Review Article

Anesthesia for Ambulatory Surgery

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Abstract

Ambulatory surgery provides surgical care to outpatients without hospital admission for postoperative care. The popularity of ambulatory surgery has grown rapidly worldwide. Appropriate selection of patient, as well as, preoperative assessment to optimize ambulatory patient is essential for delivery of safe, high-quality, efficient ambulatory surgery, and improvement of patient satisfaction. Choice of anesthesia for ambulatory surgery depends on procedures and patient medical conditions. General anesthesia is the most common choice due to quick recovery. Inadequate postoperative pain control, nausea, vomiting, dizziness, bowel and bladder obstruction delay discharged patient and often increase the admission rate. In summary, providing successful ambulatory anesthesia requires optimal preoperative evaluation, proper perioperative management, and sufficient postoperative cares.

Keywords: Ambulatory, Anesthesia, Patient selection, Anesthetic management, Discharge criteria

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Introduction

Ambulatory surgery was first reported in the 1840s as an office setting, and then the expansion of outpatient surgery continued gradually until the Society of Ambulatory Anesthesia (SAMBA) was established in 1984[1]. Since then, the use of ambulatory surgery has been reported rising dramatically. Current day case surgery estimates at greater than 70% in the United State and North America[2]. Ambulatory surgery also constitutes a large proportion of elective surgery in many other countries[3].

Due to advances in anesthesia and surgical techniques, ambulatory surgery has gained rapid popularity[4]. The availability of improved short-acting anesthetic and analgesic agents facilitate recovery and minimize side effects[1, 5]. Moreover, anesthetic techniques have enhanced, the use of ultrasound-guided regional anesthesia provides a safe, reliable anesthetic and recovery plan, and quick discharge[6]. On the other hand, the development of minimally invasive surgical procedures using endoscopic-assisted surgery promotes patient's outcomes as well as a reduction in blood loss and pain[7]. Incidence of mortality and major morbidity associated with the ambulatory surgery is very low[8]. Additionally, there are several benefits of ambulatory surgery, such as reduced health care costs, lower risk of nosocomial infection, a lower rate of cancellation, and reductions in waiting times[9].

In addition to providing prosperous ambulatory anesthesia, optimal preoperative assessment to optimize patient's health is required to minimize adverse outcomes[5, 9]. The choice of anesthesia is based on the operation and patient factors. However, the ultimate aim for ambulatory anesthesia is a rapid recovery with less undesirable side effects[9]. As well as effective postoperative care, prophylactic and effective treatment of nausea, vomiting and pain facilitate quick discharge and patient satisfaction[5].

This review article aims to discuss preoperative assessment, patient selection, intraoperative and postoperative management to provide effective ambulatory anesthesia.

Preoperative assessment

An effective assessment of the patient prior to the day surgery is crucial. An appropriate patient and procedure selection is also a key toward achieving successful ambulatory surgery. Optimize patient conditions and stabilize co-existing diseases are associated with minimizing risks and improving patient outcomes[5, 10].

Patient selection

Most patients are compatible with day case surgery unless they have unstable medical conditions requiring admission. Age is not contraindicated for ambulatory surgery as well as patient with high American Society of Anesthesiology (ASA) classification with well-controlled comorbidities[10].

The development of minimally invasive surgery and improvement of surgical techniques result in increasing range of eligible ambulatory surgery[7]. However, there should be no expectation of massive blood loss, large perioperative fluid shift, or need for specialized postoperative care.

Patient should understand all the procedure and postoperative care plan. In addition to discharge home after day case surgery, a responsible adult escort is required to take care of the patient for 24 hours[11]. Despite, The Association of Anaesthetists of Great Britain and Ireland suggested that the escort may not be required if the patient is not compromised by sedation effects after the surgery[12]. However, the patient is not allowed to drive himself home after discharged alone[11].

Anxiety

In addition to optimizing medical comorbidities, an anesthesia provider should cope with patient anxiety which is common in ambulatory surgery[13].

A preoperative visit could diminish anxiety level and improve patient satisfaction. However, anxiolytic premedication can be used in high anxious patient without delayed recovery[13].

Special considerations

Hypertension

Preoperative assessment in patient with hypertension should focus on adequacy of control of blood pressure, antihypertensive treatment, and end-organ damage[10]. Patient should continue to take antihypertensive medication, especially β-blockers[14]. On the other hand, angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs) should be withheld on the morning of surgery due to the incidence of hypotension after induction[10, 14].

Diabetes

Preoperative assessment of the patient with diabetes undergoing ambulatory surgery should evaluate complications, comorbid conditions, and glycemic control[10]. The SAMBA recommendation showed that oral and noninsulin injectable hypoglycemics should be held on the day of surgery while long-acting insulin could be continued with 50 - 75% reduction of the usual dose[15]. Additionally, the blood glucose might fluctuate while fasting, therefore, patient should be scheduled as the first case.

Obesity

Obesity is linked to increase risk for cardiovascular disease, diabetes, obstructive sleep apnea (OSA), and hypoventilation syndrome[10]. Despite, obesity and OSA are risk factors for perioperative complications, optimized obese patient is eligible for ambulatory surgery[16]. A specialized equipment should be prepared for perioperative care of morbidly obese patient.

Preoperative considerations for ambulatory surgery[5, 16]

- Stabilize co-existing diseases
- Optimize patient conditions
- Ensure adequate hydration
- Prevent postoperative complications by appropriate prophylactic therapies (e.g., nausea, vomiting, pain)

Intraoperative Anesthetic Management

The choice of anesthesia for ambulatory surgery depends on the type of surgery and the patient's status. Anesthesia for ambulatory surgery includes general and regional anesthesia, local anesthesia, monitored anesthesia care (MAC) or a combination of these methods. Furthermore, in general, the anesthetic agents that are chosen are those with a rapid onset of action and fast recovery time, and do not cause problems with respect to intraoperative control of consciousness and pain relief, and have no other side effects.

General Anesthesia

General Anesthesia is the most common choice because it is safe, economical, easy to recover from and familiar to all anesthesiologists. Nowadays we have anesthetics such as Propofol, Sevoflurane, Desflurane and Remifentanil which are easier to titrate, allows early awakening and reduce post-anesthesia care unit (PACU) stay. Nevertheless, inadequacy of postoperative pain control which may be happened requires the addition of opioids, which carry risks of nausea, urinary retention and mental obtundation.

Inhalational agents themselves carry a 20 - 50% risk of PONV but can be minimized by generous use of prophylactic medicine[15, 17].

Propofol as an intravenous anesthetic shows a rapid rate of metabolism resulting in quick recovery from anesthesia with few side effects[18]. It has antiemetic property as well. Propofol is commonly used for induction and maintenance in ambulatory surgery.

Remifentanil is quite useful during ambulatory surgery because of its rapid onset and short duration of action, which leads to rapid awakening and recovery from anesthesia[19]. Because of the rapid analgesic offset, it will be necessary to use long-acting opioids or non-opioid analgesics to provide postoperative pain relief.

Regional Anesthesia

The major types of regional anesthesia include peripheral nerve block (with or without a continuous peripheral nerve catheter) and neuraxial block (spinal and epidural anesthesia). Nowadays regional anesthesia is very popular among anesthesiologists because it's quite safe to patients under ultrasound guided. Regional anesthesia can avoid the side effects caused by general anesthesia such as nausea, vomiting, dizziness, residual muscle relaxation, aspiration pneumonia. Besides, regional anesthesia provides adequate pain control from the early postoperative period[6]. However, general anesthesia is the backup procedure in case of unsuccessful or incomplete regional block. Furthermore, the postoperative analgesic effect is greater with supplementation by peripheral nerve block in patients undergoing general anesthesia than with the use of local anesthesia. Thus, the use of narcotics and their side effects can be reduced. However, spinal block sometimes delays in the discharge of ambulatory surgery patient[20].

Monitored anesthetic care (MAC)

MAC is a method in which patients are sedated by sedative drugs and analgesic intravenously and/or orally. It sometimes used in conjunction with local infiltration or peripheral nerve block. Propofol, Ketamine and Dexmedetomidine have been used widely. Because respiratory depression can be happened by unintentional deep sedation, special attention must be paid.

Table 1 Levels of sedation and anesthesia[21]

	Minimal sedation (Anxiolysis)	Moderate sedation (Conscious Sedation)	Deep Sedation	General Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response after repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

Postoperative Anesthetic Management

Inadequate postoperative pain control, nausea, vomiting, dizziness, bowel and bladder obstruction are culprits for discharge patients and often increase the admission rate. Pain and postoperative nausea and vomiting (PONV) are most common complications after ambulatory anesthesia and are closely related. Excessive use of opioids to control pain may cause PONV and pain itself is a risk factor for PONV as well. The rate of unexpected hospitalization represents an important indicator of ambulatory surgery quality, is usually reported as 1 - 2%[22]. The most common causes for hospitalization are pain, hemorrhage, and unexpected extensive surgery[8].

Postoperative pain management

Regional anesthesia or the infiltration of local anesthetics at the surgical site reduce the dose of analgesics[6]. Thus, the recovery time is shortened. Multimodal analgesic approach (the use of more than one pain relief method and the medicines work in the different pathway) has been standard in postoperative pain control for ambulatory surgery. Multimodal analgesia is not only providing adequate pain control, it also decreases the side effects of every single analgesic such as nausea vomiting or urinary retention[8, 23.] Medicines using for multimodal analgesia, for example, are NSAIDs, acetaminophen, ketamine, alpha-2 agonists and gabapentin[23].

Postoperative nausea and vomiting

Approximately 30-50% of patients report for postoperative nausea and vomiting despite the development of various new anti-emetics[24]. In case of severe nausea and vomiting, discharge may be delayed and unexpected hospitalization may be necessary. Major risk factors for PONV include female, nonsmoking status, a history of previous PONV, motion sickness and previous use of inhalation and/or narcotics[24, 25]. For adults with more than two of these risk factors, the administration of multimodal anti-emetics, such as droperidol, dexamethasone, and ondansetron, is recommend[25]. Treatment of PONV requires the administration of antiemetic drugs of a different pharmacological class than the initial prophylactic drugs, and low dose 5-hydroxytryptamine receptor antagonists are recommended unless prophylaxis is indicated[24, 25]. Furthermore, to reduce the risk of nausea and vomiting, adequate use of propofol, fluid therapy and minimization of narcotics during perioperative treatment are also effective[25].

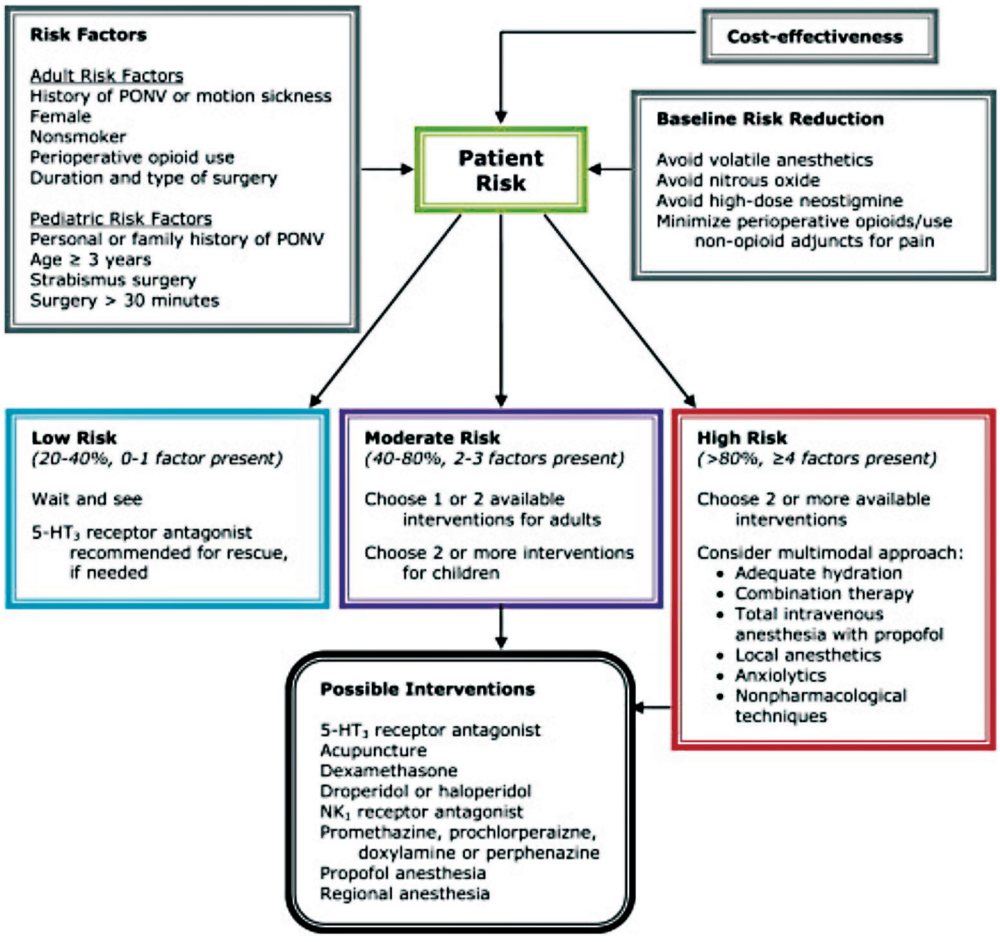

Figure 1 Antiemetic Management Strategies[26]

Recovery

The process of recovery from anesthesia can be divided into three stages[22].

Early Stage

Early recovery is the period between awakening from anesthesia and restoration of protective reflexes and motor capacity. The patient stays in Post Anesthetic Care Unit (PACU), where vital signs are monitored. Besides that, active management for postoperative pain, nausea and/or vomiting, hypoxia are achieved in this area.

Middle Stage

Most hospitals that conduct ambulatory surgery have step-down units or ambulatory surgery units where prepare patients for discharge. Patients in this phase are nursed in resting chairs. Transfer decisions from the PACU to the step-down unit commonly follow the modified Aldrete scoring system[27] or White's fast-track criteria[28].

Table 2 The modified Aldrete scoring system[27]

Assessment	Score
Patient is fully awake	2
Patient is arousable on calling	1
Patient is not responding	0
Blood pressure 30 mm of baseline level	2
Blood pressure 30-40 mm of baseline level	1
Blood pressure > 40 mm of baseline level	0
Able to deep breathe freely	2
Dyspneic or limited breathing	1
Apneic	0
Minimal to no pain or nausea	2
Moderate pain or vomiting	1
Severe pain or vomiting	0
Pink	2
Pale, dusky, blotchy or other	1
Cyanotic	0
Total score for assessment (total needs to be 9 or 10)	

Table 3 White's fast-track criteria[28]

	Score
Level consciousness	
Awake and oriented	2
Arousable with minimal stimulation	1
Responsive only to tactile stimulation	0
Physical activity	
Able to move all extremities on demand	2
Some weakness in movement of extremities	1
Unable to voluntarily move extremities	0
Hemodynamic stability	
Blood pressure < 15% of baseline MAP value	2
Blood pressure 15 - 30% of baseline MAP value	1
Blood pressure > 30% of baseline MAP value	0

Table 3 White's fast-track criteria[28]

	Score
Respiratory stability	
Able to breathe deeply	2
Tachypnea with good cough	1
Dyspneic with weak cough	0
Oxygen saturation status	
Maintain value >90% on room air	2
Requires supplemental oxygen (nasal prongs)	1
Saturation<90% with supplemental oxygen	0
Postoperative pain assessment	
None or mild discomfort	2
Moderate to severe pain controlled with IV analgesics	1
Persistent severe pain	0
Postoperative emetic symptoms	
None or mild nausea with no active vomiting	2
Transient vomiting or retching	1
Persistent moderate to severe nausea and vomiting	0
Total score	14

MAP = Mean arterial pressure

Limitations of the modified Aldrete score include that it does not address pain, nausea or vomiting, which are common side effects of PACU stay. It's also not ideal for determining fast-tracking bypass in ambulatory settings or patients undergoing regional anesthesia. Using short-acting anesthetics, such as Propofol, sevoflurane or desflurane, most patients can go directly to step-sown unit without going through the PACU. White's fast track criteria are used to determine admission patients into a step-down unit without staying in PACU. The more recently 'WAKE' score includes not only the modified Aldrete score but also 'zero tolerance' criteria to assess postoperative pain, PONV, tremors, itching, and orthostatic symptoms[29]. This score appears more suitable for the evaluation and rapid follow up of outpatients who have undergone regional anesthesia, general anesthesia or MAC.

Phase 1 recovery unit bypass should only be considered when such patients do not require any parenteral interventions for pain, nausea, vomiting, pruritis, shivering/dysthermia, or hypotension/orthostasis/lightheadedness (hereafter referred to as "Zero Tolerance Criteria"). Patient pain scores should not exceed 3-4 (out of 10, if baseline pain score is †zero) at the time of Phase 1 Unit Bypass or Phase 1 Unit Discharge. A score of ‡8 or above, based on the parameters below, is recommended for phase 1 unit bypass and/or phase 1 unit discharge, along with meeting the ◊Zero Tolerance Criteria).	
§ **Movement**	**Scores**
Purposeful movement of (at least) one lower and one upper extremity	**2**
Purposeful movement of at least one upper extremity (but neither lower extremity)	**1**
No purposeful movement	**0**
Movement Score:	
** **CV function (blood pressure / heart rate) and hydration: Two evaluations for lightheadedness (with patient sitting, or on a tilted gurney) 5-10 minutes apart, within 15-20 minutes of the "End Anesthesia Time," regardless of hospital unit location where these assessments take place. BP/HR must be checked at one or both of these evaluations.**	**Scores**
Within 20% of preoperative baseline, without orthostatic changes/lightheadedness	**2**
Between 20-40% of preoperative baseline, without orthostatic changes/lightheadedness	**1**
Less than 40% of preoperative baseline, and/or orthostatic changes/lightheadedness	**0**
CV / hydration Score:	
Level of Consciousness (LOC) / Mental Status (MS)	**Scores**
Awake and/or immediately aroused when called, follows commands without delay	**2**
Arousable to stimuli (delayed), exhibits protective reflexes, and follows commands (but delayed)	**1**
Obtunded or persistently somnolent; ± protective reflexes; ± following commands	**0**
LOC / MS Score:	
Respiratory function, rate, and effort; airway patency	**Scores**
Coughs and deep-breathes freely, and/or on command	**2**
Coughs involuntarily, but not on command; maintains airway without support	**1**
Tachypnea, dyspnea or apnea, and/or requiring airway maintenance	**0**
Respiratory Score:	
††Oxygen Saturation	**Scores**
$SaO_2 \geq 95\%$ or ≥ (Preoperative reading minus 2) without supplemental O_2	**2**
$SaO_2 \geq 95\%$or ≥ (Preoperative reading minus 2) with supplemental O_2	**1**
$SaO_2 \leq 94\%$ or < (Preoperative reading minus 2) with or without supplemental O_2	**0**
Saturation Score:	
Total Score:	

Phase 1 Patient Recovery Evaluation Criteria and Scoring System.
Adapted with permission from *Anesthesiology*. 2004;101:3–6.
BP indicates blood pressure; CV, cardiovascular; HR, heart rate; LOC, level of consciousness; MS, mental status; O_2, oxygen; SaO_2, oxygen saturation.

Figure 2 WAKE Score[29]

Late stage

It refers to the period prior to a patient being able to return to work and daily life. The Post Anesthetic Discharge Scoring System is used to decide whether or not patients can be discharged from the hospital[30]. To return home, all outpatients who receive sedative or analgesics must have been escorted by a responsible adult. These caregivers must be provided with printed instructions, including detailed information regarding precautions, guidelines and the medical personnel to contact in case of an emergency.

Table 4 The Post Anesthetic Discharge Scoring System[30]

Categories	Points
Vital signs	
BP and HR +/- 20% of pre-endoscopy value	2
BP and HR +/- 20-40% of pre-endoscopy value	1
BP and HR +/- 40% of pre-endoscopy value	0
Activity	
Steady gait, no dizziness or meets pre-endoscopy level	2
Requires assistance	1
Unstable to ambulate	0
Nausea and vomiting	
No or minimal/treated with p.o. medication	2
Moderate/treated with parenteral medication	1
Severe/continues despite treatment	0
Pain	
Minimal or no pain (Numerical Analogue Scale = 0 - 3)	2
Moderate (Numerical Analogue Scale = 4 - 6)	1
Severe (Numerical Analogue Scale = 7 - 10)	0
Surgical bleeding	
None or minimal (not requiring intervention)	2
Moderate (1 episode of hematemesis or rectal bleeding)	1
Severe (≥ 2 episode of hematemesis or rectal bleeding)	0
Patients' scoring ≥ 9 for two consecutive measurements are considered fit for discharged home	

Conclusion

When deciding on ambulatory surgery, it is important to select the type of surgery only after evaluating the patient's overall condition, including past and family history. The choice of anesthesia technique according to the patient's condition and type of surgery is an important factor affecting recovery and discharge. Postoperative complications, such as pain, nausea, and vomiting are common. They can delay recovery and the possibility of readmission is high if they are present. A multimodal and prophylactic approach to prevent postoperative complications should be planned to enable early discharge and return to daily life. Active cooperation among the patient, the patient's family, nurses, surgeons, and medical staff, including anesthesiologists, is required.

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บทคัดย่อ

การระงับความรู้สึกสำหรับการผ่าตัดแบบผู้ป่วยนอก

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การผ่าตัดแบบผู้ป่วยนอก (Ambulatory surgery) เป็นที่แพร่หลายและเพิ่มจำนวนมากขึ้นทั่วโลกในปัจจุบัน เนื่องจากลดระยะเวลาในการพักฟื้นในโรงพยาบาลของผู้ป่วย และในบางหัตถการอาจทำเป็นการผ่าตัดสำหรับผู้ป่วยนอกได้ อย่างไรก็ดี การเลือกผู้ป่วยสำหรับเข้ารับการผ่าตัดแบบผู้ป่วยนอก ตลอดจนการดูแลผู้ป่วยก่อนผ่าตัด (preoperative assessment) ระหว่าง และหลังผ่าตัดอย่างมีประสิทธิภาพจะช่วยให้การผ่าตัดเป็นไปได้อย่างราบรื่น ผู้ป่วยปลอดภัย กลับบ้านได้เร็ว และสร้างความพึงพอใจให้แก่ผู้ป่วย การเลือกการระงับความรู้สึกไม่ว่าจะเป็นการดมยาสลบหรือการระงับความรู้สึกเฉพาะส่วนนั้น ขึ้นอยู่กับชนิดของการผ่าตัดและสภาวะของผู้ป่วยรวมถึงความต้องการของผู้ป่วยเป็นหลัก อย่างไรก็ดี การดมยาสลบเป็นวิธีที่นิยมกันในการผ่าตัดแบบผู้ป่วยนอก เนื่องจากผู้ป่วยสามารถกลับบ้านได้เร็ว ซึ่งภาวะแทรกซ้อนหลังจากการดมยาสลบ เช่น การที่ผู้ป่วยได้รับการดูแลเรื่องความปวดได้ไม่เพียงพอ มีภาวะคลื่นไส้อาเจียนหลังผ่าตัด ปัสสาวะไม่ออก ไม่ผายลม หรือเวียนศีรษะ อาจทำให้ผู้ป่วยต้องพักฟื้นในโรงพยาบาลนานขึ้นหรืออาจจะต้องเข้ารับการรักษาตัวในโรงพยาบาล (hospital admission) โดยสรุปแล้ว การคัดเลือกผู้ป่วยและเตรียมผู้ป่วยอย่างเหมาะสมก่อนผ่าตัด การดูแลระหว่างผ่าตัด และการป้องกันภาวะแทรกซ้อนหลังผ่าตัดจะช่วยให้การผ่าตัดแบบผู้ป่วยนอกเป็นไปอย่างราบรื่น และลดการนอนโรงพยาบาลหลังผ่าตัดอย่างไม่จำเป็น

คำสำคัญ: ผู้ป่วยนอก, การระงับความรู้สึก, การเลือกผู้ป่วย, การจัดการให้การระงับความรู้สึก, เกณฑ์การจำหน่ายผู้ป่วยกลับบ้าน