1 Abstract

Infertility is a very common problem, affecting an estimated 1.2 million couples in Poland. As of today, IVF treatment is the most effective method. It is frequently the only effective way to cause pregnancy and the birth of a healthy child. A number of factors influence the success of this technique. One of the key steps is the selection of the embryo to be transferred; hence, one with the highest development potential are sought.

As a result of mitotic division, fertilized oocytes (zygote) is usually divided into two blastomeres. After the next round of cleavages, four blastomeres are created, then eight. Commonly, though, in over 20% of cases in one of these stages, three or even more blastomeres are created instead of two. This phenomenon is defined as Direct Unequal Cleavage (DUC) or Direct Cleavage. This dissertation attempts to determine the developmental potential of embryos in which DUC is observed. Divisions times of 4,030 embryos were analysed; on this basis, DUC cases were identified in the first (DUC-1) and second (DUC-2) round of cleavage.

In the first stage, the DUC cases were compared to those in which the anomaly was not observed. Mother's age, time of appearance of the second polar body, the appearance and fading of pronuclei, the two- and three-cell blastomere stage reached and the sizes of blastomeres, cytoplasm fragmentation, and the occurrence of multinucleation are taken into account. In addition, an important aspect was determination of the frequency of development to blastocyst stage in the studied subgroups.

In the second stage, the transferred cases were separated. This was done to determine the characteristics of embryos that result in a pregnancy. The first step was to compare the transferred DUC cases to those in which the phenomenon does not occur. The comparative analysis took into account mother's age and the morphokinetic parameters listed in the first stage. The prevalence of pregnancies with and without DUC was also assessed.

The third stage involved the use of Data Mining methods. The techniques used were basket analysis and correspondence analysis. They allowed for a detailed analysis of variables such as the occurrence of DUC in different rounds of cleavages, mother's age, multinucleation, the level of fragmentation, the equal size of blastomeres, the occurrence of development to blastocyst stage, and confirmation of clinical pregnancy. The results of these analyzes proved

to complement the basic analyzes carried out earlier. Moreover, they allowed to illustrate the relationship between the aforementioned variables in a more advanced form.

Based on the obtained results, it was found that the DUC embryos are characterized by a poorer development potential compared to embryos in which this anomaly does not occur. They reach the blastocyst stage significantly less frequently and their transfer leads to biochemical and clinical pregnancy significantly less often. Embryos in which the DUC occurred at the first mitotic division of the zygote present a particularly poor prognosis. Moreover, the DUC phenomenon is often accompanied by undesirable properties of blastomeres, such as: uneven size, high level of cytoplasmic fragmentation, or multinucleation. No relationship was found between mother's age and the presence of DUC. When analyzing quantitative morphokinetic parameters, it can be observed that in the case of characteristic phenomena of DUC, such as the appearance of a second polar body, appearance and fading of pronuclei, or the two-cell blastomere stage reached, occur visibly later.

The DUC phenomenon should definitely be the subject of further research, with the causes of its occurrence, non-invasive detection methods, and its effects in the context of embryo development as priority areas of concern.