FACTORS INFLUENCING ARTIFICIAL INSEMINATION AMONG COUPLES: A REVIEW

ABSTRACT

All men and women, who have settled in their relationships already or are beginning to think of getting settled, have to ultimately think about conceiving their babies sooner or later. However, even in a modern and advanced world like ours, this is not easy at all. There have been several instances of cases where people are unable to conceive healthy babies, due to a myriad of reasons. These reasons could solely be due to any disorders in the female partner, or in the male partner. Infrequently, these disorders are due to the combined presence of problems in both partners that lead to factors like infertility in such people. Whatever the cause behind infertility is, it would inadvertently lead to mental and emotional compromise of both partners in the long term. Thankfully enough, there are several techniques and treatment modalities that have been introduced to take care of the problem at hand. Artificial insemination is one such treatment modality that has proved to be a shining light in the lives of many people who have already tried and tested many other conventional methods of conceiving but have not received any success despite trying them. Artificial insemination has several other sub-types and variants that are employed for people depending on the underlying factors that have been creating hurdles in the process of procreating for them. Although it is found to be highly successful in the majority of cases, there are also some people who do not receive any kind of benefit from this method as well. This is when people's mental health takes turmoil and makes them even more depressed about their current situation in life. There are also several physical implications of the method itself that negatively impact a person's life and make them miserable. This review tends to deal with that side of the story and bring forward all those physical and emotional aspects of trying

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out artificial insemination in front of the world. It is only fair and wise to let the people know what they are getting into, as educating them about it would help achieve better outcomes too. This review will also explore the side effects of artificial insemination.

Keywords: Artificial insemination, infertility, childbirth, assisted reproduction, conceiving, intrauterine insemination

INTRODUCTION

Artificial insemination is also called 'intrauterine insemination' in the majority of contexts, to sound more relevant to the literature. It is a science of helping people with infertility and other related issues cope with their problems. In artificial insemination, a sample of semen that has been collected from a male partner is deposited in the upper part of the uterine cavity of the female. (1) This is the simplest type of artificial insemination that is done in patients dealing with infertility. The reason for this is that the majority of problems usually involve the failure or inability of the male semen to be transported up into the uterine cavity of the female partner. (2)

Artificial insemination has proven to be a cost-effective, less invasive, safe, and effective means of dealing with infertility issues. Its practical implementation has helped many couples in conceiving successfully. (3) Most of the problems that could be better helped and by-passed through artificial insemination include cervical factors, anovulatory cycles in females, females with functionally normal tubes, male factor-induced infertility, unexplained infertility in both males and females, ejaculatory disorders of the males, and several others as well. (4)

However, since the success rates and effectiveness of artificial insemination depends mainly upon the male factors, that is, the quality of the semen and everything related to it, it is always better to explore this part of the insemination before judging whether the insemination was successful in its attempt or not. (5)

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It is a well-known reality that the practice of intrauterine insemination has remained fundamentally consistent over time. However, significant progress has been made in various aspects, including the development of stimulation protocols, the use of gonadotropins, enhancements in sperm preparation techniques, and the application of ultrasound monitoring. These advancements have yielded increasingly promising success rates for individuals undergoing artificial insemination.(6)

To optimize the outcomes of artificial insemination procedures, it is imperative to adhere to rigorous patient selection criteria and tailor stimulation protocols to the patient's age and the underlying cause of their infertility. Implementing a strict cycle cancellation policy can also mitigate potential complications, such as the occurrence of multiple pregnancies or Ovarian Hyperstimulation Syndrome (OHSS). Typically, clinicians may recommend three to six cycles of artificial insemination before considering alternative fertility treatments. (7)

However, for patients facing challenges like advanced maternal age, severe male factor infertility, tubal issues, or severe endometriosis, a direct referral to In Vitro Fertilization (IVF)(8) or Intracytoplasmic Sperm Injection (ICSI) (9) may be more beneficial.

In the context of an IUI program, several key semen parameters come into play. These include the time taken for semen processing, the total motile sperm count after processing, the degree of rapid progressive motility after processing, sperm morphology both before and after processing, the count of motile sperm available for insemination (referred to as IMSC), the timing of the IUI procedure, and the survival rate of sperm over a 24-hour period. (10) (11)

It is crucial to note that any delays in semen processing, ranging from 30 minutes to 1 hour, or delays in performing the IUI procedure, spanning from 90 minutes to 2 hours after sperm collection, can compromise the overall success of gonadotropin-IUI cycles. Therefore, careful

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attention to these factors is essential to optimize the chances of a successful pregnancy through artificial insemination.(12)

FACTORS INVOLVED IN THE SUCCESS OR FAILURE OF ARTIFICIAL INSEMINATION

It is important to note that the success of artificial insemination or intrauterine insemination varies from person to person, and multiple factors can interact to determine the outcome.

A thorough evaluation by a fertility specialist can help identify the specific factors contributing to success or failure and guide the development of a personalized treatment plan.

In cases where artificial insemination is not found to be successful, alternative fertility treatments such as in vitro fertilization (IVF) may be considered.(13)

The success or failure of intrauterine insemination (IUI) can be influenced by various factors. These factors can be categorized into patient-related factors, semen-related factors, and procedural-related factors. In the preceding sections, an overview of these factors is discussed in detail. This would help gain an insight into all the related factors, whether directly or indirectly, to see how they influence the entire process of artificial insemination.

PATIENT-RELATED FACTORS

These factors include those components that are directly related with the health of the patient herself. These factors play a direct or indirect role in the smooth functioning of the artificial insemination process, and include the following:

- **Age of the Woman:**

  Advanced maternal age can significantly impact the success of the process of artificial insemination. As women age, their fertility declines, and the chances of conception

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through AI decrease. According to a study, it was observed that younger women generally have higher success rates, whereas the success rate of IUI decreases with increasing maternal age. (14) Therefore, it is better to keep the implementation of artificial insemination reserved for patients under 35 years old with normal ovarian reserve. For those aged 40 years and older, no IUI attempt should be proposed to save them both from the physical and mental turmoil of the situation.(10)

- **Ovulatory Disorders:**

  Generally, it was observed that artificial insemination is most effective when the woman is ovulating regularly. Irregular or absent ovulation can reduce the likelihood of success. The major reason behind this is the unavailability of several viable ovarian follicles for the process to proceed with in the first place. It is natural that when a woman would not have any normal ovarian follicles, the process would only be complicated and subjected to several trials for no apparent reason. In some cases, medications are also seen to be prescribed to stimulate ovulation in such cases.(15)

- **Tubal Patency:**

  As a general rule of thumb, a woman's fallopian tubes must be open and functioning properly for the sperm to reach the egg. Tubal blockages can prevent fertilization and implantation. This will further complicate the process of artificial insemination, and would not allow for the tubes to participate in the process of artificial insemination, which is indeed from among some of the important steps needed for it to proceed. (16)

- **Uterine Factors:**

  Several disorders and conditions such as uterine fibroids, polyps, or structural abnormalities can hinder implantation or the ability to carry a pregnancy to term.

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Disorders such as severe endometriosis can affect fertility and reduce the chances of success with AI/IUI.(17)

In some cases, a woman may be allergic to her partner's sperm, leading to immune responses that hinder fertilization. Moreover, scarring or adhesions inside the uterus, known as Asherman's syndrome, can result from previous uterine surgeries, such as dilation and curettage (D&C) or cesarean sections. These adhesions can affect the uterine lining's ability to support embryo implantation. (18)

SEMEN-RELATED FACTORS:

Just like the female partner is deeply involved in the process of artificial insemination, the male partner is also equally involved. The sperm donor or the male partner also has an equally important role for making this process a success or failure.

Some of the major male partner-related components that are involved in the process of artificial insemination include the following:

- **Sperm Count:**

  A sufficient sperm count is essential for successful fertilization. A low sperm count can reduce the chances of conception. Semen analysis helps assess sperm count and quality. This is of vital importance because the primary goal of AI/IUI is to introduce a concentrated and healthy sperm sample directly into the woman's uterus, near the fallopian tubes, where fertilization typically occurs. A sufficient sperm count is essential to increase the chances of one or more sperm successfully fertilizing the egg.(19)

- **Sperm Motility:**

  Sperm must have good motility to reach and penetrate the egg. Poor sperm motility can decrease the chances of success. A higher sperm count often correlates with a greater

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number of motile sperm. Motility is essential for sperm to swim through the cervix, reach the fallopian tube, and penetrate the egg.(20)

- **Sperm Morphology:**

  Sperm with abnormal shapes may have difficulty penetrating the egg. High percentages of abnormal sperm can affect fertilization rates. During the AI/IUI process, the semen sample is processed to isolate motile and morphologically normal sperm. A higher sperm count provides a larger pool of sperm to select from, increasing the likelihood of selecting the healthiest and most viable sperm for insemination.(21)

- **Semen Processing:**

  The techniques used to process and prepare the sperm for insemination can impact the success of AI/IUI. Proper processing is critical to enhance sperm quality and motility. One of the primary goals of semen processing is to concentrate the sperm. By removing excess seminal fluid, dead sperm, and debris, the concentration of motile and healthy sperm is increased. This concentrated sperm sample is then used for insemination, ensuring a higher number of sperm are available to fertilize the egg.(22)

  Moreover, semen processing helps select the healthiest and most motile sperm from the ejaculate. This is typically done through techniques such as density gradient centrifugation or swim-up, where sperm with good motility and morphology are separated from those with poor motility or abnormalities. Selecting high-quality sperm increases the chances of successful fertilization.(23)

PROCEDURAL-RELATED FACTORS:

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Apart from the normal male and female partner related factors that are involved in the process of artificial insemination, there are several procedure-related factors too. These factors could both help the people or create hindrances in the process of artificial insemination.

- **Timing:**

  The timing of insemination is crucial in AI/IUI. Insemination should be performed around the time of ovulation. Accurate prediction of ovulation is essential for success. Similarly, depending on the specific case, multiple insemination cycles may be recommended to improve the chances of success. Moreover, the experience and expertise of the healthcare provider performing the procedure can influence its success. Proper technique and sterile conditions are vital.(24)

- **Cervical Mucus:**

  Adequate cervical mucus is needed to facilitate the passage of sperm through the cervix. Issues with cervical mucus production can hinder sperm transport. Cervical mucus serves as a conduit for sperm to travel from the vagina through the cervix and into the uterus. It provides a protective environment for sperm, helping them survive and maintain their motility on their journey towards the egg. The quality and quantity of cervical mucus can vary throughout a woman's menstrual cycle. It tends to be more hospitable to sperm around the time of ovulation, becoming clearer, thinner, and stretchier. This “fertile” cervical mucus facilitates the passage of sperm and is optimal for conception.(25)

- **Use of Medications:**

  Certain fertility medications, such as gonadotropins or clomiphene citrate, may be prescribed to stimulate ovulation or improve the chances of multiple follicle development. Similarly, the patient’s adherence to the treatment plan, including

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medication schedules and monitoring appointments, can impact the outcome, since there are certain medical conditions such as diabetes or obesity, which can affect fertility and the success of AI/IUI.(26)

CONCLUSION

So, although the process of artificial insemination is said to have several benefits and higher success rates for people with infertility, it also has another side of the story. This other side of the story deals with the male and female partner-related factors that directly or indirectly alter the process of assisted conception.

Since the female candidate is directly linked to the process itself in such a manner that the process is being performed on her, all factors are linked to her. There are several other semen-related factors too, that help decide whether a male is the ideal candidate for donating their sperm for this cause or not.

Lastly, the procedure-related factors help decide whether a couple undergoing this procedure would be successful in conceiving their offspring or not.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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