12 months that assesses neurological signs, quality of spontaneous movement, and developmental domains. Administration of the test takes approximately 10–15 minutes. SINDA demonstrates high sensitivity for early identification of neurodevelopmental disorders, with a negative predictive value of approximately 90%, while the positive predictive value for cerebral palsy and global developmental delay ranges between 70% and 90%.[7] The screening Hand Assessment for Infants (s-HAI) focuses on the assessment of fine motor skills and functional hand use in infants aged 3 to 12 months. The test is brief, lasting 5–10 minutes, and is particularly sensitive for the early detection of unilateral motor impairments. The negative predictive value is high, while the positive predictive value is moderate, especially in infants at risk for hemiparesis.[8] As previously noted, a screening test does not provide a diagnosis, and its interpretation and application depend on the selected population. A negative screening result provides the clinician with relative reassurance that, at that time, the child does not require further confirmatory diagnostics or follow-up, whereas a positive screening result indicates the need for such procedures. Depending on the child's medical history and physical

examination, further steps may include neuroradiological, laboratory, consultative, or other evaluations (e.g., MRI, ultrasound, creatine kinase measurement, referral to a pediatric neurologist or pediatric geneticist), or the administration of additional confirmatory tests for diagnostic or monitoring purposes (e.g., the full Hammersmith examination, the Nevenka Čuturić test, Matijević's neuromotor abilities test, the Munich Functional Developmental Diagnostics, etc.).[4] Conclusion: Contemporary screening tests in pediatric rehabilitation enable early, rapid, and clinically applicable identification of children at increased risk for cerebral palsy or neurodevelopmental motor disorders. Tools such as GMA, Brief-HINE, SINDA, and s-HAI are characterized by short administration time, ease of use, and high negative predictive value. The pediatric physiatrist, in collaboration with the pediatric neurologist, physiotherapist, and other members of the rehabilitation team, plays a key role in interpreting screening results and in the timely referral of children at increased risk for cerebral palsy or neurodevelopmental motor disorders. Once the criteria for high risk of cerebral palsy or neurodevelopmental deviation are confirmed, intervention should begin as early as possible, during the critical window of neuroplasticity.[9] Such a coordinated approach allows for earlier initiation of targeted intervention and optimization of long-term functional outcomes.

**Keywords**

screening, cerebral palsy, neuromotor delay

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