Ambulatory anesthesia
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Introduction
It was predicted that by the mid-1990's over 60% of total surgical procedures in the United States would be conducted on an ambulatory basis. This development is not only attributable to cost containment measures, but also as a result of 1) improved surgical technologies, e.g. fiberoptic instruments for both diagnosis and treatment of diseases of cavitory organs, major joints, intraperitoneal structures and like, 2) development of short acting hypnotic, narcotic and potent inhalation agents, and 3) an increasing desire on the part of patients to return home for the recovery process. A growing trend toward the establishment of extended recovery centres, in which patients can have further nursing care after their release from the formal post-anesthesia care unit without a formal hospital admission, would increase the numbers of procedures suitable for this environment.

Preoperative screening
Effective preoperative screening has the potential to assure access to ambulatory surgery for the widest variety of patients that may benefit from it. This is accomplished principally by the ability of effective preoperative screening to properly evaluate, test and prepare those patients who may otherwise be excluded by the application of arbitrary criteria. An additional benefit of a preoperative screening mechanism is the avoidance of costly (patient and family members' loss of work, unused operating room time, loss of physician productivity) cancellations on the day of surgery occasioned by the arrival of an inappropriately selected or ill-prepared patient. A third benefit of appropriate preoperative screening is the avoidance of unnecessary tests because only those tests that are indicated by the patient's history or symptoms are actually obtained. A fourth benefit is that all or the appropriate information is collected and available to the anesthesiologist by the time of surgery. A fifth benefit is that patients have an opportunity to have their questions answered and their concerns addressed in advance of the day of anesthesia.

Preoperative screening is not used by some anesthesia and surgical staffs who have close working relationships with their patients' primary physicians. The primary physician can accomplish the preoperative preparation and make sure that all of the appropriate information is available. The anesthesiologist must then answer questions and establish rapport with the patient on the day of surgery.

Other centers with a wide referral base or where patients' primary care physicians are located at some distance or are not in regular contact with the ambulatory center team, have come to rely on a number of mechanisms to approach the above goals. Some rely upon surgeons to prepare their patients and obtain preoperative information with varying results. Some contact patients by telephone to identify problems for resolution. If the latter occurs the afternoon before surgery, little time is available for consultations or additional tests and the possibility of cancellations is high.

Another option is the establishment of preoperative patient visits which range from a simple anesthesia evaluation with referral back to the primary provider for tests and consultation, all the way to "one-stop shopping" preoperative visits including anesthesia evaluation, laboratory tests, ECG's, X-rays and needed consultations. Some centers offer the option of performing the preoperative history and physical examination during the patient's preoperative visit to the center by, for example, a nurse practitioner or even by the anesthesiologist. In the latter situations, provision must be made for
responsibility for missed findings and for follow-up of unanticipated abnormal findings.

**Premedication**

Premedication patterns are subject to local variation. Some practitioners are concerned that any premedication what soever will delay recovery of ambulatory surgical patients. However, many of the newer short acting sedative hypnotic agents, when used appropriately, can enhance the quality of the ambulatory experience for patients, family members and perioperative caregivers alike.

In some centers with access to the patients in advance, it is possible to prescribe an oral medication such as diazepam to be taken at bedtime on the night before surgery, on the morning of surgery or both, in attempts to allay anxiety. In other centers, medication may be given after admission to the preoperative preparation area of the ambulatory center. If time allows, oral medications may be given. Less and less often intramuscular medication are used. If appropriate staff is available, intravenous increments of a medication such as midazolam can be titrated for anxiolytic effects in the preoperative preparation area after patients have been evaluated for their suitability and potential benefit. Medication administered immediately prior to transport to surgery may be considered "pre-induction" medications and may serve not only to smooth the patient's transition to the surgical suite, but also smooth the transition to the anesthetic state reduce anesthetic requirements, etc.

Opinions vary regarding premedication for children. One purpose of pediatric premedication is to allay the fears engendered by parental separation. Since children younger than 10-12 months rarely fear parental separation, premedication is not usually required below that age. Local customs for children beyond infancy vary somewhat depend upon the architectural design of the center. In centers where parents may be present for anesthetic induction, premedication is rarely needed, as parental separation prior to the anesthetic does not occur. If children must be transported some distance from the preoperative area to the operating room, plaintive or angry crying down the hallway can be upsetting not only for the pediatric patient and his parents, but for other patients and the staff and result in a negative interpretation of the experience in the ambulatory center.

Again, a variety of options exists if premedication is desired for an ambulatory pediatric patients while avoiding the necessity for an intramuscular injection. Since modern potent inhalation agents lack vigorous sialagogic properties, prophylactic administration of atropine, even with a mask induction, can frequently wait until intravenous access has been achieved. Non-injection options for pediatric premedication include oral, rectal or nasally administered midazolam (0.5-1.0mg/kg); oral or rectal ketamine; rectal methohexital in sub-induction doses (e.g.- 20 mg/kg), etc. Nasal midazolam avoids the unpleasant taste, but can cause a burning sensation that children dislike. The bitter taste of oral midazolam can be disguised with a small amount of fruit drink, syrup, or cola and administered in a cup or syringed in increments into the mouth. Ten to fifteen minutes should be allowed for these methods of administration to take effect and the parents are advised that the child will not become fully asleep but will become more cooperative with leaving their embrace.

**Anesthetic induction and maintenance**

One of the major goals of ambulatory anesthesia is to return the patients to his preoperative mental and physiologic state as soon as practicable, thus the thrust for the development and application of agents with suitable pharmacokinetics, i.e.- quick onset and offset, short beta elimination half-lives, inactive metabolites and minimal cardiovascular or other side effects. The fact is that in many centers, propofol has displaced the short acting barbiturates as the induction agent of choice for ambulatory patients, because of prompt wake-up characteristics, antiemetic effects and the extreme clear-headedness that patients achieve soon after a brief propofol-based anesthetic. The
versatility of propofol to also serve as a maintenance anesthetic agent by continuous infusion increases its utility in the ambulatory anesthesia arena and has made it the "control" group for the testing of the newer inhalation agents.

Inhalation agents also play a role in ambulatory anesthesia. Halothane is still widely used for its smooth inhalation induction properties in children. Potent inhalation agents may provide better control of autonomic cardiovascular responses to surgical stimulation that are not easily controlled in a timely manner with propofol alone. There is also the question of cost differential with procedures of longer duration between a pure propofol anesthetic and the presently available inhalation anesthetics. Empirically for longer procedures at our ambulatory center, we sometimes use a technique that consists of anesthetic induction using propofol, inhalation maintenance, then approximately thirty minutes before the anticipated conclusion of surgery, the inhalation agent is discontinued and replaced with titration if continuous propofol infusion. The thirty minutes allows the inhalation agent to dissipate such that the patient experiences an emergence that is characteristic of a propofol emergence.

Newer inhalation agents, such as desflurane and sevoflurane, are presently being used in the ambulatory anesthesia setting with regard particularly to induction and recovery (wake-up times, post-operative nausea incidence, etc.) characteristics. Immediate wake up times may be several minutes faster with desflurane; however evidence has not yet indicated that overall discharge times are any shorter with desflurane. Post-operative nausea and emesis after desflurane is consistent with other inhalation anesthetics. Desflurane is associated with airway irritability and is not suitable for inhalation induction. Heart rate may increase with precipitous increases in desflurane concentration. Costs are decreased with low gas flows and by decreasing MAC requirements by use of nitrous oxide or other adjunctive agents. Sevoflurane, now available all over the world also been shown to have quick wake-up times consistent with its low blood solubility. Sevoflurane has low airway irritability and can be used for inhalation inductions.

Regional anesthetics have applications in the ambulatory arena. Some anesthesiologists perform the retro-bulbar blocks for their patients undergoing ophthalmological procedures. Many single extremity procedures are amenable to intravenous regional anesthesia with or without concomitant intravenous sedation. Such patients are ready for discharge in a very short period of time after deflation of the tourniquet. Blocks of the arm or hand at the elbow or the wrist may be applicable to ambulatory procedures. Brachial plexus blocks are also used in ambulatory anesthesia. In the case of an arm or hand block, in which the arm will be protected by a sling after surgery, it is not usually required that complete recovery from the block takes place prior to discharge. This has the advantage of providing some post-operative pain relief, however, the patient and his accompanying adult must be advised how to protect the arm until full recovery from the block has taken place.

Spinal anesthesia, particularly with round-point needles and short acting agents, can be used for many of the typically one-hour ambulatory procedures. Epidural anesthesia can be used, however the advantages in other settings, such as slow-onset and multiple dosing, are not necessarily relevant in healthy ambulatory patients having short procedures. Epidural or intrathecal narcotics are not used in routine ambulatory patients because the resultant prolonged post-operative observation required to check for development of late sequelae is not practicable. Ankle blocks or other blocks of the nerves of the leg may be applicable, however, unlike the arm, blocks affecting the lower extremities that compromise ambulation are all required to be fully dissipated before discharge.

Postoperative pain management
Regional anesthesia can contribute to a successful plan for management of
Review Article

Postoperative pain. Pediatric patients can also benefit from the application of regional techniques. A very frequently applied technique for young children is a caudal block with dilute concentrations of bupivacaine. In pediatric patients a caudal block is quick and simple to perform and provides excellent postoperative analgesia for approximately 6 hours. A caudal block may be appropriate to provide pain relief after lower abdominal, urological, or lower extremity procedures. The caudal block is most often places after the child is asleep with a general anesthetic. If the block is placed before skin incision, it will "set-up" during the procedure and provide relief immediately at the conclusion of surgery. When the block is placed at the end of the surgical procedure, it will not be immediately effective and the child may still require other means of pain relief initially. Parents are advised to supervise any ambulation for at least 6-8 hours postoperatively. Older children may not be suitable candidates for discharge with functional caudal blocks if there is a possibility of orthostatic changes or if the family is not able to limit ambulation.

Despite concerns of potential respiratory effects and/or nausea, opioids continue to play a role in ambulatory anesthesia. They are used to supplement maintenance anesthetic agents in order to minimize autonomic responses to surgery, as well as to provide post-operative pain relief. Neither propofol nor the newer inhalation anesthetics can alone provide patients with good postoperative analgesia. Neither alfentanil, nor the newer remifentanil, have long enough half-lives to provide reasonable postoperative pain relief in the absence of a PCA-type device. The role of non-steroidal anti-inflammatory agents is currently being defined as a sole agent or to reduce the amount of narcotic required. Older NSAID's can be given orally or rectally before surgery while newer options, such as ketorolac, can be given parenterally to accomplish these goals.

Ultimately the patient must transition to oral analgesics for discharge. If the patient is awake and not nauseated, it is possible to give the first dose of oral analgesics while the acute pain is being controlled by parenteral analgesics in order to smooth the transition. In that manner, the oral medication is absorbed and pharmacodynamically active by the time that the effects of the parenteral drug are beginning to dissipate. Newer modes of analgesic delivery can be anticipated. Unfortunately early experience with fentanyl patches indicated a high incidence of nausea and its sequelae. Intractable pain requiring continued parenteral narcotics is a reason for post-operative hospital admission.

Antiemetics

While some procedures are associated with greater likelihood of post-operative nausea and emesis (i.e.- laparoscopy approximately 40% vs. other procedures 10%-15%), it is not known exactly which patients will develop nausea. Current antiemetics have undesirable psychotropic side-effects, i.e.- dysphoria, somnolence, etc. Some anesthetic techniques are associated with greater incidence of nausea. Newly developed anti-emetics, while possessing reduced psychotropic side effects, are highly specific for certain etiologies of nausea and may not be effective with regard to all of the contributing factors to perioperative nausea. Furthermore, the newly developed agents are too expensive in the near future for routine use.

In general, routine prophylactic administration of anti-emetic agents to all ambulatory anesthesia patients is not warranted. However, for selected patients in whom, either because of their previous history or physical condition, or for whom a procedure is planned after which nausea and emesis is more likely, a judicious dose of an anti-emetic agent may be warranted in attempts to reduce the incidence of nausea or vomiting. In such patients it also may be possible to attempt to use anesthetic agents or techniques that have been reported to be less associated with postoperative nausea and emesis and perhaps to reduce the need for narcotics by efforts such as requesting instillation of local anesthetic at the incision site etc.
Discharge criteria
Most ambulatory centers use "home readiness" as an end-point for discharge, which implies that the patient is expected to be accompanied home by a responsible adult and is not expected to perform tasks requiring fine coordination or make fiscal or legally binding judgment decisions until the following day. He may need assistance with the tasks of daily living for several days. A responsible adult does not consist of a taxi driver, shared van driver, etc. The responsible adult must be someone with a sense of responsibility for that particular patient that extends beyond a pecuniary interest.

All patients must be counseled about this requirement so that they can make appropriate arrangements. Some centers require that the responsible adult be present before surgery commences.

Discharge criteria for "home readiness" are rather straightforward. They include stable vital signs, return to baseline mental status, adequate pain control, minimal nausea, minimal bleeding at the surgical site, absence of or control/treatment of surgical sequelae, absence of significant anesthetic sequelae, ambulation consistent with previous state and surgical effects, etc. Voiding is not always required during the course of the shorter recovery times now possible with short-acting anesthetic agents. Exceptions requiring demonstration of satisfactory urinary function pre-discharge would be patients receiving spinal or epidural anesthesia or those having surgery in the bladder/groin area. Examples of the latter would be: some gynecological procedures, urological procedures or inguinal herniorrhaphy.

Changes of opinion have occurred regarding oral intake post-operatively, as well. When awake, if a patient expresses thirst or if nausea is absent, clear liquids may be offered. If the clear liquids are tolerated, other intake is allowed if desired by the patient. On the other hand, in the presence of nausea, liquids are not forced in order not to provoke emesis or worsen nausea. If patients meet all other relevant discharge criteria and nausea is minimal, they may be discharged in the absence of significant post-operative oral fluid intake with clear instructions to the patient and responsible adult regarding where to obtain assistance if the patient is not able to tolerate oral liquids after a reasonable period of time.

Post-anesthesia care
A growing trend in the world today is that of extended recovery centers, short stay facilities, or 23 hour units, where patients can be observed beyond the time needed for acute recovery from anesthetic effects. After suitable patients are fully recovered per post-operative routine in the post-anesthesia care unit, they are transferred to the designated area for the remainder of their stay, with a reduced level of nursing care, comfortable surroundings and provision of meals, television, visiting hours and the like.

Such facilities meet the requirements of third party payers to avoid a full hospital admission, yet allow patients to have the equivalent of ward-level nursing care for the purpose of, for example: precautionary observance for late hemorrhage at the surgical site, intravenous pain management, and the like. There may not be a physician on the premises, rather only "on call", thus patients that need acute management of medical conditions are not suitable for those facilities. In free-standing recovery facilities, the reasons for a patient's extended stay will primarily be for surgical indication (pain control), whereas an extended recovery facility which is part of a full service hospital may also be able to include patients with medical indications for observation (e.g., a patient with asthma). The availability of observation to 23 hours enlarges the scope of surgeries that could be provided at ambulatory centers. Some examples include additional types of laparoscopic surgery, some types of parotid or parathyroid surgery, some axillary or groin lymph node dissections, extensive plastic surgery procedures on the face, orthopedic procedures such as anterior cruciate ligament repair of the knee, etc.

Extended recovery facilities differ in their ability to provide laboratory tests or x-rays
after hours, thus physiologically stable patients are most suited for man of these programs. Some centers exclude children under 13 years of age or exclude, for example, those with communicable diseases or morbid obesity in order to reduce risk and simplify staffing and facility issues.

**Conclusion**

Directors and practitioners in ambulatory surgical setting is the world are preparing to transition from Quality Assurance (QA) activities to the Continuous Quality Improvement (CQI) approach to quality management. The CQI approach has been embraced by the Joint Commission on Accreditation of Health Care Organization, which has gradually changed its accreditation requirements over the last few years from QA to CQI. Fortunately, most ambulatory surgical environments are dynamic, consumer-oriented locales which are particularly likely to be able to successfully embrace the CQI point of view with minimal adaptation. CQI strives to improve process design and execution, in order to prospectively reduce variability and improve all outcomes.

**References**

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