

Prolonged absence of meiotic spindles by birefringence imaging negatively affects normal fertilization and embryo development

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Abstract

Meiotic spindle (MS) assembly in human oocytes is a dynamic process that can be visualized by computer-assisted microscopy. At extrusion of the first polar body a spindle bridge is detected until the completion of telophase I and its reformation requires approximately 1 h. This study analysed 396 oocytes from 112 cycles for fertilization and cleavage according to MS detection at two examinations, 39 and 41 h post-human chorionic gonadotrophin (HCG). All cycles had at least one injected oocyte lacking a visible MS at intracytoplasmic sperm injection (41 h post-HCG). To evaluate the results, oocytes were divided according to the presence (group A) or absence at both observations (group B) of the MS. Compared with group A, group B oocytes had lower normal fertilization rates, higher incidence of three pronuclei and two pronuclei in early dissolution and lower development to blastocyst. Some group A oocytes showed a late MS formation (not visualized at 39 h but at 41 h) and their performance was similar to that of the oocytes with a MS visible at both time points. Although some implantations occurred in group B, these findings suggest that prolonged MS non-detection could be a marker of reduced oocyte competence.

Birefringence is an optical property associated with molecularly ordered structures, such as microtubules and other cytoskeletal components, that is visualized by polarization microscopy. As birefringence has been associated with cell integrity and viability, its non-invasive nature encouraged the clinical application. The oocyte's meiotic spindle (MS) is a birefringent structure controlling the correct chromosome alignment in the metaphase plate. According to recent publications, the MS visualization in mature oocytes is related to fertilization and cleavage, but a correlation with the clinical outcome is not so evident. As MS formation is a dynamic process, this study analysed the MS by sequential birefringence imaging at 39 and 41 h post human chorionic gonadotrophin (just before intracytoplasmic sperm injection) in a homogenous group of patients to verify whether this parameter is associated with following development. All cycles had at least one oocyte lacking a visible MS. To evaluate the results, oocytes were divided according to the presence (group A) or prolonged absence at both observations (group B) of the MS. Compared with group A, group B oocytes had lower normal fertilization rates, higher incidence of three pronuclei and of two pronuclei in early dissolution and lower development to blastocyst. Some group A oocytes showed late MS formation (not visualized at 39 h but at 41 h) and their performance was similar to that of oocytes with a MS visible at both imaging. Although some implantations

occurred in group B, these findings suggest that prolonged MS non-detection could be a marker of reduced oocyte competence.

Keywords: [birefringence](#), [embryo](#), [maturation](#), [oocyte](#), [polarization](#), [spindle](#)