Assessing DFI Testing and Its Correlation with ART Success Rates

Introduction

The DNA Fragmentation Index (DFI) is a key measure of sperm health, showing how much DNA damage is in sperm cells. High DFI can lower male fertility by harming sperm function and its ability to fertilize an egg. In assisted reproductive techniques like in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), sperm quality plays a crucial role in determining outcomes such as fertilization rates, embryo development, and pregnancy success. The purpose of this study is to assess the correlation between DFI and ART success rates, particularly focusing on fertilization outcomes, embryo quality, and pregnancy rates across different levels of sperm DNA fragmentation.

Background Study

Sperm DNA fragmentation has emerged as a reliable marker for assessing male fertility potential, especially in the context of ART. Research indicates that high DNA fragmentation correlates with lower chances of successful conception, either naturally or through ART. Since 2018, a number of research have looked into how DFI affects ART outcome. Sakkas et al.'s meta-analysis from 2019 revealed a marked decline in pregnancy rates in instances with high DFI. Utilizing sperm with lower DFI levels improved the results of IVF with ICSI for couples, according to other studies like Zini et al. (2020). On the other hand, conflicting results have also been documented. For example, a 2021 study by Moskovtsev et al. revealed that, depending on other variables like age and oocyte quality, high DFI does not always have a detrimental impact on ART outcomes.

Methodology

This study used a retrospective method of clinical data collected from Nordica Fertility Center, Lagos. A total sample size of 200 patients that underwent IVF procedures in 2021 and 2022 was analyzed. Random sampling was used to select patient records, ensuring that the study included a diverse group of patients with varying levels of DFI.

Sperm Chromatin Dispersion test (SCD) was used to analyze the DNA fragmentation of the samples. The DFI ranges used in the study were categorized as follows: less than 15% (Excellent to good sperm DNA integrity), 15-25% (Good to fair sperm DNA integrity), 25-50% (Fair to Poor sperm DNA integrity), and greater than 50% (Very poor sperm DNA integrity).

The key variables analyzed included DFI percentage, sperm concentration, motility, fertilization rates, embryo quality, blastulation rates, and pregnancy outcomes.

Statistical Analysis

The statistical analysis was performed using Pearson's correlation coefficient to examine the relationship between DFI levels and ART outcomes (fertilization rate, embryo quality, and viable pregnancy rates). A p-value of <0.05 was considered statistically significant. Chi-square tests were used to evaluate categorical data such as pregnancy success across different DFI groups. Logistic regression models were employed to assess the predictive value of DFI in determining ART success. The analysis also included ANOVA to compare mean fertilization rates and embryo quality across the different DFI groups.

Results

The total sample size for this analysis was 200 patients. Among these, 50 patients had a DFI of less than 15%, 60 patients had a DFI between 15% and 25%, 40 patients had a DFI between 25% and 50%, and 50 patients had a DFI above 50%. The following table summarizes the key outcomes for each group.

Table 1.0 summary of different DFI ranges and ART outcomes

DFI Group	Fertilization Rate (%)	Embryo Quality (Most Dominant)	Blastulation Rate (%)	Pregnancy Outcome (%)
<15%	75%	Grade A & B	80%	60%
15-25%	55%	Grade B	65%	45%
25-50%	30%	Grade C	40%	25%
>50%	20%	Grade C & D	15%	10%

Statistical analysis revealed a significant correlation between DFI and fertilization rates ($r = -0.65$, $p < 0.01$), as well as a statistically significant relationship between DFI and pregnancy outcomes ($p < 0.05$). Patients with a DFI of less than 15% exhibited the highest fertilization and pregnancy success rates, while those with a DFI greater than 50% had the lowest rates.

Discussion

The study's findings are consistent with a larger body of research showing a detrimental relationship between sperm DNA fragmentation and the outcomes of ART. Similar results were reported by Esteves et al. (2019), who found that lower

rates of fertilization and pregnancy were linked to higher DFI scores. Patients with low DFI had a better outcome in IVF/ICSI, as proven by Zini et al. (2020).

Other Studies, however, indicate that the effectiveness of DFI can vary depending on other confounding factors. For instance, Moskovtsev et al. (2021) discovered that although high DFI occasionally had a detrimental impact on pregnancy rates, the effect was less pronounced in individuals with good quality oocytes. This suggests that other variables, such as egg quality and age, should be taken into account and that sperm DNA fragmentation may not be the only factor determining the success of ART. To investigate the interactions between these variables and improve treatment regimens, more research is required.

Conclusion

This study supports the use of DFI as a predictive marker for ART success. Patients with lower DFI scores are more likely to achieve higher fertilization rates and conceive after ART. However, as some conflicting studies suggest, additional factors such as oocyte quality may also influence ART outcomes. Clinicians should consider comprehensive testing that includes both sperm and oocyte assessments to better predict success. Further research could explore interventions, such as lifestyle changes and antioxidant therapy, to reduce DFI and improve ART success rates.

Recommendations

1. Incorporate routine DFI testing as part of male fertility assessments in ART procedures.
2. Explore therapeutic interventions, such as lifestyle changes and antioxidant treatments, to reduce DFI before ART.
3. Conduct further research on the combined impact of sperm DNA fragmentation and oocyte quality on ART outcomes.

References

Esteves, S. C., et al. (2019). 'Impact of Sperm DNA Fragmentation on Male Fertility and ART Outcomes: A Review.' Journal of Assisted Reproduction and Genetics, 36(5), 749-758.
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