Journal of Clinical Anesthesia (2008) **20**, 356–363

ELSEVIER

Journal of Clinical Anesthesia

Original contribution

Anesthetic impact of body mass index in patients undergoing assisted reproductive technologies☆

Brian Egan MD (Assistant Professor of Anaesthesia)[a], Catherine Racowsky PhD (Associate Professor of Obstetrics and Gynecology)[b], Mark D. Hornstein MD (Associate Professor of Obstetrics and Gynecology)[b], Ramon Martin MD, PhD (Assistant Professor of Anaesthesia)[a], Lawrence C. Tsen MD (Associate Professor of Anaesthesia)[a,*]

[a]*Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115, USA*
[b]*Department of Obstetrics and Gynecology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115, USA*

Received 25 May 2007; revised 15 February 2008; accepted 11 March 2008

Keywords:
Anesthesia;
Assisted reproductive technologies;
Oocyte retrieval procedures

Abstract
Study Objective: To determine the prevalence and anesthetic impact of obesity in patients undergoing assisted reproductive technologies.
Design: Retrospective analysis of a complete calendar year of oocyte retrieval procedures.
Setting: Center for reproductive medicine of a tertiary care university teaching hospital.
Patients: 1,289 ASA physical status I, II, and III women undergoing oocyte retrieval procedures.
Measurements: Patient demographics, body mass index (BMI), comorbid conditions, frequency and characterization of intraoperative and postoperative events, route of oocyte retrieval, and anesthetic technique were assessed.
Main Results: Of the 1,289 women, 33% were overweight or obese. The prevalence of gastroesophageal reflux disease, depression/anxiety, hypothyroidism, diabetes, and hypertension was associated with increasing BMI ($P < 0.02$). Transvaginal oocyte retrieval and the use of total intravenous anesthesia were less common with increasing BMI ($P < 0.01$; $P < 0.003$). Oxygen desaturation occurred more frequently intraoperatively and postoperatively in patients with high BMI ($P < 0.0001$), as did the reports of postoperative discomfort and the need for additional analgesia ($P < 0.001$). No patients managed with spinal anesthesia experienced intraoperative desaturation or required conversion to general anesthesia with endotracheal intubation.

☆ Supported by the Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital (Boston, MA). No author affiliations exist that may represent a conflict of interest with this work.

* Corresponding author. Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital, Boston, MA 02115, USA. Tel.: +1 617 732 8216; fax: +1 617 277 2192.
E-mail address: ltsen@zeus.bwh.harvard.edu (L.C. Tsen).

0952-8180/$ – see front matter
doi:10.1016/j.jclinane.2008.03.003

Conclusions: Patients with high BMI have a greater prevalence of comorbid conditions, require alterations in anesthetic and oocyte retrieval management, and more often experience intraoperative and postoperative events.

1. Introduction

The prevalence of obesity among women in industrialized countries has increased dramatically over the past decade. A weight-adjusted for height calculation (kg/m^2), body mass index (BMI) classifies values of less than 18.5 as underweight, from 18.5 to 24.9 as normal weight, from 25 go 29.9 as overweight, and more than 30 as obese [1]. In the United States, obesity among women of childbearing age increased from 14.9% to 23.5% between 1995 and 2005 [2]. Similar increases have been observed in Canada and Europe, prompting Health Canada and the World Health Organization to characterize obesity as a pandemic issue. Obesity is common in women with menstrual disturbances, hyperandrogenism, and polycystic ovarian syndrome, which are conditions frequently associated with infertility [3]. Despite this association, the prevalence and anesthetic impact of obese women seeking assisted reproductive technology (ART) procedures have not been well characterized.

Together in the United States and Canada, greater than 130,000 ART cycles are performed each year [4,5]. Patients undergoing ART procedures typically undergo transvaginal ultrasound-guided oocyte retrieval in the lithotomy position with a total intravenous anesthetic (TIVA). Anecdotally, we observed that patients with ART and high BMI values frequently underwent alterations in their anesthetic management, including airway interventions, administration of a spinal technique instead of TIVA, increased drug requirements, and altered responses due to complications. The present study was designed to determine the prevalence of obesity in our ART population within a single year and to evaluate how frequently alterations in anesthetic care were observed in high BMI individuals undergoing oocyte retrieval.

2. Materials and methods

After approval by the Brigham and Women's Hospital's human research committee, the records of all ART cases that resulted in an oocyte retrieval during the 2003 calendar year were reviewed.

Oocyte retrievals are performed after a standardized ovarian stimulation and triggering regimen. In brief, patients with normal follicle-stimulating hormone (FSH) levels are down-regulated with 0.5 to 1.0 mg of leuprolide acetate followed by controlled ovarian hyperstimulation with 225 to 600 IU of FSH daily, alone or in combination with human menopausal gondotropin and a halving of the leuprolide acetate dose. When serial transvaginal ultrasound identifies at least two follicles with a mean diameter of at least 18 mm and an estradiol level of at least 500 pg per mL, 10,000 IU of human chorionic gonadotropin is administered intramuscularly. Oocyte retrieval is scheduled 36 hours later via transvaginal ultrasound-guided needle aspiration with the patient in the lithotomy position; on occasion, if the transvaginal approach is not feasible, mostly because of anatomical reasons such as obesity, a transabdominal approach is used.

At our center, oocyte retrievals are performed primarily with general anesthesia; however, spinal anesthesia may be used at the discretion of the attending anesthesiologist. The protocol for all anesthetic cases includes preoperative evaluation and written consent, placement of an intravenous (IV) catheter for administration of IV Ringer's lactate, and use of standard monitors (electrocardiogram, pulse oximetry, end-tidal CO_2 ($ETCO_2$) monitoring, and automated noninvasive blood pressure cuff). General anesthesia is administered via a TIVA technique with fentanyl followed by propofol titrated to effect; midazolam, ketamine, and metoclopramide can be added. A natural airway with oxygenation provided by a simple mask with 6 L of oxygen per min and ET CO_2 monitoring is standard practice; conversion to general endotracheal tube (ETT) anesthesia with volatile anesthetics (50% nitrous/oxygen with isoflurane) is used for episodes of recurrent desaturation or spinal anesthesia failure. The protocol for spinal anesthesia, which has been reported previously [6,7], includes the placement of an IV catheter and standard monitors, followed by 25-gauge Whitacre spinal technique with lidocaine (45 mg) and fentanyl (10 μg); additional sedation is limited to IV midazolam ($\leq$ two mg) and fentanyl ($\leq$100 μg).

Data collected included those specifically and routinely recorded on one of three forms as follows: history and physical consultation, anesthetic record, and nursing postoperative record. Age, height, and weight; comorbid conditions; ASA physical status classification and Mallampati score; type of oocyte retrieval and total time required for the procedure; type of anesthetic selected; medications administered; desaturation (defined as oxygen saturation <93%); and use of an ETT, (and whether it was part of the original anesthetic plan) were recorded. Postoperatively, data collected from the nursing record included presence of abdominal pain (by visual analog scale [VAS] >5) and