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Obstetric Postanesthesia Care Unit Stays

Reevaluation of Discharge Criteria after Regional Anesthesia

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Background: Obstetric patients may have long postanesthesia care unit (OB-PACU) stays after surgery because of residual regional block or other conditions. This study evaluated whether modified discharge criteria might allow for earlier discharge without compromising patient safety.

Methods: Data were prospectively collected for 6 months for all patients (N = 358) who underwent cesarean section or tubal ligation and recovered in the OB-PACU. Regional anesthesia was used in 94% of patients. The duration of anesthesia and PACU stays, the presence and treatment of events in the PACU, and the regression of neural blockade were recorded. Discharge from the OB-PACU required a 60-min minimum stay, stable vital signs, adequate analgesia, and ability to flex the knees. After completion of prospective data collection, events that kept patients in the PACU after 60 min were reevaluated as to whether patients needed to stay in the PACU for medical reasons. "Needed to stay" events included bleeding, cardiorespiratory problems, sedation, dizziness, and pain. "Safe to leave" conditions included pruritus, nausea, and residual neural blockade. The cumulative duration of OB-PACU stays not clearly justifiable for medical reasons was calculated.

Results: Residual block and spinal opioid side effects ac-

counted for the majority of "unnecessary" stays. Annually, 429 h of PACU time could have been saved using the revised criteria. Complications did not develop subsequently in any patient deemed "safe to leave."

Conclusions: In many obstetric patients, the duration of PACU stays could safely be shortened by continuing observation in a lower-acuity setting. This may result in greater flexibility and more efficient use of nursing personnel. (Key words: Anesthesia; economics; obstetric; productivity.)

FEW data exist describing the time course and recovery characteristics of patients in the obstetric postanesthesia care unit (OB-PACU).^{1,2} In contrast to the surgical PACU (OR-PACU) population, which includes elderly and high-risk patients undergoing a wide spectrum of surgical procedures³⁻⁵, OB-PACU patients are usually healthy young women who have undergone cesarean delivery or tubal ligation. Most patients in the OB-PACU have received general anesthesia,^{4,5} whereas most OR-PACU patients currently receive spinal or epidural anesthesia.⁶ Regional anesthesia is used extensively in obstetric patients because of patient preference and greater safety compared with general anesthesia.⁷ Furthermore, in a study of nonobstetric patients,⁵ fewer patients had an event defined by the authors as a PACU complication after regional than after general anesthesia (13.5 vs. 25%). Despite potential benefits associated with regional anesthesia, patients may remain in the OB-PACU for prolonged periods until their anesthetic block has receded. In the authors' institution, discharge from the OB-PACU requires that vital signs are stable and patients can flex their knees. We hypothesized that earlier discharge from the OB-PACU would be safe for many patients, provided appropriate care and monitoring of resolving neural blockade could be continued in a lower-acuity setting. This potentially could result in more efficient use of nursing personnel, greater patient satisfaction, and, in some settings, cost savings. The goals of this study were to (1) prospectively document the incidence, time-course, and treatment of anesthetic or ob-

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stetric events that kept patients in the OB-PACU after the first hour; (2) evaluate the appropriateness of current discharge criteria relative to information gained in the first goal; (3) suggest redefined discharge criteria, if indicated, to minimize the duration of high-acuity care; and (4) estimate the cost savings that could be realized by redefined discharge criteria.

Methods

Approval for the study was obtained from the Stanford University Human Subjects Committee. Informed consent was not necessary because existing patient records were used and patient identity was not revealed. Data were prospectively collected during a 6-month period for all patients who underwent cesarean section or postpartum tubal ligation and then recovered in the OR-PACU of our labor and delivery suite (4,300 deliveries per yr; cesarean section rate 18–20%).

Patient demographic data, type of anesthesia used, and the duration of anesthesia and PACU stay were documented. Information also was collected regarding the incidence, timing and treatment of complications occurring in the OB-PACU, including pain, dizziness, nausea, vomiting, hypotension, hemorrhage, pruritus, and other significant problems. In addition to monitoring of vital signs using pulse oximetry, conventional noninvasive blood pressure and electrocardiographic monitoring, the nurse documented the presence and treatment of side effects at the end of each 30-min period in the PACU until the patient was discharged. At the same 30-min time intervals, the patient ranked her pain using a 10-point verbal pain scale (VPS, where 0 = no pain and 10 = the worst pain imaginable) and the nurse assessed the degree of mobility of the lower extremities from 0–3 (where 0 = no mobility, 1 = ability to move feet, 2 = ability to flex knees, and 3 = ability to lift hips). The nurse also measured the upper level of sensory blockade at admission to the PACU, after 1 h, and every 30 min until discharge using an alcohol swab progressively moved from a blocked area in a cephalad direction in the anterior axillary line. At the time the study was performed, discharge criteria included a 1-h minimum stay, presence of a normal level of consciousness, stable vital signs (not further defined), adequate analgesia (VPS \leq 3), and ability to flex the knees (mobility score of 2). The time at which the patient fulfilled these discharge criteria and the time at which she was transferred to her room were recorded. The next day, patients were seen

and their charts were reviewed to determine whether any complications (*e.g.*, hemorrhage, hypotension, or persistent neurologic deficit) occurred in the first few hours after discharge from the OB-PACU (nausea, pruritus and pain were not regarded as complications for this purpose). At this visit, patients also ranked satisfaction with anesthesia, pain control, and PACU stay (1–4, where 1 = very dissatisfied and 4 = very satisfied) and rated whether they thought their PACU stay was too short, just right, or too long (scores of 1, 2, or 3, respectively).

Data were recorded and reviewed after the 6-month study period was finished. All events or complications that required patients to stay in the PACU for longer than the minimum 60 min were listed. Before further data analysis, these events were categorized by a focus group of three Stanford obstetric anesthesiologists and three senior perinatal nurse managers who reached a consensus as to whether the presence of the particular condition or complication merited the patient's remaining in the PACU receiving one-to-one care from a registered nurse (RN) for medical reasons, or whether the patient could have safely received less-intensive nursing care elsewhere. Members of this group were unaware of the frequency of any particular complication in the study group. The investigators instructed our focus group to be very conservative in classifying conditions as "needed to stay" versus "safe to leave" the PACU, with the goal of maximizing patient safety. Conditions categorized by this group as "needed to stay" included bleeding, hypotension (systolic blood pressure $<$ 100 mmHg), hypertension (systolic blood pressure $>$ 140 mmHg), tachycardia (heart rate $>$ 100 beats/min) or bradycardia (heart rate $<$ 60 beats/min), tachypnea (respiratory rate $>$ 30 breaths/min), hypoxemia (oxyhemoglobin saturation [Sp_{O_2}] $<$ 95%), sedation, dizziness, severe hyperglycemia (blood glucose $>$ 150 mg/dl), and pain (VPS $>$ 3). Conditions that detained patients in the PACU that the focus group considered "safe to leave" included pruritus, nausea, residual neural blockade, fever, and delays in transportation. The cumulative duration of unnecessary stays according to these revised criteria was calculated by multiplying the number of patients unnecessarily remaining in the PACU at each observation period by 30 min.

An estimate of potential cost savings was computed, assuming that these revised discharge criteria were implemented. The mean charge (as it appears on a patient's hospital bill) for a 1-h stay in our PACU is \$325. Assuming a cost-to-charge ratio of 0.54 (measured in a previous

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Table 1. Mean Times Patients Spent during Anesthesia in the Operating Room and in the PACU

	Spinal (n = 196)	Epidural (n = 140)	General (n = 13)
Time from arrival in PACU to leaving PACU (min)	107 ± 46	92 ± 40*	107 ± 72
Time from anesthesia administration to leaving the PACU (min)	175 ± 49	170 ± 53	173 ± 76

Values are mean ± SD.

* $P < 0.0016$ versus spinal group.

study at Stanford),⁸ the actual cost to the hospital of caring for a patient in the PACU is \$175.50/h ($0.54 \times \325). Previously, we computed that 32% of this PACU cost is variable, meaning that the hospital cost of providing PACU service changes as the amount of time the patient is in the PACU changes, as compared with fixed costs (e.g., for medical records support) that are independent of the duration of PACU stay.⁸ This suggests that for each hour of reduction in PACU stay, as might be realized using the revised discharge criteria, hospital costs may decrease by \$56.20 ($0.32 \times \175.50), which is the variable cost to the hospital of running the OB-PACU. The variable cost per hour for one-to-four nursing care on the ward is approximately \$8.90. Therefore, the potential annual savings from implementing the revised discharge criteria is the number of hours of unnecessary PACU stay per year multiplied by the difference between PACU and ward variable costs (e.g., $\$56.20 - \$8.90 = \$47.30/h$).

Statistical Analyses

Data were analyzed using the SAS system (SAS, Cary, NC). Student's *t* test with the Bonferroni correction for multiple comparisons was used to compare the duration of time patients stayed in the PACU after spinal, epidural, and general anesthesia. $P < 0.016$ was considered statistically significant.

Results

During the study period, 327 patients underwent cesarean section, and 33 underwent postpartum tubal ligation. The mean age of patients was 30 ± 6 yr (SD), with 93% classified as ASA status I or II, 7% as ASA status III, and 0.3% (one patient) as ASA status IV. The study population does not reflect the entire obstetric population because most seriously ill or high-risk patients were transferred directly to the intensive care unit and, therefore, were excluded from the study. The overall cesarean section rate was 19%, with 39% classified as "scheduled," 56% as "urgent," and 5% as "emergencies." Spinal, epi-

dural, and general anesthesia were used in 55%, 39%, and 5% of patients, respectively. One percent of the group received both spinal and epidural block, because of inadequate anesthesia with the initial block. For cesarean section, spinal anesthesia was obtained with 12 mg hyperbaric bupivacaine, 0.75%, with 0.2 mg morphine and 10 μ g fentanyl; epidural anesthesia was obtained with 2% lidocaine with 1/200,000 epinephrine, with 4 mg morphine injected after delivery. Postpartum tubal ligation was performed using spinal lidocaine, unless an epidural catheter was still in place, in which case either 3% chloroprocaine or 2% lidocaine with epinephrine was used.

The times from arrival in the PACU until the patient was ready to leave after different anesthetic techniques are shown in table 1. Although PACU stay in the epidural group was significantly shorter ($P < 0.0016$) in duration than in the other groups, there were no differences among the anesthetic techniques when the times from the start of anesthetic administration in the operating room until PACU discharge were compared (table 1). Although individual patients had delays in discharge because they waited for a physician to discharge them or for their room to be ready, there was no significant difference between the mean actual discharge time and the time at which the patient was deemed "ready for discharge" (102 ± 48 min *vs.* 106 ± 48 min; mean ± SD; not significant).

The percentages of patients discharged and remaining in the PACU at various time intervals up to 210 min are shown in table 2. Patients remaining in the PACU are further classified as to whether they had any condition placing them in the "needed to stay" category, or whether they would have been considered "safe to leave" using the revised criteria developed by our focus group. Patients who remained in the PACU with no reason documented and no event or complication apparent from inspection of medical and nursing records are categorized separately here and designated "no reason stated." The incidences of cardiorespiratory events experienced by patients during each time period after the

Table 2. Percentage of All Patients (n = 360) Who Were Discharged or Who Remained in the PACU at Each Time Interval

	61-90 min	91-120 min	121-150 min	151-210 min
Discharged	13	46	71	90
Remained in PACU*	87	54	29	10
Needed to stay	34	15	10	5
Safe to leave	44	25	13	4
No reason stated	9	14	6	1

* Patients who remained are further categorized as to whether or not they needed to stay for medical reasons (percentages of these categories add up to total percentage of patients who remained in the OB-PACU).

first hour are listed in table 3, and the incidences of noncardiorespiratory events and the need for drug treatment are listed in table 4. At each time interval studied, residual block accounted for the majority (34-47%) of stays that, using the focus group's revised criteria, were considered unnecessary. Pruritus and nausea, probably associated with epidural and spinal opioid administration, were the next most common reasons for unnecessary stays (table 4). Only 26-33% of patients in the PACU in any time period received drug treatment for any reason. Of 11 patients who had prolonged PACU stays ranging from 3-6 h, 3 had severe hypertension (systolic blood pressure > 160 mmHg), 6 experienced significant antepartum or intrapartum hemorrhage, and only 2 appeared to have stayed in the PACU because of prolonged anesthetic block. One patient with a placenta accreta and another with uterine hypotonia were transferred from the PACU to the intensive care unit.

The median mobility scores of patients remaining in the PACU are shown in figure 1, and the percentages of patients in the PACU with two-segment regression of sensory block are shown in figure 2. Although mobility scores of patients in the PACU increased sooner after epidural than after spinal anesthesia, and two-segment regression of block was present in more patients at each time interval after spinal anesthesia than after epidural anesthesia, we did not statistically compare the two regional techniques because we had no comparable data for patients who already had left the PACU. Satisfaction scores of 3 or 4 were given by 98% of women for their anesthesia and their PACU experiences and by 95% of women for their pain control. Ten percent of women thought the duration of their PACU stay was too long, 2% thought that it was too short, and the others were satisfied with its duration.

Assuming that only the patients classified as "Needed to stay" had conditions requiring one-to-one nursing care

from an RN and that all other patients could have been discharged from the PACU using the revised discharge criteria, more than 50% of patients remaining in the PACU at any time could have been discharged (fig. 3). The cumulative number of hours of PACU time that could have been saved during the 6-month study period, had the revised criteria been used, was 212.5 h (i.e., 429 h annually). With the exception of one patient who transiently had tachypnea 91-120 min into her PACU stay (table 4) but who had no other event before or after that necessitated a PACU stay, new events did not develop in any patient after 1 h in the PACU in the absence of another event that would also have necessitated a continuing PACU stay. Except for in this one patient, no complications developed in any patient who would have been discharged using the revised criteria during the remainder of PACU stay or during the first 4 h on the postpartum ward. The potential annual cost savings of implementing the revised criteria were $429 \times \$47.30 = \$20,292$ (number of unnecessary hours of PACU stay \times [PACU variable costs - ward variable costs]).

Discussion

In this observational study, we monitored the duration of OB-PACU stays for obstetric surgical patients and documented events that persisted after a 1-h minimum stay. This time was considered *a priori* as an acceptable minimum because of the need to ensure adequate hemostasis and uterine tone. Among events that persisted after the first hour, we separated those we believed required intensive nursing care from those we believed did not require one-to-one RN care. We used a 1:1 nursing care ratio for all calculations because there is frequently only one patient in the OB-PACU at a time and lower ratios are therefore not possible. Using our revised discharge criteria, we concluded that for many patients duration of PACU stay could safely be shortened by continuing observation of resolving neural blockade and treatment of opioid side effects in a lower-acuity setting, such as the postpartum ward. Decreased need for one-to-one RN care should result in increased productivity and greater flexibility in staffing, with modest direct cost savings because of the difference in nursing salaries necessary to pay for care of the patient on the postpartum ward rather than in the OB-PACU.

Our findings and conclusions are influenced by the protocols we had in place and by the judgment our focus group made as to what complications necessitated one-

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Table 3. Cardiovascular or Respiratory Events Experienced by Patients in the PACU

	61-90 min (n = 315)	91-120 min (n = 195)	121-150 min (n = 104)	151-210 min (n = 38)
Bleeding	3	2	2	2
Hypertension	27	20	10	2
Hypotension	12	5	2	1
Tachycardia	15	12	5	1
Tachypnea	0	2	1	0
Total with cardiorespiratory events	58	43	20	6
(%) of patients in PACU	18	22	19	16

Values are numbers of patients with each event remaining in the PACU during each time period. Patients may have had more than one event.

to-one RN care. Other institutions and caregivers may already use more liberal discharge criteria or might disagree with our classification of who needed to stay in the PACU. Our revised discharge criteria were deliberately conservative, to avoid discharging any patient who required more intensive care. For example, we decided that a pain score of more than 3 merited remaining in the PACU, despite the fact that pain is routinely dealt with by postpartum nurses. Our criterion for hypotension was similarly conservative for obstetric patients recovering from regional block. Also, although heart rates more than 100 beats/min and systolic blood pressure measurements greater than 140 mmHg are frequent in healthy postcesarean patients, occasionally they represent early signs of bleeding or pregnancy-induced hypertension and merit closer observation. Because of our approach, we believe that patients considered safe to leave were unlikely to be at risk as a result of earlier discharge. The

Table 4. Noncardiorespiratory Events Experienced by Patients Remaining in the PACU

	61-90 min (n = 315)	91-120 min (n = 195)	121-150 min (n = 104)	151-180 min (n = 38)
Fever (>38°C)	2 (0.6)	1 (0.5)	0	0
Pain	15 (5)	24 (12)	12 (12)	6 (16)
Sedation	3 (1)	1 (0.5)	1 (1)	0
Nausea/vomiting	13 (4)	18 (9)	5 (5)	0
Pruritus	21 (7)	12 (3)	2 (2)	1 (3)
Prolonged block	110 (35)	91 (47)	35 (34)	16 (42)
Drug treatment given for any reason	83 (26)	52 (27)	35 (34)	25 (36)

Values represent numbers (percentage) of patients in the PACU with each event at each time interval. Patients may have had more than one event.

absence of subsequent complications confirms this approach. It is possible that patients who remained in the PACU with "no reason stated" might have "needed to stay" for medical reasons. However, review of relevant medical records revealed no objective evidence of such conditions.

The stage at which patients are discharged from the PACU after regional block is fairly arbitrary, with few data to confirm any particular minimum stay. In a previous study of patients in the OR-PACU who received spinal anesthesia, Alexander *et al.*⁹ used repeated orthostatic challenges to determine the relationship between sensory and motor block and hemodynamic stability. Their previously used discharge criteria of a sensory level of \leq T10 and return of toe movement did not adequately predict subsequent hemodynamic stability, whereas hemodynamic stability was always maintained when two successive orthostatic challenges 30 min apart caused less than a 10% decrease in mean arterial pressure. These authors concluded, as did we, that patients could have been discharged much sooner from the PACU, with significant savings in PACU time and no adverse effect on patient safety.

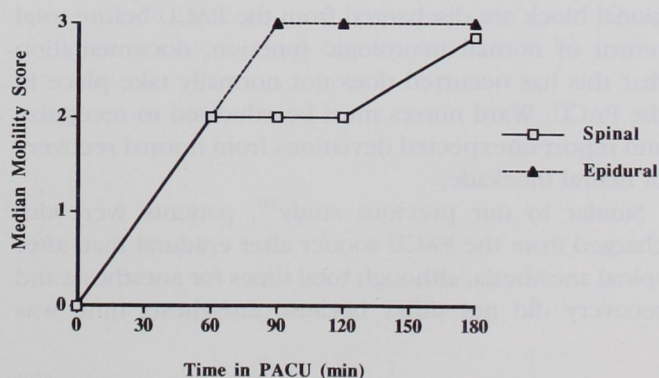


Fig. 1. Median mobility scores of patients remaining in the postanesthesia care unit after receiving epidural or spinal anesthesia.

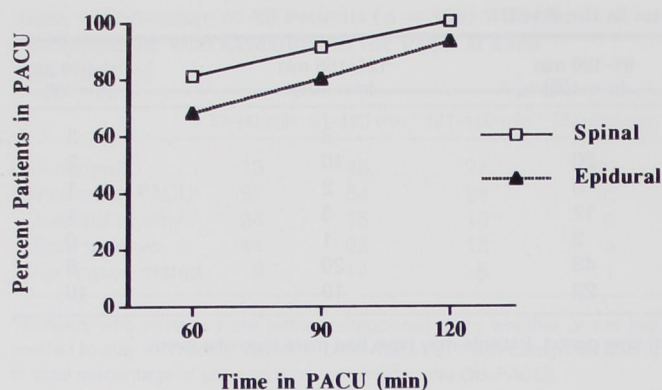


Fig. 2. Percentage of patients (of those remaining in the obstetric postanesthesia care unit) with two-segment regression of sensory block after receiving epidural or spinal anesthesia.

Patients with high blocks clearly may have hypotension and respiratory problems.¹ However, patients with such problems would not have been considered safe to leave the PACU using our revised criteria. Although we did not conduct orthostatic challenges, most women are sitting or reclining at 45° before discharge from the OB-PACU. We believe that, in addition to having stable cardiorespiratory status, it is critical to document that (1) the block has started and is continuing to recede and (2) after an appropriate interval, the sensory and motor block have completely dissipated.^{1,9} In patients in whom there is no regression of sensory block within the expected period of time, careful and continuous observation is necessary to allow timely treatment of conditions such as epidural hematoma or spinal cord ischemia that can result in permanent neurologic sequela. However, after there is evidence that the block is receding and that catastrophic complications have not occurred, there is little benefit to one-to-one nursing care as the block recedes further. Because most patients receiving regional block are discharged from the PACU before total return of normal neurologic function, documentation that this has occurred does not normally take place in the PACU. Ward nurses must be educated to recognize and report unexpected deviations from normal recovery of neural blockade.

Similar to our previous study¹⁰, patients were discharged from the PACU sooner after epidural than after spinal anesthesia, although total times for anesthesia and recovery did not differ because anesthesia time was

longer with epidural block. Prolonged residual block was the most common reason for extending PACU stay after either technique. Implementing our revised criteria should particularly hasten discharge of patients who receive spinal anesthesia, in whom motor block seems to recede more slowly. Mobility score was our primary discharge criterion^{||}, however, it was not an early indicator of receding neural blockade. Because two-segment regression of sensory block occurred early and progressed in a linear fashion (fig. 2), it may be preferable to use for this purpose.

We calculated cost savings using a model in which patients were discharged sooner to the postpartum ward. Alternative models could be constructed with different economic or personnel implications that better suit other institutions. The projected cost savings to our unit are modest but represent more significant savings (not estimated in the current study) because of greater flexibility and more productive use of personnel. In studies of OR-PACU patients, personnel costs account for the majority of PACU costs,^{8,11} and shortening duration of PACU stay does not result in cost savings unless patient census can be maintained throughout the day.¹¹ At Stanford, similar to the majority of obstetric units, there is frequently only one patient present at any time, and OB-PACU care is provided by obstetric nurses who perform this function as part of their routine work.^{2,12} The American Society of Post Anesthesia Nurses standards^{||} require that two licensed nurses, one of whom is an RN, be present whenever a patient is recovering from anesthesia. In the OB-PACU, even having one nurse may mean that additional staff must be called into the

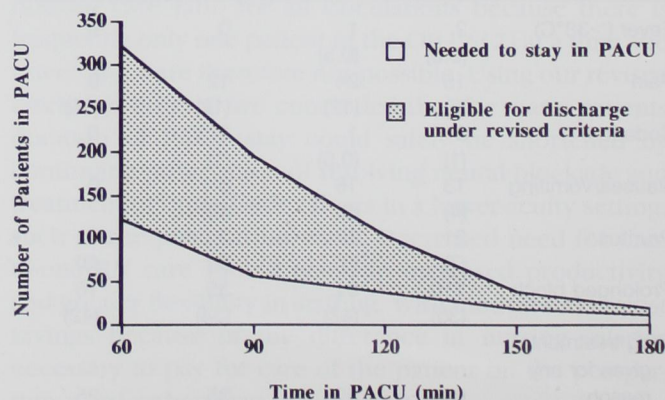


Fig. 3. Number of patients remaining in the obstetric postanesthesia care unit who needed to stay for medical reasons or who would have been eligible to leave using the revised discharge criteria.

|| Standards of Perianesthesia Nursing Practice. American Society of Post Anesthesia Nurses. Thorofare, NJ, 1995.

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hospital to work if patient census increases. In our hospital, decreased duration of OB-PACU stays modestly reduces nursing costs because the OB-PACU is closed and nursing personnel are reassigned to other duties when no surgical patients are present. Also, nurses are frequently sent home and not paid for a complete shift when patient census decreases. Our calculations may have overestimated cost savings on occasions when more than one patient was present in the OB-PACU.

Our recommendations for earlier discharge from the OB-PACU do not conflict with mandates from the American Society of Anesthesiologists (ASA)[#], the Joint Commission for the Accreditation of Healthcare Organizations,^{**} and American Society of Post Anesthesia Nurses that obstetric patients be afforded comparable PACU facilities and nursing care to other patients within the institution. None of these institutions recommends specific discharge criteria for either general or regional anesthesia or states that criteria must be identical for all patients. The obstetric population clearly differs from the general surgical population because of its relatively young age, low ASA status, short surgical times, and high incidence of regional anesthesia. Despite this, few institutions have tailored discharge criteria to fit different populations. We believe that discharge criteria for OB-PACU and OR-

PACU patients should be reevaluated to determine whether earlier discharge can be implemented for healthy patients whose only "complication" is residual regional blockade or other conditions that can be monitored in a lower-acuity setting.

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[#] Standards for Postanesthesia Care, American Society of Anesthesiologists, Chicago, IL, 1992

^{**} The Joint Commission for Accreditation of Healthcare Organizations: Accreditation Manual for Hospitals, 1989. Chicago, SA 1.6.2., p 274