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Biometry of Human Oocytes

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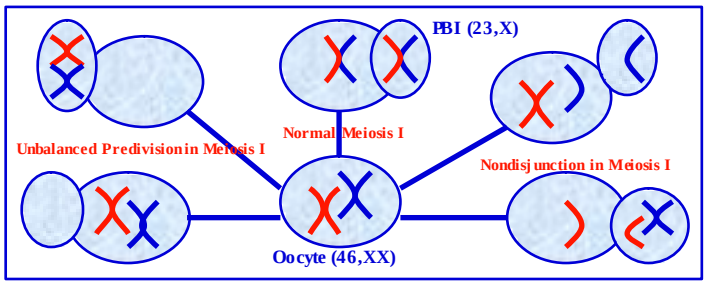
❖ INTRODUCTION

In the treatment of infertile couples with ART (Assisted Reproductive Techniques), the German embryo protection law (Embryonenschutzgesetz, ESchG) does not allow embryo selection. Only as many oocytes at the pronuclear stage (PN) as are planned to be transferred, are allowed to be cultured.

Meiotic divisions in the oocyte can be affected by exterior and interior factors. These factors cause chromosomal abnormal oocytes, zygotes and embryos.



Aneuploidy free oocytes may be preselected by testing the first polar body. In our study we analyzed the morphological and morphometrical parameters and genetic results of oocytes after polar body biopsy . We were interested in a correlation with the euploidy of the oocytes.

❖ MATERIALS AND METHODS

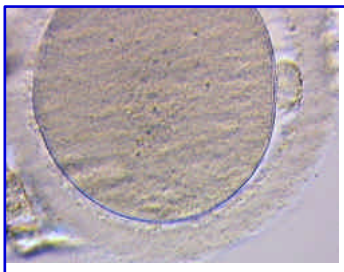
We examined a group of 20 patients (age range 25-43) with 176 oocytes who underwent PGD treatment after ICSI. We examined the following morphological parameters: regularity of the oocyte shape, granulation from 1-5 in the perivitellin space, regularity or fragmentation from 1-3 for polar body and zona pellucida thickness.

Images of the oocytes were taken and the polar body biopsy was performed by an air-oil system micromanipulator with a laser system and Octax Eyeware software.

Genetic results from FISH with chromosomes 13, 16, 18, 21, 22 were analyzed with a fluorescence microscope. Diameters and thickness were taken in two dimensions and areas were calculated for statistical analyses. Morphological, morphometrical and genetic results examined in general distribution and per patient. We analyzed the correlation of the morphological and morphometrical data with the genetic results.

❖ RESULTS

In general distribution, oocytes were usually regular in shape (93%) and area values were between 22935-19407 µm² (74%). Polar bodies were also generally regular in shape (40%) and area values were between 339-189 µm² (76%). Oocyte area and zona thickness distributions were between 10580-8365 µm² (79%) and 17– 22 µm (%70). Granulation in the perivitellin space was usually between 2 and 3 (50%-41%).

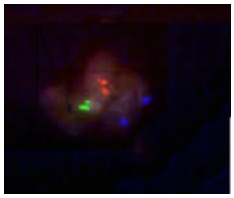


Regular oocyte with a regular PBI. Perivitellin space granulation is 2.

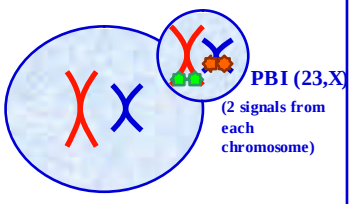
Irregular oocyte with 1st degree fragmented PBI. Perivitellin space granulation is 3.

We found 43 euploid and 69 aneuploid oocytes. We got aneuploidy results mostly in chromosome 22 and generally we got aneuploidy results because of unbalanced predivision of sister chromatids at meiosis I.

FIRST MEIOTIC DIVISION



Normal first polar body with chromosomes 18 (blue), 21(green) and 22 (red)



Oocyte in Metaphase II (23,X)

From 103 measured oocytes, 64 (62%) of them were aneuploid and 39 (38%) were euploid. Average zona pellucida thickness of aneuploid oocytes was 19.2 µm and of euploid oocytes was 20.3 µm (p=0,038).

The other correlations between morphological and morphometrical parameters of oocytes and polar bodies in general distribution with their genetic results were not statistically significant. The distribution of morphometrical parameters have big variances when examined per patient.

❖ CONCLUSION

Aneuploid oocytes seem to have a thinner zona pellucida than euploid oocytes. The clinical value of these findings need to be evaluated: is it possible to select oocytes effectively by the thickness of the zona pellucida.

1) Munne S, Dailey T, Sultan KM, Grifo J, Cohen J. The use of first polar bodies for preimplantation diagnosis of aneuploidy. Hum Reprod. 1995 Apr;10(4):1014-20.

1) Verlinsky Y., Ginsberg N., Lifchez A., Valle J., Strom CM., Analysis of the first polar body: preconception genetic diagnosis. Hum. Reprod. 1990; 5:826-9