ROLE OF ARTIFICIAL INTELLIGENCE IN ICSI (INTRA-CYTOPLASMIC SPERM INJECTION) & IUI (INTRA-UTERINE INSEMINATION)

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ABSTRACT: In contrast to natural intelligence demonstrated by humans, AI (Artificial Intelligence) is the ability of a computer to learn and display intelligence. AI has grown in popularity quickly and gradually, and it is now a part of our personal and social lives. AI has been used in almost every field, including IT companies and many other fields that collect data. AI is also used in a large number of factories. As modern technology advances, artificial intelligence is being used in the medical field. AI technology is being used in a variety of laboratories, including IVF labs. Many treatment techniques, such as ICSI (Intra-Cytoplasmic Sperm Injection) and IUI (Intra-Uterine Insemination), are used in IVF laboratories. The techniques are used in the creation of ART (Assisted Reproductive Technology). Because of its high success rate, the ICSI technique is the most commonly used technique. The review focuses on the role of artificial technologies in the IVF lab and how they can be more useful for increasing IVF treatment success rates. The article concludes that AI can be very useful for IVF laboratories and for ART techniques. The role of AI in the future of IVF can be useful and helpful in the treatment increasing rate of IVF (in-vitro fertilization). AI technologies are used in a variety of methods to select high-quality oocytes and sperm. The article discusses how AI can be used to predict the future.

KEYWORDS: AI (Artificial Intelligence), IVF, ICSI, IUI, Sperm and Oocytes selection.

1. INTRODUCTION:

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AI applications in daily life include speech recognition, face recognition, game AI, intelligent voice assistants, and self-driving vehicles. Without a doubt, AI technologies will become faster, more accessible, and more usable in the future. In recent years, artificial intelligence (AI) has been incorporated into the medical field as well, which aids in the increasing volume and complexity of biomedical data, biological experiments, hospitals, and environmental factors. AI has the potential in a large amount of biological data to help with complex algorithms and to aid in clinical activities. As a result, it collects and stores data on new medical information derived from successful clinical cases, as well as includes new guidelines to improve hospital accuracy.

In human clinical practice, AI can reduce errors in diagnosis and treatment, as well as make predictions about medical risks. As a result of the combination of AI and ART techniques, reproductive experts determine the best treatment for patients suffering from infertility in the corporation of AI and machine learning models, which can advance the development of ART. AI (Artificial Intelligence) can aid in the ICSI process by allowing us to select high-quality sperm for injection. AI can also aid in the IUI process. Artificial intelligence can also aid in the selection of the best oocytes for embryo transfer. The article also discusses the future of artificial intelligence technologies in ART techniques, which may aid in increasing the success rate of fertility and treatment.

2. DISCUSSION:

AI in ICSI (Intra-Cytoplasmic Sperm Injection):

ICSI is the most commonly used ART procedure for treating infertility. The ICSI process is thought to have the highest success rate of any treatment method because it contains the majority of the positive results. The embryologist selects the good quality of embryos and the good quality of sperms, and then the embryologist injects the good quality of sperms into the embryo for fertilization. As a result, ICSI is being used in the majority of couples even without a diagnosis of severe male factor infertility, implying that the procedure is now being practiced as a medical adaptation and development to the benefit of infertile couples. Furthermore, the common reason for the support of ICSI efficiency has favored the increased rate of mild male factors infertility and unexplained infertility among men and women (Idiopathy), but some evidences suggested these reasons are limited only to men and women. This overuse of this technique is due to the procedure's standardization and popularity as a result of increased rates of the process in recent years. However, despite being the safest and most effective process, there are flaws and weaknesses in the ICSI procedures and protocols that can occur due to a lack of attention in mechanical aspects and a lack of attention to details. These factors may be to blame for the procedure's poor performance, which results in severely dysfunctional gametes that are unsuitable for fertilization. As a result of this, the idea of using AI in ART is gaining traction among various authors in order to improve infertility treatment and reduce errors in the ICSI process. Currently, the ICSI procedure is used in up to 70–80% of cases around the world.
time being, AI is only being used in imaging for the selection of sperms and embryos for artificial insemination. However, if AI becomes a part of ART technology in the future, it will be less time consuming and more beneficial to patients who have hoped for treatment to be able to conceive a child but have been unable to do so due to errors or failure of the oocytes to form.

Fig.1. ICSI (Intracytoplasmic sperm injection) procedure ART technique.[18]

AI in IUI (Intra-Uterine Insemination):

IUI (Intra-Uterine Insemination) is a procedure in which sperms are placed directly in the uterus, allowing the sperms to move forward and fertilize the embryo on their own. However, the IUI process has fewer chances of success than the ICSI process because it has to fertilize the embryo on its own, as the embryologist selects high-quality sperms, but it does not guarantee the success of the insemination. IUI is used to treat male infertility, cervical, ovarian, and immunological factors, as well as unexplained infertility in both male and female (Idiopathy), which accounts for approximately 40% of a couple's infertility causes.[9] As a result, infertility treatment takes time and requires a lot of financial and psychological support, which has a big impact on infertile couples. Many studies show that IUI has a high success rate.[10] Despite being the most effective method, some factors can reduce IUI success rates. As a result of these flaws in IUI treatment, choosing the right treatment protocol and predicting the outcomes of assisted reproductive techniques can significantly reduce costs while also assisting infertile couples and professionals in shortening the time to pregnancy.

As a result, intrauterine insemination is commonly used as a non-invasive and relatively inexpensive procedure for treating infertility. As a result, despite advancements in sperm preparation and controlled ovary stimulation, IUI is regarded as having lower success rates than other ART procedures.[11] As a result, various baseline parameters have been identified that may affect the IUI success rate at the start of the cycle, without even considering the intra-cycle characteristics or to devise a method to provide an individual's infertility treatment plans and giving proper counseling regarding the chances of conceiving pregnancy.

To reduce the factors affecting infertility and treatment failure, the use of AI (Artificial Intelligence) techniques or machine learning techniques in comparison to other statistical methods for system prediction, modeling, and classification. Machine learning techniques have piqued the interest of medical researchers. Several studies have concluded that the failure of IUI success is primarily due to sperm morphology and motility.[12] Low motile spermatozoa (Asthenozoospermia) are unable to move forward towards the uterus and, as a result, cannot fertilize the egg. For the betterment of the future AI can be considered as the major tool in the ART field and the increase in the IUI rates.[13] Show in fig 2.
4. Future with AI in IVF:

Currently, AI technology in the IVF laboratory focuses primarily on image analysis of sperm cells and embryos; however, artificial intelligence also aids in the prediction of the outcome of ART techniques. As a result of all these features in AI technology, more research and studies are required for the excessive use of AI in reproductive medicines and treatment. As a result, AI has demonstrated many times its ability to equal or exceed its expectations in a medical field, and AI has many times outperformed expert clinicians. As a result, AI is a tool for supplementing and enhancing physicians. Machine learning, on the other hand, can handle simple and repetitive tasks more easily, saving time and reducing the amount of effort required.

As AI in the IVF lab aids in the accurate selection of better sperm and embryos for ART techniques, embryologists can have greater ease in the subsequent process without any interpretation, and more data can be collected with fewer errors. The mechanism in the IVF laboratory is being developed, which initiates new technologies for non-subjecting sperms and embryo selection, oocyte denudation, oocyte positioning, fertilization, embryo culture, and monitoring embryo development in an automated device, which can improve the effect of ART treatment and benefit infertile couples while also making the embryologists' lives easier.

5. CONCLUSION:

The use of assisted reproductive technology (ART) techniques has been cited as a primary reason for many infertile couples' success in conceiving a child. People's desire for biological children has recently become the primary criterion for every couple and reproductive experts. The review focuses on ART techniques such as ICSI and IUI, which, despite being the most cost-effective and effective method of fertilization, have flaws that make the treatment's success rate questionable. As a result, routine use of AI technology is only a matter of time, but it is about the choices in AI techniques to be used only by a better understanding of the machinery and protocols. As in ART, a standard for the use of AI has been established by using it in the selection of sperms and oocytes; similarly, it can be...
useful in different ART procedures in a standard manner. The advancement of IVF in the medical field with the assistance of AI can serve as a major model for the future of ART treatments. As a result, the review concludes by describing the possibility of using AI in ART treatment and the future benefits for couples as well as reproductive experts.

REFERENCE:


5. Harper J, Magli M, Lundin K, Barratt. When and how should new technology be introduced into the IVF laboratory? Hum Reprod 2012


8. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Open Med. 2009, 6(7); e1000097


