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ORIGINAL ARTICLE

Motor behaviour of human foetuses during the second trimester of gestation: A longitudinal ultrasound study☆

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Received 14 February 2014; accepted 14 May 2014
Available online 25 February 2015

KEYWORDS
Foetal behaviour;
General movements;
Motor generators;
Phasic movements;
Axo-rhizomelic rhythmias;
Second trimester pregnancy

Abstract
Introduction: The aim of this research is to contribute to the knowledge of the normal spontaneous motor behaviour of the human foetus during the second trimester of pregnancy. This study focuses on five patterns of spontaneous foetal movement: startle (S), axo-rhizomelic rhythmia (ARR), axial stretching (AS), general movement (GM), and diaphragmatic contraction (DC).
Methods: A cohort of 13 subjects was followed up using 2D obstetrical ultrasound images at 12, 16, 20, and 24 weeks of gestation. As inclusion criteria, neonatal neurological examination and general movements after eutocic delivery at term were normal in all of the subjects, and their neuromotor and cognitive developments until the end of pre-school age were also normal.
Results: All these five motor patterns are present at the beginning of the 2nd gestational trimester, but their quantitative and qualitative traits are diverse according to gestational ages. The phasic, isolated or rhythmically repeated movements, S and ARR, are prominent at 12 and 16 weeks of gestation, and then their presence gradually diminishes. By contrast, tonic and complex AS and GM movements increase their presence and quality at 20 and 24 weeks. RAR constitute a particular periodic motor pattern not described in previous literature. Moreover, the incidence of DC is progressive throughout the trimester, in clusters of 2–6 arrhythmic and irregular beats. Foetal heart rate increases during foetal motor active periods.
Conclusions: All five normal behavioural patterns observed in the ultrasounds reflect the progressive tuning of motor generators in human nervous system during mid-pregnancy.

☆ Please cite this article as: Reynoso C, Crespo-Eguílaz N, Alcázar JL, Narbona J. Motricidad fetal durante el segundo trimestre de gestación: estudio ecográfico longitudinal. An Pediatr (Barc). 2015;82:183–191.

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PALABRAS CLAVE
Conducta fetal;
Generadores de movimiento;
Movimientos fásicos;
Movimientos generales;
Ritmias axo-rizomélicas;
Segundo trimestre de gestación

Motricidad fetal durante el segundo trimestre de gestación: estudio ecográfico longitudinal

Resumen
Introducción: El objetivo de esta investigación es contribuir al conocimiento de la conducta motora fetal humana espontánea normal durante el 2.° trimestre de gestación. Se focaliza sobre 5 patrones de movimiento fetal: sobresaltos masivos (SM), ritmias axo-rizomélicas (RAR), estiramientos axiales (EA), movimientos generales (MG) y excursiones diafragmáticas (ED).
Métodos: Se ha observado la motricidad fetal espontánea, mediante ecografía obstétrica en 2 D, en una cohorte de 13 sujetos, en las semanas 12, 16, 20 y 24 de gestación. Constituye criterio de inclusión comprobar posteriormente la normalidad del estado neurológico neonatal a término y del desarrollo motor y cognitivo hasta la edad de 5 años.
Resultados: Los 5 patrones de movimiento citados se observan en todos los fetos durante el 2.° trimestre gestacional, pero su presencia y cualidad varían con la edad. Los movimientos fásicos SM y RAR son prominentes en las semanas 12 y 16 de gestación; en cambio, los movimientos prolongados EA y MG poseen mayor incidencia, duración, extensión y complejidad en las semanas 20 y 24. Las ED aumentan su incidencia a lo largo del 2.° trimestre, generalmente en series de 2-6 excursiones, con amplitud irregular. El ritmo cardiaco se acelera durante los periodos de movimiento fetal, frente al estado de reposo.
Conclusiones: Los 5 patrones de conducta estudiados ecográficamente reflejan el progresivo afinamiento de generadores de patrones motores en el sistema nervioso humano normal durante el 2.° trimestre de gestación. Llamamos la atención sobre las RAR, no diferenciadas en otros estudios.

Introduction

Starting at the end of the second month of gestation, the human embryo performs spontaneous movements classified by Reinold[1] in 1979 into two broad categories: phasic and tonic-complex. Other researchers[2–6] have identified movement patterns that become increasingly stable and recognisable from the end of the first trimester to the end of gestation,[6,7] facilitating the development of a prenatal neurological semiotics and adding to morphological data and haemodynamic variables in the assessment of foetal wellbeing.[7,8] Qualitative patterns are similar in foetuses of the same gestational age if their neurological status is normal.[4,9–12] Foetal motor behaviour in the third trimester of gestation has been confirmed by extrauterine observation of preterm newborns.[13]

The aim of this study was to contribute additional information on the normal developmental characteristics of five prominent types of spontaneous foetal movement in the second trimester of gestation by the visual analysis of 2D obstetric ultrasound images.

Subjects and methods

Subjects

We performed a prospective cohort study of 13 foetuses whose mothers, aged between 20 and 38 years and with no risk factors, consecutively sought prenatal care for a normal pregnancy starting at the eight postmenstrual week in the Department of Obstetrics and Gynaecology of our hospital in 2005. The project was approved by the ethics board of the hospital, and the mothers signed the informed consent form after being told that second-trimester monthly ultrasound explorations would be prolonged by 30 min to analyse foetal movements and that this was a harmless procedure, adhering to the criteria of the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG).[14,15] Every foetus in the cohort (seven females and six males) was born to term in an eutocic delivery and had a normal weight, length, and head circumference and an Apgar test score ranging from 9 to 10 measured between the first and fifth minute after birth. On the third day after birth, the spontaneous behaviour of every newborn while awake and not crying included a type of general movement known as writhing movements,[16,17] and the rest of the conventional neurological examination [18–21] was normal in all subjects. Regular paediatric follow-up visits until 5 years of age confirmed that all 13 subjects had normal psychomotor and language development and academic performance.

Methods

Transabdominal ultrasonography was performed with a Voluson 730 machine (G.E. Healthcare, Milwaukee, USA) with a 2-5 MHz probe. The morphological examination was done using the 4D mode (movement on three planes), and the foetal wellbeing parameters and spontaneous movements