

The relationship between age and rates of abnormal fertilization following intracytoplasmic sperm injection (ICSI)

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Objective: Normal fertilization is confirmed by the observation of two pronuclei (2PN) within a zygote 16-18 hours after insemination. Zygotes with no pronuclei (0PN), one pronucleus (1PN), or numerous pronuclei (≥ 3 PN) indicate failed or abnormal fertilization. Older female age has been associated with increased rates of 3PN zygotes. Studies investigating male age and abnormal fertilization are inconclusive. This study evaluates the relationship between female and male age and rates of abnormal fertilization.

Design: Retrospective cohort study

Materials and Methods: This study evaluated in vitro fertilization (IVF) cycles between January 2012 and December 2019. A couple's first IVF cycle was included if intracytoplasmic sperm injection (ICSI) was performed using fresh, ejaculated sperm. The relationship between female age, male age, and fertilization was assessed. Specifically, rates of 0PN, 1PN, 2PN, and ≥ 3 PN embryos were evaluated. Linear regression models were applied, with $p < 0.05$ considered significant.

Results: 8,308 cycles were analyzed with a mean female age of 35.4 ± 4.7 years and a mean male age of 37.7 ± 6.0 years. Normal fertilization rate (2PN) following ICSI was 84.4%. Per-cycle abnormal fertilization rates were 13.4% for 0PN, 1.4% for 1PN, and 0.8% for ≥ 3 PN.

When controlling for male age, increasing female age was not associated with a change in the proportion of 0PN, 1PN, or 2PN zygotes ($p=0.87$, 0.29 , and 0.85 respectively for female age 30-34.9, $p=0.66$, 0.12 , and 0.61 for female age 35-39.9, $p=0.74$, 0.24 , and 0.72 for female age >40) using female age <30 as a reference. Rates of ≥ 3 PN embryos were statistically elevated for women aged 35-39.9 ($p=0.02$) but were no different from the reference group in women 30-34.9 years of age ($p=0.13$) or >40 ($p=0.09$).

When controlling for female age, increasing male age did not affect rates of 0PN, 1PN, 2PN, or 3PN zygotes ($p=0.70$, 0.78 , 0.71 and 0.81 respectively for male age 30-34.9, $p=0.68$, 0.29 , 0.56 and 0.82 for male age 35-39.9, $p=0.43$, 0.64 , 0.45 and 0.72 for male age >40) using male age <30 as a reference.

Conclusions: Rates of normal fertilization were unaffected by increasing age of either partner. A woman's age may impact early embryo morphological development, evidenced by elevated rates of ≥ 3 PN zygotes in women 35-39.9 years of age. However, this trend was not observed in women >40 , indicating that further studies are necessary to fully understand this relationship.

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