

Return Hospital Visits and Hospital Readmissions After Ambulatory Surgery

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Objective

To determine the overall and complication-related readmission rates within 30 days after ambulatory surgery at a major ambulatory surgical center.

Summary Background Data

Currently in North America, 65% of the surgical procedures are carried out in ambulatory settings. The safety of ambulatory surgery is well documented, with low rates of adverse events during or immediately after surgery. The consequences of ambulatory surgery during an extended period, however, have not been studied extensively.

Methods

Preoperative, intraoperative, and postoperative data were collected on 17,638 consecutive patients undergoing ambulatory surgery at a major ambulatory surgical center in Toronto, Ontario. With the use of the database of the Ontario Ministry of Health, the authors identified all return hospital visits and hospital readmissions occurring in Ontario within 30 days after the ambulatory surgery. Return visits were categorized as emergency room visits, ambulatory surgical unit admissions, or inpatient admissions. The readmissions were categorized

as those resulting from surgical, medical, or anesthesia-related complications or those not related to the ambulatory surgery.

Results

One hundred ninety-three readmissions occurred within 30 days after ambulatory surgery (readmission rate 1.1%). Six patients returned to the emergency room, 178 patients were readmitted to the ambulatory surgical unit, and 9 patients were readmitted as inpatients. Twenty-five readmissions were the result of surgical complications, and one resulted from a medical complication (pulmonary embolism). The complication-related readmission rate was 0.15% (1 in 678 procedures). The complication rate was significantly higher among patients undergoing transurethral resection of bladder tumor (5.7%). No anesthesia-related readmissions or deaths were identified.

Conclusions

The rate of complication-related readmissions was extremely low (0.15%). This result further supports the view that ambulatory surgery is a safe practice.

The popularity of ambulatory surgery is continuously increasing because of cost saving and convenience. The low rate of adverse events or complications during the intraoperative or immediate postoperative periods further justifies the rapid growth of ambulatory surgery.^{1–3} Most of the published literature, however, reflects the results of observations during the patients' stay in the ambulatory surgical unit (ASU) or within 48 to 72 hours after discharge.^{2,4–7} To assess the overall safety of ambulatory surgery and its

burden on health care, it is essential to extend the follow-up and observation of ambulatory surgical patients for a longer period, because surgery-related complications might occur more than 48 to 72 hours after surgery.

Only a limited number of published studies include large study populations and focus on ambulatory surgical patients after discharge during an extended observation period. In studies involving large patient populations, Natof¹ reported major complications within 2 weeks, and Warner et al⁸ reported major complications and deaths within 1 month of ambulatory surgery. These studies were outcome surveys primarily based on mail-in questionnaires, phone interviews, and reviews of medical records identifying only major adverse events and deaths. Readmissions were not

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Accepted for publication May 10, 1999.

studied. Twersky et al⁹ reported return hospital visits within 30 days of ambulatory surgery. However, because their study identified return visits occurring only in the same hospital, readmissions may have been missed if patients went to another hospital. Henderson et al,¹⁰ using record linkage, reported emergency readmission rates within 28 days after day surgery; however, they did not determine whether the readmissions were related to the prior ambulatory surgery.¹⁰ There are no available published results on complication-specific readmission rates in a large study population within an extended observation period after ambulatory surgery.

The objective of our study was to determine, by linking a large outpatient database at a major teaching hospital in Toronto to the database of the Ministry of Health in Ontario, how frequently ambulatory surgical patients required medical care in a hospital after their ambulatory surgery as a result of complications. We aimed to identify all hospital visits and admissions within 30 days after ambulatory surgery, whether they occurred in the same hospital or in a different health care facility.

METHODS

A total of 17,638 consecutive ambulatory surgical patients were enrolled into a prospective study during a 3-year period at the Toronto Western Hospital. The hospital's ethics committee approved the study. Because there was no alteration from standard patient care, no written consent was required from the patients.

Preoperative, intraoperative, and postoperative data were collected on each patient, using standardized information sheets. The patients' age, sex, American Society of Anesthesiology (ASA) physical status,¹¹ medical history, type and duration of surgery, type of anesthesia, physiologic variables, and medications given were recorded by the attending anesthesiologists on specifically designed standardized anesthesia records. The occurrence of intraoperative adverse events, such as cardiovascular, respiratory, intubation-related, fluid and metabolic, neurologic, and miscellaneous events, was also recorded on standardized intraoperative event sheets by the anesthesiologists.

The occurrence of postoperative adverse events, such as cardiovascular, respiratory, fluid, renal, metabolic, and neurologic events, excessive pain, bleeding, nausea and vomiting, dizziness, drowsiness, and miscellaneous events, in the postanesthesia care unit and the ASU was recorded on standardized event sheets by trained nursing staff.

Patients were discharged when they achieved a score of 9 or 10 on the Postanesthesia Discharge Scoring System.¹² Patient records and event sheets were systematically reviewed and checked for completeness and consistency on the next day by a research assistant and an experienced anesthesiologist.

After the completion of data entry, hospital visits and admissions within 30 days of the patients' ambulatory sur-

gery were identified by using the Canadian Institute of Health Information inpatient and outpatient databases at the Ontario Ministry of Health. Patients were identified by their unique provincial health identification number. In Canada, the provincial governments are responsible for financing health care, including hospital and physician fees. To qualify for reimbursement for the provided care in Ontario, each patient's hospital visit or admission in the province must be reported to the Ontario Ministry of Health. Therefore, the use of these databases enabled us to identify all hospital visits and admissions of our patients occurring anywhere in Ontario. The information retrieved by the Ministry of Health contained the date of the visit or admission; the date of discharge; whether the patient was discharged alive; the admission category, such as elective, urgent, or emergency; the location and type of health care facility (inpatient or outpatient); the patient's diagnoses, coded according to the International Classification of Diseases, 9th revision; and the procedures completed on the patient during the patient's stay, coded according to the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures.

Based on the diagnoses and procedures in the Canadian Institute of Health Information files and our original patient files, we categorized the return hospital visits and admissions as emergency room (ER) visits, ASU admissions, or inpatient admissions. ER visits were further categorized as visits related to the previous ambulatory surgery (*e.g.*, bleeding, fever, pain, urinary retention) or visits unrelated to the previous ambulatory surgery. ASU and inpatient admissions were categorized as:

- Admissions resulting from surgical (*e.g.*, bleeding, fever), medical (*e.g.*, cardiovascular or pulmonary events), or anesthesia-related complications (*e.g.*, nausea, vomiting) related to the previous ambulatory surgery
- Admissions related to the previous ambulatory surgery but not resulting from complications (*e.g.*, stent removal after ureteral stent insertion)
- Admissions unrelated to the previous ambulatory surgery.

Rates of return hospital visits and admissions (readmission rates) due to complications or due to any reason are reported. Relative risks and 95% confidence intervals were calculated where appropriate. A *p* value <0.05 was considered significant. Because of the small number of events, multivariable analyses to identify independent risk factors for readmissions were not attempted.

RESULTS

Over a 3-year period, 17,638 patients underwent ambulatory surgery at the ASU of the Toronto Western Hospital (Tables 1, 2, and 3). Of those patients, 193 (1.1%) returned to the hospital within 30 days after their ambulatory surgery (Table 4). One hundred eighteen readmissions (61%) oc-

**Table 1. PATIENT CHARACTERISTICS
(n = 17368)**

Age (years)	47 ± 21 (range 11–98)
Sex	
Female	11,826 (67.0%)
Male	5,812 (33.0%)
ASA Status	
I	9,194 (52.1%)
II	7,301 (41.4%)
III	1,143 (6.5%)
Preeexisting Medical Conditions	
Hypertension	2,441 (13.8%)
Angina pectoris	751 (4.3%)
Myocardial infarction	449 (2.5%)
Dysrhythmia	471 (2.7%)
Valvular heart disease	302 (1.7%)
Congestive heart failure	144 (0.8%)
Smoking	2,508 (14.2%)
Asthma	1,003 (5.7%)
Chronic obstructive pulmonary disease	383 (2.2%)
Upper respiratory tract infection	95 (0.5%)
GE reflex	644 (3.7%)
Renal disease	204 (1.2%)
Diabetes mellitus	921 (5.2%)
Thyroid disease	790 (4.5%)
Obesity	2,799 (15.9%)
Arthritis	1,148 (6.5%)
Cerebrovascular accident or transient ischemic attack	234 (1.3%)
Seizure	118 (0.7%)
Peptic ulcer	139 (0.8%)
Hepatitis	138 (0.8%)
Sickle cell trait	92 (0.5%)
Substance abuse	88 (0.5%)
Anemia	46 (0.3%)
HIV-positive	17 (0.1%)

curred in the same hospital and 75 readmissions (39%) occurred at other institutions in the province. Of the 193 readmissions, 26 (13%) occurred as a result of complications (25 surgical and 1 medical), 38 (20%) were related to the previous ambulatory surgery but were not complications, and 129 (67%) were unrelated to the previous ambulatory surgery. Six patients (3%) returned to the ER, 178 (92%) were readmitted to the ASU, and 9 (5%) were readmitted as inpatients.

The complication-related readmission rate was 0.15%, or one complication in 678 procedures. No anesthesia-related complications or deaths were identified. Surgical or medical

Table 2. TYPE OF ANESTHESIA

Type	No. (%)
General anesthesia	10,110 (57.3)
Monitored anesthesia care	6,301 (35.7)
Local	586 (3.3)
Regional	484 (2.7)
Chronic pain block	157 (0.9)

Table 3. TYPE OF SURGERY

	Number (%)
Ophthalmology	6372 (36.1)
Cataract	4700 (26.6)
Strabismus	423 (2.4)
Cornea	423 (2.4)
Trabeculectomy	312 (1.8)
Other	514 (2.9)
Gynecology	5959 (33.8)
D&C	4948 (28.1)
Laparoscopy	740 (4.2)
Hysteroscopy	221 (1.3)
Biopsy/repair	50 (0.3)
Orthopedics	3179 (18.0)
Knee	1898 (10.8)
Shoulder	411 (2.3)
Hand, wrist	263 (1.5)
Ankle	220 (1.2)
Hardware removal	207 (1.2)
Hip and other	92 (0.5)
Elbow	88 (0.5)
Plastic Surgery	633 (3.6)
Hand	343 (1.9)
Skin and other	153 (0.9)
Face	96 (0.5)
Breast augmentation	41 (0.2)
Neurosurgery	484 (2.7)
Carpal tunnel	313 (1.8)
Nerve decompression, repair	171 (1.0)
General Surgery	398 (2.3)
Breast	221 (1.3)
Other	177 (1.0)
Urology	232 (1.3)
Bladder/prostate/kidney	174 (1.0)
Testicle/scrotum	29 (0.2)
Circumcision	29 (0.2)
ENT/Dental	224 (1.3)
ENT	208 (1.2)
Dental	16 (0.1)
Chronic Pain Block	157 (0.9)

complications necessitating readmission followed nine types of surgical procedures (Table 5). Although the observed numbers were small, the surgical complication rate after transurethral resection of bladder tumor (TURBT; 5.7%) was significantly higher than that after other procedures. Complication-related readmissions also occurred after breast augmentation, breast biopsy, cystoscopy, Bartholin's cyst removal, dilatation and curettage for abortion, cornea and cataract surgery, and knee arthroscopy. The calculated rates for these procedures were not statistically different from the 0.15% overall complication-related readmission rate.

Of the 26 patients with return visits due to surgical or medical complications, 23 were treated in the same hospital and 3 at other institutions. Twelve of the 26 patients returned within the first 7 postoperative days. The patients with complications were older on the average (52 ± 20 years) and were more likely to have a higher ASA physical

Table 4. HOSPITAL VISITS AND ADMISSIONS WITHIN 30 DAYS OF AMBULATORY SURGERY

Hospital Visits and Admissions	Same Hospital	Other Institutions
Total	118	75
ER		
Related—surgical Cx	4	0
Not related	0	2
ASU		
Related—surgical Cx	16	2
Related—not Cx	30	7
Not related	62	61
Inpatient		
Related—surgical Cx	3	0
Related—medical Cx	0	1
Related—not Cx	1	0
Not related	2	2

Cx, complication; ER, emergency room; ASU, ambulatory surgical unit.

status (31%, 58%, and 12% of the patients with complications were in ASA class I, II, and III, respectively) than patients without complications.

Four of the 26 patients with complications were seen in the ER (Table 6). Three patients returned on the day after surgery: two because of urinary retention after urologic procedures (TURBT and cystoscopy), both requiring catheter insertion, and one because of pain after cataract surgery, requiring no immediate treatment. One patient returned to the ER 4 days after breast biopsy because of fever and wound dehiscence and was given antibiotics as treatment.

Of the 18 patients readmitted to the ASU because of surgical complications, 11 had undergone ophthalmologic surgery. They were readmitted for repair of iris prolapse, repositioning or exchange of dislocated lens implant after cataract surgery, division of anterior synechiae after corneal graft, or secondary corneal graft for leaking corneal wound after corneal implant (Table 7). Two patients returned for repeated abortion because no fetal tissue was removed at the original procedure, and two patients returned as a result of bleeding after abortion. Two patients returned after TURBT: one for stricture requiring catheter insertion and one for hematuria, which required cystoscopy to identify the source of bleeding. One patient returned because of a deflated breast implant after breast augmentation; the implant was replaced.

Four patients were admitted as inpatients because of complications within 30 days after their ambulatory surgery (Table 8). One patient was admitted as a result of wound infection and fever 3 days after Bartholin's cyst removal; antibiotics were given, and the patient was discharged the next day. Two patients were admitted because of extensive bleeding 6 and 17 days after dilatation and curettage for

abortion; both patients were discharged after 2 days after volume replacement. A 44-year-old patient was admitted because of pulmonary embolism 20 days after knee arthroscopy; the patient was given anticoagulation therapy and discharged after 8 days.

One hundred sixty-seven of the 193 readmissions were not related to complications: 2 were ER visits, 160 were ASU admissions, and 5 were inpatient admissions. The two ER visits were not related to the original surgery and occurred in different hospitals (knee injury and lumbago). Thirty-seven of the non-complication-related ASU readmissions were for additional procedures, which were related to the original procedures but were not complications of them (e.g., ultrasound fragmentation of stone after cystoscopy, stent removal after ureteral stent insertion, knee ligament repair after arthroscopy). The remaining 123 ASU procedures were scheduled elective procedures unrelated to the original ambulatory procedures. Of the five inpatient admissions, one was related to but was not a complication of the previous ambulatory procedure: nephrolithotomy was carried out, requiring a 5-day stay 29 days after the ambulatory cystoscopy. The other inpatient admissions were unrelated to the original ambulatory surgery: two were for repeated pain block for patients with chronic pain; one was for a patient with kidney cancer who had undergone ambulatory cataract removal; and one was a 1-day admission because of syncope, which occurred 23 days after cataract surgery in an 86-year-old patient.

Table 5. PROCEDURE-SPECIFIC RATES OF READMISSION DUE TO COMPLICATIONS

Procedure (no.)	No. of Readmissions for Complications (%)	Relative Risk (95% CI)	p Value
TURBT (53)	3 (5.7)*	43 (13–140)	<0.0001
Breast augmentation (41)	1 (2.4)	17 (0.9–172)	0.06
Bartholin's cyst removal, excision/repair (50)	1 (2.0)	14 (0.9–112)	0.07
Cystoscopy (66)	1 (1.5)	11 (0.7–93)	0.1
Cornea (423)	2 (0.5)	3.4 (0.8–14)	0.1
Breast surgery, general (221)	1 (0.5)	3.2 (0.4–23)	0.3
Cataract (4700)	10 (0.2)	1.7 (0.8–3.8)	0.2
D&C for abortion (4658)	6 (0.1)	0.8 (0.3–2.1)	0.7
Knee surgery (1881)	1 (0.05)	0.3 (0.1–2.5)	0.5

Relative risks are computed as comparison to all other types of procedures.

D&C, dilatation and curettage; TURBT, transurethral resection of bladder tumor.

* Significantly higher than in other procedures.

Table 6. CHARACTERISTICS OF PATIENTS RETURNING TO THE ER WITH COMPLICATIONS

Ambulatory Surgery	Complication and Treatment	Postop. Day	Age (yr)	Sex	ASA
Cataract removal	Pain, referral	1	54	M	2
TURBT	Urinary retention, catheter insertion	1	70	M	2
Cystoscopy	Urinary retention, catheter insertion	1	33	F	2
Breast biopsy	Fever, wound dehiscence, antibiotics given	4	40	F	1

ASA, American Society of Anesthesiology classification; POD, postoperative day at emergency room visit; TURBT, transurethral resection of bladder tumor.

DISCUSSION

We observed extremely low readmission rates after ambulatory surgery: 1.1% of the patients were readmitted, and only 0.15% of the patients were readmitted as a result of complications within 30 days after ambulatory surgery. These rates are lower than previously published rates. Natof¹ reported 106 major complications among 13,433 ambulatory surgical patients, a complication rate of 0.79%, within 2 weeks after their ambulatory surgery. Warner et al⁸ found that 33 of 38,598 patients undergoing ambulatory surgery (*i.e.*, 0.09% of the patients) had major complications or died within 1 month after their ambulatory procedures. Heino et al¹³ reported that 11.7% of their 500 ambulatory surgical patients visited a doctor within 1 month of their surgery, and 4.3% of them had wound problems. None of the above studies, however, reported what percentage of patients needed hospital admission. Henderson et al¹⁰ identified emergency readmission rates of 0% to 2.3% within 28 days after ambulatory surgery. The frequency of readmissions depended on the type of surgery; however, the percentage of readmissions related to the previous ambulatory surgery was not specified. Our study showed that many readmissions were *not* related to the previous ambulatory surgery. Studies including smaller numbers of patients undergoing various surgical procedures also showed various rates (0.9% to 3.6%) of return hospital visits.^{14–16}

Twersky et al⁹ found that 187 return hospital visits (3.0%) occurred among 6243 ambulatory surgical patients within 30 days after their surgery. Eighty-two of those admissions resulted from surgical complications, a complication-related readmission rate of 1.3%. The authors may have underestimated their readmission rate, however, because they studied returns only to the same hospital. Even so, their overall readmission rate was threefold higher and their complication-related readmission rate was ninefold higher than the corresponding rates in our study. These differences between the studies could be explained by regional differences in the quality of surgical care, differences in the surgeons' attitude and judgment in the two regions about whether certain complications could be treated adequately in an office setting, or significant differences in the

patient populations and the types of completed surgical procedures. The major difference in readmission rates between the facilities in these two studies indicates the need for every ambulatory surgical facility to study its own readmission rates due to surgical, medical, and anesthesia-related complications.

The fact that we did not find any deaths is comparable to the previously reported findings. Among the studies cited above, only Warner et al,⁸ who had the largest patient population, reported deaths, and even their reported death rate was very low—4 in 38,598. The occurrence of only one medical complication (pulmonary embolism) in our study is also similar to previously published results.^{8,9} The study by Warner et al asked whether the medical complications were just untimely events or the procedures and anesthetics were contributory. The complications occurred less often than would have been expected in the general population. This may result from the fact that patients scheduled for elective surgical procedures are usually healthier than the general population.

The absence of anesthesia-related readmissions in our patient population is also congruent with previously reported findings. The use of currently available anesthetics and anesthesia techniques results in a very low rate of adverse events, mostly nausea and vomiting. These adverse symptoms generally occur immediately or shortly after the end of the procedure, usually during the patients' stay in the postanesthesia care unit or ASU, and may lead to unantic-

Table 7. COMPLICATIONS REQUIRING READMISSION TO ASU

Complication	Number
Dislocated lens	6
Iris prolapse	3
Bleeding, hematuria	3
No fetal tissue	2
Leaking corneal wound after cornea graft	1
Anterior synechiae after cornea graft	1
Urethral stricture	1
Deflated breast implant	1

Table 8. PATIENTS WITH SURGICAL OR MEDICAL COMPLICATIONS REQUIRING INPATIENT HOSPITAL ADMISSIONS

Ambulatory Surgery	Complication and Treatment	POD	DOS (days)	Age (yr)	Sex	ASA
Bartholin's cyst removal	Fever, wound infection, antibiotics given	3	1	39	F	2
D&C for abortion	Delayed extensive bleed, volume replacement	6	2	33	F	2
D&C for abortion	Delayed extensive bleed, volume replacement	17	2	23	F	1
Knee arthroscopy	Pulmonary embolism, anticoagulation	20	8	44	M	2

ASA, American Society of Anesthesiology classification; D&C, dilatation and curettage; DOS, duration of stay; POD, postoperative day at readmission.

ipated admission.¹⁷ Once these patients are discharged home, anesthesia-related symptoms do not cause readmission.

One type of procedure showed a higher-than-expected rate of hospital visits and readmissions. Of the 53 patients with TURBT, 3 returned to the hospital (5.7%). Twersky et al⁹ showed a similar incidence among their urologic patients. This high return rate may be inherent among urologic patients, because they are at higher risk for multiple complications, such as hematuria, urinary retention, and infection. The relatively high return rate (1 in 41) after breast augmentation is also consistent with other published complication rates. Readmissions after breast augmentation result mainly from implant failure.¹⁸

The low return rate after cataract extraction and other types of eye surgery is also compatible with previously published rates.¹⁹ These procedures are relatively short in duration (<1 hour); they are usually completed under monitored anesthesia care, resulting in a low rate of anesthesia-related symptoms; and they are usually less painful procedures, causing postoperative discomfort for only a limited time.

Compared with a previous report,⁹ we found a surprisingly low readmission rate (0.1%) among patients undergoing dilatation and curettage for abortion. Similarly, the return rate due to infection and bleeding was extremely low among our patients. These differences could be the result of different techniques used by surgeons or a difference in the skills of surgeons.

The use of province-wide databases by the Ontario Ministry of Health ensures that all hospital readmissions were included in our study and makes it highly unlikely that any readmission of our patients was missed. The likelihood that a patient was admitted to a hospital outside Ontario is minimal but not impossible. It is also remarkable that 23 of the 26 complication-related readmissions (88%) occurred in the same hospital as the ambulatory surgery; therefore, using only the same hospital's records may result in only a moderate underestimation of complication-related readmis-

sion rates. However, the magnitude of this underestimation depends largely on the availability of similar surgical facilities in the same region.

In conclusion, our results give further support to the view that ambulatory surgery is a safe practice. We found an extremely low rate (0.15%) of complication-related hospital visits and readmissions within 30 days after ambulatory surgery. Only urologic patients undergoing TURBT had a significantly higher rate of complications (5.7%). The number and variety of surgical procedures performed in an ambulatory setting are continuously increasing; therefore, it is necessary to evaluate readmission rates after discharge for these procedures. These readmission rates may be useful as benchmarks for comparison against outcome reports in other surgical facilities.

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