

(REVIEW ARTICLE)



Comparison of pregnancy success rates in ICSI (Intracytoplasmic Sperm Injection) success rates in cases of male and female infertility at the Graha Amerta Fertility Clinic, RSUD Dr. Soetomo Hospital, Surabaya, for the period 2018 – 2022: A Literature Review

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Abstract

Infertility, defined as the inability to conceive after one year of unprotected intercourse (WHO, 2012), affects 8–10% of couples worldwide, equivalent to 50–80 million couples, with 2 million new cases annually (WHO, 2013). In Indonesia, 10–15% of the 39.6 million reproductive-age couples face infertility, with primary causes including sperm issues (35%), ovulatory disorders (20%), fallopian tube blockages (20%), endometriosis (20%), and idiopathic factors (10%). The prevalence is rising both globally and domestically, with infertile women in the U.S. projected to reach 7.7 million by 2025. Assisted reproductive technologies like IVF achieve a success rate of 40–50%, while ICSI, a more advanced technique, offers higher success rates, particularly for cases of poor sperm quality (Wulaningsih, 2021; Aurel et al., 2023). However, routine ICSI use without clear indications should consider associated risks and costs (ASRM, 2020). ICSI success rates have improved from 44.6% in 2014 to 59.5% in 2023 (Palermo et al., 2014; Batha et al., 2023). Further research is needed in Indonesia to comprehensively compare ICSI success rates between male and female infertility cases.

Keywords: Infertility; In Vitro Fertilization; ICSI; Comparison; Pregnancy success rate

1. Introduction

Infertility, a condition marked by the inability to conceive after one year of regular, unprotected intercourse, presents significant challenges for affected couples. Infertility is divided into two types: primary and secondary, with various causal factors from the male, female, or a combination of both. In women, disorders can occur in the vagina, cervix, uterus, fallopian tubes, ovaries, or the ovulation process. Meanwhile, in men, problems are often related to coitus, ejaculation, and sperm quality. Other factors such as age, lifestyle, and stress also contribute to infertility (Novrika, 2015). Based on data from the Central Statistics Agency (BPS) in 2021, there are 39.6 million fertile couples in Indonesia, with 10-15% of them having difficulty having children. The main causes of infertility include sperm factors (35%), ovulation disorders (20%), fallopian tube occlusion (20%), endometriosis (20%), and idiopathic factors (10%).

Infertility is a global health problem, including in Indonesia, although it is not life-threatening or affects physical activity. However, for many couples, infertility has a major impact on family life, economy, and psychology (Hestiantoro et al., 2013). WHO estimates that 8-10% of couples worldwide experience infertility, equivalent to 50-80 million couples or around two million new cases each year. Data from the 2013 Riskesdas showed that the prevalence of infertile couples

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in Indonesia reached 15-25%. In addition, the National Survey of Family Growth (NSFG) survey in the US revealed an increase in infertile women from 8.4% in 1982 to 10.2% in 1995, and is predicted to reach 7.7 million in 2025 (Chandra et al., 2013).

IVF (In Vitro Fertilization) is one method of treating infertility with a success rate of 40-50% (Wulaningsih, 2021). One of the IVF techniques, ICSI (Intracytoplasmic Sperm Injection), has shown high success with the procedure of injecting sperm directly into the oocyte for fertilization, especially in cases of low sperm quality (Aurel et al., 2023). Some experts even suggest that ICSI be used routinely to prevent fertilization failure, although the risks need to be considered together with the cost of the procedure (ASRM, 2020). A 2014 study showed that the ICSI success rate reached 44.6% of 35,065 cases, while a 2023 study recorded a success rate of 59.5% of 377 couples (Palermo et al., 2014; Batha et al., 2023). However, research in Indonesia is still minimal in comparing the success rate of ICSI between male and female factors, so further studies are needed to update existing data

Literature reviews on Comparison of ICSI Pregnancy Success Rates in Male and Female Infertility Cases, is the first to clearly compare these two factors and are still limited. Therefore, based on the reviewed studies on infertility, further exploration of the ICSI method is necessary, particularly in Indonesia. This would allow for a comparison of ICSI success rates between male and female infertility cases.

2. Review Content

2.1. Infertility

2.1.1. Definition of Infertility

Infertility is the inability to conceive, affecting both humans and animals, and occurs when a couple cannot achieve pregnancy through sexual intercourse (Soleimani et al., 2023). In humans, infertility can result from various biological factors but is treatable with medical technologies. Primary infertility refers to couples unable to conceive after a year of unprotected intercourse, while secondary infertility applies to those who previously conceived but can no longer do so under similar conditions (Vander Borgh & Wyns, 2018).

2.1.2. Infertility in Male

The diagnostic process for male infertility typically involves a series of evaluations, including a comprehensive medical history to assess reproductive health, semen analysis to examine sperm quality (count, motility, and morphology), hormonal tests to measure reproductive hormone levels, physical examinations and ultrasound to detect anatomical abnormalities, ejaculatory function tests, sperm DNA integrity analysis, and testicular biopsies if necessary (Schlegel et al., 2021). Risk factors for male infertility are categorized into three main groups: pre-testicular, testicular, and post-testicular causes. Pre-testicular factors include hypothalamic and pituitary disorders, hormonal imbalances, and congenital conditions affecting spermatogenesis. Testicular factors involve issues such as varicocele, gonadotoxin exposure, trauma, tumors, systemic diseases, and idiopathic conditions. Post-testicular factors include reproductive tract obstructions, sperm motility disorders, and coital dysfunctions like erectile issues or abnormal sexual activity frequency. Additional risks include aging, obesity, alcohol consumption, smoking, exposure to environmental toxins, excessive physical activity, prolonged use of laptops or mobile devices, and high stress levels, with individual variability in contributing factors (Amelia & Rahmanisa, 2019; Gaziansyah & Janar Wulan, 2019).

2.1.3. Infertility in Female

The diagnostic process for female infertility involves various tests and procedures to identify the underlying causes. These include a comprehensive medical history, physical examination to assess reproductive anatomy, and tracking menstrual cycles to evaluate ovulation. Hormonal tests are performed to measure reproductive hormones, and pelvic ultrasound (USG) is used to examine the ovaries, uterus, and fallopian tubes for structural issues like polycystic ovary syndrome (PCOS), fibroids, or other abnormalities. Hysterosalpingography (HSG) checks for blockages in the fallopian tubes, while laparoscopy can be used to examine and treat conditions like endometriosis. Ovulation function is also tested using progesterone levels or ovulation monitoring tools. Common risk factors for female infertility include ovulation disorders, PCOS, fallopian tube problems, uterine abnormalities, increasing age, body weight issues, stress, reproductive infections, and sexually transmitted diseases, all of which can disrupt hormonal balance, ovulation, or reproductive tract function, making it more challenging to conceive.

2.1.4. Infertility solution

Several treatment options for infertility in both men and women include medical care, assisted reproductive technology (ART), donor sperm or egg, and reproductive surgery. Medical treatments may involve medications to regulate menstrual cycles, stimulate ovulation, or balance hormones, especially for conditions like hormonal imbalances, endometriosis, or polycystic ovary syndrome (PCOS). ART techniques, such as in vitro fertilization (IVF) or intracytoplasmic sperm injection (ICSI), can help couples facing fertility issues by fertilizing eggs outside the body and implanting the embryo in the uterus. Donor sperm or eggs may be considered if there are issues with sperm or egg production. In some cases, surgery may be necessary to address physical conditions such as blocked fallopian tubes or endometriosis.

2.2. In Vitro Fertilization (IVF)

The term "test tube baby" is more commonly used than "In Vitro Fertilization" (IVF), referring to the process where an egg and sperm meet in a laboratory dish (not in the fallopian tube). This technique is typically used for women with damaged or blocked fallopian tubes that cannot be repaired. In IVF, mature eggs are manually retrieved and fertilized outside the body, and the resulting embryos are then implanted back into the uterus for further development. Although "test tube baby" is widely recognized, IVF is the most popular assisted reproductive method, initially developed to treat women with fallopian tube issues but now also used for various fertility problems, such as poor sperm quality, ovulation disorders, endometriosis, and unexplained infertility (Aisiyah Anwar et al., 2022).

2.2.1. Success rates of In Vitro Fertilization (IVF)

The success rate of IVF using the ICSI method is relatively high. According to a study on the "Relationship between factors causing infertility and the success rate of IVF-ICSI at RSIA Putri Bunda Denpasar in 2017," the success rate of the IVF-ICSI procedure was found to be 30.8%. The Majority of female patients undergoing the procedure were aged 35 or younger, accounting for 69.2%, while the majority of male patients were aged 40 or younger, accounting for 82.1% (Ayu et al., 2020).

2.3. Intracytoplasmic Sperm Injection (ICSI)

2.3.1. Definition of Intracytoplasmic Sperm Injection (ICSI)

ICSI (Intracytoplasmic Sperm Injection) is an advanced technique used in assisted reproductive technology (ART) to address infertility. It involves directly injecting a single sperm into the cytoplasm of a mature egg using a specialized pipette. The fertilized egg is then implanted into the uterus. This method aims to improve the chances of fertilization in cases with sperm quality or quantity issues, and is typically recommended when there are sperm abnormalities, low sperm count, or previous unsuccessful fertilization attempts with conventional IVF (Setiadi et al., 2012).

2.3.2. ICSI technique

ICSI is typically performed on couples facing fertilization issues, where the husband is unable to produce sperm suitable for natural conception or IVF. The wife is given hormone induction to obtain mature eggs, which are retrieved about 36 hours after the administration of hCG (Mansour et al., 1994). Prior to the ICSI procedure, the eggs are processed to remove surrounding cumulus cells, and only eggs with the first polar body (PB-I) are selected. The sperm are chosen using selection methods such as swim-up or side migration and then immobilized to facilitate the injection. While ICSI has a high fertilization rate, fertilization failure or low fertilization rates can still occur, with total fertilization failure reported at 1.29% and 3% according to (Liu et al., 1995). Selecting normal sperm for manipulation is a challenge, but studies have shown that even immotile or dead sperm can still support the formation of male and female pronuclei after being injected into the egg (Saili & Said, 2005).

2.3.3. Advantages of ICSI

ICSI is an effective solution for male infertility issues such as low sperm count, poor motility, abnormal morphology, or other problems, as it involves directly injecting a selected sperm into the egg, bypassing natural fertilization barriers (Eftekhar et al., 2012). This technique increases the chances of successful fertilization by minimizing the risks associated with abnormal sperm or sperm adhesion to the egg (Zheng et al., 2019). It also ensures better sperm selection, as only the healthiest sperm is chosen for each egg, improving the chances of a healthy embryo development. ICSI is also beneficial for women facing fertility issues like ovulation disorders or endometriosis, as it guarantees fertilization by directly introducing sperm to the egg (Eftekhar et al., 2012). Furthermore, ICSI supports genetic selection techniques, such as embryo screening or genetic disease detection, which can help couples with genetic conditions or high-risk histories avoid passing on undesirable genetic traits to their offspring (Zheng et al., 2019).

2.3.4. Disadvantages of ICSI

ICSI carries certain disadvantages, including higher costs compared to traditional IVF due to the complex micromanipulation techniques and specialized equipment required for sperm injection into the egg (Sermondade et al., 2013). Additionally, there is a risk of egg injury during the process, as the microneedle used to inject the sperm can damage the egg, potentially affecting its ability to divide and develop properly (Wen et al., 2004). The direct selection of sperm by embryologists also raises concerns about undetected genetic abnormalities, which could lead to the transfer of embryos with genetic defects, increasing the risk of genetic disorders in the offspring (Li et al., 2006). Furthermore, some studies suggest that ICSI may be linked to a higher risk of reproductive disorders in children, although the risk remains low, highlighting the importance of consulting a fertility specialist before undergoing the procedure (Sermondade et al., 2013).

2.3.5. Success rate of ICSI

It is important to note that the success rate of IVF-ICSI varies, as the outcome of the procedure does not always remain the same for every cycle and depends on individual factors. In 2014, a study on ICSI showed that out of 35,065 extreme infertility cases, there were 15,646 cases (44.6%) of successful ICSI with positive β hCG indications (Palermo et al., 2014). However, in Indonesia, the success rate of IVF-ICSI in 23 IVF centers reached only 13.88%, according to available data (Ayu et al., 2020). A study conducted in 2023 on 377 couples found a success rate of 59.5% for ICSI. This research demonstrated the success rate of ICSI in patients with infertility issues in both men and women (Batha et al., 2023).

2.3.6. Factors influencing the success of ICSI

Several factors can influence the success of Intracytoplasmic Sperm Injection (ICSI). First, the quality and quantity of sperm play a crucial role, with sperm that has good motility, normal morphology, and sufficient quantity increasing the chances of successful conception (Nadila & Pambudi, 2023). The quality of the oocytes is also important, as mature oocytes with a healthy nucleus are more likely to be successfully fertilized. Additionally, the skill and experience of the embryologist performing ICSI are critical in ensuring proper sperm injection and maximizing fertilization success. The age of the woman can affect ICSI success, as older women generally have lower quality oocytes, which can negatively impact outcomes. Overall health conditions, such as endometriosis, polycystic ovary syndrome (PCOS), or hormonal imbalances in women, and genetic or sperm abnormalities in men, can also affect ICSI success. Finally, the quality of the embryo post-fertilization is crucial for successful implantation and the potential for a successful pregnancy (Nadila & Pambudi, 2023).

3. Conclusion

This study confirms that ICSI success rates are higher in male infertility cases compared to female cases. Biological factors, age, and gender significantly impact the success of ICSI procedures. These findings support ICSI as the preferred method for addressing male infertility and underscore the need for tailored strategies to improve ICSI outcomes in female infertility. These findings highlight the importance of gender-specific treatment approaches. For men, the focus should be on evaluating sperm quality and optimizing ICSI techniques. For women, improving ovarian health and addressing reproductive conditions should be prioritized.

Further research is needed to explore additional factors influencing ICSI success, such as genetic, hormonal, and environmental factors in Indonesia.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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