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ORIGINAL ARTICLE

A comparison of two different regimens of total intravenous anesthesia for transvaginal ultrasound-guided oocyte retrieval

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KEYWORDS

Oocyte retrieval;
Bispectral index (BIS);
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Abstract *Objective:* To evaluate the effects of Bispectral index (BIS)-guided total intravenous anesthesia (TIVA) with fentanyl-propofol vs. remifentanil-propofol on recovery time, total propofol consumption, length of postanesthesia care unit (PACU) stay, total hospital stay, postoperative pain and side effects in patients undergoing TUGOR.

Study design: Prospective randomized observer-blinded study. The study included 60 patients that were scheduled to undergo TUGOR under BIS-guided TIVA. They were invited to enroll in the study during the period from November 2009 to August 2011 at TAIBA Hospital in Kuwait. Patients were randomly allocated into two groups of 30 patients each: general anesthesia with fentanyl and propofol (group I) or general anesthesia with remifentanil and propofol (group II). The primary outcomes of this study were recovery time and the length of PACU stay.

Results: Patients in group II had significantly rapid recovery, shorter PACU stay (23.5 ± 1.73 vs. 27.1 ± 1.43 min; $P < 0.01$), less amount of total propofol consumption, less total hospital stay and higher patient satisfaction with analgesia and sedation compared to patients in group I with no difference in intraoperative hemodynamic parameters, postoperative VAS scores of pain, postoperative nausea and vomiting; and without affecting IVF outcomes.

Conclusion: BIS-guided total intravenous anesthesia with remifentanil and propofol appears to be a safe and an effective regimen for patients undergoing TUGOR.

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1. Introduction

The direct recovery of oocytes from the ovary is a fundamental step of in vitro fertilization treatment. Transvaginal ultrasound-guided oocyte retrieval (TUGOR) is considered a short painful procedure that requires anesthesia and/or analgesia (1). The cause of pain during oocyte retrieval is puncture of the

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vaginal mucosa and the ovarian capsule by the aspirating needle and its manipulation within the ovary during the procedure (2). It needs anesthetic technique that works quickly and effectively during the procedure, allows for a rapid recovery with minimal side effects and ensures the highest fertilization and pregnancy rates (3).

Propofol is a short acting intravenous anesthetic agent suitable for induction and maintenance of anesthesia. It has a rapid onset of action and is associated with rapid recovery. So, it has been used extensively for oocyte retrieval (4). Fentanyl is a synthetic opioid with strong affinity for the mu opioid receptor site. It has an extremely potent analgesic effect estimated to be approximately 50–100 times more potent than morphine (5). Intravenous injection of fentanyl provides a rapid onset of analgesia (1–5 min) and a short duration of action (less than 1 h) (6).

Remifentanil is a potent, selective μ-opioid receptor agonist. Remifentanil has an onset of action of about 1 min and quickly achieves a steady state. It is rapidly metabolized by nonspecific blood and tissue esterases with an elimination half-life of less than 10 min, which is independent of dose, infusion duration and hepatic or renal dysfunction (7).

Bispectral Index (BIS) monitoring is a new advanced electroencephalogram (EEG)-based method of monitoring anesthetic depth (8). The monitor uses bispectral analysis to derive an index of anesthetic depth, the BIS (9). BIS is a dimensionless number scaled from 100 to 0, with decreasing values indicating more sedation and hypnosis. BIS value of 100 represents a normal cortical electrical activity (an awake EEG) and a value of zero indicates a cortical electrical silence (cortical suppression) (10). BIS values of 95–100 reflecting awake state, 70–95 reflect light to moderate sedation, 60–70 reflecting deep sedation with low probability of explicit recall. BIS values between 40 and 60 indicate a sufficient depth of anesthesia excluding intraoperative awareness and below 40 reflecting deep hypnotic state (11).

The objective of this study was to evaluate the effects of BIS-guided total intravenous anesthesia (TIVA) with fentanyl-propofol vs. remifentanil-propofol on recovery time, total propofol consumption, length of PACU stay, total hospital stay, postoperative pain and side effects in patients undergoing TUGOR.

2. Materials and methods

This is a prospective randomized observer-blinded study conducted at TAIBA Hospital in Kuwait during the period from November 2009 to August 2011.

Sixty women with American Society of Anesthesiologists (ASA) physical status I and II, who were scheduled to undergo oocyte retrieval and had signed written informed consent, were enrolled in this study. All patients were scheduled for identical ovarian stimulation and ultrasonically guided transvaginal follicular aspiration protocol.

The study was approved by the hospital's Ethics Committee. Patients were randomly allocated into two groups of 30 patients each: general anesthesia with fentanyl and propofol (group I) or general anesthesia with remifentanil and propofol (group II).

Randomization was performed through a computer-generated; random-number list. The random number list was generated by means of the QuickCalcs (GraphPad Software Inc., La Jolla, CA, USA). The group assignment numbers were sealed in an envelope and kept by the study supervisor. After the written consent was signed, the opaque envelope was unsealed to determine which anesthetic technique would be performed.

Inclusion criteria included American Society of Anesthesiologists (ASA) physical status I-II and age between 26 and 42 years.

Exclusion criteria were history of cardio-respiratory disease, chronic use of opioids or analgesics and allergy to any of the study medications.

The hormonal stimulation protocol consisted of controlled ovarian hyperstimulation after a pituitary long down-regulation protocol starting at the midluteal phase of the preceding cycle. Ovarian stimulation was performed using recombinant follicle-stimulating hormone (FSH), urinary FSH or human menopausal gonadotrophin in combination with subcutaneous gonadotropin-releasing hormone agonist (GnRH agonist).

Follicular development was monitored by serial serum estradiol measurements and transvaginal ultrasound scans beginning on day 8 of the cycle until the day of human chorionic gonadotrophin (HCG) administration. When at least two follicles reached a mean diameter of $\geqslant 18$ mm, patients received HCG (10,000 IU), and 36 h later the oocytes were collected by ultrasound-guided transvaginal needle aspiration of the follicles.

All patients were fasting for a minimum of 8 h and did not receive any premedication. In the operating room, after wiping the skin of the forehead with an alcohol swab and allowing it to dry, a BIS–XP Quatro sensor (Aspect Medical Systems, Newton, MA, USA) was applied to the forehead of the patient according to the manufacturer's guidelines. Four electrodes are integrated in one sensor to obtain the electroencephalographic signal from the forehead. The sensor was connected to a BIS-XP monitor (BIS XP, A-2000, Aspect Medical Systems, Newton, MA, USA). This was done to evaluate the degrees of sedation for each patient. The BIS sensor was placed simultaneously with other standard monitors before induction of anesthesia. A baseline BIS value, blood pressure (BP), heart rate (HR) and oxygen saturation were recorded. In all women preoxygenation was done. In group I, all patients received fentanyl (1.5 μg/kg) and a bolus of propofol (1–2 mg/kg) for induction. After insertion of laryngeal mask airway (LMA), anesthesia was maintained with propofol infusion, that was titrated to keep BIS value between 50 and 60. In group II, all patients received a bolus of remifentanil (1.5 μg/kg) and a bolus of propofol (1–2 mg/kg) for induction. After insertion of LMA, anesthesia was maintained with propofol infusion according to BIS value as before, and remifentanil infusion (0.25 μg/kg/min). The gynecologist was blinded to the anesthetic regimen used.

Before starting the procedure, visual analogue scale (VAS) for pain was explained to all patients. Patients were told to indicate the degree of their pain by VAS scores, when they were asked to evaluate the intensity of their pain.

TUGOR was performed in a standard fashion with precautions to reduce the risk of infection. Follicles were aspirated from each ovary through the lateral vaginal fornix with double lumen oocyte aspiration needle (Cook, Australia). Aspiration pressure was kept at a negative pressure between 150 and 200 mmHg.