

Impact of sperm DNA fragmentation on reproductive outcome following IVF and ICSI: a retrospective analysis of 406 cases

Christensen P¹, Sills ES^{3,4}, Fischer R², Naether OGJ², Walsh D², Rudolf K², Coull G³, Baukloh V², Labouriau R⁵ and Birck A¹

¹ SPZ Lab A/S, Fruebjergvej 3, DK-2100 Copenhagen OE, Denmark ² Fertility Center Hamburg, Speersort 4, 20095 Hamburg, Germany ³ Sims IVF, The Sims Building, Clonskeagh Rd., Clonskeagh, Dublin 14, Ireland. ⁴ Division for Reproductive Endocrinology, Pacific Reproductive Center, Irvine CA 92618, USA. ⁵ Aarhus University, Department of Molecular Biology and Genetics, Center for Quantitative Genetics and Genomics, Gustav Wiedes Vej 10, DK-Aarhus C, Denmark.

Keywords:

sperm DNA fragmentation, ART outcome

Study question:

Currently, no published data describes the impact of sperm DNA fragmentation on the outcome of IVF and ICSI treatments in a typical population of women seen by fertility centers where no selection with regard to age or body mass index (BMI) is possible.

Summary answer:

A significant negative effect on the reproductive outcome of IVF and ICSI treatments was seen when the sperm DNA fragmentation index (DFI) was above 15% and 25%, respectively.

What is known already:

Bungum et al. (Human Reproduction 2007;22:174-179) reported that IVF and ICSI were equally successful when DFI was below 30. Interestingly, when DFI was above 30, ICSI results were significantly better than IVF. That study only included women under the age of 40 years (average 31.6) and with BMI below 30.

Study design, size, duration:

This retrospective study reviewed non-donor IVF and ICSI clinical records and corresponding laboratory data. Outcome of the first treatment cycle was included in the data. Thresholds for DFI of 15 and 25 were used for IVF and ICSI, respectively. Effect on outcome below and above the threshold was analyzed.

Materials and methods:

IVF (n=210) and ICSI (n=196) treatments were performed by two fertility centers. Pregnancy was confirmed by ultrasound at 12 week gestation. As a part of the male fertility investigation, DFI was determined using the Sperm DNA Integrity (SDI) test modified from Evenson & Jost (Current Protocols In Flow Cytometry 2000;7,13:1-27).

Main results and the role of chance:

In the IVF group, all DFI values were below 25 (according to the recommendation after the SDI test result). In the ICSI group, DFI values varied up to 61.2.

Clinical pregnancy rate was 37.6% (79/210) for first cycle IVF treatments. The clinical pregnancy rate was 45.1% when DFI was below 15, and diminished to 24.6% when DFI was between 15 and 25. Odds ratio adjusted for female age was 2.63 (95% CI 1.36-5.11), P=0.0014.

For first cycle ICSI treatments, the average clinical pregnancy rate was 40.8%. When DFI was below 25, the success rate was 48.7%. Above this threshold, the clinical pregnancy rate was 29.6%. Odds ratio adjusted for female age was 2.15 (95% CI 1.14-4.05), P=0.0045.

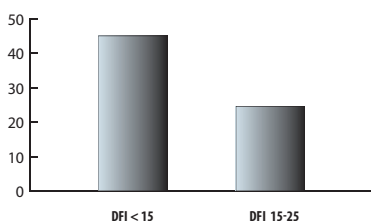


Figure 1.

For first cycle IVF treatments, the clinical pregnancy rate was 45.1% when DFI was below 15. When DFI was between 15 and 25, the clinical pregnancy rate diminished to 24.6%. The odds ratio adjusted for female age was 2.63 (95% CI 1.36 to 5.11, P=0.0014). The average clinical pregnancy rate was 37.6% (79/210).

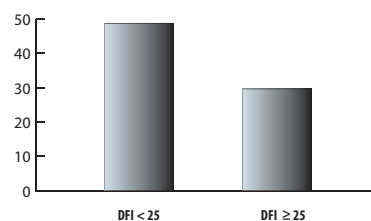


Figure 2.

For first cycle ICSI treatments, the average pregnancy rate was 40.8%. When DFI was below 25, the success rate was 48.7%. Above this threshold, the clinical pregnancy rate was 29.6%. The odds ratio adjusted for female age was 2.15 (95% CI 1.14 to 4.05, P=0.0045).

Limitations, reason for caution:

BMI is a potential confounder but was not recorded routinely at the time of the fertility treatments. A logistic statistical model was applied to account for the potential effect of female age, an additive effect of female age was detected, but no significant interaction was found.

Study funding/competing interest(s):

No external funding. P. Christensen and A. Birck are co-founders of SPZ Lab who performed the SDI test. Study registration number: Not applicable.

Wider implications of the findings:

These data show that the IVF success rate declines when DFI is above 15. For patients with DFI above 15, ICSI treatment appears to be more likely to succeed. For both treatments, the decrease in success rates with higher DFI values makes it desirable to investigate and treat the cause of sperm DNA fragmentation prior to ART. Reduction of the sperm DNA fragmentation prior to fertility treatments is likely to increase reproductive outcome.

Further information:

Please contact corresponding author P. Christensen on mail: pc@spzlab.com or phone: + 45 39 17 97 84