

# Comparative Study among Ketamine, Thiopental and Propofol for Sedation during *In Vitro* Fertilization Procedures

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**Keywords** Ketamine; Thiopental; Propofol; Fertilization; Embryo grading; Embryo development; Cleavage rate; Pregnancy rate; Implantation rate; Abortion rate

## Abstract

**Objective:** The main goal of the present prospective cross sectional study is to compare three ketamine, thiopental and propofol for sedation during *In Vitro* Fertilization procedures.

**Design:** Prospective cross sectional study.

**Setting:** Assisted conception center.

**Population:** 150 patients operated for *In Vitro* Fertilization procedures from period 1/1/2013 till 1/1/2015 divided into 3 equal groups every one containing 50 patients; group A: (Ketamine 1-2 mg/kg) ; group B: [Thiopental 4-5 mg/kg (5)]; group C: Propofol 1-2 mg/kg (2.5).

**Methods:** 150 patients operated for *In Vitro* Fertilization procedures were allocated for comparing the effect of ketamine, thiopental and propofol for sedation during *In Vitro* Fertilization procedures.

**Main outcome measures:** Cleavage rate (rate of good embryo grading+rate of poor embryo grading), implantation rate, pregnancy and abortion.

**Results:** The percentage of fertilization were for group A, B, C respectively (66.66%, 76.92%, 92.30%); the percentage of embryo development were for group A, B, C respectively (50%, 60%, 83.33%); the percentage of cleavage rate were for group A, B, C respectively (66.66%, 76.92%, 92.30%); the percentage of good embryo grading were for group A, B, C respectively (37.50%, 60%, 83.33%); the percentage of pregnancy rate were for group A,B,C respectively (20%, 30%, 50%); the percentage of the implantation rate were for group A, B, C respectively (20%, 30%, 50%); the percentage of abortion rate were for group A, B, C respectively (40%, 26.66%, 20%).

There was no significant difference of number oocyte of M II retrieved. There was significant difference in rapid recovery of group C.

**Conclusions:** By comparing the effect of ketamine, thiopental and propofol for sedation during *In Vitro* Fertilization procedures in this study the propofol show significant difference regarding rapid recovery percentage of fertilization, good embryo grading, embryo development, cleavage rate, pregnancy rate, and implantation rate, with less abortion rate.

## Introduction

From the first time anesthetics were found in the follicular fluid, there were many controversial theories have been proposed for the deleterious effects of anesthetics on oocyte retrieval during *In Vitro* Fertilization (IVF) procedures [1,2].

Anesthetics have been detected in follicular fluid, [1-3]; both animal [4] and human [5] studies suggest that these drugs may adversely affect oocyte fertilization and embryonic development. As a result, the optimal anesthetic technique for these Assisted Reproductive Technology (ART) procedures is unknown.

There are many modalities for anesthesia/ analgesia during oocytes retrieval; a retrospective monocentric study using two consecutive temporal cohorts of patients was conducted to compare two analgesic protocols: Paracetamol/Alprazolam (P/A), then Nefopam/Ketoprofen (N/K).And concluded that the protocol N/K enhances patient comfort without jeopardizing the IVF success rates [6].

Eighty patients receiving IVE-ET were randomly divided into midazolam combined with fentanyl group (midazolam group) and propofol combined with fentanyl group (propofol group). Analgesic effects, circulation status (blood pressure, heart rate), respiration status (rate, oxygen saturation and respiration depression) during operation, nausea and vomiting, and amnesic effects after operation were compared. There were No differences of analgesic effects and circulation status between two groups were observed. Percentages of respiration depression, vomiting and amnesia of midazolam group were 5.0%, 10.0% and 25%, respectively, and those of propofol group were 25%,

27.5% and 7.5%, respectively, which had statistical significance. As conscious sedation, midazolam combined with fentanyl is better than propofol combined with fentanyl in oocyte retrieval of IVF-ET [7].

Types of anesthesia that may be used for transvaginal follicular aspiration and oocyte retrieval include: general anesthesia, neuraxial anesthesia, conscious sedation, injection of local anesthetic agents into the cervix or the vaginal wall, or any combination of the above. Conscious sedation is most commonly used in IVF because it is relatively safe and does not require the presence of an anesthesiologist when opioids or benzodiazepines are used. Propofol is the preferred anesthetic agent, but should be used by specially trained personnel [8].

Conscious sedation is the most popular method of anesthesia used in IVF. Presently, a combination of propofol, fentanyl, and midazolam is used frequently. It is easy to administer in cooperative and motivated patients and is safe in healthy individuals; it has a relatively low risk for adverse effects on oocyte and embryo quality and pregnancy rates [8].

## Methods

### Study design and subject selection

**Study participants:** Institutional Review Board (IRB) approval was taken before the study and patients consent after explanation of procedure to them.

150 patients operated for *In Vitro* Fertilization procedures from period 1/1/2013 till 1/1/2015 divided into 3 equal groups every one containing 50 patients; group A: (Ketamine 1-2 mg/kg); group B: (Thiopental 4-5 mg/kg (5)); group C: Propofol 1-2 mg/kg (2.5).

**Study design:** Patients found eligible for the study were offered to undergo ICSI/IVF cycles using different 3 sedatives during oocytes retrieval in equal patient number group (Table1).

Patient number: 150

Group A: Ketamine 1-2 mg/kg

Group B: Thiopental 4-5 mg/kg (5)

Group C: Propofol 1-2 mg/kg (2.5)

**Inclusion criteria:** Age 18-35 y, male factors of infertility, tubal factor of infertility, cervical factor of infertility, same induction protocol, and same media for in vitro fertilization.

**Exclusion criteria:** Age more than 35 years, diminished ovarian reserve, refusing patients.

**Treatment protocol:** All patients are subjected to same protocol for induction and by using same media for in vitro fertilization.

150 patients operated for *In Vitro* Fertilization procedures divided into 3 equal groups every one containing 50 patients;

Group A: Using anesthetic agent (Ketamine by dosage 1-2 mg/kg);

Group B: Using anesthetic agent [Thiopental by dosage 4-5 mg/kg (5)];

Group C: Using anesthetic agent [Propofol by dosage 1-2 mg/kg (2.5)].

**Outcome variables:** The outcome variables are;

1. Cleavage rate (rate of good embryo grading + rate of poor embryo grading)
2. Implantation rate
3. Pregnancy
4. Abortion

**Statistical analyses:** Statistical analyses were performed using the Statistical Package for the Social Sciences (10.0 SPSS).

## Results

The percentage of fertilization were for group A, B, C respectively (66.66%, 76.92%, 92.30%); the percentage of embryo development were for group A, B, C respectively (50%, 60%, 83.33%); the percentage of cleavage rate were for group A, B, C respectively (66.66%, 76.92%,

**Table 1:** During operation.

	Ketamine 1-2 mg/kg		Thiopental 4-5 mg/kg (5)		Propofol 1-2 mg/kg (2.5)	
	Number	Rate /ratio	Number	Rate /ratio	Number	Rate /ratio
Antalgic effects	45/50	90%	40/50	90%	49/50	98%
Blood pressure						
Hypertension	30/50	60%	10/50	20%	5/50	10%
Hypotension	5/50	10%	30/50	60%	5/50	10%
Normo tension	15/50	30%	10/50	20%	40/50	80%
Heart rate						
Tachycardia	40/50	80%	10/50	20%	7/50	14%
Bradycardia	5/50	10%	35/50	70%	5/50	10%
Normocardia	5/50	10%	15/50	30%	38/50	76%
Respiration rate						
Tachypnea	32/50	64%	8/50	16%	10/50	20%
Bradypnea	4/50	8%	25/50	50%	8/50	16%
Normopnea	14/50	28%	17/25	34%	32/50	64%
Oxygen saturation						
Normal	40/50	80%	35/50	70%	40/50	80%
Low	10/50	20%	15/50	30%	10/50	20%
Respiration depression	10/50	20%	15/50	30%	1/50	2%

**Table 2:** After operation.

	Ketamine 1-2 mg/kg		Thiopental 4-5 mg/kg (5)		Propofol 1-2 mg/kg (2.5)	
	Number	Rate /ratio	Number	Rate /ratio	Number	Rate /ratio
Nausea	10/50	20%	35/50	70%	3/50	6%
Vomiting	10/50	20%	20/50	40%	2/50	4%
Rapid recovery	10/50	20%	25/50	50%	48/50	96%

**Table 3:** Oocyte number and maturity.

	Ketamine 1-2 mg/kg	Thiopental 4-5 mg/kg(5)	Propofol 1-2 mg/kg (2.5)
	Number	Number	Number
Total number of oocytes retrieved per patient ( average)	12	13	13
Number /rate of mature oocytes at metaphase II	8	7	8

**Table 4:** Outcome variables.

	Ketamine 1-2 mg/kg		Thiopental 4-5 mg/kg(5)		Propofol 1-2 mg/kg (2.5)	
	Number	Rate /ratio	Number	Rate /ratio	Number	Rate /ratio
Percentage of fertilization	400/600	66.66	500/650	76.92	600/650	92.30
Embryo development	200/400	50	300/500	60	500/600	83.33
Cleavage rate	400/600	66.66	500/650	76.92	600/650	92.30
Good embryo grading	150/400	37.50	300/500	60	500/600	83.33
Pregnancy rate	10/50	20	15/50	30	25/50	50
The implantation rate	10/50	20	15/50	30	25/50	50
Abortion rate	4/10	40	4/15	26.66	5/25	20

92.30%); the percentage of good embryo grading were for group A, B, C respectively (37.50%, 60%, 83.33%); the percentage of pregnancy rate were for group A, B, C respectively (20%, 30%, 50%); the percentage of the implantation rate were for group A, B, C respectively (20%, 30%, 50%); the percentage of abortion rate were for group A, B, C respectively (40%, 26.66%, 20%).

There was no significant difference of number oocyte of M II retrieved. There was significant difference in rapid recovery of group C (Tables 2 and 3).

### Baseline characteristics

All patients had primary or secondary infertility. The distributions of patients in the three different protocols of anesthetic agents were significantly different regarding the outcome variable. All patients were monitored for the evidence of anesthetic complications.

### Outcome measures

The outcome measures are:

1. Cleavage rate (rate of good embryo grading + rate of poor embryo grading)
2. Implantation rate
3. Pregnancy
4. Abortion

There was significant difference regarding group C in all outcome variables (Table 4).

## Discussion

### Main findings

Using anesthetic agent during oocyte retrieval with less complication and good outcome in *In Vitro* Fertilization procedure is the important target.

By using Propofol 1-2 mg/kg in this study in comparison with Ketamine 1-2 mg/kg and Thiopental 4-5 mg/kg indicate good result regarding cleavage rate (rate of good embryo grading + rate of poor embryo grading), implantation rate, pregnancy rate and with less abortion rate.

### Strengths

Using cross sectional prospective trial in 150 patients in 3 equal divided groups, with same induction protocol and same media of *in vitro* fertilization make a good strength in this study.

By comparing 3 different anesthetic agents with recording different effect of these agent during operation and following the effect cleavage rate (rate of good embryo grading + rate of poor embryo grading), implantation rate, pregnancy rate, and abortion rate make a good strength in this study.

### Limitations

Some limitations to this study may apply. In terms of follow up of patients for 12-14 weeks after pregnancy, the acceptance to some patients were difficult, using only 3 different anesthetic agents not using another form of anesthesia. Not measuring the concentration

of anesthesia in follicular fluid one of limitation but not scope of this study.

## Interpretation

This study in comparison to other studies as follows;

Pirola A et al. [9] mention that; By comparing four analgesic methodologies (EMLA cream, propofol, thiopental sodium, sevoflurane) for *In Vitro* Fertilization (IVF) oocyte retrieval. Most anesthetic parameters were not significantly different among all treatments. In contrast, significant differences were revealed in all groups for total number of oocytes retrieved per patient, rate of mature oocytes at metaphase II stage (MII) and percentage of fertilization and embryo development. In the EMLA cream and thiopental sodium groups we observed the highest percentage of MII oocytes ( $P < 0.001$ ). Fertilization rate in the EMLA and sevoflurane groups were similar but significantly higher than the propofol and thiopental sodium groups ( $P < 0.001$ ). The highest rate of anomalous fertilization was observed in the propofol group. Rate of embryo development was similar in all groups but sevoflurane group had a lower percentage of good embryos. By comparing different anesthetic techniques with different mechanisms of action and administration, potential negative effects of these drugs on the initial stages of human IVF procedure were revealed. Therefore, a local anesthetic cream is proposed as an acceptable alternative option for anesthesia during transvaginal oocyte retrieval [9].

So this study similar to Pirola A et al. [9] regarding efficacy of propofol; but differ from Pirola A et al. [9] regarding using local anesthetic cream as in this study local anesthetic cream not included in comparison groups.

Kwan et al. [10] mention that; their search strategy identified 390 potentially eligible reports and 12 papers met their inclusion criteria. There were no significant differences in clinical pregnancy rates per woman and patient satisfaction between the methods compared. Women's perception of pain showed conflicting results. Due to considerable heterogeneity, in terms of types and dosages of sedation or analgesia used, and tools used to assess the principal outcomes of pain and satisfaction, a meta-analysis of all the studies was not attempted. Of the three trials which compared the effect of conventional medical analgesia plus paracervical block versus electro-acupuncture plus paracervical block, there was no significant difference in clinical pregnancy rates per woman in the two groups (OR 1.01; 95% CI 0.73 to 1.4). For intra-operative pain score as measured by Visual Analogue Scale (VAS), there was a significant difference (WMD -4.95; 95% CI -7.84 to -2.07), favoring conventional medical analgesia plus paracervical block. There was also a significant difference in intra-operative pain by VAS between patient-controlled sedation and physician-administered sedation (WMD 5.98; 95% CI 1.63 to 10.33), favoring physician-administered sedation. However, as different types and dosages of sedative and analgesic agents were used in these trials, these data should be interpreted with caution [10]. There is insufficient evidence to determine the effect of different methods of pain relief when compared with conscious sedation and analgesia used during oocyte recovery. No one particular pain relief method or delivery system appeared to be better than the other. In future, greater consensus is needed to determine both the tools used to evaluate pain and the timing of pain evaluation during and

after the procedure. Pain assessment using both subjective and objective measures may merit consideration. In addition, future trials should include intra- and post-operative adverse respiratory and cardiovascular events as outcomes [10].

So this study differ from Kwan et al. [10] meta analysis of different studies regarding result which show no difference in different modalities of anesthesia but some studies included in this meta analysis contain different modalities not used in this study.

Kwan et al. [11] review mention that; No single method or delivery system appeared superior for pregnancy rates and pain relief. Future studies need to be consistent in the choice of tools used to measure pain and the timing of such evaluations [11]. Twelve trials were included. Owing to considerable heterogeneity, regarding types and dosages of sedation or analgesia used, and tools used to assess pain, a meta-analysis was attempted only in trials where appropriate data were available. Clinical pregnancy rates per woman in individual trials were comparable. Data on pain showed conflicting results [11].

So this study differ from Kwan et al. [11] review of different studies regarding result which show no difference in different modalities of anesthesia but some studies included in this meta analysis contain different modalities not used in this study.

Hayes MF et al. [12] mention that; to determine whether anesthesia affects *In Vitro* Fertilization (IVF), the authors examined 3 1/2 years' experience with IVF. Anesthesia length significantly predicted fertilization and cleavage at stage 0 of stepwise multiple logistic regression analysis, but not at the final step. Oocyte grade, retrieval order, and a quadratic term for grade remained significant for fertilization; cleavage, order, the interaction of order and grade, and the quadratic term for grade remained significant. Order correlated with anesthesia ( $r = 0.675$ ,  $P$  less than 0.001). Also inherent in order are CO<sub>2</sub>, pneumoperitoneum, increased prolactin, decreased gonadotropins, ovarian trauma, and time. First oocytes of equivalent grade from contralateral ovaries were compared. Fertilization rates were equivalent, but significantly fewer mature oocytes from the second ovary cleaved. Anesthetic agents and CO<sub>2</sub> appear to adversely affect fertilization and cleavage *in vitro* [12].

So this study differ from Hayes MF et al. [12], regarding using new technique of IVF in this study during oocyte retrieval, But different effect of anesthesia type on result of IVF cycle.

Huang HW, et al. [13] mention that; the use of propofol, as compared to barbiturates (e.g. thiopental), for short surgical procedures has been associated with more rapid recovery from the procedure. Propofol, an intravenous anesthetic drug, is frequently used as an adjunct to transvaginal oocyte retrieval but little is known about its effects upon fertilization, embryo development, and pregnancy rate when used the drug for induction of general anesthesia [13]. 92 cases of infertile patients who underwent oocyte retrieval under the induction of general anesthesia with, respectively, either propofol (Group I, 72 cases) or thiopental sodium (Group II, 20 cases) were compared for fertilization rate, cleavage rate, and pregnancy rate [13]. There were no significant differences between these two groups for fertilization rate, cleavage rate, pregnancy rate, implantation rate and abortion rate. [13] The fertilization rate was 68.9% for Group I and 66.7% for group II ( $p = 0.614$ ). The cleavage rate was 96.5% for Group I and 94.8% for Group II ( $p = 0.294$ ). The rate



of good embryo grading and poor embryo grading was, respectively, 85.1% and 14.9% for Group I, versus 85.7% and 14.3% for Group II ( $p = 0.887$ ). The pregnancy rate was 30.5% for Group I and 20.0% for Group II ( $p = 0.354$ ). The implantation rate and abortion rate was, respectively, 9.1% and 18.2% for Group I versus 7.2% and 25.0% for Group II (implantation rate,  $p = 0.590$ ; abortion rate,  $p = 0.600$ ). [13] There were no significant differences between these two groups for fertilization rate, cleavage rate, pregnancy rate, implantation rate and abortion rate. They suggest cautious use of propofol for the procedure of oocyte retrieval despite its associated more rapid post-operative recovery including less nausea/vomiting [13].

So this study result is similar to result of Huang HW et al. [13] regarding rapid recovery; but differ regarding difference in result of effect f probufol and thiopental on IVF outcome measures.

Botta G, et al. [14] mentions that; Epidural anesthesia is an effective method for transvaginal oocyte retrieval but does not improve the treatment outcome as compared to an intravenous sedation with mask-assisted ventilation using propofol and nitrous oxide [14]. In group a satisfactory anesthesia was achieved in 49 of the 50 cases (98%); one patient required additional intravenous administration of propofol owing to extreme anxiety. No complications were observed. Adversely, in group B nausea was observed in 16 cases (14%) and nausea and vomiting in 7 cases (6%). In group A the fertilization, cleavage and pregnancy rates were 67.2%, 92% and 20% respectively, while in group B the rates were 69.3%, 93% and 19.6% respectively; the differences are not statistically significant [14]. Between January 1991 and December 1992, 148 infertile patients underwent transvaginal ultrasound guided oocyte retrieval. A total of 44 patients (group A) had 50 retrievals under epidural anesthesia, and 104 patients (group B, control group) 112 retrievals under intravenous sedation (propofol) with mask-assisted ventilation (nitrous oxide) [14].

So this study differ from that of Botta G et al. [14] regarding the comparison groups , but similar regarding the good effect of usage of probufol during IVF procedure as sedative agent.

Endler GC et al. [15] mentions that; because access into ovarian tissue of drugs used during anesthesia may be potentially harmful to the oocyte and/or follicular structure, we measured concentrations of thiopental ( $n = 15$ ) and thiamylal ( $n = 9$ ) in Follicular Fluid (FF) aspirates of 24 patients who underwent laparoscopic oocyte retrieval. In both groups, measurable amounts of the respective drug were found in all FF aspirates. Within individual patients, plasma concentrations of both drugs declined during the period of sampling between initial and final follicular aspiration. The mean plasma drug concentration was  $7.99 \pm 3.97$  micrograms/ml in the thiamylal group and  $4.13 \pm 0.90$  micrograms/ml in the thiopental group. Mean drug concentrations in FF were similar in both groups (thiopental  $1.62 \pm 0.61$  micrograms/ml; thiamylal  $1.67 \pm 0.83$  micrograms/ml). The mean FF/plasma concentration ratio during the sampling period was greater in the thiopental group ( $0.41 \pm 0.19$ ) as compared with the thiamylal group ( $0.22 \pm 0.14$ ). Several steps in the clinical management of these patients can be taken to reduce exposure of oocytes to drugs used during anesthesia [15].

So this study differ from that of Endler GC et al. [15] regarding using new modality of oocyte retrieval but prove that the presence of large concentration of thiopental in follicular fluid which prove the hazards effect on result of IVF cycle which proved in this study.

Kwan I et al. [16] mentions that; The evidence from this review of 21 randomized controlled trials did not support one particular method or technique over another in providing effective conscious sedation and analgesia for pain relief during and after oocyte recovery. The simultaneous use of more than one method of sedation and pain relief resulted in better pain relief than one modality alone. The various approaches and techniques reviewed appeared to be acceptable and were associated with a high degree of satisfaction in women. As women vary in their experience of pain and in coping strategies, the optimal method may be individualized depending on the preferences of both the women and the clinicians and resource availability [16]. Only randomized controlled trials comparing different methods of conscious sedation and analgesia for pain relief during oocyte recovery were included [16]. Quality assessment and data extraction were performed independently by two review authors. Interventions were classified and analyzed under broad categories or strategies of sedation and pain relief to compare different methods and administrative protocols of conscious sedation and analgesia. Outcomes were extracted and the data were pooled when appropriate [16]. With this update, nine new studies were identified resulting in a total of 21 trials including 2974 women undergoing oocyte retrieval. These trials compared five different categories of conscious sedation and analgesia: 1) conscious sedation and analgesia versus placebo; 2) conscious sedation and analgesia versus other active interventions such as general and acupuncture anesthesia; 3) conscious sedation and analgesia plus paracervical block versus other active interventions such as general, spinal and acupuncture anesthesia; 4) patient-controlled conscious sedation and analgesia versus physician-administered conscious sedation and analgesia; and 5) conscious sedation and analgesia with different agents or dosage. Evidence was generally of low quality, mainly due to poor reporting of methods, small sample sizes and inconsistency between the trials. Conflicting results were shown for women's experience of pain. Compared to conscious sedation alone, more effective pain relief was reported when conscious sedation was combined with electro-acupuncture: intra-operative pain Mean Difference (MD) on 1 to 10 Visual Analogue Scale (VAS) of 3.00 (95% CI 2.23 to 3.77); post-operative pain MD in VAS units of 2.10 (95% CI 1.40 to 2.80;  $N = 61$ , one trial, low quality evidence); or paracervical block (MD not calculable). The pooled data of four trials showed a significantly lower intra-operative pain score with conscious sedation plus paracervical block than with electro-acupuncture plus paracervical block (MD on 10-point VAS of -0.66; 95% CI -0.93 to -0.39;  $N = 781$ , 4 trials, low quality evidence) with significant statistical heterogeneity ( $I^2 = 76\%$ ). Patient-controlled sedation and analgesia was associated with more intra-operative pain than physician-administered sedation and analgesia (MD on 10-point VAS of 0.60; 95% CI 0.16 to 1.03;  $N = 379$ , 4 trials, low quality evidence) with high statistical heterogeneity ( $I^2 = 83\%$ ). Post-operative pain was reported in only nine studies. As different types and dosages of sedative and analgesic agents, as well as administrative protocols and assessment tools, were used in these trials the data should be interpreted with caution. There was no evidence of a significant difference in pregnancy rate in the 12 studies which assessed this outcome, and pooled data of four trials comparing electro-acupuncture combined with paracervical block with conscious sedation and analgesia plus paracervical block showed an Odds Ratio (OR) of 0.96 (95% CI 0.72 to 1.29;  $N = 783$ , 4 trials) for pregnancy. High levels of women's satisfaction were reported

for all modalities of conscious sedation and analgesia as assessed in 12 studies. Meta-analysis of all the studies was not attempted due to considerable heterogeneity. For the rest of the trials a descriptive summary of the outcomes was presented [16]. Various methods of conscious sedation and analgesia have been used for pain relief during oocyte recovery in *In-Vitro* Fertilisation (IVF) and Intra-Cytoplasmic Sperm Injection (ICSI) procedures. The choice of agent has also been influenced by the quality of sedation and analgesia as well as by concerns about possible detrimental effects on reproductive outcomes [16].

So this study is similar to that of Kwan I et al. [16] regarding the good results of propofol proven in studies included but differ regarding other modalities not included in this study.

Mohammad Hossein Jarahzadeh et al. [17] mention that; Based on the findings of the study, Propofol has fewer known side effects. Vomiting and nausea as two known side effect of anesthesia are significantly lower in patients receiving Propofol than patients who received thiopental [17].

In this double blinded randomized controlled trial, 90 woman candidates for ART were randomly divided into two groups. 47 patients received Propofol (2.5 mg/kg) and 43 patients received thiopental (5mg/kg) for anesthesia induction. The entry hemodynamic parameters of the patients were documented. During the anesthesia process, hemodynamic parameters were checked at five-minute intervals [17].

The results of the study showed a statistically significant difference between two groups in terms of their response to verbal stimulation ( $p < 0.001$ ), the normalization time of the rate and quality of breathing ( $p < 0.001$ ), nausea ( $p < 0.001$ ), and vomiting ( $p < 0.001$ ). Also, in comparison with the other group, all these parameters were better in Propofol group. There was found no significant difference between two groups in terms of other variables [17].

Thiopental sodium and Propofol are two widely-used drugs in the induction of anesthesia in Assisted Reproductive Technology (ART). However, the side effects and outcome of recovery from anesthesia of these drugs on ART have not been identified yet [17].

So this study differ from that of Mohammad Hossein Jarahzadeh et al. [17] regarding similarity of effect of anesthetic agents but similar in good efficacy of propofol in oocyte retrieval.

Propofol (2, 6 disopropylphenol) is a popular anesthetic drug that is a hypnotic agent. It produces mild to moderate sedation with reported side effects like bradycardia and Asystole (1.4 per 100.000 patients) [4,5].

Mohammad Hossein Jarahzadeh, et al. [17] mention that; this double-blind, randomized clinical trial was carried out in the Yazd Research and Clinical Center for Infertility, Yazd, Iran. They studied 145 women who were participants in an ART program. During the first phase of the study, all patients underwent induction of anesthesia with thiopental and received analgesia with remifentanyl or fentanyl. The primary endpoint was pregnancy rate per transfer. The numbers of oocytes collected, fertilized and cleaved were recorded, as was the number of oocytes transferred and recovery profile. In the second phase of the study, all patients were followed for outcome of ART cycle [18].

The results of this study suggest that remifentanyl in clinical practice is superior to fentanyl (Registration Number: IRCT201009283468N3) [18].

This study suggested that in women undergoing transvaginal ultrasound-guided oocyte retrieval procedures, the likelihood of a successful pregnancy was higher with a remifentanyl-based Monitored Anesthesia Care (MAC) technique than with a fentanyl-based MAC technique. The recovery from anesthesia was significantly better in the remifentanyl group versus fentanyl group [18].

So this study differs from that of Mohammad Hossein Jarahzadeh, et al. [18] regarding using different anesthetic agents not scope of this study.

## Conclusion

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## Contribution to Authorship

W.S. contributed to the protocol, co-ordinate the study, interviewed the parents, analyzed the data and drafted the article. W.S. contributed also to the revision and final approval of the article.

## Details of Ethics Approval

The study received approval from the Research Ethics Committee. Reference: 31/7/1564. Date of approval: 1 December 2012.

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