Sex Ratio of Babies Is Unchanged After Transfer of Fast- Versus Slow-Cleaving Embryos

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Purpose: A higher proportion of male offspring has been observed after transferring faster-developing embryos in a number of animal species. Therefore, we evaluated the correlation between the sex ratio of delivered babies and the cleavage stage of transferred embryos in a human IVF-ET program.

Methods: The sex of infants born (n = 104) after transfer of exclusively slower-cleaving ≤3 cell (n = 41) versus exclusively faster-cleaving ≥4 cell (n = 63) embryos was compared. Furthermore, all boys and girls resulting from IVF-ET (n = 213) were compared with respect to: the average number of cells in the embryos that were transferred, the embryo with the greatest number of cells in the cohort transferred and the percentage of embryos that were faster cleaving.

Results: Thirty seven percent (15/41) of infants resulting from the transfer of exclusively slower-growing embryos were girls (NS). The analysis all 213 babies born after 145 embryo transfer procedures did not suggest any differences in embryo cleavage rates in embryo transfers leading to male versus female infants.

Conclusions: A greater number of boys born was not observed after transfer of faster-cleaving embryos as has been described in other animal species. The race to be male may not occur until later cleavage divisions or may not occur in the human embryo.

KEY WORDS: fertilization; in vitro; sex ratio; embryo cleavage; embryo quality sex differentiation; sex related growth; X chromosomal function; Y chromosomal function.

INTRODUCTION

It is well known that male newborns weigh more than females at birth (1). It has also been observed that the crown-rump length and biparietal diameter of human male fetuses measured on ultrasound are slightly larger than that of female fetuses (2). Furthermore, it has been demonstrated in murine and bovine species that male embryos divide at a faster rate than their female counterparts (3). In this study, we examine human embryos produced from in vitro fertilization (IVF) prior to embryo transfer to the uterus to determine whether or not slower-cleaving embryos lead more often to female infants.

MATERIALS AND METHODS

Standard in vitro fertilization-embryo transfer (IVF-ET) was performed using a GnRH analogue...
SEX RATIO OF BABIES

Down regulation and human menopausal gonadotropin stimulation protocol. Oocyte harvest was scheduled 34–36 h after 5000 units human chorionic gonadotropin (hCG) was administered intramuscularly. Oocyte retrieval was performed by ultrasound-guided needle aspiration. Percoll gradient centrifugation was used for sperm preparation. Insemination was performed 4–6 h post-egg retrieval.

Fertilization was defined by the presence of two distinct pronuclei 18 h postinsemination. One to four embryos were transferred to the uterus 42 h after insemination. The embryos transferred range from 2-cell stage to 5/6 cell stage. Embryos composed of 4 or more cells were classified as faster cleaving, whereas embryos with 3 cells or less were designated as slower cleaving.

We then studied the offspring that resulted from pregnancies after IVF-ET. In the first part of this study we compared the sex of infants born after the transfer of exclusively slower cleaving (<3 cell at ET) versus infants born after the transfer of exclusively faster cleaving (≥4 cell at ET) embryos.

In the second part of this study, we analyzed all embryo transfers that resulted in the birth of an infant at our center between April 1989 and May 1994. Boys and girls were compared with respect to: the average number of cells in the embryos that were transferred, the embryo with the greatest number of cells in the cohort transferred and percentage of embryos that were faster cleaving (≥2 cell and also as defined as ≥3 cell at ET). Chi-square and two-tailed Student’s t test were used for statistical analysis. P < 0.05 denotes statistical significance.

RESULTS

From April 1989 to May 1994, there were 213 viable pregnancies produced through the Ottawa Civic Hospital’s IVF GOAL Program. These pregnancies resulted from a total of 463 embryos transferred at 145 embryo transfer (ET) procedures. Of all the viable pregnancies, 63 were produced from ET of exclusively fast-cleaving (>4 cell) embryos and 41 from ET of exclusively slow-cleaving embryos. Fifteen of 41 (37%) infants from transfer of exclusively slow-cleaving embryos were girls. Twenty-four of 63 (38%) infants from the exclusively fast-cleaving embryos were girls (NS).

In the second part of this study, all babies born after IVF-ET (n = 213) between April 1989 and May 1994 were analyzed (Table I). When the average number of cells per embryo in the cohort of embryos transferred was compared, there was 3.4 ± 0.9 and 3.4 ± 0.8 average number of cells per embryo when the ET led to a boy versus a girl (NS). Looking at the fastest-cleaving embryo in the cohort of embryos at ET, boys resulted from the fastest embryo having 4.2 ± 1.1 cells and girls resulted with the fastest having 4.2 ± 1.0 cells (NS). If faster-cleaving embryos were defined as having more than 2 cells, boys had 69.6 ± 32.7% faster-cleaving embryos transferred and girls had 67.6 ± 30.8% (NS). If faster-cleaving embryos were defined as having more than 3 cells, boys had 56 ± 37% faster-cleaving embryos transferred and girls had 52 ± 36% (NS). Thus, boys did not result more often from faster-cleaving embryos than girls observed just prior to ET at 42 h postinsemination after in vitro fertilization.

DISCUSSION

In human beings, it has been observed that baby boys are heavier than baby girls. Penrose found that of 13,000 babies studied, the average weight of newborn males (3334 gm) was significantly greater than newborn females (3234 gm) (1). When male and female fetuses were compared in terms of ultrasound measurements of crown-rump length and biparietal diameter, at the 12th menstrual week, female embryos were 1 day behind their male counterparts and at term, females are 6–7 days smaller than male fetuses (2).

At the preimplantation embryonic stage, Tsunosa et al. studied mouse embryos cultured in vitro from

<table>
<thead>
<tr>
<th>Boys</th>
<th>Girls</th>
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<td>n = 127</td>
<td>n = 86</td>
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| Exclusively fast (≥4 cell) embryos transferred (n = 63) | 39 | 24 |
| Exclusively slow (<3 cell) embryos transferred (n = 41) | 26 | 15 |
| Average number of cells/embryo transferred | 3.4 ± 0.9 | 3.4 ± 0.8 |
| Number of cells found in the fastest embryo transferred | 4.2 ± 1.1 | 4.2 ± 1 |
| % fast (≥2 cell) embryos transferred at ET | 70 ± 33 | 68 ± 31 |
| % fast (>3 cell) embryos transferred at ET | 56 ± 38 | 52 ± 36 |

*All data not significant (NS) ± SD.