

Intracytoplasmic sperm injection: a novel selection method for sperm with normal frequency of chromosomal aneuploidies

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The technological advance of intracytoplasmic sperm injection (ICSI) enabled a single sperm to be introduced into an oocyte (1). Although this approach has provided a unique opportunity for infertile men to father children, serious concerns remain. First, male offspring conceived by ICSI have been linked to increased rates of chromosomal aneuploidies and propagation of disorders related to Y-chromosome deletions (2-4). Second, for the first time in evolution the natural process of sperm oocyte self selection is superseded by a random choice of an embryologist. Thus, sperm that have never been part of the fertilizing pool might initiate zygote formation.

In the United States, >30,000 cycles of ICSI are conducted yearly; some centres use ICSI for up to 70% of IVF cycles, to enhance fertilization rates. Proponents of ICSI argue that in the approximately 10,000 ICSI children (who are now up to 10 years old), the rate of congenital malformations does not differ from that of the normal population, although ICSI has been linked to a threefold to fourfold increase in de novo chromosomal aberrations in offspring compared with conventional fertilization (2-6). However, other investigators suggest that ICSI might cause an increase in malformations and adverse development effects and pregnancy outcome (7-9).

Furthermore, the future public health consequences of ICSI with sperm containing fragmented DNA are as yet unknown with respect to individual physical and mental development, as is the life span or cancer rates of the ICSI offspring. Another concern related to ICSI with diminished maturity sperm is the possible presence of an abnormal apoptotic process in such sperm (10). However, we have recently shown that hyaluronic acid (HA) selected sperm are devoid of DNA degradation and of active caspase-3, which is a central component of the apoptotic process (11). In general, it seems desirable to keep the genetic impact of ICSI fertilization at the traditional evolutionary level by introducing only mature spermatozoa that would have been part of the physiological fertilization pool. In this report, we describe a scientifically based, non-invasive ICSI selection strategy for mature spermatozoa that show a normal frequency of chromosomal aneuploidies and are devoid of apoptosis (11).

Objective: To test a newly invented intracytoplasmic sperm injection (ICSI) sperm selection method based on sperm hyaluronic acid (HA) binding.

Design: Comparison of chromosomal disomy and diploidy frequencies in sperm arising from semen and in HA bound sperm

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Setting: Academic andrology laboratory

Patient(s): Men presenting for semen analysis

Intervention(s): Washed sperm fractions of 32 semen samples were applied to Petri dishes or glass slides coated with immobilized HA. The unbound sperm were rinsed gently, and the HA bound sperm were removed with an ICSI pipette. The control sperm population was the unselected sperm. Both HA selected and unselected sperm were treated with fluorescence in situ hybridization with centromeric probes for the X, Y and 17 chromosomes.

Main Outcome Measure(s): Chromosomal disomy and diploidy frequencies.

Result(s): In the HA bound sperm (495-2,079 per man, 41,670 in all) compared with unselected sperm (4,770 per man, 162,210 in all), the chromosomal disomy frequencies were reduced to 0.16% from 0.52% diploidy to 0.09% from 0.51% and sex chromosome disomy to 0.05% from 0.27% (a 5.4 fold reduction vs. 4 fold respective increase in ICSI offspring)

Conclusion: The HA sperm selection method for ICSI, which is based on a relationship between sperm receptors for zone pellucida and HA will likely reduce the potential genetic complications and adverse public health effects of ICSI (Fert Steril 2005;84:1665-73. ©2005 by American Society for Reproductive Medicine).

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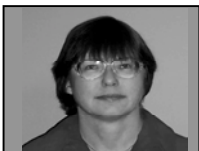
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