EUPLOIDY RATES BY PATIENT AGE IN INTRACYTOPLASMIC SPERM INJECTION (ICSI) VERSUS CONVENTIONAL INSEMINATION (CI) FOR MALE FACTOR (MF) AND NON-MALE FACTOR (NMF) INFERTILITY

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BACKGROUND

Since the introduction of intracytoplasmic sperm injection (ICSI) in 1992, it has been a well-established method for treating male factor infertility due to its requirement for a very small number of viable sperm. Its use has expanded beyond male factor due to some studies suggesting enhanced fertilization, and lower risks of failed fertilization or inadvertent contamination of embryo biopsy specimens (1,2). However, there are potential risks associated with ICSI, including damage to the injected oocyte, inadvertent selection of chromosomally abnormal sperm, imprinting disorders, birth defects and the significantly increased cost of IVF compared to conventional insemination (3). It is also unclear whether ICSI contributes to genetic abnormalities by bypassing the egg's ability for natural sperm selection and potentially disrupting the meiosis apparatus (4). There is minimal information available as to whether the ICSI procedure can increase the incidence of aneuploidy in embryos.

OBJECTIVE

We previously investigated fertilization, blastocyst development, and euploidy rates for intracytoplasmic sperm injection (ICSI) versus conventional insemination (CI) among patients with male factor (MF) and non-male factor (NMF) infertility, and found a trend towards higher euploidy rate with CI. This study builds upon our previous work, with a much larger sample size, and stratification by age.

MATERIALS & METHODS

This was a retrospective cohort study of 1822 patients from January 2023 to December 2024. Patients undergoing in vitro fertilization (IVF) at a single clinic, with pre-implantation genetic testing for aneuploidy (PGT-A) were included. Patients were grouped into ICSI for MF infertility, ICSI for NMF infertility, or CI, and stratified by age group. The primary outcome was euploidy rate, which was defined as the number of euploid embryos per total biopsied blastocysts. Secondary outcomes included fertilization rate (FR; 2pns/eggs injected/inseminated), blastocyst development rate (BR; blastocysts/2pns), mosaic and no result rate (per biopsied blastocysts). Percentage data was compared using N-1 Chi-squared test and a p-value of <0.05 was considered statistically significant.

RESULTS

	<35 yr			35-37 yr			38-40 yr			41-42 yr			>42 yr			Donor			Total (all age groups)		
	ICSI		CI	ICSI		Ins	ICSI		CI	ICSI		CI	ICSI		CI	ICSI		CI	ICSI		CI
	MF	NMF		MF	NMF		MF	NMF		MF	NMF		MF	NMF		MF	NMF		MF	NMF	
N	237	383	87	162	235	75	129	177	48	41	88	15	14	50	8	26	32	15	609	965	248
Fert rate (%)	73.0^{a}	78.6^{ab}	71.0^{b}	75.0^{df}	78.5^{de}	65.7^{ef}	74.8^{gh}	79.9^{gi}	65.6^{hi}	73.4^{jk}	78.9^{jl}	63.6^{kl}	76.8^{m}	81.6^{n}	65.7^{mn}	71.8^{q}	80.1^{qr}	72.5^{r}	73.8^{tu}	79.0^{tv}	68.3^{uv}
Blast rate (%)	44.8	44.9	43.1	39.3	42.3	39.1	35.9	37.6	34.2	31.2	29.9	31.8	29.2	35.9	18.1	47.8^{s}	44.6	39.5^{s}	40.8	41.7^{w}	39.1^{w}
Euploidy rate (%)	66.8	67.6	70.4	62.2	59.0	56.5	46.9	41.7	40.4	32.8	35.9	40.8	21.4	34.1^{p}	5.9^{p}	73.6	66.7	76.6	60.8	59.1	61.4
Mosaic rate (%)	1.9	2.5	2.6	2.8	2.1	1.6	1.3	1.0	1.8	0.8	0.4	40.8	0.0	1.2	0.0	2.1	3.1	3.1	2.0	2.1	2.2
No result rate (%)	3.4	3.4^{c}	1.8^{c}	3.7	3.9	3.5	5.5	5.2	3.0	4.8	3.0	6.1	3.6	3.0	0.0	4.7	9.2	5.5	4.0	4.1	2.9

Table 1 Fertilization rate, blastocyst development rate, fertilization rate, euploidy rate, mosaic rate, and no result rate for male factor and non-male factor patients who underwent IVF with ICSI and patients who underwent conventional insemination across various age groups

p-values (values with same superscript are significantly different):
a,b,e,f,h,i,l,n,t,u,v: p<0.0001 c: p<0.0499 d: p<0.0029 g: p=0.0003 j: p=0.0145 k: p=0.0055 m: p=0.0464 o: p=0.0008 p: p=0.0175 q: p=0.0008 r: p=0.0034 s: p=0.0251 w: p=0.0094

Fertilization rate was higher for non-male factor (NMF) infertility patients who underwent IVF with ICSI than both male factor infertility patients who underwent ICSI as well as patients who underwent IVF with conventional insemination (CI) in all age groups except the >42 group. Fertilization rate for ICSI for male factor patients was higher than conventional insemination in most age groups.

Blastocyst development rate was higher for male factor patients who had ICSI than donor group patients who underwent conventional insemination. Total blastocyst development rate for non-male factor patients with ICSI was slightly higher than patients with conventional insemination. Otherwise, there were no significant differences in blastocyst development rate.

For the >42 group, euploidy rate was higher for non-male factor ICSI patients than conventional insemination patients, though these groups had small sample sizes. There were no significant differences in euploidy rates in any other age group. There were no significant differences in mosaic rates in any age group.

In patients <35, the no result rate was slightly lower for conventional insemination than for ICSI for non-male factor, though this did not hold true in other age groups.

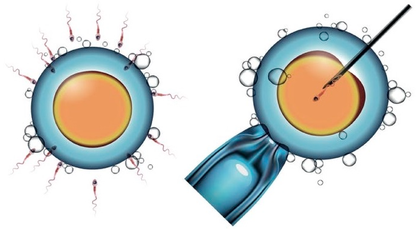

Figure 1 Rendering of conventional insemination (left) and ICSI (right)

CONCLUSION

As literature has previously reported, ICSI generally yielded a higher fertilization rate than conventional insemination. Blastocyst development rate, euploidy, mosaic, and no result rates were similar between all groups. Our study demonstrates that ICSI may not provide significant benefit over conventional insemination in non-male factor infertility patients.

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