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# A postanaesthetic discharge scoring system for home readiness after ambulatory surgery

F F Chung[1], V W S Chan[2], D Ong

[1]Department of Anaesthesia, University of Toronto, Canada; [2]Department of Anesthesia, University of San Francisco, USA

The assessment of a patient's home readiness is an important element in ambulatory surgery. No objective scoring system exists which systematically determines home readiness. A new postanaesthetic discharge scoring system (PADSS) has been designed and evaluated for reliability and validity against the existing clinical discharge criteria (CDC) in the ambulatory surgery unit of the hospital. Two hundred and forty-seven ambulatory surgery patients undergoing general anaesthesia were studied. Overall, there was a close correlation between the end of anaesthesia to the time patients were fit for discharge using either the PADSS or the CDC (Pearson's correlation coefficient $r = 0.89$). The internal consistency reliability of the PADSS ($\alpha = 0.65$) was superior to that of the CDC ($\alpha = 0.14$). The interobserver reliability coefficients of the PADSS at 1.0 and 1.5 h post surgery was also superior to the CDC for the dilatation and curettage patients. We have validated the PADSS against the CDC and found it to have superior measurement scaling and diagnostic properties.

Key words: Ambulatory surgery, patient discharge, postoperative complications

## Introduction

Ambulatory surgery is becoming more common, and does not only involve simple and short surgical procedures on healthy patients: the trend is towards lengthier 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 is crucial to future developments in this area of care[3].

A major concern in the quality of patient care is the safe timing of patient discharge, in relation to recovery from general anaesthesia or conscious sedation. At the time of discharge from the ambulatory surgery unit, the patients should be home ready, meaning that patients are clinically stable and able to rest at home under the care of a responsible adult.

Several discharge criteria have been described but none have been evaluated for their validity and reliability[4–10]. The Aldrete score used for discharging patients from the postanaesthetic care unit cannot be applied to ambulatory surgery patients[11]. The ability to ambulate, the level of hydration and the ability to tolerate oral intake are unique to the ambulatory surgical patient[12]. These factors are not taken into account by the Aldrete scoring system. Though psychomotor impairment may persist hours after a patient has left the unit, this does not mean that the patient cannot be discharged safely[4]. 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[4].

In this study, we have designed a simple cumulative index, the postanaesthetic 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 hospital.

## Materials and methods

After obtaining Institutional Human Ethics Committee approval, patients scheduled for outpatient ambulatory surgery were selected at random and informed consent

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*Correspondence and reprint requests to:* F Chung, Toronto Western Division, The Toronto Hospital, 399 Bathurst Street, Toronto, Ontario, Canada M5T 2S8

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**Table 1.** Postanaesthetic discharge scoring system (PADSS) and the clinical discharge criteria used in our ambulatory surgery unit

*Postanaesthetic discharge scoring system (PADSS)*
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 × 3 AND has a steady gait
   1 = Oriented × 3 OR has a steady gait
   0 = Neither
3. Pain, nausea and/or vomiting
   2 = Minimal
   1 = Moderate
   0 = Severe
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

*Clinical discharge criteria (CDC)*
1. Stable vital signs
2. Patient is alert and oriented
3. Patient is free of nausea and vomiting
4. Steady of gait
5. Patient is not bleeding

Total PADSS score is 10; score ≥9 considered fit for discharge

obtained. Two hundred and forty-seven patients received general anaesthesia and had a variety of operative procedures. After the operation, they were transported to the postanaesthetic care unit. The initial assessment using the PADSS and the CDC was made by an independent investigator not directly involved in the care of the patient 1 h after the operation (Table 1). Subsequently, the evaluation was repeated at 30-min intervals until the patient obtained a postanaesthetic discharge score of at least 9 and until the time the patient fulfilled all clinical discharge criteria, respectively. The scores were not made known to hospital personnel directly involved in the care the patients and the decision to discharge the patients was made independently by hospital personnel according to the CDC. The time that the patients were actually discharged from the ambulatory surgery unit was noted.

To eliminate intraobserver and interobserver bias, another 80 patients for dilatation and curettage were studied. For the elimination of intraobserver bias, two investigators scored 40 patients, one using the PADSS, and the other using the CDC at the same intervals. To determine interobserver agreement, two independent investigators assessed 40 patients separately using both the PADSS and the CDC at the same time intervals.

The PADSS is based on five main criteria:

1. vital signs – blood pressure, heart rate, respiratory rate, and temperature;
2. activity and mental status;
3. pain or nausea/vomiting;
4. surgical bleeding and
5. intake/output.

Qualifications for discharge include: (1) a postoperative discharge score of greater than or equal to 9; and (2) presence of a competent adult to accompany the patient home.

Since each of the three variables (0, 1 and 2) in each category have equal weights in the rating scales, a summated score of 9 or 10 was designed to indicate that the patient is fit for discharge. All patients were interviewed 24 h postoperatively by telephone with a standardized questionnaire to document the postoperative course of the patient and to detect delayed complications after discharge.

The proposed PADSS was validated against the existing clinical discharge guideline in the ambulatory surgery unit by comparing the respective discharge times achieved using the proposed scoring system and the current discharge criteria of the unit.

All data were stored in a computerized database and compared for statistical difference using Student's $t$ tests and $\chi^2$. Pearson's correlation was used to assess the time taken to discharge patients using the PADSS and the CDC.

Computation of Cronbach's alpha was done to assess the internal consistency of the measurement scales in all the data[13,14]. When one combines measurements on distinct items into a single summary score as in the PADSS, statistical evidence that the items form a scale or that the scale is internally cohesive, must be demonstrated[13]. Internal consistency reliability coefficients (Cronbach's alpha) increase directly with the number of items in the scale and with the heterogeneity of the individuals who are measured through the scale[14]. Interobserver agreement was assessed using kappa statistics[15]. 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 1.0 reflects perfect agreement beyond chance. Data are presented as mean ± SEM. A $P$ value of $<0.05$ was considered statistically significant.

## Results

Two hundred and forty-seven patients were entered into the study. The demographic and clinical characteristics of the patients are summarized in Table 2. The surgical procedures included 151 dilatation and curettage (D&C) (61.1%), 58 arthroscopies (23.5%), 20 laparoscopies (8.1%), and other minor surgical procedures (7.3%). For purpose of analysis, the study population was divided into two main surgical groups – D&C and patients undergoing arthroscopy, laparoscopy and minor surgeries.

At 2.5 h postoperatively, 96% of the patients who had

**Table 2.** Demographic data

| | *D&C* | *Arthroscopy, laparoscopy & others* |
|---|---|---|
| No. of patients | 151 | 96 |
| Gender | 151 F | 43M : 53F |
| Age (yr) | 27 ± 9 | 38 ± 11 |
| ASA class | | |
| I | 141 | 75 |
| II | 9 | 21 |
| III | 1 | 0 |
| Duration of anaesthesia (min) | 20 ± 7 | 62 ± 26 |

Mean ± SEM.

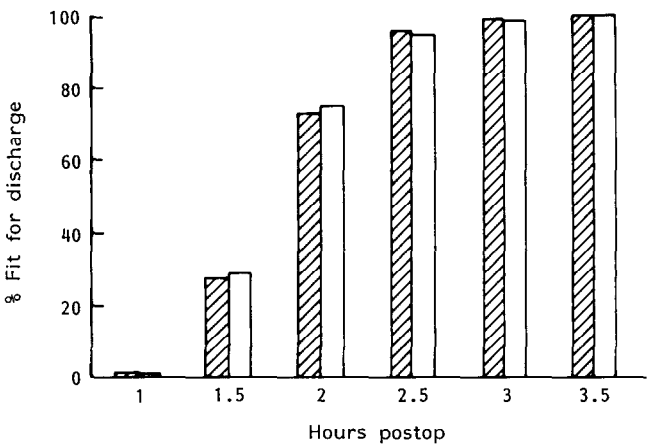


**Figure 1.** Percentage of D&C patients fit for discharge using the PADSS (▨) and the CDC (□).

D&C could have been discharged using the PADSS compared to 94.7% of patients using the CDC (Figure 1). On the other hand, 88.5% of patients who underwent arthroscopy, laparoscopy or other minor surgical procedures were suitable for discharge 3 h postoperatively using the PADSS vs. 86.5% of patients achieving satisfactory clinical discharge criteria (Figure 2).

On average, patients who had D&C required 111 ± 31 min postoperatively to achieve a postanaesthetic discharge score ≥9 as compared to 120 ± 35 min needed to fulfil the clinical discharge criteria satisfactorily ($P<0.001$). Patients who underwent arthrosocopy, laparoscopy or other minor surgeries needed 139 ± 50 min to be discharged using the PADSS vs. 145 ± 53 min needed for satisfactory fulfilment of the CDC ($P<0.001$).

The actual postoperative discharge time for the D&C patients was 177 ± 52 min while for the arthroscopy/laparoscopy/minor surgeries group it was 232 ± 70 min. These results show that patients had stayed significantly longer in the ambulatory surgery unit than the time needed to achieve a safe postanaesthetic discharge score of ≥9 or a satisfactory clinical discharge criteria ($P<0.0001$).

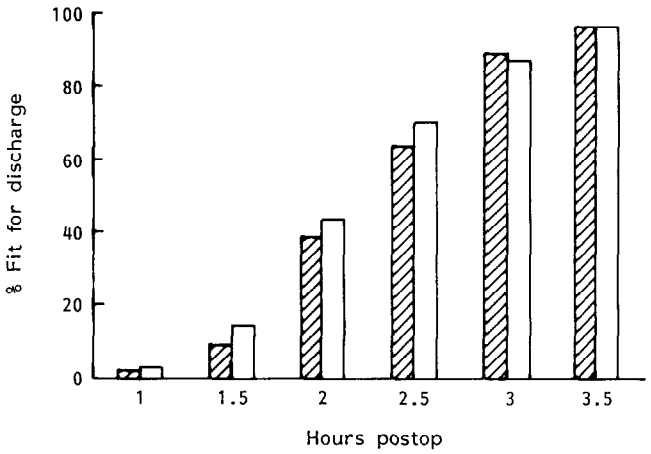


**Figure 2.** Percentage of patients fit for discharge using the PADSS (▨) and the CDC (□) after undergoing arthroscopy, laparoscopy or other minor surgical procedures.

**Table 3.** Times (min)

| | *D&C* | *Arthroscopy, laparoscopy & others* |
|---|---|---|
| End of anaesthesia to PADSS | 111 ± 32 | 139 ± 50 |
| End of anaesthesia to CDC | 120 ± 35 | 145 ± 53 |
| End of anaesthesia to actual discharge | 177 ± 53 | 232 ± 70 |

Note: There are significant differences between and within each surgical group ($P<0.001$) at all levels.

Using the PADSS, patients undergoing D&C and arthroscopy, laparoscopy and other minor surgical procedures could be discharged 66 ± 46 min and 89 ± 65 min earlier, respectively. If the CDC were strictly followed, patients undergoing D&C and arthroscopy, laparoscopy and other minor surgical procedures could be discharged 58 ± 44 and 85 ± 63 min earlier, respectively (Table 3).

Overall, there was a close correlation between the end of anaesthesia to the time patients were fit for discharge using either the PADSS or the CDC (Figure 3) (Pearson's correlation coefficient $r = 0.89$).

The internal consistency reliability coefficients (Cronbach's alpha) of the 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 min post surgery. The largest internal consistency reliability coefficient for the CDC was 0.14 reached at 120 min post surgery for the arthroscopy/laparoscopy/minor surgical group, all other coefficients being close to 0 (Table 4). The Cronbach's alpha is similar to Pearson's coefficient in that the higher the value, the better the internal consistency.

Independent observations were made by two investigators scoring 40 patients, one scoring the PADSS and

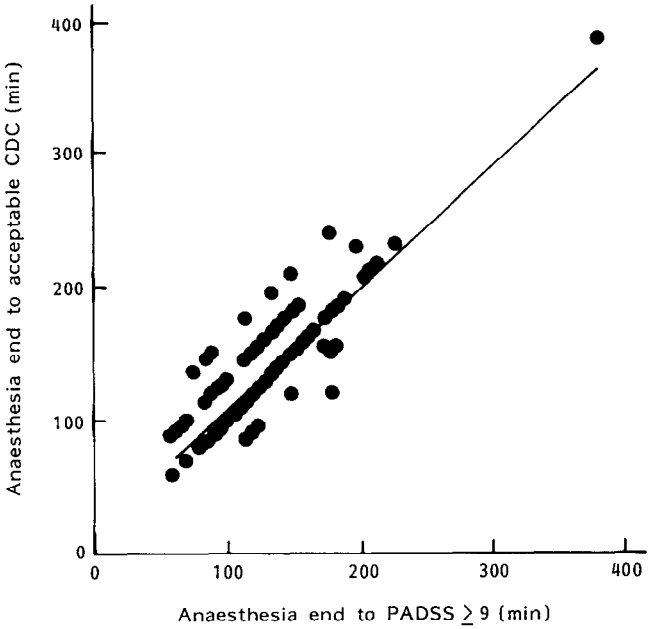


**Figure 3.** Correlation between time from end of anaesthesia to discharge using the PADSS and the CDC (Pearson's correlation coefficient $r = 0.89$).

**Table 4.** Internal consistency reliability coefficient (Cronbach's alpha)

| | *D&C* | *Arthroscopy, laparoscopy & others* |
|---|---|---|
| PADSS | 0.65 | 0.48 |
| CDC | 0.00 | 0.14 |

**Table 5.** Interobserver agreement (kappa agreement coefficient)

| | *1 h postop* | *1.5 h postop* |
|---|---|---|
| PADSS | 0.84 | 0.80 |
| CDC | 0.87 | 0.52 |

$P < 0.001$.

the other the CDC. Pearson's correlation coefficient was high, $r = 0.79$, between the time taken to achieve a discharge score of $\geq 9$ and the time taken to obtain a satisfactory clinical discharge criteria.

The interrater reliability coefficients (kappa agreement coefficients) of the PADSS were high, 0.84 and 0.80, at 1.0 and 1.5 h post surgery respectively. The interrater reliability coefficients of the CDC were 0.87 and 0.52 at 1.0 and 1.5 h post surgery. All kappa were significant at $P < 0.001$ and are substantial according to the Fleiss criteria[15]. Kappa agreement coefficients are 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 phone 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 as the basis for discharging patients with objective observations which are summarized in a single index with the aim of providing simple and consistent ways of assessing home-readiness. The development of any scale is a multistep process, which is aimed at establishing both its 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[16].

To determine concurrent validity, we compared the discharge time using the PADSS with those achieved using the standard CDC followed in the ambulatory surgery unit of our hospital. Overall, there was a close correlation between the end of anaesthesia to the time patients were fit for discharge using either the PADSS or the CDC (Pearson's correlation coefficient $r = 0.89$). Using independent observers, the correlation coefficient was higher between the time taken to achieve a discharge score of $\geq 9$ and the time taken to obtain a satisfactory clinical discharge criteria ($r = 0.79$). We considered these results as empirical evidence for the diagnostic superiority of the PADSS.

Our results showed that patients stayed longer after the CDC or PADSS were satisfied. The reason being that the health care personnel were not evaluating the patients every 30 min or escorts were not immediately available.

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 and the state of the individual or an object is assumed to be constant. For the D&C patients the interrater reliability coefficients of the PADSS at 1.0 h and 1.5 h post surgery was 0.84 and 0.80, respectively, as against 0.87 and 0.52 for the CDC, again suggesting the relative superiority of the PADSS.

For any scoring system to be useful it must be practical, simple, easy to remember, and it should be applicable to all postanaesthesia situations. Using only the commonly observed physical signs will avoid any added burden to the postanaesthesia care personnel. By assigning numerical values to parameters indicating patient recovery, progress or lack of it, 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, and it may have added medicolegal value for assessment of home readiness. It can

determine the optimal length of stay in the ambulatory surgery unit so that it is safe for the patient and also reduce nursing time per patient and increase the efficiency of the 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 labour-efficient strategy. Ambulatory surgery in certain procedures is deemed cheaper even when allowing for treatment failures and readmissions[17]. 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.

We recommend using the Aldrete score to evaluate the initial recovery of the patients. Once the Aldrete score is satisfied, home readiness can be evaluated by PADSS. If the PADSS is satisfied twice at 30-min intervals, the patient can be discharged home. 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.

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