Combination between amino acids profile of the spent culture media and morphokinetics parameters of human embryos to determine its viability

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Study question:

- How to determine human embryo viability noninvasively before embryo transfer?

Summary answer:

- We propose that the combination of the amino acid profile of an individual embryo with its morphokinetics will provide noninvasive tool to determine its viability.

What is known already:

- It was already known that human embryos at early cleavage require non-essential amino acids, while at the 8-cell to blastocyst stages, a mixture of non-essential and essential amino acids.
- Amino acids have important roles during embryo development.
- Acting as biosynthetic precursors,buffers of intracellular pH in the embryo, antioxidants, energy sources and regulators of usedmetabolic function and signaling pathways.
- Many studies used time-lapse to analyze human embryonic development including the process of fertilization and assessment of early events and introduced noninvasive prognostic markers which predict embryo development and correlate it to IVF treatment outcomes.

Study design, size, duration:

- This study was a prospective cohort study approved by the Clinical Trial Ethical Committee of Faculty of Medicine, Alexandria University according to ethical standards of scientific research (Serial number: 0303721).
- Thirty females aged 30.13 ± 4.83 years undergoing ICSI cycle in Madina fertility center between March 2018 to November 2019.
- 202 MII oocytes were incubated individually in embryoscope.

Participants/materials, setting, methods:

- Embryos (n=161) were divided on Day 5 into two groups –developed embryos "Group D" (embryos that developed to blastocyst) and arrested embryos "Group A" (embryos remain at cleavage stage and fail to develop to blastocys).
- Developed embryos (Group D) included 99 embryos, and Arrested embryos (Group A) included 62 embryos.
- For each group, morphokinetic developmental points using embryoscope and the different amino acids concentrations in spent culture medium were analyzed using LC- mass spectrometry.

Main results and the role of chance:

- On one hand, the first appearance of pronuclei (TPNa), t2, t4 and CC2 in group D occurred significantly earlier than those of Group A

.Analysis of 19 essential and non-essential amino acids in spent culture medium of each embryo in the two studied groups D and A showed a significantly higher concentration of two essential amino acids L-Valine (145.73 ± 150.96) and L-Phenylalanine (61.59 ± 55.78) in Group D than their concentration in Group A (104.58 ± 33.58, 44.24 ± 14.61, respectively , p≤ 0.05).and significantly lower concentration of three non-essential amino acids L-Tyrosine (62.56 ± 41.03) , L-Cysteine (19.48 ± 11.90), and L-Alanine (136.0 ± 389.83) observed in Group D when compared to Group A (69.57 ± 20.78, 22.37 ± 8.59,145.33 ± 165.22, respectively, p ≤ 0.05) .Group D had higher levels of L-proline than Group A, P=0.010*.

	Group D	Group A	P
TPNa	11.36 ± 2.93	12.82 ± 3.58	0.004*
t2	27.09 ± 3.26	33.65 ± 14.61	<0.001*
t3	37.01 ± 4.05	40.14 ± 13.95	0.274
t4	39.78 ± 4.75	43.64 ± 13.70	0.043*
t5	49.74 ± 6.01	50.37 ± 13.61	0.666
CC2	9.92 ± 3.50	5.19 ± 13.41	0.010*
S2	12.29 ± 6.10	8.58 ± 14.38	0.078

Limitations, reasons for caution:

It is important to note, that results were developed on a data set from one clinic with different stimulation protocols, a multicenter data and a correlation with the stimulation protocol used should be involved in future studies, in addition a larger sample size to avoid high standard deviation is recommended

Wider implications of the findings:

- We can conclude that amino acid turnover is independent of the traditional morphological assessment of embryos and it may reflect its viability.
- The prospective combined use of amino acids profile of individual embryo and its morphokinetic parameters may contribute to introduce a new noninvasivs tool that may improve implantation rate.

- I have no potential conflict of interest to disclose