

ORIGINAL RESEARCH

Inter-rater reliability of general movements assessment in newborns treated in a neonatal intensive care unit in Colombia

Fiabilidad interevaluador de la evaluación de movimientos generales en recién nacidos atendidos en una unidad de cuidados intensivos neonatal en Colombia

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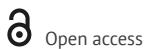
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Abstract



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Introduction: The Prechtl's method for the qualitative assessment of general movements (GMs) is a valid, reliable, and noninvasive instrument used to detect multiple neurodevelopmental and cognitive disorders, including cerebral palsy (CP). To date, no studies evaluating the inter-rater reproducibility of this method in the Colombian population have been carried out.

Objective: To evaluate the inter-rater reliability of the Prechtl's method for GMs assessment in preterm neonates and low-birth-weight full-term neonates admitted to a neonatal intensive care unit in Colombia.

Materials and methods: Diagnostic test evaluation study performed in 32 preterm neonates and low-birth-weight full-term neonates included in the kangaroo mother care program of a university hospital in Zipaquirá (Colombia) during 2023. The writhing and fidgety phases of the GMs were evaluated (2 videos per infant, 1 for each phase) by two physical therapists certified in the Prechtl's method. Inter-rater reliability was evaluated using the Cohen's Kappa index.

Results: The results showed a kappa index of 0.563 for the writhing phase (moderate agreement) and 0.624 for the fidgety phase (substantial agreement), taking into account the Landis-Koch's classification and after performing the statistical analysis using the Reliability Calculator Software (ReCal3).

Conclusion: Inter-rater reliability of the Prechtl's method for the qualitative assessment of GMs was moderate and substantial in the writhing and fidgety phases, respectively, suggesting that it is a useful instrument to detect neurological alterations in preterm neonates or low-birth-weight full-term neonates in Colombia.

Resumen

Introducción. El método de Prechtl para la evaluación cualitativa de los movimientos generales (MG) es una herramienta válida, confiable y no invasiva que permite detectar múltiples trastornos del neurodesarrollo y la cognición, incluyendo la parálisis cerebral (PC). Hasta el momento, no hay estudios que evalúen la reproducibilidad interevaluador de este método en población colombiana.

Objetivo. Determinar la fiabilidad interevaluador del método de Prechtl para la evaluación de MG en neonatos prematuros y a término con bajo peso al nacer admitidos a una unidad de cuidados intensivos neonatal de Colombia.

Materiales y métodos. Estudio de evaluación de pruebas diagnósticas realizado en 32 neonatos prematuros y a término con bajo peso al nacer incluidos en el programa de madre canguro de un hospital universitario en Zipaquirá (Colombia) durante 2023. Los MG fueron evaluados en las fases *writhing* y *fidgety* (2 videos por niño, uno para cada fase) por dos fisioterapeutas certificadas en el método de Prechtl. La fiabilidad interevaluador se evaluó con el índice Kappa de Cohen.

Resultados. Los resultados mostraron un índice kappa de 0.563 para la fase *writhing* (concordancia moderada) y de 0.624 para la fase *fidgety* (concordancia considerable) teniendo en cuenta la clasificación de Landis y realizando el análisis estadístico mediante el Software *Reliability Calculator* (ReCal3).

Conclusión. La fiabilidad interevaluador del método de Prechtl para la evaluación cualitativa de MG fue moderada y considerable en las fases *writhing* y *fidgety*, respectivamente, lo que sugiere que es una herramienta útil para detectar alteraciones neurológicas en neonatos prematuros o de bajo peso al nacer en Colombia.

Introduction

Cerebral palsy (CP) refers to a group of permanent neurological disorders that affect the ability to move and maintain balance and posture,^{1,2} and are caused by abnormal development or damage to the developing brain.¹ When the damage or abnormal development occurs before birth, it is known as congenital CP (most cases), but it can also occur during and after birth, being denominated acquired CP when it occurs 28 days after birth.¹

According to the Cerebral Palsy Alliance Research Foundation, approximately 18 million people of all ages have CP worldwide, making it the most common permanent physical disability with 1 in 345 children diagnosed with CP in the United States alone.³ Moreover, CP has been reported to be the most frequent cause of disability in infants, occurring in 1.5-2.5 per 1 000 live births, with a significantly higher prevalence in preterm newborns and in newborns with low birth weight (<1 500g).⁴

There is no unified epidemiological surveillance system for CP in Latin American children, but studies on the subject, although limited, offer an approximation to the current situation of this condition in the countries of the region. For example, in Colombia, according to data from the World Health Organization compiled by the Centro de Cirugía Especial (Center for Special Surgery) in Mexico, the prevalence of CP was 1.4% in 2017, which is equivalent to approximately 719 130 individuals with CP.⁵ Furthermore, according to the Observatorio Nacional de Discapacidad (National Disability Observatory) in Colombia, 1.24% of children aged 0-17 years had some type of disability in 2012; however, there is no specific information about the prevalence of CP in children in the country.⁶

It has been established that early diagnosis and treatment of CP significantly improves functional prognosis, as interventions are more effective at younger ages because the brain is at its peak of plasticity and there is more family commitment to treatment.⁷ In this sense, the Prechtel's method for the qualitative assessment of general movements (GMs) is a valid, reliable, and non-invasive instrument that allows for the detection of multiple neurodevelopmental and cognitive disorders, including CP.⁸⁻¹⁰

GMs are complex, spontaneous, prominent gross movements involving the whole body, particularly the arms, neck, trunk and legs. They are observed from the onset of fetal development until approximately 20 weeks of corrected age,^{7,11-14} when voluntary movements appear.^{6,10} The normal repertoire of GMs is classified into two types: writhing movements and fidgety movements.^{7,11-14} Synchronized jerky or stiff movements, as well as chaotic movements, are considered abnormal.¹¹

This method has been increasingly used in clinical settings to screen infants who could benefit from early interventions.⁹ Inter-rater agreement percentages of 87-93% and sufficient to near-perfect inter-rater reproducibility have been reported for this instrument.⁹ However, it should be kept in mind that the level of expertise that the observer has in the use of the Prechtel's method may contribute to the interpretation of the GMs, which is why it is important to know the reliability of the observations, as this could have a significant impact on crucial aspects such as the recommendations that the clinician makes for follow-up care.¹⁰ In addition, after conducting a literature search, no studies evaluating the inter-rater reproducibility of this method in the Colombian population were found.

In view of the above, the objective of the present study was to determine the inter-rater reliability of the Prechtel's method for the qualitative assessment of GMs in preterm neonates and low-birth-weight full-term neonates admitted to a neonatal intensive care unit (NICU) in Colombia.

Materials and methods

Study type

Diagnostic test evaluation study to evaluate the Precht's method for the qualitative assessment of GMs in preterm neonates and low-birth-weight full-term neonates.

Study population and sample

The study population consisted of preterm neonates (<32 weeks of gestation) or low-birth-weight full-term neonates (<1 500g) who presented abnormal findings in cranial ultrasound (grade III or IV hemorrhages) taken between birth and week 35 and in the Alberta infant motor scale at 3 months of age. These infants were also included in the Kangaroo Mother Care program of the Hospital Universitario de la Samaritana - Zipaquirá Functional Unit during 2023 (N=50). Neonates with health conditions that could interfere with the assessment of GMs were not considered eligible; for example, infants with chromosomal syndromes, dysmorphic features, and/or metabolic syndromes diagnosed or under study. The study included infants who had a video of their GMs filmed following the requirements of the Precht's method for the qualitative assessment of GMs (writhing phase: assessed until week 8 of corrected age; fidgety phase: assessed from week 12 to week 16 of corrected age) and whose parents or legal guardians authorized the use of their data for the study.

Procedures

GMs assessment was performed by 2 physical therapists certified (advanced level) in the Precht's method for the qualitative assessment of GMs with more than 15 years of professional experience. For this purpose, they simultaneously and independently reviewed the videos of the children filmed by their parents or by one of the expert physical therapists, following the guidelines established by the Precht's method.^{11,12} Two videos per child (one for each phase) were reviewed, each with a duration between 1 and 2 minutes.

The videos were recorded in a suitable, quiet, and disturbance-free space within the neonatal unit or at the infant's home. At the time of recording, the infant had to be awake, quiet, in supine decubitus position, and wearing as little clothing as possible. In all cases a cell phone was used for recording.

The Precht's method for qualitative assessment of GMs is an instrument used to assess the spontaneous movements of infants to identify neurological disorders predictive of CP and other developmental disabilities.^{11,12} GMs are distinctive patterns of spontaneous movements observable in infants before birth and up to 20 weeks of age, which change in a specific order. Writhing movements occur from birth to week 8 of corrected age and are characterized by small to moderate amplitude and slow to moderate speed, while fidgety movements occur from week 9 to week 20 of corrected age and are characterized by circular, small amplitude, variable acceleration, and moderate speed, and occur in the whole body.¹¹⁻¹⁴ This assessment is conducted by trained individuals from the General Movements Trust.¹²

In the present study, movements in the writhing phase were considered normal (coded as 1) if they were fluent in all four limbs and had moderate amplitude and variable velocity, with evidence of complexity in rotational movements. Conversely, movements

were considered poor repertoire (coded as 0) if there was evidence of decreased amplitude, speed and fluidity, as well as lack of complexity in joint rotations (monotonous and repetitive movements).

In turn, movements in the fidgety phase were classified as normal (coded as 1), when oscillatory movements of small amplitude and variable speed were observed in the neck, trunk, and joints; sporadic (coded as 2), when there were prolonged pauses between movements or the movements occurred in isolation in certain parts of the body; abnormal (coded as 3), when the movements were rapid, disordered, uncontrolled, and with no pause; and absent (coded as 4), when no movements were observed.

The following data were also obtained for each infant based on review of their medical records: sex, gestational age, and presence of the following neonatal conditions: neonatal respiratory distress syndrome, birth asphyxia, and/or bronchopulmonary dysplasia.

Statistical analysis

Data were entered and organized in a spreadsheet created in Microsoft Excel 2016®. Inter-rater reliability was assessed using the Cohen's Kappa index in the Reliability Calculator software (ReCal3);¹⁵ the level of agreement was interpreted based on the Landis & Koch scale¹⁶ (Table 1).

Table 1. Level of agreement.

Kappa	Strength of agreement
0.00	Poor
0.1-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.0	Almost perfect

Ethical considerations

The study was conducted taking into account the provisions of Law 528 of 1999, which regulates the professional practice of physical therapy in Colombia,¹⁷ as well as the ethical principles for biomedical research involving human subjects established in the Declaration of Helsinki,¹⁸ and the scientific, technical and administrative standards for health research contained in Resolution 8430 of 1993 issued by the Colombian Ministry of Health.¹⁹ In addition, the study was part of the research entitled *Parálisis Cerebral, Movimientos Generales, Desarrollo Motor en Lactantes y Estrategias de Afrontamiento Familiar* (Cerebral Palsy, General Movements, Motor Development in Infants, and Family Coping Strategies), which was approved by the Research Ethics Committee of the Faculty of Nursing and Rehabilitation of the Universidad de La Sabana according to Minutes No. 022 of November 20, 2020, with registration code No. ENF-58-2020.

Results

Of the 50 infants considered eligible, 18 were excluded, as their neurological risk was identified between 2-3 months of age and the assessment of GMs was performed only at

the fidgety stage. Therefore, the qualitative assessment of GMs according to the Prechtel's method was done in 32 preterm neonates or low-birth-weight full-term neonates.

A total of 53.12% (n=17) of the infants were male, 96.87% (n=31) were preterm, 96.87% (n=31) had neonatal respiratory distress syndrome, and 71.87% (n=23) developed bronchopulmonary dysplasia (Table 2).

Table 2. Main characteristics of the infants included in the study (n=32).

	Variable	n (%)
Sex	Male	17 (53.12%)
	Female	15 (46.87%)
Classification according to gestational age	Extremely preterm (<28 weeks)	3 (9.37%)
	Very preterm (28-32 weeks)	20 (62.50%)
	Moderate to late preterm (33-37 weeks)	8 (25.00%)
	Term (38-40 weeks)	1 (3.12%)
Neonatal respiratory distress syndrome	Yes	31 (96.87%)
	No	1 (3.12%)
Birth asphyxia	Yes	4 (12.50%)
	No	28 (87.50%)
Bronchopulmonary dysplasia	Yes	23 (71.87%)
	No	9 (28.12%)

Table 3. Results of the assessments in the writhing phase.

Classification	Observer 1	Observer 2
Normal (1)	16	23
Poor repertoire (0)	16	9

Table 4. Results of the assessments in the writhing phase.

Classification	Observer 1	Observer 2
Normal (1)	28	27
Sporadic (2)	3	4
Abnormal (3)	0	0
Absent (4)	1	1

Cohen's Kappa was 0.563 in the writhing phase and 0.624 in the fidgety phase, which shows a moderate and considerable level of agreement between the observers, respectively.

Table 3. Inter-rater agreement with the Prechtel's method of assessment.

Phase	Cohen's Kappa index value
Writhing	0.563
Fidgety	0.624

Discussion

The present study established the inter-rater reliability of the Prechtel's method for the qualitative assessment of GMs in a sample of preterm and term infants admitted to a

Colombian NICU, finding a moderate level of agreement (0.563) in the writhing phase and a substantial level of agreement (0.624) in the fidgety phase.

These findings are relatively consistent with those reported in other studies that have evaluated the inter-rater reproducibility of this instrument.^{8,20,21} For example, in the study conducted by Alexander *et al.*,²⁰ in which 2 observers reviewed the videos of the GMs of 773 infants in Perth, Australia, it was reported that the classification of the GMs assessment had almost perfect inter-rater reproducibility (Gwet's agreement coefficient [AC1]: 0.999) with an agreement percentage of 99.9%, whereas Cohen's Kappa values in the GMs assessment that included 2 categories (normal and aberrant) and in the fidgety movements subdomain were 0.856 (95%CI: 0.576-1.000) and 0.857 (95%CI: 0.576-1.000), respectively.

Similarly, Valencia *et al.*,⁸ in a study of 69 infants (<37 weeks gestation) born in France, found high inter-rater reproducibility (5 pairs of assessors) (AC1: 0.84±0.5) with an agreement percentage of 88% for the binary classification of GMs (normal vs. abnormal). Along the same lines, Bernhardt *et al.*,²¹ in a study conducted in Switzerland in which 5 physical therapists reviewed videos of 20 preterm and writhing movement-aged infants (31-41 weeks postmenstrual age) and 10 fidgety movement-aged infants (49-54 weeks postmenstrual age), found substantial to almost perfect inter-rater reproducibility for the binary classification of GMs (normal vs. abnormal) (mean kappa: 0.53-0.63).

However, Katz & Perenyi,²² in a study in which 2 novice observers used the Precht's method to assess the GMs of 43 infants under 20 weeks of corrected age admitted to a NICU in the United States, reported Cohen's Kappa values lower than those found in our study (writhing phase: 0.35, 95%CI: 0.19-0.51; fidgety phase: 0.39, 95%CI: 0.15-0.62). This difference could be explained by the fact that, although both studies used a similar methodology, in our case both observers had extensive professional experience (+15 years) and were certified (advanced level) in this method of GMs assessment.

Based on the findings and on what is described in the relevant literature, it is recommended to use the Precht's method for the qualitative assessment of GMs for the early detection of neurodevelopmental problems in preterm and term infants, provided that such assessment is performed by appropriately trained professionals. Moreover, to optimize its effectiveness, it is important to consider the infant's medical history and to complement this assessment with other diagnostic aids.

The limitations of the present study include the small number of observers included, given that there are few professionals certified in the Precht's method in the country, as well as the lack of updated information on the incidence and prevalence of CP in the infant population in Colombia. This makes it impossible to determine with certainty the real impact of using this instrument for the detection of this condition in Colombian preterm and low-birth-weight infants.

Regarding its strengths, the support of the infants' parents is noteworthy, considering that, in addition to authorizing the recording of their children, they participated in the recording, which had a positive impact on the babies' well-being during the study, resulting in a better working material for an accurate, objective, and reproducible assessment by the experts.

Conclusion

The present study found that the inter-rater reliability of the Precht's method for the qualitative assessment of GMs was moderate and substantial in the writhing and fidgety phases, respectively. This suggests that it is a useful instrument for the early detection

of potential neurodevelopmental disorders in preterm and low-birth-weight full-term infants in Colombia.

Conflicts of interest

None stated by the authors.

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