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Unveiling the Influence of Xylocaine on Patient Pain Sensation Preceding Propofol Administration

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Abstract:
In Vitro Fertilization (IVF) is one of the world's fastest growing operations in the world and is a groundbreaking reproductive technology discovery that has changed the lives of countless families around the planet. However, such a paramount discovery would not be possible without advancements in anesthetics, particularly the local anesthetic Xylocaine(lidocaine), and the intravenous (IV) anesthetic Propofol. Xylocaine is used to provide a loss of sensation in a discrete region of the body by disrupting nerve impulse generation or propagation. Depending on the patient's body mass, 1-2 milligrams per kilogram is administered. Propofol, on the other hand, is used to induce and maintain a controlled state of unconsciousness and analgesia (pain relief), when a dosage of 2 milligrams per kilogram is administered. The purpose of this investigation was to unveil the true extent to which Xylocaine affects the perception of pain on the IV line in patients during the administration of Propofol by measuring each patient's pain score on a scale from 0 to 10. Two groups were compiled for this endeavor: one being the control group, which did not receive Xylocaine and was represented by the digit 0, and the other being the counterpart group, which was administered the anesthetic and represented by the digit 1. Initial averaging of the complete data set of pain scores concluded that Xylocaine did, in fact, help reduce pain on the IV line in patients prior to Propofol infusion. Further statistical analysis with IBM SPSS v.25, including a T- test and an independent samples test, was conducted and further validated the significance of the use of Xylocaine in pain reduction on the IV line during Propofol infusion. Overall, this study confirms the effectiveness of combining these two anesthetics on IVF patients on reducing side effects, improving patient's satisfaction, and providing legitimacy to an ever- growing IVF industry.

Introduction:
In vitro fertilization is one of the most successful methods for achieving pregnancy for those who struggle to conceive. The process involves a complex series of procedures, including ovarian stimulation, oocyte retrieval, fertilization in a lab, and embryo transfer. IVF is considered the main treatment for infertility couples who have not been able to conceive after a year of trying. Additionally, IVF can be used to prevent passing on genetic conditions to the child through techniques such as preimplantation genetic diagnosis (PGD). **[1]** However, such a complex process cannot be done so easily and requires support from various types of medicine, including Propofol and Xylocaine, which are used in anesthesia.
Oocyte retrieval is one of the most important and painful parts of the IVF process. This operation is usually performed with the use of anesthesia, which ensures patient comfort and minimize pain and anxiety. The

oocyte retrieval process involves inserting a needle through the vaginal wall to retrieve oocytes from the ovaries, which can be quite painful. Anesthesia helps make the procedure more tolerable and allows the physician to perform the retrieval with greater precision.

Usually, one or more IV anesthetics will be administered per clinical encounter and when used appropriately, IV anesthetics provide many advantages and only a few drawbacks. Undoubtedly the biggest advantage is the rapid onset of hypnosis, allowing the patient to quickly become unconscious and remain comfortable during the procedure. The biggest drawback is the inability to precisely quantify the effect site, meaning anesthesia must be administered only by true professionals to ensure optimal and safe usage. **[2]**

Propofol is the most frequently administered IV anesthetic because of its many advantageous properties. When administered as a bolus, propofol provides rapid hypnosis, excellent suppression of airway reflexes, a short duration of action, and largely predictable hemodynamic side effects. All of this makes Propofol an absolute essential for such operations. **[3]** Propofol has three pharmacokinetic properties that make it ideal for use as a continuous IV infusion in various kinds of operations including oocyte pick up. These include its efficient plasma clearance, rapid metabolism, and slow redistribution from poorly perfused compartments back into the central compartment. As a result, patients awaken relatively quickly after prolonged infusion of Propofol as compared to other IV anesthetics. **[4]** In the central nervous system, Propofol primarily acts as a hypnotic without providing analgesia. It reduces the cerebral metabolic rate for oxygen, which leads to decreased cerebral blood flow (CBF) through preserved flow metabolism coupling. This results in decreases in cerebral blood volume, intracranial pressure, and intraocular pressure. Another substantial advantage associated with the administration of Propofol is its ability to significantly reduce nausea and vomiting, thereby enhancing the overall patient experience. **[5]** A combination of all of Propofol's properties make it a crucial part of IVF operations.

Pain from the injection of Propofol is a common complaint that can lead to patient distress or dissatisfaction during the operation. The most effective way to overcome this issue is to administer Propofol into the antecubital vein, which is larger and has a faster venous flow rate. Alternatively, if a hand vein is chosen, premedication with a small dose of opioid along with up to 1.5mg/kg of Xylocaine injected through the same IV, with or without proximal venous occlusion, is effective in reducing pain. **[6]**

This then leads us to Xylocaine, a local anesthetic known for loss of sensation in a discrete region of the body by disrupting nerve impulse generation or propagation. **[7]** It is the most commonly used local anesthetic and is utilized for local, topical, and regional intravenous block; peripheral nerve block; and spinal and epidural anesthesia. Xylocaine is known to be extremely effective, acting rapidly and being free from toxicity and sensitivity. It is frequently combined with adrenaline (epinephrine) to prolong the duration of anesthesia, reduce associated bleeding, and increase the intensity of the nerve blockade through the reduction of systemic absorption. **[8]** These properties allow Xylocaine to be effective in reducing the pain of Propofol injection prior to oocyte pick up.

This study is undertaken in order to examine whether or not preoperative Xylocaine prior to oocyte pick-up is effective in reducing the pain on the IV line caused by the administration of Propofol anesthesia.

Methods:

In order to undertake this experiment, it is imperative to carefully create two distinct groups of patients. The first group consisted of individuals who have not been administered Xylocaine, serving as a

representation of the impact on pain perception in the absence of this local anesthetic. The second group encompasses those who have received Xylocaine, thereby demonstrating the effect on sensation when Xylocaine is present. To create these two groups, a method was employed, involving the selection of two table tennis balls of distinct color in a bag. The selection of the orange ball meant the patient was administered Xylocaine, whereas the selection of the white ball meant no such administration. During initial data collection, individuals selected for Xylocaine infusion were represented by the number one, while their counterparts were represented by the number zero.

Transitioning to the administration of Xylocaine, the dosage regimen is correlated to the patient's body mass, with the general rule of thumb being 1-2 milligrams per kilogram, prior to administration of Propofol. However, in this experiment, to minimize potential side effects, a reduced dosage of 0.5 milligrams per kilogram of Xylocaine was used. Subsequently, Propofol was administered at 2 milligrams per kilogram.

Following the injection of Xylocaine, the patient's level of pain was assessed pre-operation. To determine this, a numerical scale from zero to ten was used to query the patient before the Propofol injection, with zero representing no pain sensation and ten representing maximum pain sensation. Subsequent to the full data collection of 71 patients, the average pain scores of both groups were calculated using IBM SPSS v.25 software. Statistical analysis was then performed using the same software to conduct an independent samples T-Test, in order to determine the significance and correlation of the data.

Results and Discussion:

After performing statistical analysis on IBM SPSS v.25, it was determined that there is a correlation between the postPropofol pain score and the administration of Xylocaine before Propofol infusion.

Figure 1. Data on Mean and Standard Deviations of data sets on IBM SPSS v.25

	N	Mean	SD	P-value
Not receive Xylocaine (0)	34	4.0588	2.75176	< 0.001
Receive Xylocaine (1)	37	1.6216	1.97697	

Figure 1 demonstrated that the average pain score, represented by "0.00," for the group devoid of Xylocaine administration, stands visibly higher at 4.0588 when compared with the counterpart group, represented by "1.00," which exhibits a notably lower mean of 1.6216. This initially leads to the conclusion that the correlation between pain scores after Propofol infusion and Xylocaine administration is present, due to the divergence between these two means.

However, this alone is not enough to establish a clear significance as also shown in Figure 1, significance can also be further proven through the use of standard deviation. For the group of individuals who did not receive the local anesthetic, the standard deviation equated to 2.75176, whereas the counterpart group had a noticeably lower standard deviation at 1.97697. The standard deviation illustrates how dispersed from the mean the data is and the standard deviation of 2.75176 represents a higher spread of results which leads to the conclusion that the data from the non-Xylocaine group is less reliable than the counterpart group, which can potentially negate the significance of the data. On the other hand, due to the considerably lower standard deviation of the counterpart group, it can be said that the pain score data of this group is reliable and accurate.

Figure 2. Independent Samples Test on IBM SPSS v.25

Independent Sample Test

									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pain	Equal variances assumed	17.37	.000	3.119	56	.003	2.04737	.65643	.73237	3.36236
	Equal variances not assumed			3.695	55.812	.001	2.04737	.55415	.93719	3.15754

In order to combat this, an Independent Samples test was used. In figure 2, the column of Sig. (2-tailed) shows a twotailed p- value, which can be used to determine true significance of data sets. Here a p-value of (p-value < 0.01) leads us to the conclusion that the data is truly significant, and due to the fact that the p-value of both data sets are at 0.003 and 0.001 respectively, it can be concluded that Xylocaine administration is correlated to and has an effect on the patient's pain score post-Propofol administration on the IV line.

Although statistical analysis determines the significance of this data, there are various factors as to why this data may not be as accurate as possible. One of the reasons is each patient's perception of pain on the numerical scale will most definitely vary from patient to patient and a selection of a number of this scale for one patient may not be the same as another, despite the fact that they potentially experienced the same levels of pain. Additional factors that must also be taken into account are the patient's BMI and disease and drug history, which could all affect the perception of pain for each individual patient. The final statistics may point towards a specific correlation between pain score and Xylocaine administration; however, other factors must also be taken into account when discussing the true accuracy of this endeavor.

Conclusion:

In conclusion, In Vitro fertilization is one of the most paramount discoveries made and is increasing in popularity by the day. The aim of this endeavor was to investigate the true significance of the local anesthetic Xylocaine in reducing the pain sensation on the IV line of IVF patients when using Propofol as the main anesthetic. After performing grouping methods and the oocyte pick-up operation, it was initially confirmed that Xylocaine has a major effect on pre-operative pain perception on the IV line during the application of Propofol through simple averages of pain scores per opposing cohorts. Additionally, through further statistical analysis with IBM SPSS v.25, the statistical T-test and independent samples test further supported the initial findings, proving the data to be significant, concluding that administration of Xylocaine before Propofol administration does indeed have a significant correlation with reduced pain perception. In the future, the industry of IVF will continue to grow and these two important anesthetics will continue to play a crucial role in the foreseeable future of this lucrative industry.

Ethical Considerations:

This research was approved by Chada IVF Ethics Committee on the 16th of November 2023.

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