Ambulatory Anesthesia:  
The Original ERAS

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The goal of ambulatory anesthesia is to maximize the quality of patient care. We must provide anesthesia with a smooth onset, good intraoperative conditions, and rapid recovery with minimal symptoms. Ambulatory ERAS- Enhanced Recovery after ambulatory surgery focuses our efforts even more on patients’ return to normal function as rapidly as possible. This requires the integration of preoperative, intraoperative and postoperative care elements. The preoperative issues concern patient education and setting realistic expectations for ambulatory anesthesia outcomes. Today we will briefly address intraoperative anesthetic choices and then focus on managing postoperative factors to help reach these goals.

Choice of maintenance anesthetic agents

How can the choice of intraoperative agents contribute to the goals we want to achieve with Ambulatory ERAS? Some general conclusions can be drawn, as background. Both desflurane and sevoflurane show faster early and intermediate recovery and fewer side effects than isoflurane when used for maintenance. However, times to facility discharge were not significantly different; this may reflect the need to change recovery care protocols in order to actualize the drug differences. When the two newer volatile agents are compared with propofol maintenance for ambulatory anesthesia, propofol infusion has slower recovery indices. In studies that compare desflurane with sevoflurane directly, there appear to be no significant recovery time differences between them for cases approximately 1-hr duration. Remifentanil infusion provides hemodynamic and autonomic control without prolonging recovery. However, the use of TIVA opioid-neuromuscular blocker combination anesthetics without a volatile appears to increase the risk of intra-operative awareness.

For specifics: Using “better” agents only for the end of the anesthetic is, in general, not effective. Giving 30 min of desflurane after 90 min isoflurane produces recovery indices that are indistinguishable from an isoflurane-only group. Computer simulations of this anesthetic show that the low-solubility agent washes out promptly, and the remainder of anesthetic elimination and clinical recovery are attributable to the residual isoflurane. Similarly, use of a propofol "sandwich" technique to reduce PONV, by substituting the final 30 minutes of a propofol induction-isoflurane maintenance anesthetic with a propofol infusion, results in minimal recovery differences: similar postoperative sedation and nausea/vomiting [N/V] rates. Volatile anesthetics -with opioid- are a cause of early (<6h) but not later PONV. Despite common belief, fat solubility is not the primary determinant of volatile anesthetic wake-up, because limited amounts of anesthetic go into fat for procedures <10 h; instead it is muscle that is the functional anesthetic storage site. [GasMan®, MedMan Simulations]. Monitored anesthesia care can successfully promote fast tracking if the surgeon gives effective local anesthesia or field
block; side effects with sedation are less if the anesthesiologist gives sedation and not general anesthesia; and if both surgeon and patient understand that goal is sedation and not completely “out”. Regional anesthesia, such as interscalene blocks for shoulder surgery, can provide lower pain VAS scores, less nausea, and faster times to ambulation, fluid intake, and home readiness.

**Recovery Challenges**

Building on a thoughtfully-designed anesthetic, the two major recovery challenges for ambulatory procedures are management of postoperative pain and management of postoperative N/V. ERAS principles of opioid minimization and appropriate hydration are key, and have been long-time core principles of ambulatory anesthesia. For optimum results, it is important to plan for recovery from the beginning of the anesthetic.

Management of postoperative pain is best addressed by a multimodal approach. The cornerstone of ERAS pain control is the consistent use of pre- or intra-operative local infiltration and regional blocks. These can be used alone or as adjuncts to general techniques, and preferably with long-acting agents. Whenever possible, nonsteroidal anti-inflammatory analgesics should be given to improve analgesia, such as oral celecoxib preop or IV ketorolac as well as acetaminophen oral or IV, given so that the drugs will be effective by the end of the operation. Operationally, small boluses of opioids such as fentanyl 25-50 mcg should be given near the end of the operation to maximize their effect for postoperative pain management. It is also important to educate patients that the abolition of pain after surgery is not a realistic goal.

Nausea/vomiting remains the most common reason for admission after ambulatory anesthesia and surgery. It is a multifactorial problem, and therefore has no single solution. Each potential contributing cause should be assessed and addressed, with a systematic and cost conscious approach.

N/V is affected by hydration and food intake. It is important to instruct patients about the appropriate duration for preoperative fast. The ASA Preoperative Fasting Guidelines (first 1999) recommend that most patients of all ages may have unlimited amounts of clear fluids until 2 hours before surgery, human milk until 4 hours, and nonhuman milk or light solids e.g. toast and clear liquid until 6 hrs; for other foods 8 hrs. Patients who have disease processes that delay gastric emptying or have positional gastroesophageal reflux should continue to be treated with "full stomach" precautions and have a complete fast after midnight. At the Brigham and Women's Hospital, we have administratively interpreted the general NPO recommendations to permit clear liquids until 2 hrs preoperatively, and no solids after midnight; this permits us to maximize flexibility of the operating schedule.

Oral preoperative hydration is usually supplemented by intravenous fluid administration. Consider the patients' 24-hour fluid requirement in these assessments. ASA Postanesthesia Guidelines recommend that patients should not be required to drink fluids before discharge. Do not push patients to eat solid foods in the ambulatory surgical facility. Over 35% of postoperative N/V occurs after discharge from the surgical facility, and often in patients who have not had symptoms before. Anecdotes from postop telephone contacts have suggested that the car ride home frequently precipitates N/V.

Another major factor in the control of N/V for ambulatory patients is the appropriate use of opioids. Literature suggests that the conventional use of 75-100 ug of fentanyl at the time of
anesthesia induction is ineffective for postoperative pain, because of the short duration of action of fentanyl at these doses. However, when compared with the administration of ibuprofen PO or ketorolac IV, patients who received fentanyl experienced more postoperative pain and more postoperative nausea, with more rescue emetics, longer times to ambulation and discharge readiness, and more pain at home. Furthermore, the effects are dose related. Therefore, the dose of opioids given to ambulatory surgery patients should be limited to the amount that is needed after administering local/regional anesthesia and nonsteroidal analgesics. The opioids should be given in small increments beginning before the end of the procedure to maximize analgesic benefit at wakeup and to minimize N/V. Long acting opioids should in general be avoided for ambulatory surgery, to limit long acting side effects.

Opioid alternatives should be considered. Both local anesthetics and NSAIDs have been shown to reduce opioid dose and reduce opioid side effects. Beta-blockers should be used to address autonomic responses instead of opioids. Beta-blockers reduce anesthesia drug requirements (MAC); in ambulatory patients, esmolol has been shown to decrease heart rate and BP response to intubation, hasten emergence, and decrease postop analgesic requirement. Alpha-2 adrenergic agonists such as clonidine and dexmedetomidine can result in reduced pain VAS after laparoscopic tubal ligation, but have uncertain impact on N/V and are long-acting; their benefit of sedation with little respiratory depression has primarily been used for long cosmetic surgery. Low-dose ketamine 10-20 mg can reduce postoperative pain, and complementary pain control techniques such as acupuncture or TENS may also help. Remifentanil infusion has reliably rapid offset of acute effect but carries the risk of postoperative opioid-induced hyperalgesia even after ambulatory surgery cases. [Anesthesiology 2016;124:483-8].

The first step in antiemetic therapy is to determine patient and surgical risk factors for PONV. Antiemetic drug prophylaxis should be considered for medium- and high-risk patients. A discussion of the pros and cons of the antiemetic drugs can be found in consensus guidelines [Anesth Analg 2014;118:85–113]. The clinical application of this information is an incremental approach to PONV treatment based on effectiveness and cost. At BWH, routine prophylactic antiemetics include dexamethasone 4 mg IV postinduction, ondansetron 4 mg preawakening, and preoperative transdermal scopolamine patch; ephedrine 35-50 mg IM and metoclopramide 20 mg IV are also used. Serotonin antagonists such as ondansetron and dolasetron are useful as treatment drugs if they have not been given for prophylaxis; treatment doses appear to be 1/4 the prevention doses. Promethazine 6.25 mg is more sedating but can be used at that dose for ambulatory patients postop if an additional drug is needed. Droperidol 0.6-1.25 mg is highly effective although not currently available. Propofol TIVA is a popular antiemetic regimen, however, systematic review of RCTs reveals that TIVA has similar efficacy to inhalational anesthesia with one added antiemetic drug, and has an increased relative risk of late PONV. [Eur J Anaesthesiol 2016; 33:750–760]. The consistent incidence of post-discharge nausea and vomiting reinforces the need for long-acting antiemetics given in facility.

A final factor to consider in Ambulatory ERAS is patient satisfaction. Postoperative patients have identified factors that determine satisfaction with ambulatory surgery care. [Am J Anesthesiol 1998;25:154-7]. #1 was Friendliness of staff and #2 was Surgeon’s postop visit in PACU – above all other issues.