ESHRE 2008 Abstract:

A viability index determined by non-invasive metabolomic profiling of embryo culture media correlates with ART outcome.

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Introduction: One of the major dilemmas surrounding ART is the inability to precisely estimate the reproductive potential of individual embryos. Recently, we reported that non-invasive metabolomic profiling of embryo culture media using Raman and near infrared spectroscopy correlates with reproductive potential of embryos in women undergoing in vitro fertilization (Seli et al., 2007). This technology assesses modifications of the chemical composition of the embryo's surrounding medium using spectroscopy and generates a value termed the "viability index" (VI). In the current study, we hypothesized that VI value may positively correlate with reproductive outcome and be a useful adjunct to morphologic embryo assessment currently used worldwide.
Materials and methods: Single embryo transfers (n= 506) were performed on Day 2 or 3 at the VU University medical center IVF department, Amsterdam, The Netherlands and Kato Ladies Clinic, Tokyo, Japan. A wavelength specific genetic algorithm (Molecular Biometrics, USA) was used to determine a relative embryo viabilty index (VI) based on differences between transferred embryos which did or did not result in implantation (fetal heart detection) (Seli et al., 2007). This is performed by measuring concentrations of key functional groups (for eg. -SH, C=C, -CH, -OH, and –NH groups), adjusted for parallel controls. All VI were generated blinded to the knowledge of embryo morphology and transfer outcome. A ROC curve analyses of the VI was also used to select thresholds with the greatest ability to discriminate outcomes.
Results: Embryos with Grade A (excellent) and B (good) morphology showed wide ranging VI (N=429; VI range 0.86 to -0.26) indicating that regardless of morphology their intrinsic metabolism differed drastically. For Grade A embryos (N=261) the VI was (0.293 + 0.09) and for Grade B (N=168) embryos the VI was (0.292 + 0.13). When a VI cut-off value of 0.3, generated by ROC curve analysis, was used the implantation rates of embryos with a VI of >0.3 were significantly higher for both Grade A (39% for VI >0.3 versus 26% for VI <0.3) and B (36% for VI >0.3 versus 20% for VI <0.3) morphology. In addition, a further 77 poor morphology (Grade C and D) day 2 and 3 embryos underwent single embryo transfer. When a VI cut-off value of 0.3, was used for these poor morphology embryos the implantation rates of those with a VI of >0.3 [6/28 (21.4%)] were higher compared to those with a VI of <0.3 [6/49 (12.2%)]. Finally, when an incremental analysis of the VI and implantation rates was performed there was a step wise increase in implantation rates as the VI increased. For Grade A embryos with a VI

>0.4 implantation rates reached 57% and for Grade B embryos with a VI>0.4 implantation rates reached 45%.
Conclusions: A Viability Index is able to discriminate between embryos of the same morphology indicating that the metabolism of the embryo remains largely independent regardless of morphology. Using a calculated cut off for the VI in addition to morphology implantation rates were significantly higher than when a low VI score was obtained. The added armoury of metabolomic profiling by NIR to current morphological assessment techniques might allow a greater discrimination for selection of embryos for transfer and has the potential to improve IVF outcomes. Currently, additional studies are being performed to investigate the true value of metabolomic profiling by NIR spectroscopy.

Seli E. et al. Fertil Steril. 2007; 88:1350-7.