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THE DEVELOPMENT OF A NEW MODEL OF HCG DYNAMICS TO PREDICT PREGNANCY OUTCOME

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OBJECTIVE:

Few studies have evaluated the rate of human chorionic gonadotropin (hCG) rise and its capacity to predict pregnancy outcomes following single euploid embryo transfer (SEET). The aim of this study is to develop a new model of hCG rise to serve as a decision support tool for patients in the era of SEET to determine pregnancy outcome.

MATERIALS AND METHODS:

This study evaluated patients with confirmed pregnancy outcomes who underwent SEET between January 2016 to February 2023. Patients were grouped by pregnancy outcome: biochemical pregnancy loss (Group 1), ectopic pregnancy (Group 2), early pregnancy loss (EPL) (Group 3), and ongoing pregnancy/live birth (LB) (Group 4). Growth curves of hCG levels by day post-SEET were created using GEE models with day represented with restricted cubic splines. The models were used to estimate the average percent change in hCG from days 9-11 and days 11-13 post-SEET for each pregnancy outcome. Tukey's test was used to test differences in mean hCG and hCG change between pregnancy outcomes.

RESULTS:

A total of 39,805 cycles were evaluated. Baseline demographics and cycle characteristics were similar across groups. Most patients were in Group 4 (n=34,234). Mean (95% CI) hCG values (mIU/mL) on day 9 post-SEET were 43 (40.6, 45.6) (Group 1), 26 (18, 37.5) (Group 2),92.1 (85.8, 98.9) (Group 3), and 168 (163.9, 172.2) (Group 4). The average percent change in hCG between

day 9 to day 11 post-SEET was -5.6(-12.3, 1.6) (Group 1), 66.4 (8, 156.5) (Group 2), 113.4 (95.5, 133.1) (Group 3), and 140.6 (133.6, 147.9) (Group 4). Mean percent change in hCG between day 11 to 13 post-SEET was 9.4 (2.6, 16.6) (Group 1), 111.1 (55, 187.4) (Group 2), 111.4 (96.6, 127.4) (Group 3), and 138.6 (132, 145.4) (Group 4). D9-11 hCG change was significantly different between all groups except group 2 was not significantly different from any other group.

Table 3. P values comparing hCG levels and changes (mean) between groups

Groups	Ongoing/LB	Biochemical	EPL	EP
hCG, day 9				
Ongoing/LB				
Biochemical	<.0001			
EPL	<.0001	<.0001		
EP	<.0001	0.84	<.0001	
% change, d9-11				
Ongoing/LB				
Biochemical	<.0001			
EPL	0.0005	<.0001		
EP	0.79	0.19	0.98	
% change, d11-13				
Ongoing/LB				
Biochemical	<.0001			
EPL	0.14	<.0001		
EP	0.89	0.02	0.99	

CONCLUSIONS:

An hCG level above 83.7 mIU/mL combined with an HCG rise of at least 94.5% 9 days post-SEET powerfully predicts ongoing pregnancy/live birth. This new model not only aligns with existing understanding of hCG dynamics in viable intrauterine pregnancies, but also offers enhanced specificity to IVF pregnancies, and valuable insights into various types of abnormal pregnancies.

IMPACT STATEMENT:

Early hCG dynamics may be a surrogate marker for trophectoderm mitotic activity and possible efficacy of implantation. We developed a novel model to provide prognostic information and a decision support tool for patients in the era of SEET.

REFERENCES:

N/A