Recovery Pattern and Home-Readiness After Ambulatory Surgery

Frances Chung, MD, FRCPC

Department of Anaesthesia, Toronto Western Division, The Toronto Hospital, Toronto, Ontario, Canada

Despite increased use of ambulatory surgery, few data exist regarding patient recovery patterns and home-readiness. We prospectively identified the pattern of home-readiness, the persistent symptoms after surgery, and the factors that delay discharge after home-readiness criteria are satisfied. Five hundred patients were scored by the same investigator using the Post-anesthetic Discharge Scoring System (PADSS) every 30 min, commencing 30 min after surgery, until the PADSS score was ≥ 9. The same investigator telephoned each patient 24 h after discharge to administer a standardized questionnaire so that postoperative symptoms could be identified. Eighty-two percent of patients were discharged 2 h and 95.6% 3 h after surgery. These patients could have been discharged earlier. After home-readiness criteria were satisfied, some patients had delayed discharge because of the unavailability of immediate escorts or the recurrence of pain. Persistent symptoms delaying discharge occurred in 4.4% of patients. Patients who underwent certain ambulatory surgical procedures, such as laparoscopy or orthopedic and general surgery, had a sixfold increased risk of developing persistent symptoms in the ambulatory surgery unit. The time to home-readiness was 2.5-fold longer and the incidence of 24-h postoperative symptoms, two- to eightfold higher in the group with persistent symptoms in the ambulatory surgery unit. In summary, periodic objective evaluation of home-readiness revealed that the majority of patients would achieve a satisfactory score on or before 2 h after surgery. The time to home-readiness by objective evaluation correlated with the type of surgery. Most delays after satisfactory home-readiness scores were reached were due to nonmedical reasons. Patients with persistent postoperative symptoms in the ambulatory surgery unit correlated with increased 24-h postoperative symptoms.

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Ambulatory surgery is becoming more commonplace. Its increase and the emphasis on its efficiency, are the result of attempts of cost-saving, a shortage of nurses, fewer beds, and its popularity with patients.

Crucial to the future development of ambulatory surgery, however, is the timing of patient discharge (1), which is dependent on the patient's recovery from general anesthesia or monitored anesthesia care. There may be medicolegal implications involved in discharge after ambulatory surgery and anesthesia (2,3). At the time of discharge from the ambulatory surgery unit, patients should be home-ready: they should be clinically stable and able to rest at home under the care of a responsible adult. However, there is very little information and documentation about the recovery pattern and the home-readiness of the ambulatory surgical patient in the medical literature.

This study tested the hypothesis that periodic, objective evaluation of home-readiness would reveal that the majority of patients at the Toronto Western Division Ambulatory Surgery Center would achieve a satisfactory discharge score on or before 2 h after the conclusion of surgery. We also tested the hypotheses that time to home-readiness by an objective evaluation would correlate with the type of surgery, that persistent postoperative symptoms would correlate with complaints at the 24-h followup, and that most delays after satisfactory home-readiness scores were reached were due to nonmedical reasons.

Methods

This study was approved by the institutional human ethics committee. Informed consent was obtained from 500 patients, chosen at random, who were representative of the type of ambulatory surgical procedures at the Toronto Western Division of The Toronto Hospital, Toronto, Ontario. The age, sex, ASA class,

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Address correspondence and reprint requests to Frances Chung, MD, FRCPC, Department of Anaesthesia, Toronto Western Division, The Toronto Hospital, 399 Bathurst St., Toronto, Ontario, Canada M5T 2S8.

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and type of surgery, and anesthesia (general, spinal, or monitored anesthesia care) were recorded for each patient.

After undergoing surgery, patients were transported first to the postanesthesia care unit (PACU). Aldrete scores (Appendix 1) (4) were evaluated every 15 min from the time patients arrived in the PACU until their scores were ≥ 9. They were then discharged to the ambulatory surgery unit.

Using the Postanesthetic Discharge Scoring System (PADSS; Appendix 2) (5), the same investigator scored each patient every 30 min, commencing 30 min after surgery, until the patient's PADSS score was ≥ 9. After the patient obtained the score, the discharge process was begun. It consisted of patients changing into street clothes and being given information about their postoperative surgical care. The time taken to obtain a PADSS score ≥ 9 and the time patients were actually discharged were both recorded. The threshold criterion for delay in discharge was defined as 30 min. The reasons for any delay in discharge more than 30 min after a PADSS score ≥ 9 was obtained were noted. Patients who had a PADSS score ≤ 9 and postoperative symptoms that prevented their discharge within 3 h after anesthesia were classified as having persistent symptoms. The reasons for persistent symptoms delaying discharge from the ambulatory surgery unit were documented.

Using a standardized questionnaire (Appendix 3), the same investigator documented each patient's postoperative course in a follow-up phone call 24 h after discharge to detect any delayed complications. In addition, any patient's readmission to the hospital or emergency visit 2 wk after surgery was documented through The Toronto Hospital's computer system (Ulticare; The Toronto Hospital, Toronto, Ontario).

All data were stored in a computerized database (dBASE III PLUS). Student's *t*-tests and χ^2 were used to analyze the data. Results were expressed as mean ± SD; a P value less than 0.05 was considered significant.

Results

Five hundred patients (81 men, 419 women), mean age 35.6 ± 1 yr (range, 16–85 yr), who underwent ambulatory surgery at the Toronto Western Division of The Toronto Hospital were included in the study. The patients' demographic data, surgical procedures, and duration of anesthesia are summarized in Table 1. The type of anesthetic and the dose is shown in Table 2.

The number of patients who satisfied the PADSS home-readiness criteria at each 30-min interval after surgery is shown in Figure 1. Home-readiness criteria were satisfied in 19% of patients at 60 min, 60% at 90 min, and 82% at 120 min. The majority (95.6%) of patients achieved a PADSS score ≥ 9 within 3 h after anesthesia. Only 4.4% of patients had to stay in the ambulatory unit more than 3 h after anesthesia. The patients undergoing dilation and curettage and cataract procedures achieved PADSS score at 96 ± 33 min and 83 ± 33 min, respectively. Their home-readiness time was significantly different from the patients undergoing laparoscopy (129 ± 38 min) or orthopedic (123 ± 39 min), and general surgical procedures (123 ± 53 min), $P < 0.05$. These findings support the hypothesis that periodic objective evaluation of home-readiness would reveal that the majority of patients in the Toronto Western Ambulatory Surgery Center would achieve a satisfactory discharge score on or before 2 h after the conclusion of surgery. Patients undergoing shorter surgical procedures, such as dilation and curettage or conscious sedation with cataract procedures, were discharged home faster than patients undergoing laparoscopy or orthopedic, or general surgery.

Of the 500 patients studied, 227 (45.4%) were promptly discharged when their PADSS scores were ≥ 9. However, the discharge of the majority (53.8%) of patients was delayed ≥ 30 min after PADSS criteria were satisfied: 252 (50.4%) of 500 patients because their companions were not immediately available. These patients were discharged 109 ± 3 min after their

Table 1. Demographics

	n	Percent
Total patients	500	100
Age (yr)		
Mean	36 ± 1	
Range	16–85	
Gender		
Male	81	16.2
Female	419	83.8
ASA class		
I	405	81.0
II	91	18.0
III	4	0.8
Surgical procedure		
Dilation and curettage	265	53.0
Cataract	57	11.4
Others: laparoscopy, orthopedic, general surgery	178	35.6
Duration of anesthesia (min)		
Dilation and curettage	26 ± 18	
Cataract	61 ± 20	
Laparoscopy	46 ± 19	
Orthopedic surgery	64 ± 18	
General surgery	78 ± 39	
Anesthesia technique		
General anesthesia	438	87.6
Spinal	1	0.2
Monitored anesthesia care	61	12.2

Values are mean ± SD.

Table 2. Anesthetic Drugs and Doses

	Dilation and curettage (n = 265; GA, 264; MAC, 1)		Cataract (n = 57; GA, 3; MAC, 54)		Laparoscopy (n = 58; GA, 58)		Orthopedic (n = 74; GA, 73; MAC, 1)		General surgery (n = 46; GA, 40; MAC, 5; SA, 1)	
Anesthetic technique	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD
Propofol (mg)	240	184 ± 78	16	46 ± 52.5	49	178 ± 54	59	205 ± 88	36	154 ± 75
Thiopental (mg)	24	344 ± 147	1	20	9	209 ± 158	14	371 ± 119	5	355 ± 57
Droperidol (mg)	90	0.65 ± 0.6	10	0.54 ± 0.1	32	0.7 ± 0.8	26	0.7 ± 0.3	14	0.85 ± 0.9
Midazolam (mg)	17	2 ± 3	42	1 ± 0.6	9	2 ± 2.6	10	1 ± 0.8	20	1 ± 0.6
Diazepam (mg)			3	5 ± 2.5						
Fentanyl (μg)	152	58 ± 39	33	56 ± 19	32	65 ± 22	54	91 ± 38	39	83 ± 40
Alfentanyl (μg)	92	541 ± 221	17	568 ± 176	22	768 ± 330	16	777 ± 416	3	1500 ± 866
Succinylcholine (mg)					38	140 ± 50	11	121 ± 38	16	118 ± 29
Atracurium (mg)					4	12 ± 9	1	35	3	10 ± 1.3
Vecuronium (mg)					7	2 ± 1	8	9 ± 1.5	10	6 ± 4

GA = general anesthesia; MAC = monitored anesthesia care; SA = spinal anesthesia.

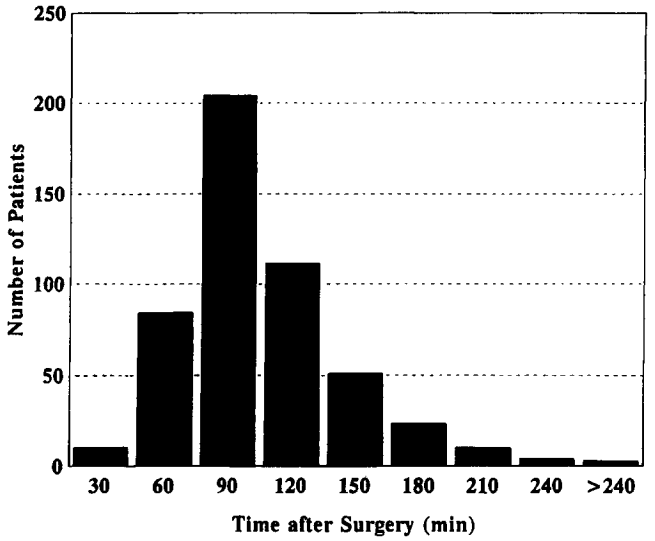

Figure 1. Number of patients who satisfied Postanesthetic Discharge Scoring System home-readiness criteria at each 30-min interval after surgery.

PADSS home-readiness criteria were satisfied. After home-readiness criteria were met, the discharge of 17 patients was delayed (127 ± 16 min) for various other reasons: two patients had to wait for a physiotherapist, three for doctors' specific instructions, and two for RhoGAM injections; while dressing, eight patients had recurrent pain requiring oral medication and one developed syncope; one patient had an asthmatic attack that required treatment before discharge. There was no significant difference between prompt and delayed discharge groups in age, sex, ASA class, type of anesthesia, and type of surgery. Postoperative phone interviews revealed no significant difference in the postoperative symptoms experienced by patients in the prompt and delayed discharge groups. These findings support the hypothesis that most delays after satisfactory home-readiness scores were reached were due to nonmedical reasons.

Twenty-two (4.4%) patients had persistent symptoms and could not achieve a PADSS score ≥ 9 3 h after anesthesia. The persistent symptoms identified are listed in Table 3. These consisted mostly of persistent pain, nausea, vomiting, hypotension, bleeding, unsteady gait, and delayed voiding. Some patients with unsteady gait had dizziness. These symptoms occurred mostly in patients undergoing laparoscopy, orthopedic procedures, and general surgery. Eighteen of the 22 patients were discharged between 3 and 4 h after anesthesia. Four patients had not achieved a PADSS score ≥ 9 4 h after anesthesia. One patient had persistent pain after septorhinoplasty and one after removal of a tibial nail; they were discharged 6 h after anesthesia. One patient who had undergone laparoscopic tubal ligation had persistent vomiting and was admitted to the hospital. One patient discharged herself, in spite of having hypotension after dilation and curettage, against medical advice. No significant differences in age, sex, ASA class, and anesthetic technique were found between the groups with or without persistent symptoms (Table 4).

Development of persistent symptoms in the ambulatory surgical unit delaying discharge was associated with the type of surgery and duration of anesthesia. Patients who underwent surgical procedures other than cataract extraction or dilation and curettage (e.g., laparoscopy, orthopedic and general surgery) had a sixfold (11.3%; $P < 0.05$) increased risk of developing persistent symptoms compared with that of patients who underwent cataract extraction (1.8%) or dilation and curettage (1.2%). The group with persistent symptoms in the ambulatory surgical unit delaying

Table 3. Persistent Symptoms Observed

Symptom	*n*
Persistent pain	5
Pain and nausea	3
Vomiting	4
Hypotension	2
Bleeding	1
Unsteady gait	2
Unsteady gait and delayed voiding	5

Table 4. Demographics of Patients With or Without Persistent Symptoms

	Persistent symptoms	No persistent symptoms
No. of patients	22	478
Age (yr)	32 ± 3	36 ± 1
Gender (M:F)	5:17	76:402
ASA Class		
I	17	388
II	5	86
III	0	4
Surgery		
Dilation and curettage	3 (13.6%)	262 (54.8%)
Eye	1 (4.6%)	56 (11.7%)
Others	18 (81.8%)	160 (33.6%)
Laparoscopy	6	52
Orthopedic	6	68
General surgery	6	40
Anesthesia technique		
General anesthesia	20 (90.9%)	418 (87.5%)
Spinal	0 (0)	1 (0.2%)
Conscious sedation	2 (9.1%)	59 (12.3%)

discharge had significantly longer duration of anesthesia than the group with no persistent symptoms (68 ± 6 min vs 42 ± 1 min, $P < 0.05$). The time to home-readiness, as indicated by the time between the end of anesthesia to attainment of a PADSS score ≥ 9, was significantly longer in the group with persistent symptoms (238 ± 10 min versus 100 ± 1 min, $P < 0.05$).

Four hundred fourteen (83%) patients were successfully interviewed 24 h after surgery. The 17% were lost to followup because of patient refusal or inability to contact patients after surgery. Postoperative symptoms of pain, sore throat, hoarseness, drowsiness, headache, dizziness, fever, nausea, vomiting, and bleeding are summarized in Figure 2. At the 24-h postoperative follow-up phone call, patients with persistent symptoms in the ambulatory surgical unit delaying discharge who were subsequently sent home reported a significantly higher incidence of vomiting, nausea, dizziness, drowsiness, hoarseness, sore throat,

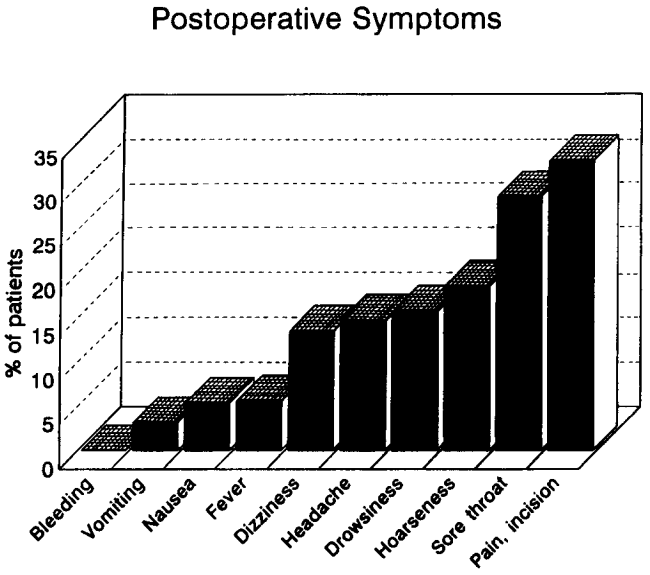

Figure 2. Overall percentage of patients with postoperative symptoms 24 h after surgery.

and incisional pain than patients without persistent symptoms in the ambulatory surgical unit ($P < 0.05$) (Fig. 3). This finding supported the hypothesis that patients with persistent postoperative symptoms in the ambulatory surgery unit correlated with increased 24-h adverse outcomes.

The incidence of unanticipated admission was 1 (0.2%) in 500 patients. This patient was admitted because of persistent nausea and vomiting. Seven (1.4%) of 500 patients were readmitted to hospital 24 h to 2 wk after discharge because of surgical complications: cellulitis after carpal tunnel (one patient), redness and pain after cataract extraction (one patient), swelling after breast biopsy (one patient), recurrent abdominal pain after laparoscopy because of missed abortion (one patient), endometritis (one patient), ectopic pregnancy (one patient), and difficulty breathing after knee arthroscopy (one patient).

Discussion

Ambulatory surgery, as it is now commonly practiced, not only involves simple, short surgical procedures on healthy patients, but also lengthier procedures on geriatric and debilitated patients (6). This prospective study identified the pattern of home-readiness, the persistent symptoms after ambulatory surgery, and the factors that delay discharge after home-readiness criteria were satisfied. We found that some patients had further delay in discharge after home-readiness criteria were satisfied because escorts were not immediately available or because of recurrence of pain.

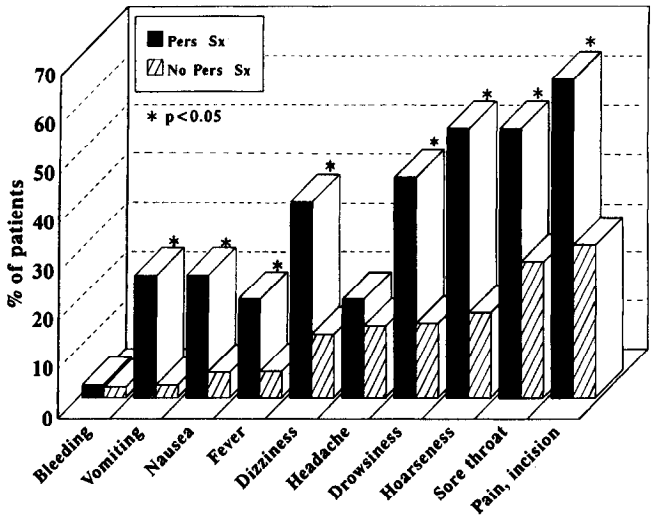

Figure 3. A comparison of postoperative symptoms 24 h after surgery between patients with and without persistent symptoms in the ambulatory surgical unit. Pers Sx = persistent symptoms; No Pers Sx = no persistent symptoms. *$P < 0.05$ compared to No Pers Sx.

Persistent symptoms delaying discharge occurred in 4.4% of patients. Patients who underwent certain ambulatory surgical procedures, such as laparoscopy or orthopedic and general surgery, had a sixfold increased risk of developing persistent symptoms. The time to home-readiness was 2.5-fold longer and the incidence of 24-h postoperative symptoms, two- to eightfold higher in the group with persistent symptoms in the ambulatory surgery unit.

The safe and expeditious conduct of ambulatory surgical care can be achieved by prudent and timely discharge of patients, which can be achieved when an appropriate tool is used to evaluate each patient's readiness. The discharge scoring system we use is simple, practical, and easy to remember. It provides a uniform assessment for all patients, it may have added medicolegal value, and it establishes a routine of repeated reevaluation of home-readiness.

Symptoms may develop or recur after meeting the criteria but before discharge. For example, in this study, after PADSS criteria were satisfied but before discharge, one patient developed syncope while dressing and one patient had an asthmatic attack that required treatment before discharge. It is essential that the use of the scoring system be combined with medical judgment and common sense.

Delayed discharge could be due to several factors: unavailable escort, recurrence of symptoms, and persistent adverse symptoms. When home-readiness criteria were satisfied, 50.4% of patients had delayed discharge because their companions were not immediately available. Some patients had delayed discharge because of recurrent pain. In units with limited space, this can create backlog in the PACU and operating rooms. In addition, if the patient is waiting for his/her escort, nurses have to stay overtime even if the unit is scheduled to close. Ensuring the immediate availability of a companion to accompany patients home and better pain management will ensure a more cost-effective ambulatory surgical unit and avoid any delay in discharge.

Although the duration of stay in the ambulatory surgical unit after surgery may vary with the specific surgical case mix in each unit, the short duration of postoperative stay may reflect the recent advances in anesthesia and surgical care of these patients. In this study, 82% of patients were discharged 1–2 h after their surgery and 95.6% of patients were discharged within 3 h of their surgery; patients undergoing dilation and curettage and cataract procedures were discharged home faster than patients undergoing laparoscopy or orthopedic and general surgical procedures.

Persistent symptoms delaying home-readiness were related to the type of surgery and the duration of anesthesia. Patients who underwent certain surgical procedures, such as laparoscopy or orthopedic and general surgery, had a sixfold increased risk of developing persistent symptoms. Therefore these findings indicated that certain surgical procedures such as laparoscopy are more demanding on the time of the PACU nursing staff.

The incidence of persistent pain, nausea or vomiting, and unsteady gait or dizziness in the ambulatory surgical unit was 1.6%, 1.4%, and 1.4%, respectively. In the group with persistent symptoms in the ambulatory surgical unit, the time to home-readiness was longer and their incidence of postoperative symptoms 24-h after surgery was higher. It is important to note that patients with persistent symptoms in the ambulatory surgical unit continued to have an increased risk of postoperative symptoms 24 h after surgery. Further studies to identify the specific characteristics of patients with persistent symptoms are warranted.

Unexpected hospital admission after ambulatory surgery has been used as an index of ambulatory patient morbidity and complications. The reported incidence of unanticipated hospital admission rates varies between 0.1% and 5% (7,8). The incidence of unanticipated admission in this study was low (0.2%). In a case-control study (9) of 9616 patients undergoing ambulatory surgery, factors associated with an increased likelihood of admission were general anesthesia, abdominal procedures, lengthy procedures, postoperative vomiting, and age. More extensive surgery than anticipated, rather than surgical misadventure, accounted for 63.2% of unanticipated admissions in one study (8). Preexisting medical diseases and perioperative complications accounted for 19.9%; anesthesia-related reasons, such as

persistent nausea and vomiting and prolonged somnolence, 12.7%; and social reasons, 4.7%.

In this study, we had a success rate of 82% in the postoperative telephone interview 24 h after discharge. This response rate may be due to the sensitive nature of some ambulatory surgical procedures, such as dilation and curettage. In addition, the phone interview was done only in the daytime. Some patients might be lost to follow-up phone call because they had returned to work. The 24-h postoperative symptoms recorded were mainly pain at the operative site and sore throat. Outpatient postoperative pain management is one area in which anesthesiologists can help reduce adverse outcome and increase patient satisfaction. The high incidence of sore throat (28.6%) was surprising since 70% of these patients were not intubated and did not have an oropharyngeal airway. This issue requires further study. Philip (10) also found 86% of patients reported at least one minor sequela persisting after discharge. Laparoscopy patients experienced significantly more aches, drowsiness, dizziness, sore throat, nausea, and vomiting. The readmission rate in ambulatory surgery is usually low (9). In this study, the readmission rate was 1.4%. The majority of reasons were surgical complications.

In summary, periodic objective evaluation of home-readiness revealed that the majority of patients are ready to go home 1–2 h after the conclusion of anesthesia and surgery. The time to home-readiness by objective evaluation was found to correlate with the type of surgery. Further delay in discharge after home-readiness criteria were met was mostly due to the unavailability of immediate escorts or because of pain. Patients with persistent symptoms in the ambulatory surgical unit had a longer stay in the unit, and had increased 24-h postoperative symptoms. Further studies to identify the special characteristics of patients with persistent symptoms and delayed anesthesia discharge are warranted.

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Appendix 1
Aldrete Scoring System

Activity: Able to move voluntarily or on command	
4 extremities	2
2 extremities	1
0 extremities	0
Respiration	
Able to deep breathe and cough freely	2
Dyspnea, shallow or limited breathing	1
Apneic	0
Circulation	
BP ± 20 mm of preanesthesia level	2
BP ± 20 to 50 mm of preanesthesia level	1
BP ± 50 mm of preanesthesia level	0
Consciousness	
Fully awake	2
Arousable on calling	1
Not responding	0
Color	
Normal	2
Pale, dusky, blotchy	1
Cyanotic	0

BP = blood pressure.

Appendix 2
Postanesthetic Discharge Scoring System (PADSS)

Vital signs	
2	within 20% of preoperative value
1	20%–40% of preoperative value
0	40% of preoperative value
Activity, mental status	
2	Oriented and steady gait
1	Oriented or steady gait
0	Neither
Pain, nausea, vomiting	
2	Minimal
1	Moderate
0	Severe
Surgical bleeding	
2	Minimal
1	Moderate
0	Severe
Intake and output	
2	PO fluids and voided
1	PO fluids or voided
0	Neither

The total score is 10; patients scoring ≥ 9 are considered fit for discharge to home.
PO = *per os*.

Appendix 3
Postoperative Evaluation Phone Call

Date and time of postoperative call	___/___/___	_____
Problems since discharge:		
Was there any bleeding significant enough for you to return to the hospital or to your doctor?	( ) Yes	( ) No
Do you have a sore throat?	( ) Yes	( ) No
Did you have any hoarseness of voice?	( ) Yes	( ) No
Did you feel you had a temperature?	( ) Yes	( ) No
Did you experience any pain at the operative area?	( ) Yes	( ) No
Did you experience any pain at the injection site?	( ) Yes	( ) No
Did you experience any pain in other areas?	( ) Yes	( ) No
Have you been nauseous or felt that you wanted to vomit?	( ) Yes	( ) No
Did you actually throw up?	( ) Yes	( ) No
Did you experience any headache?	( ) Yes	( ) No
Did you find yourself very sleepy or difficult to wake-up?	( ) Yes	( ) No
Did you feel faint, or lightheaded?	( ) Yes	( ) No
Do you feel any form of generalized discomfort, or weakness?	( ) Yes	( ) No
Do you have any other complaints? _____		
What medications did you take? _____		
On a scale of 1 to 10, 1 being no activity and 10 being back to your normal activities, where would you rate yourself? (Score 0–10)* _____		
Did you have to go back to the emergency room or the hospital?	( ) Yes	( ) No
Did you have to call you doctor since discharge?	( ) Yes	( ) No
Reason: _____		
Do you wish to make any additional comments? _____		