Anesthesia Outside the Operating Room (2 ed.)

Edited by Richard D. Urman, Wendy L. Gross, and Beverly K. Philip

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Anesthesia for Assisted Reproductive Technologies

Chapter: Anesthesia for Assisted Reproductive Technologies

Author(s): Vesela Kovacheva and Patricia M. Sequeira

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Introduction

In vitro fertilization (IVF) is a broad term used to describe the process of obtaining an oocyte, uniting it with sperm in a laboratory setting, and subsequently placing the fertilized oocyte or embryo into the uterus in hopes of achieving a live birth. In terms of anesthesiology, IVF primarily means oocyte retrieval. Historically, the oocytes were retrieved laparoscopically. With the introduction of the transvaginal ultrasound, the method of retrieval changed to a less invasive and costly procedure. Transvaginal ultrasound-guided oocyte aspiration changed the requirements for anesthesia. In this chapter, the anesthesia for oocyte retrieval and related IVF procedures is described.

Causes of Infertility

Infertility is defined as the inability to conceive for a given period of time, usually 1 year. The causes of infertility include (fallopian) tubal factors, ovulatory dysfunction, diminished ovarian reserve, endometriosis, uterine factors, male factors (very low sperm count or abnormal sperm motility), other factors (not treatable by current available methods), and unknown factors. Female infertility causes account for approximately one-third of the infertility cases; male infertility causes account for another one-third, and the remaining one-third of cases are caused by a mixture of female and male problems or by idiopathic factors.[1]

Assisted Reproductive Technologies

Assisted reproductive technologies (ARTs) refer to all techniques involving the direct extraction of oocytes from the ovaries.[2] Advances in endocrine assays, controlled ovarian stimulation (COH), hormonal manipulation, cryopreservation, ultrasonography, and procedures on eggs, sperm, and embryos have transformed IVF. The ART physician is a gynecologist subspecialty trained in reproductive endocrinology and infertility. IVF usually refers to the process of oocyte retrieval and fertilization in the laboratory with subsequent embryo transfer to the uterus. Intrauterine insemination (IUI) is the placement of prepared sperm into the endometrial cavity via a small catheter. Intracytoplasmic sperm injection (ICSI) is an ART procedure where a single sperm is injected into the retrieved ovum. IVF also refers to other ART techniques, such as gamete intrafallopian transfer (GIFT) and zygote intrafallopian transfer (ZIFT). The GIFT procedure involves the transfer of

retrieved oocytes and washed sperm into the fallopian tube by laparoscopy. The ZIFT procedure involves transfer of one or more embryos laparoscopically into the fallopian tube. Since the introduction of the transvaginal ultrasound probe for oocyte retrieval, these technologies are rarely used. IVF–embryo transfer (IVF-ET) is a widely used term for transvaginal ultrasound–guided oocyte aspiration and the subsequent transcervical embryo transfer.

The IVF Cycle

The IVF cycle consists of several ART steps over a period of approximately 2 weeks. The cycle is considered a series of treatments rather than a single procedure. The IVF cycle starts when a woman begins taking hormonal medications to stimulate oocyte production or starts ovarian monitoring with the intention of having embryos transferred. A successful IVF cycle starts either naturally or with medication and is followed by the production of oocytes. Next is oocyte retrieval. If fertilization is successful, then the next step is incubation and subsequent embryo transfer. If the embryo implants within the uterus, then pregnancy is achieved. This is followed by the delivery of one or more live births. The absence of oocyte production, excessive ovarian hyperstimulation, or other medical reasons may require the discontinuation of the cycle.

Controlled Ovarian Hyperstimulation

Controlled ovarian hyperstimulation (COH) is an ART process through which the ovaries are purposely stimulated to develop more than one dominant follicle. This is considered the start of an IVF cycle. Having multiple dominant follicles will increase the number of oocytes retrieved and the likelihood of successful pregnancy from transferred embryos. The goal of COH is to promote the development of a relatively synchronous cohort of ovarian follicles so that the oocyte retrieval can be performed at a specified time. A typical COH protocol uses a combination of a gonadotropin-releasing hormone agonist (GnRH-a), human menopausal gonadotropin (hMG), and human chorionic gonadotropin (hCG). Ovarian suppression and follicular variation are achieved with GnRH-a. The ovaries are monitored by serial ultrasound examinations. Ovarian stimulation is begun with hMG administration. Serial follicular diameters and estrogen levels guide the timing of the administration of hCG. Oocyte retrieval is usually approximately 36 hours after the start of hCG. COH also achieves the development of the proper endometrial environment for the subsequent embryos to be transferred.[3] The hormonal protocols vary by clinic, endocrinologist, and patient and adjustments can be done to account for the individual hormonal response. COH is always carefully monitored with serial ultrasound examination to evaluate the follicle size and progression of hormonal blood levels.

Ovarian Hyperstimulation Syndrome and IVF Surgical Risks

The ART of COH is not without adverse effects. Ovarian hyperstimulation syndrome (OHSS) is an iatrogenic, potentially life-threatening complication of COH. Symptoms begin with abdominal bloating and progress to nausea, vomiting, and diarrhea. Lethargy and loss of appetite follow. Shortness of breath and decreased urine output may indicate accumulating ascites and increasing morbidity. The patient with moderate or severe OHSS may have signs of rapid weight gain, oliguria, hemoconcentration, leukocytosis, hypovolemia, electrolyte imbalance, ascites, pleural and pericardial effusions, adult respiratory distress syndrome, hypercoagulability and thromboembolic events, and multiorgan failure. OHSS should be self-limiting, and regression takes place as long as prompt and appropriate supportive care is provided. Exogenous and endogenous hCG will worsen OHSS.[4]

Surgical risks for IVF transvaginal ultrasound-guided oocyte retrieval may include bleeding, infection, and injury to pelvic or abdominal organs. These surgical complications may require hospitalization or subsequent surgery. Oskowitz et al.[5] reported on a series of 6776 procedures performed in a freestanding surgical facility dedicated to ART. Of the 4199 patients who had vaginal oocyte retrieval procedures, seven required hospital admission during the first 24 hours after surgery. Two patients had serious morbidity, defined as requiring major intervention, such as a repeat surgery. Nausea and vomiting, syncope, hemoperitoneum, and ovarian hematoma were included in the admitting diagnoses.

Anesthesia for Transvaginal Oocyte Retrieval

Ultrasound-guided oocyte retrieval can be performed under a paracervical block, intravenous sedation, or general, spinal, and epidural anesthesia. The literature concerning the choice of anesthesia on the success of IVF should be interpreted with caution. Specific anesthetic drugs and techniques must be evaluated for their compatibility. Animal data may not reflect the human experience.[6]

UK and US IVF Anesthesia Practice Evaluations

According to Elkington’s questionnaire of ART centers in the United Kingdom, there are significant variations in the personnel present during the procedure, the choice of medications, the degree of monitoring, and the availability of emergency drugs.[7] Eighty-four percent of the ART centers used intravenous sedation, and 16% used general anesthesia for transvaginal oocyte retrieval.

Results from a Ditkoff et al.[8] telephone survey in the United States of 278 ART programs revealed that 91 private (68%) and 41 academic (56%) programs used personnel from the Department of Anesthesiology. A large number of ART programs used their own trained personnel to provide sedation. Ninety-five percent of the transvaginal oocyte retrievals and transcervical embryo transfers were performed under conscious sedation.

For the remaining 5%, general, regional, or local anesthesia was used. The majority of the IVF personnel typically used meperidine and midazolam. Ninety percent of the anesthesiology personnel used midazolam or propofol with fentanyl.

IVF Patient Demographics

Although the majority of IVF patients are healthy adult women, overweight and morbidly obese patients are sometimes encountered. Other medical conditions common in this population include asthma and hypertension. Psychosocial disorders such as anxiety, depression, and stress secondary to the infertility status may be present. The women typically range in age from the late 20s to mid-40s.

The IVF Facilities

According to a questionnaire by Yasmin and colleagues,[9] 69% of the responding IVF centers performed oocyte retrieval outside of the general operating room environment. A typical IVF procedure room may be located within a university-based or freestanding fertility clinic. The embryology and andrology laboratories are usually adjacent to the procedure room for immediate processing of the oocytes and sperm. The IVF anesthesiologist is required to be familiar with the IVF procedures, the fertility center’s choice of sedation/analgesia and anesthesia, the individual surgeon’s needs, and the needs of the IVF patient.

Anesthesia for IVF

Goals

The anesthetic goals for IVF oocyte retrieval and related procedures are effective pain relief and sedation, together with minimal postoperative nausea and vomiting (PONV). These goals should be executed in a safe manner. IVF goals also include the ease of administering intravenous medications and patient monitoring. The medications should be short acting and easily reversible. These drugs should minimally affect the oocytes, the embryos, and the endocrine and the immune systems. It is important to keep in mind that these procedures are costly, and economic factors should be considered.[10]

Considerations

The foremost anesthetic considerations for the IVF patient in the preprocedural period are patient anxiety management. This unique population of patients may have stress, anxiety, and depression due to their infertile status. They may arrive with varying degrees of anxiety from the expectant wait of the oocyte or sperm retrieval. Empathy from all those involved in their care, such as the IVF nursing staff, the procedure room staff, the embryologist, the reproductive medicine physician, and the anesthesiologist, is invaluable.

Preprocedural anesthesia concerns are minor due to the general health of the IVF patient. On occasion, airway issues can arise from patients who have a history of loud snoring, sleep apnea, or obesity. The patients with a history of asthma or hypertension are usually medically compliant, and most commonly their conditions are well controlled. A history of PONV or motion sickness should be elicited and reduction of baseline risks planned for and initiated. Pain management should be discussed with the patient. Patients who did not adhere to the instructions to take nothing by mouth represent a unique challenge because the oocyte retrieval is a carefully timed procedure, and postponing it for more than 30 minutes puts the patients at risk for spontaneous ovulation. In those patients, full aspiration precautions are needed, and spinal anesthesia should be considered.

Once in the procedure room, any airway issues should be communicated to the surgeon because the sedation level or anesthetic may be different from usual. Care and vigilance should be taken during the placement of the patient in the dorsal lithotomy position. Positioning while awake and not sedated ensures proper padding for comfort of the patient. Adequate anesthesia and sedation should ensure an immobile patient to help avoid injury to pelvic vessels or organs.

Risks

When administering intravenous anesthetic agents, attention should be directed to avoiding apnea. Recognition and immediate treatment are therefore essential. Reducing the dose of intravenous agents and providing a greater stimulus (chin lift or a jaw thrust) may help overcome the apnea. In a case of airway obstruction, oral or nasal airway insertion may be necessary. Bag/mask ventilation may become necessary if the patient experiences prolonged apnea. Opioid or benzodiazepine reversal should not be routinely used. Instead, the desired anesthetic level is achieved by careful titration of the intravenous agents to proper effect.

Patients at risk for aspiration should be identified during the preoperative consultation. Aspiration needs to be recognized quickly, and suction should be readily available. Laryngospasm is a risk in the anesthetized and obtunded patient. Successful laryngospasm management includes early recognition followed by positive pressure ventilation and deepening of the anesthetic level, possible intubation, or waking up the patient. Hypotension from an anesthetic agent such as propofol is treated with generous fluid hydration. Vasopressors are rarely needed. PONV can be seen in this patient population, and appropriate prophylaxis strategies should be employed.

IVF Procedures

The most common procedure that requires anesthesia during an IVF cycle is oocyte retrieval. On occasion, an embryo transfer procedure will be scheduled with anesthesia. The dilation and curettage

(D&C) procedure is sometimes scheduled in the IVF suite. Additionally, the urologist may request anesthesia services for microscopic epididymal sperm aspiration (MESA) and testicular sperm extraction (TESE) procedures.

Oocyte Retrieval

The reproductive medicine surgeon selectively retrieves oocytes from the individual ovarian follicles, which have been stimulated via COH. Because the patient has been given hormonal drugs to induce ovulation, there is a small time window in which the oocytes can be retrieved. As oocyte retrieval is a specially scheduled and timed procedure, the anesthesia service should be available to accommodate these patients 7 days a week. The surgeon may request a dose of antibiotics for the patient with a history of tubal disease to prevent a pelvic infection.

The patient is positioned in the dorsal lithotomy position. Once the patient is sterilely prepped and draped, the surgeon places a transvaginal ultrasound probe equipped with a long needle to aspirate the ovarian follicles. The aspirating needle is usually of a 16 or 17 gauge and is guided through the posterior vaginal wall to the ovary, where each follicle is aspirated. Follicular fluid is aspirated into a test tube with culture medium. These test tubes are given to the embryologist, who then examines and counts the oocytes. The oocyte retrieval is then continued on the contralateral ovary. The duration of this procedure is usually 5–10 minutes.

Embryo Transfer

Embryo transfer is a short IVF procedure. The process consists of transferring one or several embryos from the laboratory to the patient’s uterus. The patient is placed in the dorsal lithotomy position with stirrups. The vagina is sterilely prepped. A small, semirigid catheter containing the embryos is placed into the uterine cavity via the cervix. When the uterine anatomy is difficult or abnormal, an abdominal ultrasound may aid in this process. The catheter is then returned to the embryology lab to ensure the embryos are no longer in the catheter. Patients with difficult, or abnormal, cervical or uterine anatomy and those who are extremely anxious may require anesthesia.

Dilation and Curettage

The IVF patient is at a higher risk for miscarriage. The D&C procedure in the outside of the operating room (OOOR) environment, such as the IVF suite, should be done only on carefully selected patients. A healthy patient of normal weight and normal coagulation who is not excessively bleeding and is less than 12 weeks’ pregnant is ideal for D&C in the OOOR setting. D&Cs for obese patients, those with a full stomach, and patients with second-trimester pregnancies should be reserved for the operating room.

The patient is placed in a dorsal lithotomy position with stirrups. The vagina is sterilely prepped and draped. The surgeon examines the uterus with the vaginal ultrasound to reconfirm the miscarriage. A vaginal speculum is inserted, and the cervix is grasped with a clamp. The cervical canal is then dilated with progressively larger dilators. Utmost care is taken not to perforate the uterine cavity. The endometrial lining and products of conception are removed with the curette and the suction aspirate.

Sperm Retrieval Techniques

Microscopic epididymal sperm aspiration, percutaneous epididymal sperm aspiration (PESA), and TESE are a few of the different sperm retrieval procedures that take place at an infertility center. These methods refer to certain cases of male infertility. These procedures are done by the urologist and are tailored to the individual couple's needs. The sperm that is obtained is then used for intracytoplasmic sperm injection. The MESA technique utilizes microsurgical techniques to obtain sperm from the epididymis. The TESE technique involves removal of a small sample of testis tissue for extraction of sperm by the andrology laboratory. During the PESA technique, a needle is used to draw sperm from the epididymis.

The male patient is in the supine position. The scrotum is sterilely prepped and draped. Local anesthesia is used. If the procedure is an open one, the urologist will use the operating microscope. The sperm retrieval usually lasts approximately 1 hour. The urologist may request anesthesia services.

Criteria for Selection of Anesthetic Type

The selection of anesthesia type will depend on the IVF center and the surgeon's preference. This is seen by the variation in personnel and drugs used. The anesthesia provider can modify those choices, especially in select patients who may have a difficult airway, are obese, or have a history of PONV.

Anesthesia for Egg Retrieval: Moderate Sedation

Intravenous moderate sedation for transvaginal ultrasound-guided oocyte retrieval is the most commonly used anesthetic type.[8] This is usually accomplished by the IVF center's dedicated anesthesia group or its own personnel who are specially trained in administering moderate sedation. The personnel may include nursing staff or medical doctors who are trained and experienced in IVF procedures.

According to the American Society of Anesthesiologists (ASA), moderate ("conscious") sedation is defined as follows:

> *A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.*[11]

Keeping in mind the goals of moderate sedation, oocyte retrieval can be safely accomplished. The patient's chart is reviewed, including the nursing staff's preoperative assessment. This includes the medical and surgical history and the patient's medications and allergies. The height, weight, and baseline vital signs are noted.

The patient interview includes the status of nothing taken by mouth, medical and anesthesia history, as well history of PONV or motion sickness. After the physical examination, the sedation plan and the expectations are explained to the patient. This explanation helps alleviate some of the anxiety associated with the procedure.

The discussion should include the information that the patient will be sedated yet responsive to tactile touch or voice commands for the evaluation of pain or discomfort. The patient should be reassured that comfort and pain control are the goals of moderate sedation. The anesthesia consent is obtained. The IVF procedure team readiness is checked so that the patient can be brought into the procedure room. This is necessary because the embryology laboratory also participates in this procedure by accepting the collected oocytes and reports the oocyte count intraprocedurally. Once in the procedure room, the nursing staff, surgeon, embryologist, and anesthesiologist will identify the patient and perform a safety checklist.

The patient is positioned supine on the operating room table. The routine monitors and an intravenous catheter are placed. Oxygen is usually provided via a nasal cannula. As soon as the intravenous line is in place, the patient is repositioned to the dorsal lithotomy position with perineum positioned at the edge of the operating room table.

Once the patient reports no discomfort in this position, the sedation is started. The opioid is usually the first agent given because the goal of sedation is pain management during oocyte retrieval. The opioid most frequently used is fentanyl. The usual dose of fentanyl is in the range of 50 to 100 µg IV.[7] Once fentanyl titration is begun, then the anxiolytic is administered. The most common agent is a benzodiazepine, such as midazolam or diazepam. This agent is also titrated to the desired effect: The patient is relaxed and sedated yet responsive to light tactile touch and voice.

When the desired sedation level is achieved, the surgeon places the ultrasound probe into the vagina. Both ovaries are examined, and the physician reports a gross estimate of the oocytes to be retrieved. This report helps gauge the length of time expected for the procedure. The

placement of the probe can be very stimulating when the ovaries are difficult to visualize and maximal pressure is applied into the posterior vaginal wall. The next stimulus is the puncture through the vaginal wall into the ovary and follicles. A 16- or 17-gauge needle is used alongside the vaginal probe. Each follicle that is visualized is aspirated until there are no follicles left in the ovary. This procedure is then repeated on the contralateral ovary. Once the retrieval is complete, the probe is used to evaluate the ovaries for possible bleeding or surrounding vessel and tissue injury. Finally, the probe is withdrawn. A vaginal speculum is then placed to evaluate for bleeding or vaginal wall injury. Pressure is typically held at the vaginal wall puncture sites for a short time. Usually, no additional medication is needed at this point because the inspection of the vagina may not be uncomfortable or painful. If the surgeon needs to place a suture or hold extensive vaginal pressure, additional opioids may be needed as well as further verbal reassurance. Once there is no bleeding, the patient is brought to a more awake state. The patient is then transferred to a gurney and transported to the adjacent postprocedure room.

General Anesthesia

Anesthesiologists use general anesthesia (most commonly total intravenous anesthesia) extensively during IVF procedures. The most commonly used drug for general anesthesia is propofol, as reported by Ditkoff and coworkers.[8] This type of anesthesia may need airway support, but it rarely requires endotracheal intubation. The support of the airway is generally assisted with minimally invasive maneuvers, such as a chin lift or jaw thrust. On occasion, a nasopharyngeal airway may be needed in the patient who is obstructing his or her airway, has a small chin, or is obese. The goals of this type of anesthetic are an immobile, or nearly immobile, patient who is unconscious. Associated risks such as apnea, aspiration, laryngospasm, or hypotension need to be considered. Therefore, the specially trained anesthesiologist is required, and expert airway management is essential. In this anesthetic, plans for emergency management of the airway include having equipment available in the procedure room. A laryngoscope, various sizes of blades and endotracheal tubes, and a self-inflating type of bag-mask should be present.

After careful review of the IVF patient chart and checking status of having nothing by mouth, the interview focuses on medical and anesthesia issues, and a focused airway examination is performed. A past history of PONV, pain management, and any vasovagal events are noted.

The goals of the anesthetic are discussed, and a brief description of the procedure and postprocedure anesthesia plan are outlined. This overview is very much appreciated by the patient receiving IVF and may alleviate some of the preprocedural anxiety. The oocyte retrieval anesthesia consent is obtained. Once the procedure team, which includes the embryologist, is ready to proceed, the patient is brought into the

procedure room. The patient identifications are obtained by the IVF nursing staff and the embryologist, and a safety pause is performed. The patient is placed supine on the operating room table. The routine monitors that are placed include a continuous electrocardiogram, pulse oximetry, noninvasive blood pressure, and CO_2 analysis. An intravenous catheter is placed. The patient is repositioned into the dorsal lithotomy with the perineum at the edge of the table. Pressure points and any discomfort are checked and relieved. Oxygen is administered by a nasal cannula or face mask.

Once the patient positioning is complete, the anesthetic is begun with the opioid. Fentanyl is titrated along with the hypnotic agent propofol by boluses or continuous infusion. The usual required doses of fentanyl range from 75 to 150 µg, with the most common total being 100 µg. A small dose of lidocaine is usually administered along with the start of the propofol when the intravenous catheter is in place. Lidocaine is usually not needed when the intravenous catheter is located at the antecubital area in a large vein.

The surgeon is allowed to start once the patient has been rendered unconscious and immobile. There are two potentially stimulating portions of the IVF-oocyte retrieval. The first stimulus is the placement of the vaginal probe deep into the vagina to examine the ovaries. The second stimulus is the puncture of the vaginal wall and ovarian follicle with the 16- or 17-gauge aspirating needle. This procedure is repeated until all the follicles have been aspirated, and then it is continued on the contralateral ovary. Once the aspiration is completed, the ovaries and surrounding tissue and vessels are examined by ultrasound for bleeding or injury. The probe is removed and replaced with a vaginal speculum for inspection of the posterior vaginal wall for bleeding or injury. On occasion, a bleeding puncture site may need a suture or maximal tamponade with pressure. If this is the case, the patient is kept sedated until the vaginal wall examination is completed.

The patient is awakened at the end of the procedure and asked to move to the awaiting gurney. The patient is transported to the adjacent recovery room. The dedicated recovery room nursing staff is given a report and monitors the patient until discharge.

Intravenous General Anesthesia for Embryo Transfer

Occasionally, the patient receiving IVF will request anesthesia for the transcervical embryo transfer. The main reason is to alleviate the procedural anxiety and discomfort of the vaginal speculum and cervical stimulation. Usually, the IVF center will administer an oral benzodiazepine for those with mild-to-moderate anxiety because the patient is kept “awake” for this very short, yet anxiety-provoking, event. The reproductive medicine physician may request anesthesia for the patient with a difficult cervical or uterine anatomy. Having the patient under a brief period of deep anesthesia will facilitate the maneuvering of

the small plastic catheter containing the embryos into the uterus. The embryo transfer is facilitated by the simultaneous use of the abdominal ultrasound by an assistant to visualize the uterine cavity. This ultrashort procedure is not very stimulating or painful; therefore, the use of short-acting agents is encouraged.

The patient chart is reviewed, and the history and physical exam are obtained. The goal of the anesthetic is discussed with the patient. Patient safety, comfort, and anxiolysis are emphasized. Describing the anesthetic/IVF procedure helps ease some of the preprocedure anxiety.

In the procedure room, the patient's identification is verified by the nurse and again by the embryologist. The patient is positioned supine on the operating table. The routine monitors and an intravenous catheter are placed. Then, the patient is repositioned into the dorsal lithotomy position. Pressure points are padded and checked. The anesthesia is started during the vaginal preparation, which also includes the placement of a vaginal speculum by the proceduralist. Deep sedation/general anesthesia can be accomplished with a combination of fentanyl and propofol. Approximately 50 µg of fentanyl are titrated along with 75 to 150 mg of propofol. Care is taken to keep the patient breathing spontaneously and deeply and in an immobile state for the embryo transfer.

Anesthesia for Dilation and Curettage

From time to time, the IVF anesthesiologist will be scheduled to administer an intravenous deep sedation or general anesthesia for a missed abortion. This is not unusual because the IVF patient has a higher risk for a missed abortion. The ideal patient for a D&C in the OOOR environment is a healthy patient of normal weight. This should not include the morbidly obese individual or a patient with a coagulation abnormality or difficult airway. Additionally, the patients should not be past 12 weeks' gestational age and should adhere to the guidelines for nothing by mouth. The more challenging patients, the morbidly obese, or those with a difficult airway or coagulation abnormalities should be scheduled in an operating room facility equipped to handle these situations. They may need general anesthesia with an endotracheal tube, a regional anesthetic, or blood products available. Few reproductive medicine surgeons may elect to do the D&C without the anesthesiologist's presence. In these instances, the surgeon may provide moderate intravenous sedation together with a paracervical block.

The patient's chart is reviewed with emphasis on the reason for the D&C and the approximate gestational age. The laboratory work is reviewed for the hematocrit, platelet count, and blood type. When an Rh-negative woman carries an Rh-positive pregnancy, RhoGAM® is given to prevent the woman's immune system from reacting to Rh-positive blood of any subsequent pregnancy.

The goals of the anesthetic are reviewed with the patient. Safety and comfort are emphasized. Empathy and reassurance help with the preprocedural anxiety.

The anesthesia setup should include an emergency intubation kit and vasoactive drugs. Major surgical risks include uterine bleeding and perforation. A dose of antibiotic will likely be requested by the reproductive medicine surgeon. The most stimulating part of the D&C is the serial dilation of the cervical os and canal.

In the procedure room, the nursing staff, surgeon, and anesthesiologist should perform a safety pause. The patient is positioned supine onto the operating room table. The routine monitors are placed. A minimum of a 20-gauge intravenous catheter is placed. The patient is then repositioned in the dorsal lithotomy position with the perineum at the lateral edge of the table. Pressure points are checked for any discomfort. Oxygen is administered via a nasal cannula or face mask. A small dose of midazolam is given for anxiolysis and amnesia. A few minutes later, fentanyl is titrated in doses of 25 µg. The usual required doses of fentanyl range from 50 to 100 µg, with the most common total a 100-µg dose. Propofol is usually administered in a bolus (250–500 µg/kg) followed by an infusion (25–75 µg/kg/min) to induce hypnosis yet keep the patient spontaneously breathing with minimal airway assistance. The duration of the D&C procedure is usually short, lasting from 10 to 20 minutes.

IVF Postanesthesia Care Unit Considerations

After IVF, the care of the patient in the postanesthesia care unit (PACU) or recovery room has a few, yet very important, considerations. In the designated recovery area, patient care is transferred to the assigned recovery room nurse. The patient care transfer begins with proper patient identification, followed by a description of the procedure, the anesthetics used, drug allergies, antiemetics, antibiotics, and fluids administered. Anesthesia or surgery-related complications encountered are communicated. Pertinent patient details for the patient receiving IVF, such as history of PONV, extreme preprocedural anxiety, large amounts of anesthetics required intraprocedurally, and approximate oocyte count, should be communicated. This information will help patient management. A young patient or egg donor with many oocytes retrieved will most probably require additional analgesic care in the PACU.

On arrival in the PACU, attention is focused on the oxygenation, ventilation, and circulation by monitoring the pulse oximetry, respiratory frequency, airway patency, systemic blood pressure, and heart rate. Supplemental oxygen and suction should be readily available. The vital signs are recorded at the very least every 15 minutes while in the recovery room. Initially in the PACU, care may be directed toward the need for airway support for a sedated patient. This is treated by patient stimulation and a chin lift. Initial hypotension is usually secondary to the

propofol anesthesia and is self-limiting. Continuing the intravenous fluids and awakening the patient usually will resolve the hypotension. Moderate-to-severe pain on admission should be immediately treated with intravenous fentanyl; discharge may be otherwise delayed secondary to increasing pain or PONV.

Patients who have received IVF usually stay in the PACU from 90 to 120 minutes.[8] Typical causes for a delay in the discharge from the recovery room are abdominal cramping or pain, PONV, a vasovagal event, or delay in urination.

The approach to the treatment and relief of abdominal or pelvic pain in the IVF patient is to first identify what type of pain the patient is experiencing and where it is located. It is also important for the anesthesiologist to quantify the amount of pain experienced in order to achieve treatment success. Moderate-to-severe pain is treated with opioids, while mild pain is treated with nonopioids such as acetaminophen. Any unrelenting pain should be evaluated by the reproductive medicine surgeon. The evaluation involves talking to the patient, a physical examination, and possibly a pelvic ultrasound. A full bladder also may be responsible for ongoing abdominal pain. If this is the case, the patient is encouraged to urinate; otherwise, the patient may undergo straight catheterization of the bladder.

Considerations for PONV actually start during the preprocedure period. The recognition that the IVF population is at risk is the first step.[12] Furthermore, the identification of the individual at high risk for PONV is extremely important for patient safety, satisfaction, and efficiency. By identifying the individual in need of prophylactic antiemetic therapy, patient care and satisfaction can significantly improve. According to Apfel and colleagues,[13] the four primary risk factors for PONV are female gender, nonsmoking status, a history of PONV, and opioid use. The typical patient receiving IVF has at least three of the four risk factors. A history of PONV and motion sickness can be specifically determined during the patient interview. The PONV risk reduction strategies include preprocedural anxiolysis, aggressive intravenous hydration, supplemental oxygen, and total intravenous anesthesia with propofol. PONV antiemetic prophylaxis coupled with these strategies is known as a multimodal approach.[12]

The PONV risk reduction begins with a calming and reassuring interview and plan. Intravenous hydration is started intraprocedurally and continued in the PACU. Oxygen is administered during the procedure, and prophylactic antiemetics are given to select patients, such as those with a history of PONV and motion sickness. Additionally, a patient with many aspirated follicles and an increased opioid requirement will benefit from prophylactic antiemetics.

When PONV occurs in the PACU and the patient has not received prophylaxis, a 5-hydroxytryptamine (serotonin) receptor 3 (5-HT_3) antagonist such as ondansetron should be administered. Aggressive intravenous fluid administration should be verified as ongoing, and a vasovagal event eliminated. In the event that PONV prophylaxis with a 5-HT_3 antagonist is found to be inadequate, an additional dose of a 5-HT_3 antagonist should not be used as a rescue agent because it does not give additional benefit when used within the first 6 hours after surgery.[14] Prochlorperazine, droperidol, dexamethasone, or metoclopramide have been used for PONV rescue.

On occasion, a patient may experience lightheadedness and nausea as a result of becoming bradycardic and hypotensive. This vasovagal event should be immediately identified and treated. Placing the patient in the supine position and administering a bolus of crystalloid fluid should suffice. Symptoms usually resolve quickly. If bradycardia accompanied by hypotension persists, a dose of atropine should be administered. Cramping pain may be responsible for the vasovagal event and should be treated.

Rarely, brisk vaginal bleeding is observed in the PACU. If this is the case, the reproductive medicine surgeon should evaluate the patient. This may involve a trip back to the procedure room for a thorough vaginal examination. Persistent hypotension is rarely seen but should be evaluated as well by the reproductive medicine surgeon.

The IVF nursing staff documents the patient’s PACU course. Once the PACU criteria for discharge are met, the patient and the adult escort are given written discharge instructions. A postprocedure follow-up call is made the following morning by the nursing staff.

Conclusion

Oocyte retrieval is a very important part of the IVF cycle. Transvaginal oocyte retrieval is increasingly being performed OOOR. Moderate sedation is most commonly used for oocyte retrieval in the United States and the United Kingdom, although the trend is toward greater involvement of anesthesia professionals and more cases performed under deep sedation and general anesthesia. There is variability in personnel and medications used. A significant number of IVF centers are providing their own sedation team. The best sedation and anesthetic practices have yet to be proven.

References

1. US Department of Health and Human Services Centers for Disease Control and Prevention. Assisted Reproductive Technology Success Rates. Available at: https://www.cdc.gov/art/Archived-PDF-Reports/2006ART.pdf. Accessed on January 15, 2018.

2. Bokhari A, Pollard BJ. Anaesthesia for assisted conception. *Eur J Anaesth*. 1998;15:391–396.

3. Wallach EE, Zacur HA. *Reproductive medicine and surgery*. Saint Louis, MO: Mosby; 1995.

4. Schenker JG, Ezra Y. Complications of assisted reproductive techniques. *Fertil Steril*. 1994;61:411–422.

5. Oskowitz SP, Berger MJ, Mullen L, et al. Safety of a freestanding surgical unit for the assisted reproductive technologies. *Fertil Steril*. 1995;63:874–879.

6. Tsen LC. From Darwin to Desflurane? Anesthesia for assisted reproductive technologies. *Anesth Analg*. 2002;94(suppl):109–114.

7. Elkington N, Kehoe J, Acharya U. Intravenous sedation in assisted conception units: a UK Survey. *Hum Fertil*. 2003;6:74–76.

8. Ditkoff EC, Plumb J, Selick A, et al. Anesthesia practices in the United States common to in vitro fertilization (IVF) centers. *J Assist Reprod Genet*. 1997;14:145–147.

9. Yasmin E, Dresner M, Balen A. Sedation and anaesthesia for transvaginal oocyte collection: an evaluation of practices in the UK. *Hum Reprod*. 2004;19(12):2942–2945.

10. Trout SW, Vallerand AH, Kemmann E. Conscious sedation for in vitro fertilization. *Fertil Steril*. 1998;69:799–808.

11. American Society of Anesthesiologists. Continuum of depth of sedation: definition of general anesthesia and levels of sedation/analgesia, last amended October 2014. http://www.asahq.org/quality-and-practice-management/standards-guidelines-and-related-resources/continuum-of-depth-of-sedation-definition-of-general-anesthesia-and-levels-of-sedation-analgesia. Last amended: October 2014. Accessed on January 15, 2018.

12. Gan TJ, Meyer T, Apfel CC, et al. Consensus guidelines for managing postoperative nausea and vomiting. *Anesth Analg*. 2003;97:62–71.

13. Apfel CC, Laara E, Koivuranta M, et al. A simplified risk score for predicting postoperative nausea and vomiting. *Anesthesiology*. 1999;91:693–700.

14. Kovac AL, O'Connor TA, Pearman MH, et al. Efficacy of repeat intravenous dosing of ondansetron in controlling postoperative nausea and vomiting: a randomized, double-blind, placebo-controlled multicenter trial. *J Clin Anesth*. 1999;11:453–459.