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Delayed discharge and acceptability of ambulatory surgery in adult outpatients receiving general anesthesia

Gotaro Shirakami[1,2], Yuriko Teratani[1], Tsunehisa Namba[2], Hideo Hirakata[2], Misako Tazuke-Nishimura[1,2], and Kazuhiko Fukuda[2]

[1]Day Surgery Unit, Kyoto University Hospital, 54 Shogoin-kawahara-cho, Sakyo-ku, Kyoto 606-8507, Japan
[2]Department of Anesthesia, Kyoto University Hospital, Kyoto, Japan

Abstract
Purpose. Delay in discharge after ambulatory surgery impairs its cost-effectiveness. However, it is not self-evident that prolonged postoperative stay is associated with low quality of care and patient acceptability of ambulatory surgery. The aims of this study were to document factors affecting delay in discharge, recovery profiles, and patient acceptability in adult outpatients.
Methods. Perioperative data were collected prospectively on consecutive 726 adult same-day surgical patients receiving general anesthesia. Factors that affected home-readiness, discharge, and unanticipated admission were noted. Patients were followed up 24 h after discharge using a standardized questionnaire to identify postdischarge symptoms, patient's self-rated resumption of normal activity (RNA) level, and preference of outpatient procedure.
Results. Eighty-two percent of patients were discharged home <270 min after operation, 16% were delayed (≥270 min), and 2% required unanticipated admission. Delayed patients reported postdischarge pain more frequently (53%) and a lower 24-h postoperative RNA level (7.2 ± 1.8) and preference ratio (76%) than no-delay patients (34%, 8.0 ± 1.9, 87%, respectively; $P < 0.001$). Delay in home-readiness (≥165 min) was mainly due to an adverse symptom, and delay in discharge after reaching home-readiness (≥150 min) was mainly due to a persistent symptom (58%) or a social/system problem (34%). Causes of admission were perioperative complications (80%) or social reasons (20%).
Conclusion. Delays in discharge are mainly due to adverse symptoms or social/system problems. Delayed discharge is associated with increased postdischarge pain, lower RNA level, and patient acceptability. Appropriate care of postoperative symptoms and system management could prevent delay in discharge and improve patient RNA level and acceptability.

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Key words Ambulatory anesthesia · Delayed discharge · Unanticipated admission · Postoperative complication · Patient acceptability

Introduction

One of the most significant changes in health care practice over the past two decades is the dramatic shift from impatient to outpatient surgical care in many industrialized nations [1–3]. Recent remarkable advances in anesthetic and surgical techniques have allowed the growth of ambulatory surgery. Increasing cost in the healthcare system is the critically important factor in increasing the number of ambulatory surgeries. Besides cost savings, ambulatory surgery has many advantages such as reduction of hospital infections, drug use, and preoperative testing, thinning of waiting lists, increasing available beds for other pathologies, decreasing patient's disability days, and improving patient's convenience and preference as compared with inpatient surgery [2,3].

In ambulatory surgery, to discharge patients safely at an appropriate time is essentially important [3]. There was no universal definition of an appropriate length of postoperative stay or minimal mandatory stay after ambulatory surgery [3,4]. From the aspect of health care economy, prolonged postoperative stay or unanticipated hospital admission after ambulatory surgery increases cost and impairs its efficiency [3,5]. Therefore, it is of interest to identify the reasons that may lead to prolonged discharge time, or the length of time from the end of surgery until a patient is discharged home. Discharge time and the rate of unanticipated admissions are commonly used as a measure of efficacy and an indicator of outcome in ambulatory surgery [6–10].

Previous studies have suggested that the factors for increasing discharge time and unanticipated admission

rate are postoperative adverse symptoms, cardiovascular events, type of surgery, and duration of surgery [3,6–19]. Although common side effects after ambulatory surgery such as pain, nausea, vomiting, dizziness, drowsiness, and fatigue may impair patient acceptability of ambulatory surgery, it is not necessarily self-evident that prolongation of discharge time is associated with a patient's unwillingness to receive a surgery at outpatient settings. Patients who are urged to return home too early would have a poor impression of ambulatory surgery and may not accept a procedure at an outpatient setting.

In Japan, ambulatory surgery is becoming popular but is not accepted widely yet at present. The aims of this study were to document factors that may affect delay in discharge and to verify patient's recovery profile and acceptability of same-day surgery associated with delayed discharge in adult patients receiving general anesthesia in our Day Surgery Unit (DSU). Our intention was to improve outpatient care and organizational management system of our DSU through prevention of delay in discharge.

Methods

We studied all consecutive adult patients who were scheduled to receive a same-day surgery under general anesthesia between January 2000 and April 2004 in our DSU (n = 726, male 167, female 559; age 15–84 years). Data were prospectively collected with the approval of our institutional ethics committee, and a written informed consent was obtained from each patient preoperatively. Preoperative consultation with an attending anesthesiologist was arranged at the preoperative evaluation clinic in DSU several days before the operation. Patients were selected on a basis of ambulatory surgery features [2,20]. Patients who were less than 15 years old, scheduled overnight stay, or refused the procedures on outpatient settings, or patients for whom the anesthesiologist concluded that hospitalization was necessary, were excluded from the study. Patients were informed regarding their perioperative course, recovery, discharge, and postoperative recovery at home by both the anesthesiologist and a trained nurse in the clinic.

All patients were admitted to DSU in the morning on the day of surgery after a fast of 2 h or more. Patients received no sedative drugs unless they wanted to have them. An intravenous line was placed at the preoperative preparation area in DSU if suitable. The general anesthesia methods were dependent on the attending anesthesiologist. Local infiltration anesthesia and nonsteroidal antiinflammatory drugs (NSAIDs) were encouraged for use for intraoperative and postoperative analgesia [2,21]. There is no definite protocol for prophylaxis of postoperative nausea and vomiting (PONV). Antiemetic drugs were administered at the discretion of the anesthesiologist. Intraoperative use of opioids was restricted to minimum (fentanyl $\leq$100 μg or pentazocine $\leq$15 mg), if possible, to decrease the incidence of PONV [2,21,22]. Data pertaining to patient characteristics [age, sex, physical status classification of American Society of Anesthesiologists (ASA PS), body weight and height, and medical history], anesthetic technique including drugs and patient monitoring, perioperative complications, type of surgery, and duration of surgery and anesthesia were recorded.

After undergoing surgery, patients were transported first to the postanesthesia care unit (PACU) and then to the stepdown recovery area (SRA) in DSU. Trained nursing staff recorded routinely vital signs and scores of the modified Aldrete scoring system [23] and the modified postanesthesia discharge scoring system (mPADSS) [2,24] every 15–30 min in PACU and SRA. They also documented adverse events including pain and PONV, drugs administered, and discharge location. The times taken to obtain modified Aldrete's score $\geq$9 and mPADSS score $\geq$9 and the times at which patients drank fluids, ate light meals, walked, voided, and were actually discharged from the DSU were recorded.

Home-readiness was defined as obtaining a mPADSS score $\geq$9. After the patient satisfied the mPADSS home-readiness criteria, the discharge process was begun. In addition to a mPADSS score $\geq$9, the discharge criteria consisted of patients having stable vital signs for at least 60 min and being oriented to person, place, and time, changing into street clothes, being given verbal and written instructions including contact phone number for the patients, being provided postdischarge prescriptions, having an appointment for follow-up consultation at the surgeon's clinic, and having a responsible adult who escorted the patient home and provided care at home [2,3,24,25]. Moreover, the criteria required assessment by a surgeon, an anesthesiologist, and a nurse in charge and their approval of discharge. Although the discharge criteria did not include being able to drink fluids and to void, patients were encouraged but not forced to do so before discharge. If the patient underwent inguinal, perirectal, gynecological, or urological surgery or if the patient had a history of urinary retention or prostate hypertrophy, voiding before discharge was required.

The patients who did not satisfy the discharge criteria were transferred to an extended recovery area in the inpatient ward from DSU. The decision to admit the patient was made by both the surgeon and the anesthesiologist in charge. The primary reason for unanticipated admission was classified into one of four groups and recorded: surgical reasons (such as pain, bleeding,

Appendix 1. Questionnaire for 24-h postoperative evaluation

After you got home did you have any of the following problems?

- Did you find yourself very sleepy or difficult to wake up? Yes/No
- Did you feel faint, or lightheaded? Yes/No
- Did you feel any form of generalized discomfort or weakness? Yes/No
- Did you feel you had a temperature? Yes/No
- Did you sleep well last night? Yes/No
- Was there any significant bleeding at operative site? 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 headache? Yes/No
- Did you experience muscle ache? Yes/No
- Did you experience any pain in other areas? Yes/No
- Did you take a painkiller? Yes/No
- Did you have a sore throat? Yes/No
- Did you have any hoarseness? Yes/No
- Have you been nauseous or felt that you wanted to vomit? Yes/No
- Did you actually throw up? Yes/No
- Did you take a medicine for nausea or vomiting? Yes/No
- Did you have a poor appetite? Yes/No
- Did you actually eat? Yes/No
- Did you have much thirst? Yes/No
- Did you have any trouble with urination? Yes/No
- Did you have any other complaints?
  Problem(s):
- Did you take a medicine except painkiller or antinausea drugs?
  Medicine(s):
- On a scale of 0 to 10, 0 being no activity and 10 being back to your normal daily activities, where would you rate yourself?
  Score (0–10):
- Did you call any doctor since discharge? Yes/No
  Did you go back to the emergency room or the hospital? Yes/No
  Reason(s):
- If you should receive the same operation in future, which would you choose: outpatient or inpatient setting? Outpatient/Inpatient
  Reason:
- Do you wish to make any additional comments? Yes/No
  Comment(s):

misadventure, and more extensive surgery), medical reasons (e.g., preexisting disease and various complications), anesthesia reasons (e.g., PONV, dizziness, somnolence, and aspiration), and social reasons (e.g., patient request, surgeon request, and no available escort) [9,10,12,13]. When an attending nurse regarded the postoperative course as unusually prolonged, the reason was recorded.

After discharge from DSU, a trained nurse or an anesthesiologist followed up each patient in a telephone call or by meeting the patient directly on the day after surgery using a standardized questionnaire (Appendix 1). Patients were asked about postdischarge complications including PONV and pain, score (0–10) of resumption of normal activities (RNA) level, and preference of outpatient procedure if needed again in future.

Discharge time was defined as the length of time from entry into PACU until the patient was actually discharged home. Because there is no clear definition of delay in discharge, discharge time $\geq$ mean + 1SD was arbitrarily regarded as delayed. Patients who were discharged home were classified into three groups according to the length of discharge time: No-Delay (discharge time $<$ mean + 1SD), S-Delay (discharge time $\geq$ mean + 1SD, $<$ mean + 2SD), and L-Delay (discharge time $\geq$ mean + 2SD). In patients who needed unplanned hospital admission (Admission group), the length of time elapsed from PACU admission to transfer to inpatient ward was regarded as discharge time.

Aldrete $\geq$9 time, home-readiness time, drinking time, ambulation time, and voiding time were defined as the length of time from PACU admission until the patient obtained a modified Aldrete's score $\geq$9 and a mPADSS score $\geq$9, drank fluid, walked, and voided, respectively. The length of time from obtaining a mPADSS score $\geq$9 (home-readiness) to being actually

discharged home was defined as discharge-waiting time. In the Admission group the length of time from obtaining a mPADSS score ≥9 to transfer to inpatient ward was regarded as discharge-waiting time. Home-readiness time ≥ mean + 1SD min and discharge-waiting time ≥ mean + 1SD min were arbitrarily regarded as prolonged home-readiness and discharge-waiting, respectively.

The recorded data were reviewed systematically the next day by both an experienced anesthesiologist (G.S.) and chief nurse (Y.T.). Values are expressed as mean ± SD. Statistical analyses for four groups were performed using the Kruskal–Wallis test followed by Wilcoxon's rank sum test based on joint ranking for detection of significant differences among groups. Statistical analyses for two groups were performed using the Mann–Whitney U test. Differences at $P < 0.05$ were considered statistically significant.

Results

Of the 726 patients, 2% required unanticipated admission. The others were discharged home on the day of surgery, and their discharge time was 75–447 (214 ± 57) min (Fig. 1). The discharged-home patients were arbitrarily grouped into three groups: No-Delay (discharge time 75–268 min), S-Delay (270–325 min), and L-Delay (330–477 min).

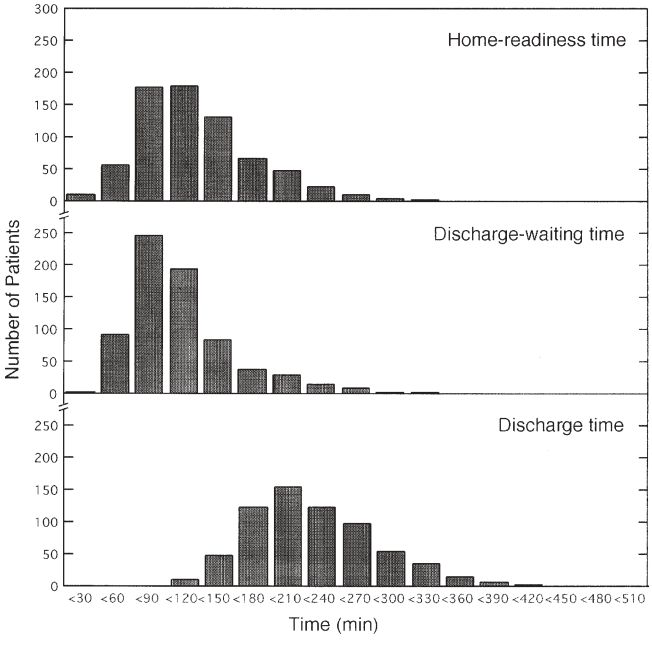

Fig. 1. Distribution of home-readiness time, discharge-waiting time, and discharge time at each 30-min interval in discharged-home patients (total $n = 711$)

There were no significant differences among the four groups in age, body weight, body mass index, ratios of ASA PS I and II, and amount of intraoperative bleeding (Table 1). The ratio of ASA PS III patients was higher in Admission than in other groups. Patients in S-Delay were more often male persons and taller than those in No-Delay. Surgical specialty was different among groups. Fewer patients received gynecological surgery in the delayed (S- and L-Delay) groups than in No-Delay. More patients in Admission received general surgery. Durations of surgery and anesthesia in No-Delay were shorter than those in other groups. In airway management, fewer patients were intubated and more managed by face mask in No-Delay. More delayed patients were induced anesthesia with propofol. Anesthesia maintenance drugs were not considerably different among groups. More of the delayed patients received opioids, NSAIDs, and local anesthesia than in No-Delay.

Modified Aldrete's score at PACU admission was higher and Aldrete ≥9 time was shorter in No-Delay (Table 2). Score of mPADSS at PACU admission was not different among groups. A larger percent of patients consumed analgesic drugs in the delayed than in No-Delay during PACU/SRA stay. The incidence of PONV was higher in L-Delay. There was no difference in antiemetic drug use among groups. Drinking, ambulation, and voiding times were shorter in No-Delay. In Admission, four patients could not walk and three could not obtain a mPADSS score ≥9 in PACU/SRA.

Home-readiness and discharge-waiting times were 114 ± 51 (14–315) and 100 ± 47 (20–305) min, respectively, in the discharged-home patients (see Fig. 1). Home-readiness and discharge-waiting times were longer in the delayed than in No-Delay (see Table 2). Home-readiness time ≥165 (165–315) min and discharge-waiting time ≥147 (150–305) min were regarded as prolonged. More patients revealed prolonged home-readiness and discharge-waiting in the delayed than in No-Delay. Discharge (transfer to inpatient ward) time in Admission was longer than No-Delay but shorter than those in the delayed.

The major reasons for hospitalization, prolonged home-readiness, and discharge-waiting are summarized in Tables 3 and 4. The causes of hospitalization were adverse events or symptoms (80%) or social reasons (20%). Almost all reasons for prolonged home-readiness were adverse symptoms. The reasons of prolonged discharge-waiting were adverse symptoms (58%) or social/system problems (34%).

All patients responded to the 24-h postoperative interview (Table 5). More patients reported pain and used analgesic drugs in the delayed than in No-Delay. More patients expressed pain in L-Delay than in S-Delay.

Table 1. Patient demographics, surgery, and anesthesia

Group	No-Delay	S-Delay	L-Delay	Admission	*P*
Discharge home time (min)	75–268	270–325	330–477	—	—
Number	592	94	25	15	—
Age (years)	44 ± 15	42 ± 16	42 ± 18	52 ± 19	0.108
Male sex (%)	20	34*	40	40	0.001
Body weight (kg)	56 ± 10	58 ± 12	58 ± 13	57 ± 6	0.387
Height (cm)	160 ± 8	163 ± 8*	161 ± 9	161 ± 7	0.001
Body mass index (kg/m^2)	22 ± 3	22 ± 4	22 ± 4	22 ± 3	0.864
ASA PS (%)					
PS I (n = 380)	52	55	60	40	0.595
PS II (n = 328)	46	41	40	47	0.816
PS III (n = 18)	2	3	0	13	0.040
Surgical specialty (%)					
Gynecology (n = 398)	61	29*	12*	33	<0.001
Oral (n = 158)	19	35*	40	7	<0.001
General (n = 80)[a]	9	14	16	47*,**	<0.001
Orthopedic (n = 50)	5	16	24	0	<0.001
Other (n = 40)[b]	5	6	8	13	0.490
Duration of surgery (min)	40 ± 34	56 ± 37*	46 ± 17*	57 ± 37*	<0.001
>60 min (%)	22	40*	16	47	<0.001
Duration of anesthesia (min)	74 ± 46	100 ± 44*	91 ± 29*	104 ± 45*	<0.001
Intraoperative bleeding (ml)	3 ± 26	5 ± 25	5 ± 21	15 ± 41	0.165
Airway (%)					
Intubation (n = 208)	25	45*	48*	47	<0.001
LMA (n = 368)	52	43	48	40	0.272
Face mask (n = 142)	22	10*	4*	7*	0.003
Other (n = 4)	1	3	0	7	0.026
Anesthesia induction agent (%)					
Propofol (n = 457)	59	80*	88*	67	<0.001
Sevoflurane (n = 187)	28	16	8	20	0.120
N_2O + sevoflurane (n = 77)	12	4	0	13	0.041
Other (n = 5)	1	0	4	0	0.190
Anesthesia maintenance agent (%)					
Sevoflurane (n = 517)	72	66	76	60	0.440
Propofol (n = 111)	14	26	12	13	0.032
N_2O + sevoflurane (n = 89)	13	6	4	20	0.108
Other (n = 9)	1	2	8	7	0.002
Intraoperative use of					
Opioids	14	27*	24	33	0.002
NSAIDs (%)	64	88*	100*	67	<0.001
Local anesthesia (%)	37	69*	80*	33**,***	<0.001

Mean ± SD

ASA PS, Physical Status Classification of the American Society of Anesthesiologists; LMA, laryngeal mask airway; N_2O, nitrous oxide; NSAIDs, nonsteroidal antiinflammatory drugs

[a] General surgery includes breast, inguinal, anal, vascular, thoracic surgeries

[b] Other includes plastic, dermatological, urological, otorhinolaryngological surgeries

P value by Kruskal–Wallis test; * $P < 0.05$ vs. No-Delay, ** $P < 0.05$ vs. S-Delay, *** $P < 0.05$ vs. L-Delay by Wilcoxon's rank-sum test

More patients in L-Delay reported a fever, PONV, muscle pain, and appetite loss and used antiemetic drugs than No-delay, although fewer reported bleeding ($P < 0.05$ by Mann–Whitney U test). Patient-rated score of RNA level was lower in the delayed than in No-Delay and in L-Delay than in S-Delay. Ratios of preference to outpatient procedure in Admission (53%) and the delayed (76%) were lower than in No-Delay (87%) ($P < 0.001$ by Mann–Whitney U test).

Discussion

In this study, we have confirmed the previous reports demonstrating that delays in discharge are due to adverse symptoms or social/system problems [3,6–19]. In addition, we found that delayed discharge was associated with increased postdischarge pain, lower RNA level, and patient's unwillingness to receive same-day surgery again.

Table 2. Recovery profile at the postanesthesia care unit (PACU) and stepdown recovery area (SRA)

Group	No-Delay ($n = 592$)	S-Delay ($n = 94$)	L-Delay ($n = 25$)	Admission ($n = 15$)	P
Modified Aldrete score at PACU admission	9.5 ± 0.7	9.2 ± 0.8*	9.0 ± 0.7*	8.9 ± 0.9*	<0.001
mPADSS score at PACU admission	7.9 ± 0.4	7.8 ± 0.6	7.8 ± 0.4	7.7 ± 0.6	0.376
PONV (%)	6	11	28	7	<0.001
Use of analgesic drug (%)	24	43*	64*	20***	<0.001
Use of antiemetic drug (%)	3	5	12	7	0.141
Aldrete ≥9 time (min)	5 ± 17	12 ± 29	16 ± 32	28 ± 46	<0.001
Drinking time (min)	100 ± 34	152 ± 54*	159 ± 66*	142 ± 68*	<0.001[a]
No drink (%)	0	0	0	27	<0.001
Ambulation time (min)	104 ± 39	157 ± 64*	194 ± 73*	156 ± 93	<0.001[b]
No walking (%)	0	1[c]	0	27*,**	<0.001
Voiding time (min)	105 ± 44	158 ± 69*	182 ± 90*	125 ± 84**	<0.001[d]
No voiding (%)	2	4	4	27	<0.001
Taking a light meal (%)	56	52	36	13*,**	0.002
Home-readiness time (min)	104 ± 39	156 ± 67*	203 ± 77*,**	147 ± 89*,*,*	<0.001[e]
No mPADSS score ≥9 (%)	0	0	0	20	<0.001
Home-readiness time ≥165 min (%)	7	53*	72*	42*	<0.001[e]
Discharge-waiting time (min)	92 ± 35	137 ± 67*	157 ± 81*	85 ± 61 **,***	<0.001[e]
Discharge waiting time ≥147 min (%)	8	35*	52*	17	<0.001[e]
Home-readiness time ≥165 min and discharge waiting time ≥147 min (%)	0	0	24*	0	<0.001[e]
Discharge time (min)	195 ± 39	293 ± 17*	360 ± 33*	236 ± 92*,**,***	<0.001

Mean ± SD
PACU, postanesthesia care unit; mPADSS, modified post anesthesia scoring system; PONV, postoperative nausea and vomiting
[a] Patients who did not drink fluid were not included in the statistics
[b] Patients who did not walk were not included in the statistics
[c] One patient was not able to walk before operation
[d] Patients who did not void were not included in the statistics
[e] Patients who did not obtain mPADSS score ≥9 were not included in the statistics
P value by Kruskal–Wallis test; * $P < 0.05$ vs. No-Delay, ** $P < 0.05$ vs. S-Delay, *** $P < 0.05$ vs. L-Delay by Wilcoxon's rank-sum test

Table 3. Primary reason for unanticipated admission

Reason	Number of patients ($n = 15$)
Surgical	
Postoperative bleeding (herniorrhaphy 1, hysteroscopy 1)	2
More extensive surgery (hemorroidectomy)	1
Uterine perforation (hysteroscopy)	1
Inadequate preoperative preparation (inadequate cervical dilatation for hysteroscopy)	1
Medical	
Unstable cardiovascular condition	1
Hypoxemia	1
Asthma attack	1
Tracheal bleeding from hemangioma	1
Anesthesia	
PONV	1
Aspiration	1
Somnolence	1
Social	
Patient's request	2
Surgeon's request	1

Table 4. Major reason for prolonged home-readiness and discharge waiting in discharged home patients

Reason	Home-readiness time ≥165 min (n = 112)	Discharge waiting time ≥150 min (n = 96)
Surgical		
Bleeding	4	2
Pain	18	9
Medical		
Unstable cardiovascular condition	0	1
Hypoxia	2	0
Lumbago	1	0
Perspiration	1	0
Abdominal distension	1	0
Fever	0	1
Anesthesia		
Drowsiness[a]	59	38
PONV	13	5
Nasal bleeding after nasal intubation	2	0
Headache	1	0
Social/system		
Waiting for approval of surgeon	0	17
Waiting for approval of anesthesiologist	0	1
Waiting for escort person	0	12
Waiting for discharge medication	0	1
Patient's request	0	1
Surgeon's request	0	1
Not clear	10	7

[a] Drowsiness, sleepiness, dizziness, and general malaise were grouped together, because it was often difficult to distinguish one from another clearly

Table 5. Postoperative interview 24 h after operation

Group	No-Delay (n = 592)	S-Delay (n = 94)	L-Delay (n = 25)	Admission (n = 15)	P
Symptoms after discharge (%)					
Sleepiness	32	32	30	23	0.923
Dizziness	11	10	22	8	0.394
General malaise	24	34	30	31	0.189
Fever	11	17	30	15	0.009
Sleeplessness	15	26	20	36	0.017
Bleeding	32	29	8	33	0.085
Pain	34	47*	76*,**	40	<0.001
Headache	15	15	20	27	0.579
Muscle pain	6	6	17	0	0.114
Sore throat	47	45	64	51	0.341
Hoarseness	9	13	4	20	0.215
PONV	6	5	16	0	0.133
Appetite loss	8	14	24	14	0.027
Thirst	25	29	44	30	0.305
Urinary disturbance	1	1	0	7	0.323
Medication after discharge (%)					
Analgesics	30	51*	56*	20	<0.001
Antiemetics	1	1	8	7	0.011
RNA[a] score at interview	8.0 ± 1.9	7.5 ± 1.8*	6.3 ± 1.7*,**	7.3 ± 2.4	<0.001
Preference[b] (%)	87	78	68	53*	<0.001

[a] RNA, resumption of normal activity (see Appendix 1); score 0, no activity; 10, back to normal activity
[b] Preference to outpatient-basis procedure (see Appendix 1); the ratio of positive answers to all (positive, negative and no) answers
P value by Kruskal–Wallis test
* $P < 0.05$ vs. No-Delay, ** $P < 0.05$ vs. S-Delay, by Wilcoxon's rank-sum test

Our patients stayed ≥75 min postoperatively in DSU, partially because our discharge criteria require a stable vital sign for ≥60 min. We arbitrarily defined discharge time ≥270 min (mean + 1SD) as delay in discharge because discharge time ≥ mean + 1SD was apparently unusual (13% of our patients) and ≥ mean + 2SD obviously extraordinary (3%). Chung regarded delay in discharge as stay ≥30 min after a PADSS score ≥9 was obtained (54% of her patients) [17]; Pavlin et al., stay ≥50 min in phase 1 recovery (72% or 59% of their patients) or ≥70 min in phase 2 recovery (63% or 66%) [6,18]; and Junger et al., postoperative stay >180 min (81%) [8]. According to their definitions, the majority of their patients and all or most of our patients were classified as "delayed." We used SD because our intention was to identify definite delayed patients to improve our DSU system.

Delayed patients in our study had longer durations of surgery and anesthesia and underwent gynecological surgery less often and oral, general, or orthopedic surgery more often than nondelayed patients. Previous reports demonstrated that duration and type of surgery are important factors determining the length of stay [3,6,7–10,17,18], which is consistent with our study. Our delayed patients used more intraoperative and postoperative analgesics and reported more frequent postdischarge pain. In addition, they had a higher incidence of PONV. These results confirm the previous reports demonstrating that longer stay is associated with procedures with higher incidence of excessive pain and PONV [3,7].

We documented reasons of unanticipated admission, delay in home-readiness (obtaining a mPADSS score ≥9), and delay in discharge after home-readiness criteria were satisfied separately, because different factors were involved. Two percent of our patients required unanticipated admission, which compares well with results from the former studies (0.3%–10% including other types of anesthesia) [9–15]. Reported risk factors related to unanticipated admissions are type of surgery, duration of surgery >60 min, PONV, ASA PS >1, and patients who live >1-h drive from the facility [9–15], which are similar to ours. The most common reasons for hospitalization are surgery-related problems (40%–80%) in previous reports [9–15], which is almost consistent with our study (33%). Because admission for a surgical or medical reason (47% in our study) is apparently unavoidable, preoperative evaluation is important. As admission due to an anesthesia-related problem (20% in our study) may be potentially avoidable, better anesthesia management could decrease it. As admission for social reasons (20% in our study) is avoidable, better preoperative screening and education of patients, family, and surgeons can significantly reduce it. In our study, discharge (transferring to an inpatient ward) and discharge-waiting times were shorter in the admission patients than in the delayed because of early decision of hospitalization.

Delay in home-readiness was influenced mostly by drowsiness (53%), pain (16%), and PONV (12%) in our study. Pavlin et al. reported that common causes of delay in phase 1 recovery were pain (30%), PONV (30%), and drowsiness (15%) [18]. Chung reported that pain, PONV, hypotension, bleeding, unsteady gait with dizziness, and delayed voiding were the reasons for a PADSS (her PADSS included drinking and voiding) score <9 180 min after anesthesia [17]. Adequate prevention and better management of postoperative symptoms would decrease the incidence of delay in home-readiness.

Social/system problems are involved in prolonged discharge-waiting. Pavlin et al. reported that system factors mainly contributed to phase 2 delays (51% for lack of immediate availability of an escort, 20% for shortage of nursing staff looking after the patient, and 17% for unprepared discharge medication) [6]. Chung demonstrated that delays were mostly due to lack of immediate availability of an escort for the patient (94%) [17]. In our study, the reasons for delay were similar to their study, but contribution of social/system factor was lower (34%), partially because our definition of delay was less stringent and nursing efficiency was not a consideration. Because social/system reasons are avoidable, efforts to improve system-factor delays, especially obtaining timely discharge instruction and permission from surgeons/physicians and a prompt available escort, should be done. Better education of personnel involved with the postoperative phase (surgeons, anesthesiologists, nursing staff, family, and escort persons) and implementation of clinical pathways may decrease discharge-waiting time. In our study, 40% of patients with prolonged discharge-waiting had drowsiness after mPADSS home-readiness criteria were satisfied, which is inconsistent with Chung's report [17]. A dizzy patient who can walk with assistance can have a mPADSS score of 9 [2,24]. These kinds of patients may be immature in home-readiness, even if they have a score of 9, and may not want to return home soon.

We had a success rate of 100% in the 24-h postoperative interview, which is much better than the previous reports (52% or 83%) [17,26]. Most of our patients (88%) reported at least one postdischarge symptom, which is consistent with the previous report (85%) [27]. The most frequent postdischarge symptoms were sore throat (47%) and pain at operative site (37%). The high incidence of sore throat is noteworthy because 71% of patients were not intubated, and for 51%, a laryngeal mask airway (LMA) was placed in our study. The incidence in our patients with LMA was 58%, which is higher than that which appeared in previous reports

(6%–34%) [28]. Further investigation of this issue is needed.

This study may be criticized because it was performed in a single university institution during a long study period of 52 months. It was an observational study and not controlled strictly in patient selection and perioperative management including anesthesia technique. Therefore, our results could not draw definitive conclusions about the relationship between cause and effect and be applicable directly to other institutions. However, our study provides basic information contributing to improvement of patient care and the DSU system. To our knowledge this is the first report to describe patient recovery profiles and discharge after same-day surgery in a sizable Japanese population. In our study, 85% of patients would choose same-day surgery again, suggesting that the procedures at outpatient settings are no less acceptable under difficult situations for ambulatory surgery in Japan. Since 85% was low compared with 97% reported by Philip, although response rate in her study was only 41% [27], there may be much room for improvement in our DSU.

In summary, our study demonstrates that delay in home-readiness is mostly due to side-effect symptoms of general anesthesia, prolonged discharge-waiting is due to persistent symptoms, or waiting for surgeons/physicians or escort persons, and that delayed discharge is associated with increased postdischarge pain, lower RNA level, and patient's negative attitude to same-day surgery. Better management, especially in analgesic therapy, would decrease adverse symptoms, accelerate discharge, and improve patient acceptability of outpatient procedure.

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