

NON-INVASIVE PREDICTION OF HUMAN EMBRYO IMPLANTATION BY MASS SPECTROMETRY FINGERPRINTING



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INTRODUCTION

The aims of this project were to utilise the analytical power of mass spectrometry with minimal sample preparation and minute analysis (MS fingerprint) to characterise the chemical patterns of culture media used to produce embryos from patients undergoing ICSI cycles by electrospray ionisation (ESI) coupled to a linear ion trap mass spectrometer (LTQ XL), combined with a Fourier transform ion cyclotron resonance (FT-ICR) mass spectrometer and relate the chemical profiles to embryo implantation outcomes.

MATERIALS AND METHODS

Culture media samples split according to the day of embryo transfer

Group 1, n=395
Samples harvested from embryos transferred on Day 3.

Group 2, n=488
Samples harvested from embryos transferred on y day 5.

Group 3, n=439
Samples harvested from refreshed culture medium on day 3, from embryos transferred on day 5.

Samples injected directly to the ESI source coupled LTQ XL, combined with a FT-ICR mass spectrometer



Samples in each group

Negative implantation

Positive implantation

33.3%

50.0%

66.6%

100%

Sensitivity and specificity in predicting implantation were calculated for each group using a multivariate statistical model.

RESULTS

Measures of diagnostic accuracy in the calibration set (0% and 100% implantation) and in each validation group (66.7%, 50% and 33.3% implantation)

Group 1

Implantation Group	PPV	NPV	Sensitivity	Specificity
Calibration set	35%	100%	100%	90%
33.3% implantation	64%	100%	100%	71%
50% implantation	100%	87%	85%	100%
66.7% implantation	100%	83%	90%	100%

Group 2

Group 2

Implantation Group	PPV	NPV	Sensitivity	Specificity
Calibration set	49.5%	100%	100%	79%
33.3% implantation	55%	100%	100%	59.3%
50% implantation	81.4%	100%	100%	77.1%
66.7% implantation	88%	100%	100%	72.7%

Implantation Group	PPV	NPV	Sensitivity	Specificity
Calibration set	39.2%	99.3%	98%	61%
33.3% implantation	46.1%	100%	100%	41.6%
50% implantation	100%	96.6%	96.5%	100%
66.7% implantation	100%	64.3%	72.2%	100%

CONCLUSION

MS fingerprinting is a useful predictive tool for embryo implantation, especially when the samples are collected on the third day of development.

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