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Piezo-assisted intracytoplasmic sperm injection improves the process of micromanipulation compared with conventional intracytoplasmic sperm injection

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Objective: Piezo-assisted intracytoplasmic sperm injection (Piezo-ICSI) is frequently used in animal experiments, as well as in human assisted reproductive technology. The method provides successful fertilization as a result of complete immobilization of sperm, injection of sperm inside the oocyte cytoplasm and an optimal setting for micromanipulation. In this study, to evaluate whether Piezo-ICSI is superior to conventional ICSI (cICSI), we assessed fertility outcomes, damage of the cytoplasmic membrane of immobilized sperm and the status of injected sperm when inside the oocyte or not.

Method: 860 patients were randomly divided into Piezo-ICSI (436 oocytes) and cICSI (3209 oocytes) groups. The rate of fertilization (normal or abnormal), non-fertilization and degeneration were compared between the two groups. To assess sperm immobilization, we measured the required time of staining by hypo-osmotic solution including eosin after immobilization (Piezo-pulse or squeezing). The status of the cytoplasmic membrane during injection procedure, that is, whether the tip of the injection pipette was completely inside the cytoplasm after breaking cytoplasmic membrane, was also assessed.

Result: The rate of two pronuclei by Piezo-ICSI was significantly higher than that by cICSI (81.0 vs. 73.4, $p < 0.01$). Moreover, in the Piezo-ICSI group, the degeneration rate was significantly lower than that of cICSI (2.3 vs. 5.4, $p < 0.01$). The required time of staining sperm immobilized by Piezo-pulse was significantly faster than that by squeezing (5.1s vs. 29.6s, $P < 0.01$). In the Piezo-ICSI group, significantly higher rates of complete cytoplasmic membrane insertion were seen than in the cICSI group (91% vs. 69%, $P < 0.01$).

Conclusion: In the process of micro-manipulation, Piezo-ICSI is a more accurate method than cICSI.