

A Post-Anesthetic Discharge Scoring System for Home Readiness after Ambulatory Surgery

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Study Objective: To evaluate the validity and reliability of an objective scoring system, the Post-Anesthetic Discharge Scoring System (PADSS), which was compared against existing Clinical Discharge Criteria in the ambulatory surgery unit of our hospital.

Design: randomized, open study.

Setting: Ambulatory surgery unit at a university teaching hospital.

Patients: 247 ambulatory surgery patients undergoing general anesthesia.

Interventions: One hour after the operation, the initial assessment using PADSS and the Clinical Discharge Criteria was made by an independent observer. Evaluations were repeated at 30-minute intervals until patients obtained a Post-Anesthetic Discharge Score of at least 9 and fulfilled the Clinical Discharge Criteria.

Measurements and Main Results: There was a close correlation between the end of anesthesia to time patients were fit for discharge using either PADSS or the Clinical Discharge Criteria (Pearson's Correlation Coefficient $r = 0.89$). The internal consistency reliability of PADSS ($\alpha = 0.65$) was superior to that of the Clinical Discharge Criteria ($\alpha = 0.14$).

Conclusions: We have found PADSS to have superior measurement scaling and diagnostic properties.

Keywords: Ambulatory surgery; patient discharge; postoperative complications.

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Received for publication May 31, 1994; revised manuscript accepted for publication February 2, 1995.

Introduction

Ambulatory surgery is becoming more common and not only involves simple and short surgical procedures on healthy patients but the trend is towards longer procedures in infants, geriatric, and debilitated patients.¹ It is predicted that by the end of this decade, 60% of the hospitals' surgical caseload may be performed on an ambulatory basis.² The question of how long patients should remain in hospital following ambulatory surgery before they can be discharged safely is crucial to future developments in this area of care.³

Essential to the quality of patient care is the safe timing of patient discharge, in relation to recovery from general anesthesia, regional, or local

anesthesia with sedation. At the time of discharge from the ambulatory surgery unit, the patients should be home-ready, clinically stable and able to rest at home under the care of a responsible adult. The ability to ambulate, the level of hydration, and the ability to tolerate oral intake are unique to the ambulatory surgical patient.⁴ The time course of recovery can be divided into early recovery, intermediate recovery, and late recovery.⁵ Early recovery is the time interval during which patients emerge from anesthesia, recovering their protective reflexes and motor activity. Intermediate recovery is the period during which coordination and physiologic function normalize and the patient may be considered in a state of "home-readiness" and is able to return home in the company of a responsible person. Later recovery, which can be hours to days, is the period after which the patient has fully recovered and is capable of full psychomotor functioning, including returning to work or driving.

Several discharge criteria have been described but none has been evaluated for their validity and reliability.⁶⁻¹¹ The patient's readiness for discharge needs to be addressed in a simple, clear, reproducible manner. Nursing staff need to be able to evaluate the postoperative course of the patient in a systemic way and meet guidelines to seek physician consultation when necessary.⁶

In this study, we have designed a simple cumulative index, the Post-Anesthetic Discharge Scoring System (PADSS), to measure home-readiness of ambulatory surgery patients. We have evaluated its validity and reliability against the existing clinical discharge criteria in the ambulatory surgery unit of The Toronto Hospital, Toronto Western Division.

Materials and Methods

After obtaining Institutional Human Ethics Committee approval, patients scheduled for ambulatory surgery were selected at random and informed consent was obtained. The study included 247 patients who had received general anesthesia for a variety of operative procedures. After the operation, they were transported to the postanesthesia care unit. The initial assessment using PADSS and the Clinical Discharge Criteria was made by an independent investigator not directly involved in the care of the patient one hour after the operation (*Figure 1*). Subsequently, the evaluation was repeated at 30-minute intervals until the patient obtained a Post-Anesthetic Discharge Score of at least 9 and fulfilled the Clinical Discharge Criteria, respectively. The hospital personnel directly involved in the care of the patients were unaware of the scores obtained, and the decision to discharge the patients was made independently by hospital personnel according to the Clinical Discharge Criteria. The time that the patients were actually discharged from the ambulatory surgery unit was recorded.

To eliminate intraobserver and interobserver bias, another 80 patients scheduled for dilatation and curettage (D&C) were studied. For the elimination of intraobserver bias, two investigators, one using PADSS and the other using Clinical Discharge Criteria, assessed 40 patients at 30-minute intervals. To determine interobserver agreement, two investigators assessed 40 patients separately using both PADSS and the Clinical Discharge Criteria at 30-minute intervals.

PADSS is based on five main criteria: (1) vital signs—

Post Anaesthetic Discharge Scoring System (PADS)

1. Vital Signs

- 2 = Within 20% of preoperative value
- 1 = 20-40% of preoperative value
- 0 = > 40% preoperative value

2. Activity and mental status

- 2 = Oriented x3 AND has a steady gait
- 1 = Oriented x3 OR has a steady gait
- 0 = Neither

3. Pain, nausea and/or vomiting

- 2 = Minimal
- 1 = Moderate, having required treatment
- 0 = Severe, requiring treatment

4. Surgical bleeding

- 2 = Minimal
- 1 = Moderate
- 0 = Severe

5. Intake and output

- 2 = Has had PO fluids AND voided
- 1 = Has had PO fluids OR voided
- 0 = Neither

Total pads score is 10; Score ≥ 9 considered fit for discharge

Clinical Discharge Criteria (CDC)

1. Stable vital signs
2. Patient is alert and oriented
3. Patient is free of nausea and/or vomiting
4. Steady of gait
5. Patient has no significant bleeding

Figure 1. The Post-Anesthetic Discharge Scoring System and the Clinical Discharge Criteria used in our ambulatory surgery unit. PO = oral administration.

Table 1. Demographic Data

	D & C	Arthroscopy, Laparoscopy and minor surgery
No. of patients	151	96
Gender	151 F	43M:53F
Age (yrs)	27 ± 9	38 ± 11
ASA physical status		
I	141	75
II	9	21
III	1	0
Duration of Anesthesia (min) Mean ± SEM	20 ± 7	62 ± 26
End of anesthesia to PADSS (min)	115 (10 to 210)	125 (0 to 385)
End of anesthesia to CDC (min)	120 (10 to 230)	140 (0 to 385)
End of anesthesia to actual discharge (min)	170 (20 to 351)*	220 (60 to 485)*

Note: D & C = dilatation and curettage; PADSS = Post-Anesthetic Discharge Scoring System; CDC = Clinical Discharge Criteria.

End of Anesthesia to PADSS, to CDC, and to actual discharge data are medians (range).

* $p < 0.05$.

and 2) presence of a competent adult to accompany patient home. All patients were interviewed 24 hours postoperatively by telephone with a standardized questionnaire to document the postoperative course of the patient and to detect delayed complications after discharge (*Appendix*).

Statistical Analysis

All data were stored in a computerized database and compared for statistical difference using a nonparamet-

ric test (Mann-Whitney) and the Chi square test. Pearson's Correlation was used to assess the correlation between the times home-readiness was achieved by PADSS and the Clinical Discharge Criteria.

When measurements on distinct items are combined to a single summary score, statistical evidence that the items form a scale, or that the scale is internally cohesive, must be demonstrated.¹² Computation of the internal consistency reliability coefficients (Cronbach's Alpha) was done to assess the internal consistency of the measurement scales in all the data.^{12,13} Cronbach's Alpha increases directly with the number of items in the scale and with the heterogeneity of the individuals measured.¹³ The Cronbach's Alpha is similar to Pearson's Coefficient in that the higher the value, the better the internal consistency. Interobserver agreement was assessed using kappa statistics.¹⁴ The Kappa Coefficient is a measure of interrater agreement beyond what would be expected by chance alone. Kappa is appropriate when the measurement or rating of individuals is on a categorical or ordinal scale. A Kappa of 0 reflects agreement at chance level, while a Kappa of 1.00 reflects perfect agreement beyond chance. A Kappa of greater than 0.75 denotes excellent agreement between the investigators, i.e. the test is highly reliable. A Kappa between 0.4 and 0.75 means good agreement and moderate reliability, and a Kappa less than 0.4 means poor agreement and poor reliability. Data are presented as medians (range) or means ± SEM. A p value less than 0.05 was considered statistically significant.

Results

Two hundred forty-seven patients were entered into the study. The demographic and clinical characteristics of the patients are summarized in *Table 1*. The surgical procedures included 151 D&Cs (61.1%), 58 arthroscopies (23.5%), 20 laparoscopies (8.1%), and other minor surgical procedures (7.3%). The study population was divided into two groups: D&C (mean duration of anesthesia of 20 minutes), and other procedures: arthros-

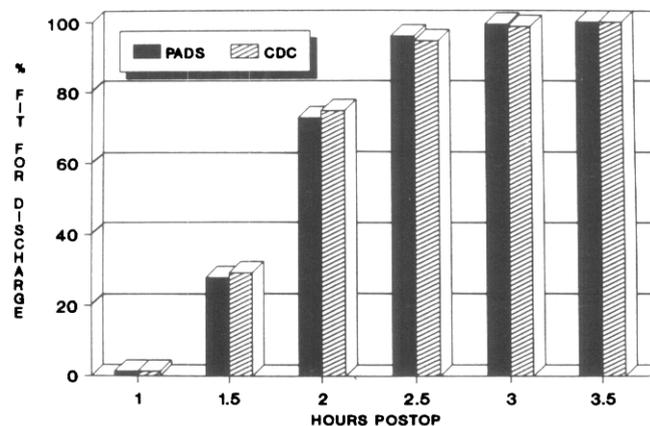


Figure 2. Percentage of dilatation and curettage patients fit for discharge using the Post-Anesthetic Discharge Scoring System and the Clinical Discharge Criteria. Postop = postoperative.

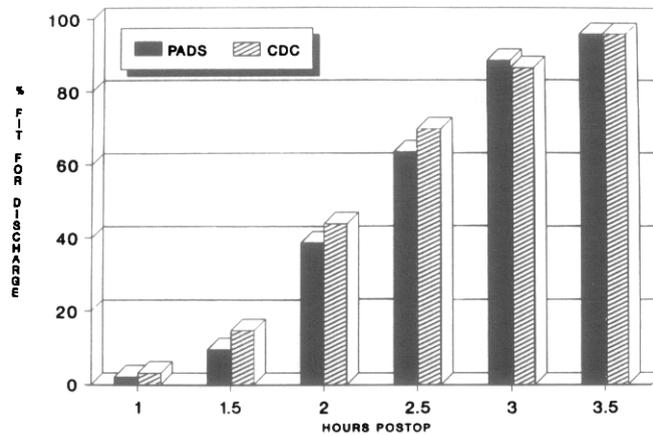


Figure 3. Percentage of patients fit for discharge using the Post-Anesthetic Discharge Scoring System and the Clinical Discharge Criteria after undergoing arthroscopy, laparoscopy or other minor surgical procedures. Postop = postoperative.

copy, laparoscopy, and minor surgeries (mean duration of anesthesia of 62 minutes).

At 2.5 hours postoperatively, 96% of the patients who had D&C could have been discharged using PADSS compared to 94.7% patients using the Clinical Discharge Criteria (NS) (*Figure 2*). Of the patients in the group with longer anesthesia, 88.5% were suitable for discharge 3 hours postoperatively by PADSS compared to 86.5% by the Clinical Discharge Criteria (*Figure 3*).

On an average, patients who had D&C required 115 (10 to 210) minutes postoperatively to achieve a Post-Anesthetic Discharge Score of at least 9 as compared to 120 (10 to 230) minutes needed to satisfactorily fulfill the Clinical Discharge Criteria (NS). Patients who underwent arthroscopy, laparoscopy, or other minor surgeries needed 125 (0 to 385) minutes to be discharged using PADSS versus 140 (0 to 385) minutes needed for satisfactory fulfillment of the Clinical Discharge Criteria (NS).

The actual postoperative discharge time for the D&C patients was 170 (20 to 351) minutes while for the arthroscopy/laparoscopy/minor surgeries group was 220 (60 to 485) minutes. This was significantly longer than the time needed to achieve a Post-Anesthetic Discharge Score or fulfill the Clinical Discharge Criteria (*Table 1*, $p < 0.05$). The time interval was due to patients obtaining home instructions, making follow-up appointments, changing into street clothes, and waiting for their escorts to accompany them home.

There was a close correlation between the discharge time assessed by PADSS or the Clinical Discharge Criteria (Pearson's Correlation Coefficient $r = 0.89$).

The internal consistency reliability coefficients (Cronbach's Alpha) of PADSS reached 0.65 overall for the D&C type surgical group. For the arthroscopy/laparoscopy/minor surgical group, overall internal consistency coefficient reached 0.48 at 150 minutes post surgery. In the group with longer anesthesia, the largest internal consistency reliability coefficient for the Clinical Discharge Criteria was 0.14 at 120 minutes post-

anesthesia while coefficients at all other times were close to 0. The Pearson's Correlation coefficient for the independent observations by two investigators on 40 D&C patients was higher, $r = 0.79$.

The interrater reliability coefficients (Kappa agreement coefficients) of PADSS were high, 0.84 at one hour and 0.80 at 1.5 hours post-surgery respectively. The interrater reliability coefficients of the Clinical Discharge Criteria were 0.87 at one hour and 0.52 at 1.5 hours post-surgery. All Kappa were significant at a p-value less than 0.001 and were substantial according to the Fleiss criteria.¹⁴ Kappa agreement coefficients were similar to Pearson's Correlation in that the higher the value, the better the correlation.

There were no hospital readmissions or significant postoperative complications by postoperative follow-up telephone call.

Discussion

There is a growing need to design a discharge scoring system so that home-readiness of patients can be addressed in a simple, clear, reproducible manner. It is important to replace subjective clinical impressions by assigning numeric values to parameters indicating recovery so that recovery and achievement of home-readiness become more obvious. The development of any scale is a multi-step process, which is aimed at establishing the scale's validity and its reliability. A scale is valid if it measures what it intends to measure, while reliability refers to its tendency to produce consistent results when applied to the same individual by different observers, or by one observer at different times.¹⁵

To determine concurrent validity, we compared the discharge times achieved by PADSS with those achieved by the standard Clinical Discharge Criteria of our hospital. Overall, there was a close correlation in discharge times between the two methods (Pearson's Correlation

Coefficient $r = 0.89$). This finding suggests that PADSS can be used to replace the Clinical Discharge Criteria.

Our results showed that patients stayed longer in hospital than indicated by the Clinical Discharge Criteria or PADSS. If the Clinical Discharge Criteria were strictly followed, patients undergoing D&C and arthroscopy, laparoscopy, and other minor surgical procedures could have been discharged 50 minutes and 80 minutes sooner than actually happened. Delay in discharge may be due to failure to evaluate the patients every 30 minutes and escorts not being immediately available to bring patients home. In addition, it is necessary to change the mind-set and practice habits of physicians and nursing staff to speed up discharge after ambulatory surgery.

A measurement is perceived to be reliable if it yields essentially the same measure. When it is repeatedly taken under similar conditions on an individual or an object, the state of the individual or an object is assumed to be constant. The interrater reliability coefficients of PADSS at 1.0 hour and 1.5 hours post surgery was 0.84 and 0.80, respectively, for the D&C patients. The interrater reliability coefficients of the Clinical Discharge Criteria, on the other hand, was 0.87 at 1 hour and 0.52 at 1.5 hours post surgery for the D&C patients. This finding suggests that PADSS has better interobserver agreement for D&C patients.

The ability to tolerate fluids by mouth before discharge is controversial. Although a patient cannot be discharged when he or she is actively vomiting, the ability to tolerate fluids may not be a necessary criterion for discharge. Schreiner *et al.*¹⁶ found that requiring children to drink before hospital discharge appeared to increase the rate of vomiting and prolonged the duration of hospital stay. Similarly, the requirement for patients to have voided before discharge is not universally adopted in most institutions. We have designed a modified PADSS that has eliminated intake of fluids and has voided as a discharge criterion and we are in the process of verifying its safety.¹⁷

In this study, we used 30-minute testing intervals to evaluate patients. Difference in recovery parameters between PADSS and the Clinical Discharge Criteria might have been missed because of the length of the testing intervals. In addition, more frequent testing intervals probably would result in earlier and shorter discharge times.

To be useful, a scoring system should be practical, simple, easy to remember, and applicable to all postanesthesia situations. Using only the commonly observed physical signs will avoid any added burden to the postanesthesia care personnel. By assigning numerical values to parameters indicating patient recovery, progress, or lack of it becomes more objective and more easily understood. The scoring system that we have designed is a simple way of providing uniform assessment for all patients. It can determine the optimal length of stay in the ambulatory surgery unit so that it is safe for the patient and also may reduce nursing time per patient and increase the efficiency of nursing staff.

Reduction in the length of stay in the ambulatory

surgery unit by the prompt and safe discharge of patients is a cost reduction and labor efficient strategy. Ambulatory surgery in certain procedures is deemed cheaper even when allowing for treatment failures and readmissions.¹⁸ However, discharge of patients should be achieved without compromising the quality of patient care, and the discharge scoring system we developed enabled us to discharge patients safely. We have now discharged 30,000 patients home safely with PADSS. These patients had undergone different types of anesthesia; general anesthesia, monitored anesthesia care and regional anesthesia. The system is used with a combination of clinical judgment and common sense.

In conclusion, practical discharge criteria or a post-Anesthetic discharge scoring system should be implemented in every ambulatory surgery center to ensure safe recovery and discharge after anesthesia. PADSS is simple, practical, and safe. It establishes a routine of repeated reevaluation of home-readiness, and it provides a uniform assessment for all outpatients. Home-readiness of these patients means that these patients are suitable for discharge from the ambulatory surgery unit directly to home. It does not mean street fitness of these patients. For example, patients who have arthroscopy surgery on their knees or lower limb orthopedic surgery, often do not have steady gait. They are sometimes discharged by wheelchairs or crutches. Therefore, steady gait is never achieved in these patients. Sometimes, elderly patients may have disorientation after sedation with cataract surgery.¹⁹ We discharge these patients home with their spouse. In addition, we also make home-care arrangements for these patients. Further studies on adverse outcomes after discharge are warranted.

Acknowledgment

We acknowledge the assistance of Dr. C. Seyone and Dr. N. Mati in collecting the data.

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