Perspectives
Recovery Strategies from the OR to Home

Anesthetic Management: Hysterectomy

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Demographics

According to Stovall[1] removal of the uterus is the second most commonly performed surgical procedure in the United States after cesarean delivery. The following demographic characteristics are summarized to reveal that:[1,2]

- 650,000 hysterectomies are performed annually. By 2005, the number will increase to ~834,000.
- The rate of hysterectomy is 6.1 to 8.6 per 1,000 women.
- The Northeastern United States have the lowest hysterectomy rate, while the southern United States have the highest rates.
- The mean and median ages of women undergoing hysterectomy are 42.7 and 40.9 years with a range of 15 to 80 years.
- The ratio of abdominal to vaginally performed hysterectomies is 3:1.
- African-American women experience hysterectomy more frequently than European-American women.
- Male gynecologists perform hysterectomies more frequently than female gynecologists.

Indications

The indications for hysterectomy are varied and greatly influenced by the patient's age, pathology, diagnosis, and reproductive status. Table I succinctly lists Gambone and Reiters'[3] adaptation of "Hysterectomy Indication Profile" cited in Stovall.[1] Because of the diversity among indications, anesthetic management must be congruent with both the gynecological diagnosis and co- morbidities such as chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), coronary artery disease (CAD), hypertension (HTN), cancer and obesity.

Table 1: Hysterectomy Indication Profile

Indication			Number of Patients	Percentage	Percentage Confirmed*
Acute condition (emergencies)					
	A-1	Pregnancy catastrophe[1]	27	1.5	93
	A-2	Severe infection[2]	2	<1	100
	A-3	Operative complication[1]	1	<1	100
Benign Diseases					
	B-1	Leimoyomas[2]	522	29	86
	B-2	Endometriosis[2]	95	5.3	92
	B-3	Adenomyosis[2]	27	1.5	44
	B-4	Chronic infection[2]	29	1.6	100
	B-5	Adnexal mass[2]	146	8.1	100
	B-6	Other[2]	1	<1	100
Cancer or prealignment disease (known)					
	C-1	Invasive cancer[2]	164	9.1	100
	C-2	Preinvasive disease[2]	137	7.6	100
	C-3	Adjacent or distant cancer[2]	6	<1	100
Discomfort (chronic or recurrent)					
	D-1	Chronic pelvic pain[1]	144	8	80
	D-2	Pelvic relaxation[1]	189	10.5	100
	D-3	Stress urinary incontinence[1]	86	4.8	100
	D-4	Abnormal uterine bleeding[1]	225	12.5	94
Extenuating circumstances (peer-reviewed)					
	E-1	Sterilization[3]	3	<1	100
	E-2	Cancer prophylaxis[3]	5	<1	100

	E-3	Other[3]	2	<1	100	
Total			1011	100	92	

*Validated by the American College of Obstetricians and Gynecologists criteria set1 or verified by tissue pathology2 or perioperative review3
Information based on single designated (first listed) preoperative diagnosis for 1011 operations performed at Naval Hospitals in San Diego and Camp Pendleton, CA and UCLA Medical Center.
Adapted from Gambone JC Relter RC. Nonsurgical management of chronic pelvic pain; a multidsciplinary approach.
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Preoperative considerations

Psychosocial influences

Patients express many apprehensions about anesthesia, including the fear of dying, being probed with needles, smothered with the anesthesia mask, awakening during the procedure, and vomiting postoperatively.[4] Some believe that regional anesthetics (spinals, epidurals) frequently result in paralysis. These apprehensions, often magnified by public misinformation, are heightened during the preoperative period.

Regarding surgery, the anesthetist must also acknowledge psychosocial beliefs that can exacerbate the expected preoperative anxiety. In earlier decades, removal of the uterus was thought be curative for women's "hysteria" or emotional lability associated with menopausal symptoms (hence the name hysterectomy). It was commonly believed that the procedure "castrated" women both physically and psychologically.

Greater understanding of gynecological function and hormone replacement therapy (HRT) have largely eliminated hysterectomy as the primary treatment for distressing menopausal symptoms.[1] Public education has also helped to reduce the degree of misinformation related to this surgical procedure. Yet, unresolved conflicts about issues such as loss of femininity, post operative sexual dysfunction, depression, and bereavement over termination of reproductive capability, [5-15] can compound preoperative anxiety. Likewise, fear of mutilation or eventual death following a diagnosis of endometrial carcinoma may contribute considerably to anxiety.

In contrast, many women gladly anticipate the cessation of gynecological dysfunction and welcome the freedom from undesired conception. Others report heightened sexual responsiveness, relief from pain, and alleviation of suboptimal hygiene caused by uterine or rectal prolapse, urinary incontinence, and menorrhagia.

By recognizing these issues, the nurse can care for the patient more holistically. Development of a trusting rapport during the preanesthetic assessment, truthful

discussion of anesthetic risks, and administration of anxiolytics will diminish fear and reduce anesthetic morbidity.

History and physical

Within this framework, a systematic review of the patient's medical health is elicited. If available, old charts are also perused for data pertinent to the impending anesthetic.

The neurological system is investigated for the presence or absence of seizure disorders, depression, cerebrovascular disease (TIAs, CVAs, AVMs), or fainting episodes. Cognitive function and hearing disabilities are also evaluated.

Any history of hypertension, coronary artery disease, congestive heart failure, or myocardial infarction is obtained. Evidence of valvular prolapse, dysrhythmias, angina, deep vein thrombosis (DVT), or pacemaker insertion is sought. Anesthesia can exacerbate morbidity if measures to optimize myocardial function in cardiac patients are neglected.

Questions about the respiratory tract involve the patient's history of smoking, chronic obstructive pulmonary disease (COPD), asthma, seasonal allergies, shortness of breath (SOB), and activity tolerance. Presence or absence of orthopnea, coughing or wheezing is also determined. Knowledge of respiratory abnormalities guides interventions that will support intraoperative oxygenation.

Of interest regarding endocrine function is the presence of diabetes (insulin dependent and non-insulin dependent) and thyroid, adrenal or pituitary dysfunction. It is also important to note whether or not the diabetic, NPO patient injected insulin prior to arrival for surgery. If the answer is affirmative, administration of dextrose containing intravenous solutions may be necessary to prevent intraoperative hypoglycemia. Blood glucose levels will be monitored throughout the surgery as well.

Musculoskeletel concerns include the presence of muscle cramps, osteoporosis, contractures, arthritis, metallic hardware (screws, plates, pins), and problems with lower back pain or movement of extremities. Inability to abduct or externally rotate the hips can cause injury during lithotomy positioning in stirrups. Limited arm mobility may require inventive positioning strategies to avoid nerve or orthopedic trauma. Electrolyte abnormalities may also be present with muscle or bone density disorders.

A gastrointestinal history of hiatal hernia, peptic ulcers, gastroesophageal reflux disease [GERD], or heartburn predisposes the patient to intraoperative aspiration of gastric contents. Problems with post operative nausea and vomiting (PONV) can cause unplanned overnight admission for same-day surgery patients. Because these problems occur commonly in gynecologic surgery patients, prophylactic measures can be taken to reduce the incidence and severity.

Anesthetic agents can affect liver function, particularly if the patient has been (or currently is) infected with hepatitis. Recollections of being jaundiced or "yellow" may indicate bile outlet obstruction or previous infection with variant forms of hepatitis. Accordingly, universal precautions should be practiced with any body fluids.

A history of chemotherapy and/or radiation for previous carcinoma must be determined, whether recent or remote. Sequelae to treatments, such as pulmonary fibrosis, hematologic dysfunction, and cardiomyopathy can affect anesthetic management.

Laboratory tests are necessary to screen for hematocrit, electrolyte, or coagulation abnormalities. Women with chronic menorrhagia or acute hemorrhage may be anemic and require preoperative blood typing and cross- matching for transfusion. ECGs, urinalysis, pregnancy, and pulmonary function tests (PFTs) must be acquired when indicated. Chest xrays (CXR) and pelvic/abdominal scans may be necessary to diagnose and optimize the patient's physical status prior to surgery.

Any previous surgeries, anesthetics, blood transfusions, or problems with airway management are investigated. Patients are also asked about any family history of anesthetic-related morbidity or mortality such as malignant hyperthermia, death under anesthesia, or postoperative MI. Identification of familial or prior perianesthetic problems enhances planning and reduces the likelihood of reoccurrence.

Because the efficacy of anesthetic medications can be altered by certain chemicals, the patient's social history is important. Current or previous use of tobacco (inhaled or chewed), illicit or "recreational" drugs, alcohol, and caffeine is determined. For example, chronic ingestion of alcohol and analgesics can greatly increase anesthetic requirements. Acute ingestion of sedatives or intoxicants reduces it.

Consumption of prescription medications, health food supplements such as St. John's Wort or Ma Huang, and over -the- counter (OTC) drugs must be quantified. Use of diet pills requires a two week abstinence prior to general anesthesia. Cardiac medications are usually taken up to the morning of surgery, as are immunosuppressant medications in transplant patients.

Allergies to drugs, food (shellfish, eggs), skin cleansers, adhesive tapes, and latex must be recorded. Height, weight, vital signs, and general appearance are documented. These data are used to determine appropriate drug dosing by body weight and to establish intraoperative hemodynamic norms. Findings from auscultation of the heart and breath sounds are noted. Examination of the airway for ease of intubation during the induction of general anesthesia is performed and described.

Lastly, the patient will be assigned an American Society of Anesthesiologists (ASA) I - VI preoperative health status classification. Thus labeled, each patient is stratified according to her preoperative hardiness to undergo an anesthetic. ASA I patients are the healthiest; ASA V patients are the least healthy. The ASA VI category is reserved specifically for brain-dead organ donors. If emergency surgery is required, the letter "E"

is affixed to the classification (e.g., IE, IIE, etc.) to indicate emergency status. The ASA designation, though not predictive of anesthetic risk, indicates the prospect of increased perioperative morbidity and mortality. It also influences decisions about the anesthetic technique and necessity for invasive hemodynamic monitoring.

Anesthetic options

Two categories of anesthesia techniques are utilized for hysterectomy. These are general and regional (spinal or epidural). With general anesthesia, the patient is rendered completely unconscious. With spinal or epidural anesthesia, the patient is temporarily paralyzed, "numbed from the waist down" (T6-T8 level), and moderately sedated.

The risks associated with general anesthesia are death, dental/soft tissue injury, aspiration of gastric contents, awareness under anesthesia, sore throat, postoperative nausea and vomiting, and the possibility of postoperative mechanical ventilation. The benefits are that the patient will sleep through the hysterectomy and awaken in the recovery room.

The risks accompanying regional anesthesia are post lumbar puncture headache (PLPH), low blood pressure, allergic reaction to the local anesthetic, rare neurological injury, hematoma, spotty block, and infection. The benefits are that the patient is not rendered unconscious, thus she retains spontaneous reflexes and cognitive responsiveness.

Anesthetic options are also governed by surgical intention, the patient's condition, calculated length of the procedure, and urgency of the surgery. The types of surgical approaches used are radical, subtotal, vaginal, laparoscopic-assisted vaginal hysterectomy (LAVH) , or total abdominal hysterectomy (TAH). Bilateral salpingo-oophorectomy (BSO) or lymph node dissections may be done concomitantly.

With healthy patients undergoing elective hysterectomy, either the regional or general anesthetic technique may be selected. Epidural anesthesia has the added benefit of permitting continuous analgesic dosing through the catheter for postoperative pain management. Spinal anesthesia provides excellent muscle relaxation and anesthesia suitable for surgeries lasting between one and three hours. In contrast, coagulopathic, traumatized, or hemorrhagic patients needing emergency hysterectomy are generally excluded from regional anesthesia. The need to obtain rapid surgical hemostasis and psychosomatic cooperation of the patient obviates the use of regional techniques.

Consent for anesthesia

Analysis of the data obtained from the history, physical examination and chart review culminates in the anesthetic plan. The anesthetist will present the options, benefits and risks of the anesthetic plan to the unsedated patient. Regardless of the diagnosis, the goal is to inform the patient satisfactorily when possible, of the anesthetic choices and possible negative sequelae. After all the patient's questions are answered, verbal consent is obtained and documented on the preanesthesia note. At this point, anxiolytics, analgesics, antibiotics, and antiemetics may be administered.

Preparing for the operating room

Patients can be hypovolemic from bowel cathartics, vaginal bleeding, vomiting, and NPO status when they present for surgery. Before arrival in the operating room, a 16- or 18-gauge intravenous catheter will be inserted and infused with normal saline or lactated Ringers solution. The large bore catheter permits intravenous injection of drugs and rapid infusion of crystalloids, volume expanders, or blood products for rehydration and maintenance of hemodynamic stability. If the patient has labile blood pressure or requires frequent lab tests such as hematocrits, arterial blood gases, or serum glucose levels, a radial arterial line may be inserted. Because the arterial line must be sutured into an immobile wrist, the Dale Bendable Armboard ¨ or other devices may used to splint and securely stabilize the wrist in a flexed position for continuous monitoring.

In the OR

Upon arrival to the O.R., the sedated patient is transferred to the operating table. Oxygen mask, electrocardiographic electrodes, a pulse oximeter (to assess oxygen saturation), and blood pressure cuff are applied. Vital signs, including internal or external temperature monitoring, will be recorded every 5 minutes and as needed (p.r.n.). Any pre-existing or subsequently inserted devices, such as Swan -Ganz, CVP, or arterial catheters are monitored after placement and calibration is confirmed. The patient's privacy and dignity is protected by preventing needless bodily exposure during positioning. Warming devices (fluid warmers, blanket warmers, airway humidifiers) will be applied, when indicated, to prevent hypothermia from prolonged evaporative, conductive, convective, and radiating heat loss in the cool operating room. A Foley catheter will be inserted after the induction of anesthesia to decompress the bladder, reduce accidental surgical trespass, and enhance access to the uterus. Catheterization is required to monitor urine output (which should be 0.5 to 1 ml/kg/hr) and detect hematuria. To reduce undesired traction and irritation to the urethral meatus, a Dale Foley Catheter HolderR can be applied to the thigh and retained as long as the Foley is in place.

Induction of anesthesia: regional

While initiating either the spinal or epidural anesthetic, an IV fluid bolus (about 500 cc) will be briskly infused. This intervention offsets moderate hypotension produced by injection of the local anesthetic into the epidural or subarachnoid spaces. The patient then sits upright or lies in the lateral decubitus position. Choice of positioning is dictated by the patient's condition, anatomy, and ability to cooperate. Aseptic cleansing and sterile draping of the patient's back ensues.

If spinal anesthesia (subarachnoid block/SAB) is intended, the anesthetist will select a 22-, 25-, or 26 -gauge spinal needle to access the subarachnoid space. Use of smaller spinal needles, whenever possible, is associated with reduced incidence of spinal headache.18 Successful puncture is apparent when clear cerebral spinal fluid (CSF) is returned. Anesthetic solution is then injected into the subarachnoid space and the patient is positioned supine until the spinal "sets" at the appropriate dermatomal level.

The patient's level of anesthesia is determined by her ability to discern pinpricking or coolness when an alcohol pledget is swiped over the skin toward the chest. A T6 to T8 dermatomal level, once achieved, provides excellent anesthesia for uterine surgery. Lithotomy or supine positioning may then proceed. Spinal anesthesia, depending upon the local anesthetic solution selected (lidocaine, tetracaine, marcaine), can last from one to three hours.

With epidural anesthesia, a 17-gauge Tuohy introducer is directed into the epidural space. An epidural catheter is then threaded though the Tuohy into the epidural space to a depth of about 3 cm. After removal of the introducer, a small "test" dose of lidocaine with epinephrine is injected into the catheter. This maneuver helps to detect an undesired intravascular cannulation with the epidural catheter. If the catheter lies in an epidural vein, tachycardia (about 20 beats per minute above the baseline heart rate) is apparent due to intravenous injection of epinephrine.

Once proper placement is confirmed, the catheter is secured to the patient's back. Doses of anesthetic solution are then given continuously or by bolus to attain appropriate dermatomal levels of anesthesia. As mentioned earlier, the epidural catheter may be used postoperatively for pain management with local anesthetics or narcotics.

General anesthesia

General anesthesia commences after intravenous boluses of hypnotic, paralytic, analgesic and amnestic drugs produce unconsciousness and loss of reflexes. During this period of profound, drug-induced obtundation, endotracheal intubation with a cuffed endotracheal tube or less frequently, a laryngeal mask airway (LMA) is performed. When proper airway placement is insured by bilateral equal breath sounds, presence of end tidal carbon dioxide (ETCO2) and an equally rising thorax, the tube is secured. The patient's eyes are lubricated with water-soluble ointment and covered with tape to protect them from corneal injury. Manual "bagging" or mechanical ventilation via a gas machine suffuses mixtures of oxygen, nitrous oxide, and inhalational anesthetic agents, such as Forane, Sevoflurane, or Desflurane into the patient's lungs. Alternatively, total intravenous anesthesia (TIVA) can be induced without the use of inhalational anesthetic gases. Intravenous injection of large doses of narcotics, benzodiazepines, and hypnotic agents cause unconsciousness, amnesia , and analgesia. Muscle relaxing drugs, which produce temporary paralysis of abdominal , thoracic, and pelvic musculature, further enhance surgical access for both inhalational and intravenous techniques.

Surgical Positioning and Approach

Positioning

If abdominal hysterectomy is planned, the patient will be positioned supine. Arms may be either tucked at the sides or abducted (less than 90 degrees) on armboards. If vaginal or laparoscopic assisted vaginal hysterectomy (LAVH) is planned, the patient will be positioned in lithotomy with arms tucked or slightly abducted on armboards.

The patient must be protected from injuries that may occur due to malposition- ing of the extremities. Peroneal and ulnar nerve compression can cause foot drop and a limp arm. Lumbosacral strain and femoral nerve damage can arise from excessive abduction and suspension of the hips and legs in the stirrups. These injuries can occur in cachectic, healthy, or very obese patients. Padding of bony prominences (heels, elbows, scapulae) and areas compressed against stirrups or the OR table (elbows, lateral knees) reduces the incidence of nerve injury and skin breakdown. All personnel - anesthetists, surgeons, and OR nurses- must collaborate to insure that the patient is not harmed by lackadaisical positioning.

Surgical approach

Surgical approach is determined by urgency, uterine pathology, patient mobility and uterine size compared with gestational age. Other considerations are the morbidity and mortality of the approach and patient recovery time. Vaginal hysterectomy when possible, is the preferred and safest approach.[1,16,17]

Abdominal hysterectomy is accomplished by either midline (umbilicus to pubis) or Pfannenstiel (bikini) incision. Generally, an exploratory laparotomy combined with hysterectomy and lymph node dissection for suspected carcinoma uses the midline approach. Grossly enlarged uteri and numerous adhesions are more easily excised with a midline incision. The Pfannenstiel incision, which aesthetically is more popular, is used for uncomplicated uterine extraction and/or bilateral salpingo-oophorectomy (BSO) when midline approach is unnecessary. Abdominal hysterectomy with either incision and standard vaginal removal are manageable under general or regional anesthesia.

LAVH, which is used for direct intra-abdominal visualization (adhesions, uterine size, pathology) and technical enhancement during vaginal hysterectomy, always requires general anesthesia. To visualize the uterus laparoscopically, large volumes of high pressure carbon dioxide (CO_2) gas must be insufflated through trocars to distend the abdominal wall away from adjacent organs. The pneumoperitoneum caused by CO_2 insufflation impedes lung expansion and increases arterial carbon dioxide ($PaCO_2$). Additionally the gas produces significant subcostal and abdominal discomfort. Satisfactory levels of regional anesthesia cannot be achieved due to disruption of spontaneous respiration. For these reasons, general anesthesia for LAVH is compulsory to support adequate ventilation, relaxation, and analgesia.

Intraoperative events

Occasionally, the transfusion of blood, electrolytes, and large volumes of crystalloid solutions is required. Transfusion may be preceded by hemorrhage (friable, hypervascular tumor resections), surgical misadventure (vessel perforation, laceration of tissue with laparoscopic trocar, bladder injury) or other events (cardiac, allergic reaction).

The patient's hemodynamic status and projected surgical course directly influence the decision to transfuse. Healthy patients can be expected to withstand hematocrits as low as

25% without hemodynamic compromise. Conversely, patients who are hemorrhagic or hemodynamically unstable require fluid volume and component specific transfusion.

Prior to waking ("emerging") the patient, the anesthetist may empty the patient's stomach by gavage of gastric contents. Stomach evacuation reduces the volume of vomitus that can be aspirated if regurgitation occurs. It likewise ameliorates the severity or incidence of postoperative nausea and vomiting (PONV). Aliquots of antiemetic medications (droperidol, 5HT3 antagonists) are often given prophylactically to prevent it.

When surgery is completed, the anesthetic agent is stopped and the muscle relaxant is reversed. Shortly thereafter, the patient will resume spontaneous breathing and become conscious enough to follow simple commands, such as "lift your head" . If satisfactory respirations, oxygen saturation and muscle tone (exhibited by a greater than 5 second head lift) are present, the patient will be orally suctioned and extubated. Nasal cannula oxygen is provided for transport to the recovery room. If regional anesthesia was employed, the patient's sedation is discontinued. She is then assisted to the transport gurney. The spinal or epidural block will resolve according to the pharmacokinetic profile of the local anesthetic used.

Recovery room

Once in the recovery room, responsibility for the patient will be transferred to the postanesthesia care unit (PACU) nurse. A narrative of the patient's history, diagnosis, surgical procedure, and intraoperative events is presented. The ASA status, drugs given, allergies, fluid intake and output, and vital sign trends will be described. When the patient is deemed stable by the PACU nurse, the anesthetist signs off on the operative record, which began at the time of arrival to the OR

Postoperative visit

Within 24 hours, a postoperative visit by the anesthetist or a qualified colleague must occur. During the visit, the patient is examined primarily for expected resumption or improvement of preoperative homeostasis. The heart and lungs are auscultated to detect deviations from or similarities to the preoperative findings. Postoperative laboratory values and vital signs are reviewed. The presence or absence of sequelae pertinent to the anesthetic are noted (headache? sore throat? back pain? neurological dysfunction? hematoma? infection? chipped tooth? no sequelae?). The patient is also asked if there are any questions about the anesthetic. If unexpected morbidity or mortality results within 24 hours of the anesthetic, it must be documented and reported to the appropriate institutional committee. This data is used for statistical surveillance and maintenance of quality assurance. Thereafter, the anesthetist's involvement with the case is terminated.

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