The predictive validity of general movements: a systematic review

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CRD summary
This review concluded that qualitative assessment of general movements, especially during the fidgety movements’ period (eight to 20 weeks post-term), may be a useful prognostic tool to identify infants with neurodevelopmental impairments. Included studies used a variety of methods of uncertain validity to establish neurological diagnoses and some reported poor performance for general movements. The conclusions should be viewed cautiously.

Authors' objectives
To determine the value of general movements in early infancy to predict neuromotor outcome in 12- and 24-month old infants.

Searching
MEDLINE, CINAHL, PEDro, The Cochrane Library, Science Direct, ProQuest (Science Journals, Medical Library and Social Science Journals) and PsycINFO were searched from inception to May 2008 and search terms were reported. Searches were restricted, where possible, to studies of humans published in English or Dutch and to infants from birth to 23 months and preschool children from two to five years of age. The website of General Movements Trust and bibliographies of included studies were screened for additional articles.

Study selection
Descriptive research studies that used Prechtl's method of qualitative assessment of general movements to assess spontaneous movements in infants were eligible for inclusion. Included studies could be in high-risk and/or low-risk, preterm and/or full term infants and were required to report neurodevelopmental outcome at 12 or 24 months corrected age.

Studies of infants diagnosed with chromosomal defects or known syndromes (such as Down Syndrome and Rett Syndrome) or with birth defects that involved the central nervous system (such as myelomeningocele) were excluded.

Most included studies were of pre-term and/or high-risk infants only. Included studies assessed general movements during some or all of the following four key age periods: before term age; at term age; from three to seven weeks post-term; and during the fidgety movements’ period (eight to 20 weeks post-term). A wide variety of neurodevelopmental assessments at 12 or 24 months of age were used as the reference standard to establish neurodevelopmental outcomes. Most included studies also used neuroimaging techniques to assess participants: cranial ultrasound; magnetic resonance imaging (MRI); computed tomography (CT); and electroencephalography (EEG).

Titles and abstracts of retrieved studies were assessed for inclusion. Where there was insufficient information to judge suitability for inclusion, full-text versions were retrieved. The authors did not state how many reviewers assessed studies for inclusion.

Assessment of study quality
Methodological quality of included studies was assessed using a critical appraisal tool for quantitative research designs from The Canadian Occupational Therapy Foundation. The tool covered aspects of reporting quality, appropriateness of analysis and interpretation of results, and handling of drop-outs. Overall quality scores were generated by summing the 12 closed questions from the tool as either 1 (completely fulfilled the criterion) or 0 (did not fulfil the criterion).

Two reviewers assessed methodological quality of included studies.

Data extraction
Descriptive data were extracted for each included study on participant details (birth history, gestational age, birth weight, high risk or low risk), timing of and techniques used for evaluation of neurodevelopmental outcome and results (predictive validity of general movements compared to other neuromotor and neurodevelopmental assessment techniques).
The authors did not state how many reviewers performed data extraction.

**Methods of synthesis**
Studies were combined in a narrative synthesis.

**Results of the review**
Seventeen studies with total of 1,926 participants were included in the review: 1,728 (89.7%) were preterm and 198 (10.3%) were full term. Two studies included only full-term infants, 11 studies included only preterm infants and nine studies included only high-risk infants.

The mean quality score of the included studies was 8.82 (standard deviation 0.73). No study fulfilled the criterion of no biases introduced into the study and no study described reliability of neurodevelopmental assessments used as the reference standard to determine neurological outcomes. Only one study reported on validity of the neurodevelopmental assessments used.

Five studies assessed a total of total 285 infants at 12 months corrected age: 42 were lost to follow-up; 105 were assessed as normal; 40 had mild neurological deficits; and 34 had severe neurological deficits (cerebral palsy).

Twelve studies evaluated a total of 1,742 infants at 24 months corrected age: eight were lost to follow-up; 1,243 were assessed as normal; 214 had mild neurological deficits; and 277 had severe neurological deficits (cerebral palsy).

Thirteen studies calculated the sensitivity and specificity of general movements in predicting neurological outcomes of infants at 12 or 24 months of age. Eight of these studies reported data for two or more of the different key age periods after birth and five found that the sensitivity and specificity values from the pre-term and/or term period increased and reached a maximum at eight to 20 weeks post-term (fidgety movements’ period). Sensitivity of general movements at eight to 20 weeks to predict neurological deficit at 12 to 24 months ranged from 50% to 100% (13 studies); specificity ranged from 35% to 100% (13 studies).

Four studies assessed correlation between general movements during the fidgety movements’ period and neurodevelopmental outcome at 12 and 24 months corrected age and all found a high correlation (p<0.01).

Data were also reported on the predictive value of general movements, as well as traditional neurological assessments and neuroimaging techniques.

**Authors’ conclusions**
The results of this systematic review indicated that qualitative assessment of general movements, especially during the fidgety movements’ period (eight to 20 weeks post-term), may be used as a prognostic tool to identify infants with neurodevelopmental impairments.

**CRD commentary**
The review addressed a clearly stated research question and some inclusion criteria were defined. However, inclusion criteria were not defined for the method used to establish neurological diagnoses; these methods varied widely and their reliability/validity was largely unreported. The search strategy was restricted to studies published in English or Dutch, which left open the possibility of language and/or publication biases. The methodological quality of included studies was assessed and the results of this assessment were reported in full. The quality assessment process incorporated measures to reduce potential for error and/or bias; it was unclear whether similar measures were applied throughout the review process. Given the heterogeneity of included studies, use of a narrative synthesis was appropriate. Despite some discussion of the possible reasons for the low prognostic performance reported by some studies, the authors' overall conclusion regarding the usefulness of general movements to predict neurodevelopmental impairments appears optimistic and should be viewed with caution.

**Implications of the review for practice and research**
**Practice:** The authors stated that the combination of general movement assessments with neuro-imaging or standardised neurological evaluations was recommended over a single neurodevelopmental assessment in order to evaluate neurodevelopmental outcome. Only if both assessments were normal could it be assumed that close surveillance and additional follow-up may not be necessary.
The authors stated that there was a need for further research in larger randomly selected populations of high- and low-risk infants over a longer follow-up period to clearly define the relationship between the quality of general movements and subtle neurological symptoms in infants and older children.

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