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Predictive value of General Movement Assessment for preterm infants' development at 2 years – implementation in clinical routine in a non-academic setting

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ABSTRACT

Background: General movements (GM) are used in academic settings to predict developmental outcome in infants born preterm. However, little is known about the implementation and predictive value of GM in non-academic settings.
Aims: The aim of this study is twofold: To document the implementation of GM assessment (GMA) in a non-academic setting and to assess its predictive value in infants born preterm.
Methods and procedures: We documented the process of implementing GMA in a non-academic outpatient clinic. In addition, we assessed the predictive value of GMA at 1 and 3 months' corrected age for motor and cognitive development at 2 years in 122 children born <33 weeks' gestation. Outcome at two years was based upon the Bayley Scales of Infant Development-II (mental/psychomotor developmental index (MDI, PDI)) and a neurological examination. The infants' odds of atypical outcome (MDI or PDI ≤70 or diagnosis CP) and the predictive accuracy of abnormal GMA were calculated in a clinical routine scenario, which used all available GM information (primarily at 3 months or at 1 month, when 3 months were not available). In addition, separate analysis was undertaken for the samples of GMA at 1 and 3 months.
Outcomes and results: Tips to facilitate GMA implementation are described. In our clinical routine scenario, children with definitely abnormal GM were more likely to have an atypical two-year outcome than children with normal GM (OR 13.2 (95% CI 1.56; 112.5); sensitivity 55.6%, specificity 82.1%). Definitely abnormal GM were associated with reduced MDI (−12.0, 95% CI −23.2; −0.87) and identified all children with cerebral palsy (CP) in the sample of GMA at 3 months only.

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GMA can be successfully implemented in a non-academic outpatient setting. In our clinical routine scenario, GMA allowed for adequate prediction of neurodevelopment in infants born preterm, thereby allaying concerns about diagnostic accuracy in non-academic settings.

What this paper adds

For nearly a decade, the assessment of general movements (GM) at 3 months' corrected age has been well recognised as a clinical, non-invasive method to predict neurodevelopment and cerebral palsy (CP) in infants born preterm. Yet GM assessment (GMA) tends to be used in academic contexts rather than in non-academic out-patient centres, which in contrast see the majority of infants born preterm for follow-up. This could be because the organisational effort behind GMA is perceived as high for a relatively small group of patients. Moreover, the implementation of GMA in non-academic settings has not been evaluated up to now, and thus little is known about the diagnostic accuracy of GMA in such settings.

Based on documentation of organisational structures in our Social Paediatric Centre, a non-academic outpatient centre, we developed a series of useful and standardised tips for implementing GMA in non-academic routine. Our analysis of more than one hundred infants born at <33 gestational weeks additionally showed that GMA reliably predicts neurodevelopment and CP in high-risk infants, thereby allaying concerns about diagnostic accuracy in non-academic settings.

1. Introduction

Worldwide, 5–18% of infants are born preterm (Romero, Dey, & Fisher, 2014). Yet while modern neonatology care enables even the very preterm of these infants to live, this survival is often associated with increased morbidity in later life. For instance, 5–10% of children born preterm are diagnosed with cerebral palsy (CP) (Sellier et al., 2016). In addition, children born preterm have increased risks for minor cognitive and motor developmental problems (Crump, Sundquist, Winkleby, & Sundquist, 2013).

Early interventions may reverse or ameliorate risk profiles during the first years of life (Einspieler & Prechtl, 2005; Guralnick, 2012; Nordhov et al., 2012; Spittle, Orton, Anderson, Boyd, & Doyle, 2015) as they rely on the plasticity of potentially injured brains. However, to ensure that such interventions are as efficient and cost-effective as possible and to avoid unnecessary treatment, methods are needed that identify children with high developmental risks at an early age. Recent years have demonstrated that when infants are evaluated in academic settings, the assessment of general movements (GM, spontaneous infant movements) is a reliable method to identify children at high risk for CP and other developmental problems (Bosanquet, Copeland, Ware, & Boyd, 2013; Burger & Louw, 2009; Hadders-Algra, 2004; Oberg, Jacobsen, & Jorgensen, 2015). GM assessment (GMA) is based on pattern recognition of spontaneous movements of young infants that are video-recorded.

Currently two variants of GMA exist: the one developed by Prechtl (Einspieler, Prechtl, Bos, Ferrari, & Cioni, 2005; Prechtl, 1990; Prechtl et al., 1997) and the one by Hadders-Algra (Hadders-Algra, 2007; Hadders-Algra et al., 2004). Both variants measure essentially the same construct, i.e. they assess with Gestalt perception the variation, complexity and fluidity of GM (Hadders-Algra & Prechtl, 1992; Prechtl, 1990). Nevertheless, there are differences. Hadders-Algra, for instance, pays more attention to the presence of minor abnormalities – in line with the tradition of Groningen research. Through such detailed scoring on the non-pathological part of the GM spectrum, it was possible to demonstrate adverse effects of, for example, hyperbilirubinaemia (Lunsing, Pardoen, & Hadders-Algra, 2013; Soorani-Lunsing, Woltil, & Hadders-Algra, 2001) and subfertility (Middelburg, Haadsma, Heineman, Bos, & Hadders-Algra, 2010). In addition, at 6–18 weeks' corrected age (CA), Hadders-Algra pays attention primarily to the general aspects of GM, i.e. movement variation and complexity (Hamer, Bos, & Hadders-Algra, 2011; Hamer, Bos, & Hadders-Algra, 2016) – and does not consider merely the presence or absence of fidgety movements. The similarity of the two variants of GMA, however, implies that their prediction of CP is largely comparable. –

GMA is most predictive at 3 months of CA (Guzzetta et al., 2007; Hadders-Algra, 2004; Prechtl et al., 1997; Spittle et al., 2013). The predictive value of GM depends, as in any diagnostic test, on the age and prevalence of risks at follow-up. For instance, in high-risk children born at <30 weeks of gestation, GMA evaluated in an academic centre at 3 months' CA had a high sensitivity and specificity for adverse neurological outcome (100% sensitivity and 84% specificity for CP), a moderate-to-good prediction of cognitive problems (41% and 85% specificity for cognitive impairment at 2 and 4 years, respectively) and moderate prediction of language problems at 2 years (58% sensitivity and 83% specificity) (Spittle et al., 2013). GMA in low-risk groups, however, yields lower predictive values. For instance, a study in the Dutch general population indicated that GMA at 3 months had a sensitivity of 67% and a specificity of 97% to predict CP (Bouwstra et al., 2010).

Only a handful of publications have reported on the use of GM in non-academic settings (Brown, Greisen, Haugsted, & Jonsbo, 2016; Palchik, Einspieler, Evstafeyeva, Talisa, & Marschik, 2013; Yuge et al., 2001). Besides an anecdotal report in a German-language journal (Seme-Ciglenecki, 2007) and a small follow-up study of 37 children born preterm in Brazil (Manacero, Marschik, Nunes, & Einspieler, 2012), a study used GMA in Dutch well-child clinics (Bouwstra et al., 2009, 2010), however without specifically reporting on the process GMA implementation. Another report studied the applicability of GMA