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ARTICLE

Istanbul consensus workshop on embryo assessment: proceedings of an expert meeting☆

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Alpha — Scientists in reproductive medicine — is a non-profit organization which provides an international forum for scientists in reproductive medicine. Alpha's objectives are to advance the art and science of clinical embryology for the benefit of the public worldwide, through international promotion of education, communication and collaboration. The scope of the Special Interest Group on Embryology (European Society of Human Reproduction and Embryology) is broad, incorporating all from basic scientific advances to laboratory practices and policy influences. This area is the primary interest for many ESHRE members who are interested in the present and future developments of clinical embryology.

Abstract This paper reports the proceedings of an international consensus meeting on oocyte and embryo morphology assessment. Following background presentations about current practice, the expert panel developed a set of consensus points to define the minimum criteria for oocyte and embryo morphology assessment. It is expected that the definition of common terminology and standardization of laboratory practice related to embryo morphology assessment will result in more effective comparisons of treatment outcomes. This document is intended to be referenced as a global consensus to allow standardized reporting of the minimum dataset required for the accurate description of embryo development.

KEYWORDS: Assisted conception, Consensus meeting, Embryo assessment

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Introduction

Although the advent of '-omics'-based technologies may ultimately enhance the non-invasive assessment of human embryos *in vitro*, there are still no routinely applicable techniques or analytical devices available. Hence, IVF clinics worldwide continue to select embryos for transfer based on their development rate and morphological features as assessed by light microscopy. However, the many variations in embryo grading schemes applied by different clinics make inter-clinic comparisons extremely difficult, if not impossible. Although national consensus schemes exist in some countries, e.g. Spain and the UK, these are relatively few. Having an international consensus on embryo assessment would also help to validate the use of embryo morphology as an endpoint in clinical trials and other studies to assess new technologies and products in IVF, if it were shown to act as at least a partial surrogate for clinical pregnancy outcome — one example might be registration of new drugs for approval by the US Food and Drug Administration. Therefore, it has been suggested that if common primary endpoints based on embryo quality could be defined and validated, it might be possible to develop and register new fertility products and technologies more readily. This is also an extremely important element of the continual drive to improve the safety and efficacy of clinical IVF treatments.

The Alpha Executive, and European Society of Human Reproduction and Embryology (ESHRE) Special Interest Group of Embryology, in response to suggestions and requests from members of both international societies concerning the need for international consensus in the morphological assessment of embryos, convened a 2-day workshop to address this need. The workshop was held on 26—27 February 2010 in Istanbul, Turkey. In order to realize an effective consensus, the meeting had to be sufficiently small to allow consensus to be reached, while at the same time involving enough recognized experts to support the credibility of the consensus. The ultimate goal of the workshop was to establish common criteria and terminology for grading oocytes, zygotes and embryos that would be amenable to routine application in any IVF laboratory.

This report presents the proceedings of this Expert Meeting, incorporating the text of the presentations as well as the consensus points developed.

Workshop presentations

ESHRE Embryology SIG Atlas project (Cristina Magli)

It is recognized that embryology is the central reference point for all of the Special Interest Groups and Taskforces of ESHRE, and therefore that there is a need for consensus in the way embryos are assessed and described. To work towards this consensus, an Atlas of Embryology was published in 2000 (Gianaroli et al., 2000) using images of oocyte and embryo development submitted by members of the ESHRE Special Interest Group of Embryology.

The next step in this project will be to design an embryo-scoring system that can be shared among all embryologists. Once this is achieved, the Atlas will be revised to provide photographic illustrations for each of the points of the scoring system. In this way, the scoring system will be a practical reference for all embryologists.

The current state of consensus

Spain: the ASEBIR consensus scheme (Gloria Calderón)

Asociación Española para el estudio de la Biología Reproductiva (ASEBIR) is the Spanish society for every professional working in the IVF laboratory. Since embryo morphology is currently the most important factor for the prediction of pregnancy, ASEBIR agreed that a dynamic system of embryo scoring was required that included all stages from gamete to blastocyst. A consensus was reached for scoring, which was then tested in a multicentre trial of IVF laboratories across Spain, with each reporting the scores throughout embryo development and outcomes, for 15 cycles. Overall, pregnancy rates were higher when day-3, rather than day-2, embryos were replaced (Torelló et al., 2005).

Oocyte scoring

The factors that were included in the evaluation of oocyte quality were oocyte cytoplasmic dysmorphisms, extracytoplasmic dysmorphisms and the oocyte—corona—cumulus—complex. It was concluded that extracytoplasmic anomalies were phenotypic deviations.

Zygote scoring

The morphological parameters for zygote scoring were polarization, the presence of a cytoplasmic halo, the number of pronuclei and pronuclear appearance. It was agreed that since the morphological features are related to the time post fertilization, zygote scoring must be performed within a fixed time period post insemination. The ASEBIR consensus was that if a zygote had one polar body and two pronuclei, it should be discarded, whereas if there were two polar bodies and one pronucleus, it was the individual laboratory's decision whether to follow development *in vitro*.

Cleavage-stage embryo scoring

It was agreed that embryos would be scored in four categories:

A = top quality
B = good quality (not for elective single-embryo transfer)
C = impaired embryo quality
D = not recommended for transfer (includes all multinucleated embryos).

Because the culture medium and culture system were recognized as having a significant impact on embryo morphology, they need to be taken into account when making these comparisons. Therefore, each laboratory was encouraged to develop their own descriptions for embryos in each of these categories, based on existing observations. The ASEBIR consensus scoring for embryos is presented in **Table 1**.

Blastocyst scoring

It was agreed that embryos should be assessed on day 4 for evidence of compaction, as this was a good prognosis for