Determinations of DNA Damage From Sperm Preparation Methods in ICSI Cycles and Mitigation with Sperm Chip Method

- IVMED Fertility Centre, Kyiv, Ukraine
- Chaplia Olga, Aydin Birol, Maliuta Olga, Pischana Tetiana, Korobko Maksim, Kotliarova Olena, Gudkova Daria, Smiian Polina

Introduction: what is already known

Almost 50% of all cases of infertility may be associated with a male factor (1). Still standard semen analysis does not provide any information about the genetic constitution of the sperm, which is essential for normal embryo development. Thus a high level of DNA damage and aneuploidy of sperm cells may represent a cause of male infertility that conventional examinations cannot detect. Therefore, sperm chips based on microfluidic channel mechanics appear to be a promising tool for a selection of physiologically competent sperm for fertilization, thus increasing efficiency of male infertility treatment. But does this method give any benefit in oocyte donation programs, or young and healthy eggs are able to compensate sperm abnormalities by themselves?

Materials and methods

In order to assess the influence of sperm DNA fragmentation on development of embryos created from donor oocytes, fertilization and blastocyst formation rates were estimated retrospectively for two groups of cases from 2018-2019. Control group (n=40) included couples with normal results of DNA fragmentation assay while patients whose sperm DNA fragmentation rate initially exceeded 30% were assigned to study group (n=40).

For the investigation of sperm chip efficacy, we compared results of oocyte donation cycles where fertilization was done with sperm with a high DNA fragmentation index. So, in the control group (n=50) sperm processing was done by density gradient centrifugation method, while in study group (n=50) sperm chip technology was used for sperm preparation.

DNA fragmentation of raw and washed sperm was tested with Halosperm kit (Halotech). “Fertile” sorting chips were used for sperm processing. Fertilization was performed with ICSI-method. For every studied cohort fertilization, good blastocyst (AA, BA/AB and BB grades) and ongoing pregnancy rates were calculated.

Results

Investigation of sperm DNA fragmentation impact on donor oocytes ICSI results showed that in study group fertilization rate of donor cells was 77.2%, while in the group with normal sperm DNA fragmentation it reached 84.7% (NS, p>0.05). A significant difference in the blastulation rate after fertilization with sperm with different indices of DNA fragmentation was revealed as in the group with a high degree of sperm DNA fragmentation only 37.4% of zygotes formed blastocysts, while in the control cohort blastocysts rate was 51.2% (pic.1).

While assessing sperm sorting chip efficacy, we noted 83.3% fertilization, 57.5% blastocyst formation and, after transfer of two embryos, 59.3% pregnancy rates in control group (mean male age – 33.7±4.2 years). In the study group (mean male age – 34.6±3.7), where sperm chip technology was used as the sperm preparation method, 90.4% fertilization, 68.3% blastulation and 70.4% pregnancy rates were achieved with a statistically significant difference for blastocyst rate and PR (p<0.05). Thus, usage of microfluidic sorting chips for sperm processing significantly increased probability to obtain blastocysts for transfer and freezing and gave a chance to expect more clinical pregnancies for couples with male infertility factor.

Conclusions

Since severe sperm DNA fragmentation negatively affects the embryologic step of IVF, careful sperm selection for fertilization may be a crucial step towards positive cycle result. As microfluidic sperm chips sperm selection supposedly enhance treatment effectiveness in terms of embryo development and clinical pregnancy rate, their use may be recommended for couples with damaged sperm DNA to increase efficacy of infertility treatment even in case of oocyte donation.

Literature list
