Intracytoplasmic sperm injection completely negates the implantation problem associated with conventional fertilization with sperm with low hypo-osmotic swelling test scores as evidenced by evaluating donor-recipient pairs

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Summary

Purpose: To corroborate or refute the claim that intracytoplasmic sperm injection (ICSI) can overcome the problem found after conventional insemination of oocytes with sperm with low hypoosmotic swelling (HOS) tests of forming embryos with low implantation potential. *Methods:* Matched couple pairs sharing one pool of oocytes were identified where one of the male partners had a low HOS test score and the other one with a normal one. Intracytoplasmic sperm injection was always used in those with low HOS test scores (i.e., < 50%) vs ICSI only used for semen abnormalities in the normal HOS group. *Results:* There were no differences found in either fertilization rates or clinical or live delivered pregnancy rates or implantation rates between these groups. *Conclusions:* Intracytoplasmic sperm injection can completely negate the adverse effect that fertilization with sperm with subnormal HOS scores has on embryo implantation potential.

Key words: Hypoosmotic swelling test; Conventional oocyte insemination; Intracytoplasmic sperm injection.

Introduction

Previous studies have shown normal fertilization rates but low pregnancy rates for couples whose male partner has a low score of < 50% tail swelling following a hypoosmotic swelling (HOS) test [1, 2]. The low pregnancy rate has been hypothesized to be related to the transfer of an unknown toxic substance from the sperm to the zona pellucida [3].

Intracytoplasmic sperm injection (ICSI) can be used to overcome low pregnancy rates [4, 5]. One uncontrolled study revealed a clinical pregnancy rate per transfer > 40% when using ICSI [5].

The present study was conducted to corroborate or refute the previous conclusions that ICSI can be used to achieve higher pregnancy rates by performing a matched controlled study, and to determine pregnancy rates following ICSI in couples sharing one pool of eggs with one woman having a male partner with HOS test score < 50% and the other woman a male partner with an HOS score of ≥ 50%.

Materials and Methods

A retrospective review of donor-recipient pairs was conducted over a 7-year time period in which one of the two couples had a male partner with a low HOS test score. Pregnancy outcome was evaluated for fertilization with sperm with low vs normal HOS test scores: only pairs having one male partner with a low HOS test score were evaluated. Intracytoplasmic sperm injection was used on all oocytes when using sperm with low HOS test scores. Intracytoplasmic sperm injection was only used in the normal group when other abnormal semen parameters were present.

Only cycles with at least two embryos transferred on day 3 were evaluated. Two methods of controlled ovarian hyperstimulation were used; either luteal phase leuprolide acetate or antagonist protocols using ganirelix or cetrorelix.

Results

A comparison of pregnancy outcome rates for low HOST and normal HOST groups is seen in Table 1. Seventy-three paired cycles were evaluated, leading to 49 transfers using sperm with low HOS test scores vs 53 with normal HOS test scores. Some fresh transfers were deferred and embryos frozen instead for risk of ovarian hyperstimulation or for inadequate endometrial thickness.

There were no cycles with failure to attain a day 3 embryo. One woman in the normal group transferred only one embryo so the analysis was based upon 49 transfers in the low HOS group vs 52 in the normal HOS test group.

The fertilization rate was 73.1% (483 of 781) in the low HOS test group compared to 65.8% in the normal HOST group. Implantation rate was 29.6% (45/152) for low HOS test group as compared to 27.4% (43/157) for the normal HOS test group (chi-square, p = NS). Clinical pregnancy/transfer rate (evidenced by ultrasound at 8 weeks) was 53.1% (26/49) in the low HOS group as compared to 55.8% (29/52) in the normal HOS test group (p = NS). Delivered pregnancy rate was 49.0% (24/49) for the low HOS test group and 50.0% for the normal HOS test group (p = NS).

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Table 1. — *Shared oocyte pairs were used to determine if intracyto-plasmic sperm injection fully corrects the embryo implantation defect caused by sperm with low HOS test scores.*

	Los HOS	Normal HOS[b]
No. cycles	73	73
No. transfers	49	53
No. transfers ≥ 2 embryos transferred	49	52
No. eggs retrieved	781	775
No. metaphase II oocytes	583	649
No. inseminated	661	714
No. fertilized	483	470
% fertilized	73.1%	65.8%
No. pregnancies	32	31
% pregnant/transfers	65.3%	59.6%
No. clinical pregnancies	26	29
% clinical pregnancy/transfers	53.1%	55.8%
No. chemical	5	1
No. ectopic	1	1
No. live deliveries	24	26
% live delivery/transfers	49.0%	50.0%
# miscarriages	2	6
% miscarriage/pregnancies	7.7%	20.7%
No. embryos transferred	152	157
Average no. embryos transferred	3.1	3.0
No. sacs implanted	45	43
Implantation rate	29.6%	27.4%

Discussion

This is the first study attempting to corroborate or refute previous claims that ICSI can overcome the HOS test sperm abnormalities. These data confirm previous conclusions and is the first controlled study showing that ICSI fully overcomes the HOS test defect. The fertilization of oocytes by ICSI can completely overcome the embryo implantation problem seen when using conventional insemination methods.

Previous studies have found dismal pregnancy results following conventional oocyte insemination and subsequent embryo transfer when using sperm with low HOS test scores. A matched controlled study found a clinical pregnancy rate of only 3.7% per transfer with low HOS test scores versus 25.9% with normal HOS test scores [1]. A study comparing the sharing of one pool of oocytes by two couples both having male partners with normal semen parameters except for one of the two having a HOS test score < 50% found a 0% clinical pregnancy rate with low HOS test score versus 50% with a normal score [2]. In contrast to the present study this previous study used conventional oocyte insemination not ICSI for low HOS test scores [2].

A retrospective study of IVF-ET cycles from 1991 to 1994 using conventional oocyte insemination using sperm with single abnormalities found a 25.7% rate with subnormal motile density, 44.4% with subnormal morphology using strict criteria, 25.7% with all factors normal, but 0% with the HOS test < 50% [6]. There have been no studies refuting this claim of normal fertilization rates but poor pregnancy rates with conventional insemination of oocytes with sperm with low HOST scores.

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