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Anaesthesia for Oocyte Retrieval

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Review Article

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Abstract

Oocyte retrieval is a common procedure performed in assisted reproductive therapy, where the needle is inserted with transvaginal ultrasound probe. The aims of anaesthesia for oocyte retrieval are ensuring immobility, patients comfort and safety during the procedure. The average duration of the procedure is about 20-30 minutes and procedures are carried out in the day care basis. Most preferred mode of anaesthesia is total intravenous anaesthesia using short acting anaesthetic agents.

Keywords: Oocyte Retrieval; General Anaesthesia; Isoflurane Anesthesia; Anaesthesia

Introduction

Oocyte retrieval is a procedure commonly performed in assisted reproductive therapy (ART), where mature oocyte is extracted. Transvaginal ultrasound probe containing port for the aspirating needle is inserted through vagina [1]. The fine needle pierces the lateral vaginal wall and ovum is aspirated through the needle under visualization in the test tube [2]. Pain during oocyte retrieval is caused by the puncture of the vaginal skin and ovarian capsule by the aspirating needle as well as manipulation within the ovary during the entire procedure [1].

Sometime the position of ovum is posterior to uterus, which can be reached after piercing the uterus and cervix, which is very painful. After the retrieval of ovum, the artificial fertilization is carried out.

Associated Comorbidities in Such Patients

Majority of women suffer from anxiety-depression problems dealing with infertility issues. Dose adjustment of anaesthetic agent should be done in patient taking the antidepressant and anxiolytic drugs. There are various unseen social aspects going on the female's life. Besides, majority of them suffer from hypothyroidism. Assessment of the thyroid function tests and appropriate anaesthetic precautions is important. A few of them have obesity associated infertility [1].

Anaesthesia for the Oocyte Retrieval

Oocyte retrieval is emotionally stressful procedure. Besides, the painful stimulus by the aspirant needle causes majority of the discomfort [2]. This can lead to jerky movements which can pierce the surrounding structure leading to damage or haemorrhage. Repeated attempts are often necessary before success is achieved. The aims of anaesthesia for oocyte retrieval are ensuring immobility, patients comfort and safety during the procedure [3].

The duration of retrieval is around 20-30 minutes and generally carried out in day care basis [3].

Common Types of Anaesthesia for Oocyte Retrieval are

Monitored Anaesthesia Care and Conscious Sedation

This involves administration of quick acting sedatives and analgesics intravenously, allowing the patient to stay conscious but in a thoroughly relaxed state [3]. After the operation, individuals typically have very little recall memory. This type of anaesthesia is sufficient enough for retrieval and is the most preferred technique of anaesthesia for oocyte retrieval [4].

Regularly monitoring of vital parameters, such as heart rate, blood pressure and oxygenation level, is indicated. To maintain oxygenation, a face mask supplementing oxygen is usually sufficient. To preserve spontaneous breathing and reduce the need for adjuncts or airway manipulations, sedative should be carefully titrated.

General Anaesthesia

General Anaesthesia (GA) provides highest degree of relaxation and immobility of patients for the surgery [1]. For GA, polypharmacy, airway instrumentation and other monitoring aspects need to be considered. If a simultaneous laparoscopic intervention is planned, when longer procedure time or more procedural manipulation is expected, this method of anaesthesia may be offered [4]. Prolonged period of exposure with GA can lead to lower pregnancy and delivery rates. Pharmacological exposure to the anaesthetic agents should be for the least possible duration with minimal penetration to follicular fluid [3].

Paracervical Block

Paracervical block help to alleviate the pain and discomfort associated with oocyte retrieval [1]. However, in many cases, particularly when oocyte retrieval is anticipated to be complicated, a single paracervical block may not be sufficient. It can be used in conjunction with conscious sedation to reduce the consumption of anaesthetic medications [5].

Central Neuraxial Block

Single shot spinal anaesthesia can provide the immobility and relaxation required for the oocyte retrieval. However, it has its own risks and potential complications. The risk versus benefit of spinal anaesthesia should always be weighted over conscious sedation. Spinal anaesthesia is not the typical choice of anaesthesia for oocyte retrieval; however, this can be offered to patients who have contraindication to other form of anaesthesia (sedation or general anaesthesia) or for patients who want to be awake throughout the procedure [3]. Regional anaesthesia has the advantage of minimal systemic absorption of the local anaesthetic agent and thereby very minimal follicular fluid concentration [4].

Epidural anaesthesia can accomplish the goal of oocyte retrieval however the complexity of procedure, the possibility of complications, the amount and type of medications used, and the length of time needed to achieve the anaesthesia for the procedure fail to provide superiority over conscious sedation [3]. It is not typically used mode of anaesthesia [1].

Anaesthetic Drugs used for Oocyte Retrieval

While selecting a desired agent, the main concerns are:

- Whether the substance enters the follicular fluid?
- What are its toxic effects on the fertilization, cleavage and pregnancy rates?

Midazolam

It is short acting benzodiazepine. It facilitate the actions of GABA at GABA-A chloride ionophore. It is used as a premedication, for procedural sedation, and as a general and regional anaesthesia supplement [2]. Its dose ranges from 0.03 -0.05 mg/kg for anxiolytics effects to 0.1- 0.3 mg/kg for sedation [6]. Patient undergoing oocyte retrieval experience higher levels of stress compared to other stages of the procedure taking into account the fear of not obtaining enough oocytes, the pain caused by the needle and the fear of needle. Premedication with midazolam can be a good anxiolytic agent. For conscious sedation, it can be used with fentanyl or ketamine. Although only trace amounts of this medication are found in follicular fluid, no detrimental effects have been established and its safety has been established [3].

Opioids

Opioids exert anti-nociceptive effects by acting as agonists at specific opioid receptors at presynaptic and postsynaptic locations in the central nervous system (primarily in the brainstem and spinal cord) [6,7]. Opioids have been used a part of protocol for conscious sedation as analgesic in assisted reproductive technique [3]. Fentanyl, alfentanil, and remifentanil are the most often used opioids. They were found to be effective when combined with propofol or midazolam. Follicular fluid is barely penetrated by fentanyl [3]. The level of alfentanil in the follicular fluid is 10 times lower than the serum levels at the same point. There are no negative effects of alfentanil or remifentanil on the rate of fertilization, embryo development, or clinical pregnancy rate [1]. Due to its quick onset and quick recovery, Remifentanil and alfentanil are preferable than fentanyl

in clinical settings. Pregnancy rates in women undergoing transvaginal oocyte retrieval for ART were higher with a remifentanil than with a fentanyl-based anaesthesia [8].

Propofol

Propofol selectively modifies GABA-A receptors, causing hyperpolarization of cell membranes and functional inhibition of the postsynaptic neuron in the central nervous system [6]. It is safe and effective drug for induction and maintenance of general anaesthesia. It is used either alone or in combination with midazolam and fentanyl for oocyte retrieval due to highly lipophilic nature, faster onset, short and predictable duration of action. It is perfect for day care IVF procedures because it offers the extra benefits of antiemetic property and speedier recovery [3].

Numerous studies have been done on how it affects the rates of pregnancy, embryo cleavage, and fertilization. A steady increase in propofol levels proportional to the total dose administered was found in follicular fluid. Although earlier research had shown that increased exposure to propofol had negative effects on the cleavage of oocytes, a more recent study found that, despite a rise in propofol follicular concentration, there was no difference in the rates of mature to immature oocytes [9]. However, accumulation of propofol in follicular fluid may adversely affect oocyte fertilization rate and embryonic development [9].

Thiopental Sodium

Thiopental proved to be a safe alternative choice to propofol, as there is no significant difference between thiopental and propofol in terms of pregnancy outcomes [10]. But thiopental as adjuncts for conscious sedation should be considered due to many factors.

Ketamine

Ketamine is also proved to be safe for oocyte retrieval. Combined with midazolam, it provide a good alternative to general anaesthesia [1]. However, a study found that remifentanil is preferable than ketamine in regular general anaesthetic treatments for oocyte retrieval due to its significantly higher fertilization rate, pregnancy rate, and quicker recovery time [11]. As compared to propofol, use of ketamine during oocyte retrieval could affect fertilization rate, but no differences was noted in implantation, clinical pregnancy [12].

Inhalation Agents

Gonen O, et al. [13] discovered that general anaesthesia with N_2O had a negative impact on the success of IVF as compared with sedation combine with local anaesthesia and epidural block. Compared to the epidural or sedation groups, the N_2O group had significantly lower clinical pregnancy rates. Methionine synthetase is inactivated by N_2O, which lowers the quantity of thymidine accessible for DNA synthesis in proliferating cells. However, this effect is negligible clinically as the inactivation of methionine proceeds slowly in the human liver. Additionally, the oocytes are briefed exposed to N_2O because of its poor soluble in fluid. Contrarily, Hadimioglu N, et al. [14] showed that N_2O increases the success rate of IVF by reducing the concentration of other potentially harmful and less diffusible anaesthetic agents. Thus, the effect of N_2 O on IVF outcome is still uncertain.

Isoflurane and Sevoflurane are two frequently used volatile agents in other cases. The majority of researches have shown that halogenated fluorocarbons have a negative impact on the success rate of IVF, leading to decreased cleavage rates and increased abortions [3]. However, Matt DW, *et al.* [15] observed insignificant effect of N_2O and isoflurane anesthesia on human IVF pregnancy rate. The potential of operation room contamination, the frequency of nausea and vomiting and the hangover effect following the exposure inhalational agents should always be considered.

Conclusion

The role of the anesthetist for oocytes retrieval is to provide adequate comfort and pain relief to the patients. The generally used anaesthesia method is conscious sedation [3]. If sedation is contraindicated or the patient would prefer to remain awake, spinal anaesthesia can be performed. Different studies that looked into how anaesthesia affected IVF results concluded with conflicting results. These variations could be explained by the differences in the study's design and randomization, the anaesthetic medications used, or the anaesthetic technique used. The patient's comorbidities, medications, and choice should be considered for anaesthesia. Additionally, the anaesthesia should be provided for the shortest possible duration.

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