

Effect of return hospital visits on economics of ambulatory surgery

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This review examines the effect of unanticipated admission, return hospital visits and readmission on the economics of ambulatory surgery. The overall rate of unanticipated admission was approximately 1% and the overall rate of readmission to hospital was approximately 1%. Ambulatory surgery allows total cost savings of 20–50% when compared with inpatient surgery. If 98% of ambulatory surgery patients experience uneventful recovery, the decrease in cost savings caused by unanticipated admission and return hospital visit is very small. Modifications of anesthesia and surgical technique can help to further reduce the incidence of unanticipated admission or readmission to hospital.

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Introduction

Ambulatory surgery has undergone a rapid increase in volume in the past 20 years. In 1986 an estimated 40% [1] of all surgical procedures in North America were being done on an ambulatory basis, compared with an estimated 65% [2] today. It is well documented [3–6] that ambulatory surgery reduces the cost of health care delivery. Various studies have been done which describe factors that contribute to extended medical attention following ambulatory surgery, and hence increase the cost of ambulatory surgery. In a retrospective study of 6000 patients, examining return hospital visits, Twersky *et al.* [7] suggested that visits to the emergency room following ambulatory surgery might increase the costs. This review examines the effect of unanticipated admission and return hospital visits on the cost of ambulatory surgery.

When a patient undergoes ambulatory surgery, four outcomes are possible. The first outcome is an uneventful recovery, when the patient is discharged on the day of surgery and suffers no complications. The second possible outcome is unanticipated admission, in which the patient requires more extensive surgery or develops a complication thus requiring admission to hospital. The third outcome is a return visit to the emergency room following discharge for further management. Fourth is readmission in which the patient is discharged home but returns to the emergency room and is then readmitted to hospital.

Unanticipated hospital admission

Unanticipated hospital admission is the admission of patients booked for ambulatory surgery, but who are admitted because of unforeseen problems such as surgical or anesthesia complications [1,8–12]. Of the six papers in the literature, two were prospective studies [8,10] and four were retrospective studies (Table 1) [1,9,11,12]. Consecutive patients were examined documenting reasons for admission, patient demography, ASA status and surgical speciality. Factors associated with unanticipated admission were also examined. The methods of analysis used varied from case-control design [12] to simple percentage analysis [11]. The numbers of patients studied ranged from 6000 to 90 000. Rates of unanticipated hospital admission stated ranged from 0.28 to 1.42% (Table 1) [1,8–12].

Causes of unanticipated admission

Causes of unanticipated admission can be due to surgery, anesthesia, medical and social reasons. The

most common surgical causes were pain, bleeding, surgical misadventure (e.g. perforated viscus, pneumothorax) and more extensive surgery. Anesthetic related complications included postoperative nausea and vomiting, somnolence, laryngospasm and syncope. Medical complications caused admission in those with pre-existing conditions such as diabetes, ischemic heart disease, and sleep apnea. A significant proportion of patients had no adult to escort them home and look after them for the first postoperative night. These patients were admitted for social reasons.

Surgically related admissions were significantly more than anesthesia related admissions, being two to six times more frequent (Table 2). Surgery related causes may be bleeding, pain and more extensive surgery (Table 3). Bleeding was the most common cause of surgery related unanticipated admission, being responsible for 26% in some studies [11]. Most cases involved minor bleeding, requiring conservative management only. Vaghadia *et al.* [13] examined the frequency of unanticipated readmission due to surgical bleeding after ambulatory surgery. In the retrospective review of 172 000 procedures the readmission rate was 0.04%, with gynecological and urological surgery accounting for the majority of the bleeding.

Pain accounted for 24.8% of unanticipated admissions [9], and was the leading cause of unanticipated admission in some studies. Direct surgical complications such as perforated viscus, pneumothorax and failed laparoscopy accounted for up to 27% of unanticipated

admissions (Table 3) [1]. More extensive surgery accounted for 21% of admissions in one study [1].

Anesthesia related causes may include nausea and vomiting, somnolence and aspiration. Nausea and vomiting, somnolence and aspiration were the most frequently cited causes. Nausea and vomiting was the most common reason for unanticipated readmission. One study had an 18.5% incidence of nausea and vomiting [12]. Nausea and vomiting is most strongly influenced by the type of surgery, for example, laparoscopic surgery. Volatile agents used in general anesthesia, anticholinergics such as neostigmine and opiates, are known causes of nausea and vomiting [14]. Somnolence varied from 0 to 5% [8,11]; it occurred in patients who had general anesthetics and in those oversedated during local anesthesia [1,8,10–12].

Aspiration was featured in most of the studies. Often ICU admission was required. Other anesthesia related causes of unanticipated admission were dizziness, hypotension, pseudocholinesterase abnormality, bronchospasm, laryngospasm, syncope and malignant hyperthermia susceptibility [8,10,11].

Medical reasons accounted for 0–20.1% of unanticipated admissions [9,11]. Despite the fact that patients with multiple co-morbid conditions are now presenting for ambulatory surgery and that these pre-existing conditions are predictive of perioperative adverse events [15], medical conditions are not significant predictors of unanticipated admission. Social reasons accounted for

Table 1. Summary of papers reviewed for unanticipated admission

Authors	No. studied	Period of study	Type of study	Unanticipated admission (%)
Fortier <i>et al.</i> (1998) [10]	15172	32 months	Prospective	1.42
Osborne and Rudkin (1993) [8]	6000	3.5 years	Prospective	1.34
Gold <i>et al.</i> (1989) [12]	9616	2 years	Retrospective	1.04
Biswas and Leary (1992) [1]	18321	6 years	Retrospective	1.2
Greenburg <i>et al.</i> (1996) [9]	15132	3 years	Retrospective	0.85
Francourt-Smith <i>et al.</i> (1990) [11]	90234	10 years	Retrospective	0.28
Weighted overall % ^a				0.65

^aWeighted overall % = (%₁ × n₁ + %₂ × n₂ + . . .)/(n₁ + n₂ + . . .).

Table 2. Categories of unanticipated admission (%)

Authors	Surgery	Anesthesia	Medical	Social
Fortier <i>et al.</i> (1998) [10]	38.1	25.1	17.2	19.5
Osborne and Rudkin (1993) [8]	70	9.8	6.1	8.6
Gold <i>et al.</i> (1989) [12]	62	29	6	0
Biswas and Leary (1992) [1]	49.3	8.8	9.3	5.7
Greenburg <i>et al.</i> (1996) [9]	58.1	17	20.1	0
Francourt-Smith <i>et al.</i> (1990) [11]	79	31	0	4.8
Weighted overall % ^a	58.4	21	9.4	7.4

^aWeighted overall % = (%₁ × n₁ + %₂ × n₂ + . . .)/(n₁ + n₂ + . . .).

Table 3. Causes of unanticipated admission (%)

Authors	Bleeding	Pain	Other direct surgical complication	More extensive surgery	Somnolence	Aspiration	Nausea/vomiting	Urinary retention	Cardiac/pulmonary	Fever/infection/antibiotics	Social admissions
Fortier <i>et al.</i> (1998) [10]	7.4	12.1	6	3.3	2.3	1.86	14.4	ND	6.5	ND	19.5
Osborne and Rudkin (1993) [8]	23.4	11.1	27	18.6	4.9	1.2	ND	ND	ND	ND	8.6
Gold <i>et al.</i> (1989) [12]	18	18	7	6	3	3	17	5	9	ND	ND
Biswas and Leary (1992) [1]	13.3	7.1	7.5	21.5	3.5	0.4	2.6	0.8	ND	4.8	5.7
Greenburg <i>et al.</i> (1996) [9]	14.7	24.4	ND	13.9	ND	ND	11.6	4.6	20.9	ND	ND
Francourt-Smith <i>et al.</i> (1990) [11]	26	8.8	17.6	9.6	ND	2.4	0.08	ND	21	ND	4.8
Weighted overall % ^a	16.7	12.2	10.3	11.8	1.9	1.5	6.8	1.3	10.2	N/A	7.4

^aWeighted overall % = (%₁ × n₁ + %₂ × n₂ + ...)/(n₁ + n₂ + ...).

ND, no data.

0–19.5% of unanticipated admissions [10,12]. Adequate patient education will help to reduce unanticipated admissions due to social reasons such as no escort or unavailable escort.

Significant predictors of unanticipated admission

Independent predictors of unanticipated admission were general anesthesia, emesis, abdominal surgery, operating time of over 1 h and age [12]. Multiple medical disease, obesity, sex, intraoperative narcotics were not found to be predictive in this study. Preoperative predictive factors were ASA 2 and 3 and the male sex [10]. Intraoperative factors were surgical specialities, for example ENT and urology, surgery ending after 3 pm and anesthesia of more than 1 h duration [10]. Urology was twice as likely as orthopedics and plastics to cause unanticipated admission. Postoperative factors causing unanticipated admission were bleeding, pain, drowsiness, nausea/vomiting and dizziness [10].

Return hospital visit and readmission

The return hospital visit is defined as a visit to the emergency room or ambulatory surgery unit within 30 days of surgery. Hospital readmission is defined as an ambulatory surgery patient requiring inpatient admission following discharge from an ambulatory surgery unit due to complications.

Mezei and Chung [2] prospectively studied 17 638 patients examining emergency room visits, ambulatory surgical unit admissions and inpatient admissions following ambulatory surgery. The incidence was 0.15%. Of the 26 patients requiring further attention, 15% were treated in the emergency room and 85% were admitted. Twersky *et al.* [7] examined 6243 patients over a 12-month period. Their incidence of return visits and readmission was 1.3%. Fifty-four percent were treated in the emergency room and 46% required admission. There

were no anesthesia related causes in both studies (Table 4). Mezei and Chung [2], however, noted one medical cause for readmission. This was due to pulmonary embolism within 30 days of ambulatory surgery. The average length of stay for readmitted patients in this study was 2.7 days.

Causes of return hospital visit and readmission

The leading causes of readmission to hospital are bleeding and direct surgical complications [2,7]. Other causes are pain, urinary retention and infection. The surgical complication rate following trans-urethral bladder tumor resection was particularly high (5.7%) [2]. In addition, Twersky *et al.* [7] found genitourinary surgery emerging as the only significant predictor of return hospital visits. Most of the cases in this study with high return rates were hydrocelectomy and varicocelectomy.

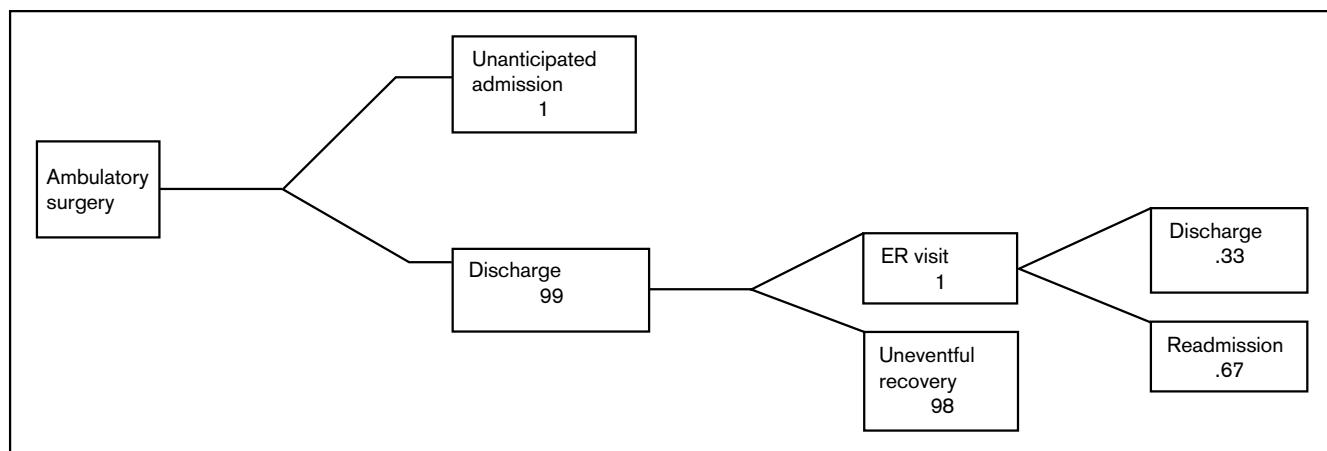
Cost implications of unanticipated admissions and return hospital visits

Ambulatory surgery when compared with inpatient surgery is associated with 20–50% reduction in total costs [16]. Much of this cost saving is from the reduction in the days spent in hospital as inpatients [17]: a 22-bed ward requiring 24 h nursing staff 365 days of the year converts to a day-care facility requiring 14 h nursing staff for 250 days of the year. Therefore, when admission or readmission occurs the number of days spent is pivotal to added costs. In the paper by Mezei and Chung [2], the average length of stay after readmission was 2.7 days. The possible outcomes following ambulatory surgery and the rate at which they occur are shown in Fig. 1. The figures reflect the overall rates from the papers reviewed. The majority of patients, 99%, will be discharged home. Only 1% of patients have unanticipated admission to hospital. Of those who are discharged home, only 1% of patients will return to the hospital within 30 days. Two-thirds of these patients will require

Table 4. Causes of return hospital visits and readmission (expressed as %)

Authors	Bleeding	Other direct surgical complications	Pain	Urinary retention	Fever/infection/antibiotics
Twersky et al. (1997) [7]	41	14.6	9.7	6	15.8
Mezei and Chung (1999) [2]	11.5	57	3.8	7.6	3.8
Weighted overall % ^a	33.8	24.8	8.3	6.4	12.9

^aWeighted overall % = $(\%_1 \times n_1 + \%_2 \times n_2 + \dots) / (n_1 + n_2 + \dots)$.

Figure 1. Diagram showing the possible outcomes in ambulatory surgery

One percent unanticipated admissions occurred. Another 1% returned to the hospital, a third of which required readmission. A total of 98% had an uneventful recovery.

readmission to hospital, while a third require only an emergency room visit.

When a patient is scheduled for ambulatory surgery, it is presumed no complications will arise. The cost impact of complications such as unanticipated admission or readmission to hospital is the cost of the stay of the patients in the hospital instead of being discharged home. Suppose 100 patients are scheduled for ambulatory surgery with an estimated cost of x dollars per patient. Unanticipated admission, return hospital visits and readmission will cost y dollars per patient. The cost impact (in percent) of complications can be quantified by the following relationship:

$$\text{Cost impact (\%)} = (\text{Actual cost} - \text{Expected cost}) / (\text{Expected cost}) \times 100$$

For example, if the expected cost per patient is x and the cost per complicated case is y , if the complication rate is 1%, then

$$\text{Actual cost for 100 patients} = (99x + 1y)$$

$$\text{Expected cost} = 100x$$

$$\text{Cost impact (\%)} = [(99x + 1y) - 100x] / (100x) \times 100$$

If $x = \text{US\$1000}$ and $y = \text{US\$5000}$, the cost impact will be US\\$4000 more. Using the above formula, the cost impact is 4% more than the estimated cost.

Literature reviewed shows that with over 65% of surgical cases being done on an ambulatory basis in North America, unanticipated admission rates are low, approximately 1%. Return hospital visit and readmission rates are also low at approximately 1% (fig. 1).

In a series involving 99 patients [3], in which the decision analysis method was used, outpatient laparoscopic cholecystectomy was stated as making a cost saving of US\\$2127 per case. The incidence of unanticipated admission was 6.2% and the readmission rate was 4.2%. When emergency room visit charges and home healthcare visit charges were taken into consideration, average baseline cost savings of US\\$742 per patient were still possible. Therefore, this is still a good cost saving in spite of higher unanticipated admission and readmission rates.

In another paper [4], a prospective randomized controlled trial included 194 consecutive women who had hysteroscopic endometrial ablation carried out. The

median ward costs were estimated at £38 per woman for ambulatory surgery, and £170 per woman for inpatients. This represents a fourfold difference in charges. In this series, there was a 9% unanticipated admission rate, albeit for observation only. For every 100 women, 91 had no complications with cost savings of £132 (170–38) per case, or £12 012 in total. Admission of nine cases per 100 hardly dents the substantial savings already made.

Williams [18] wrote, after examining real figures from six community hospitals in Michigan, that the true cost of non-urgent care in the emergency department is relatively low. He also stated that the potential savings by directing these non-urgent visits to private physician's offices might be less than widely believed. To buttress this fact, 76% of bleeding complications in the Twersky *et al.* [7] study were treated and discharged from the emergency room. Patient education may reduce the incidence of return to hospital.

It can, therefore, be more cost effective to do as much ambulatory surgery as possible with allowance for higher incidence of unanticipated admission and readmission. The education of surgeons, anesthesiologists, nurses and patients is essential to make this a success. Adequate instructions to prepare patients for postoperative pain, and so on, and what to expect will reduce anxiety and lessen returns to hospital. Education of anesthesiologists to use appropriate anesthetic drugs and techniques for ambulatory surgery will reduce postoperative complications. Home care arrangement is essential. Access of patients to a phone in order to contact the ambulatory surgery unit for queries and concerns is also important.

How to reduce unanticipated admission and return hospital visits: surgical aspects

Surgical causes are the leading reasons for unanticipated admission and return hospital visits. Surgical causes are two to six times more likely to cause admission, readmission and return hospital visits than anesthesia (Table 3) [1,2,7,8–12]. Decreased incidence of perforated viscus and bleeding and avoidance of more extensive surgery than planned is achievable by improving surgical skills and preoperative investigations. In recent years, surgeons have tried new surgical techniques in a mock ambulatory setting before introducing the procedure in ambulatory surgery [3]. In a study of 99 patients, those designated for mock discharge were placed in a clinical research center overnight. This method facilitates the introduction of surgical procedures as outpatients.

The quest for lower cost of ambulatory surgery will continue, 23 h admissions now being classed as ambulatory surgery [19]. Laparoscopic donor nephrectomy is described as a procedure with a 23 h day protocol

surgery. More complex surgery is now done in an ambulatory setting, for example, awake craniotomy, and ambulatory procedures in orally anticoagulated patients [20••,21]. Better patient preparation, improved surgical techniques and newer anesthetic agents and techniques enable the revolution in ambulatory surgery and anesthesia.

Benchmarking unanticipated admission and readmission rates on a procedure by procedure basis may be necessary before that procedure is deemed acceptable for ambulatory surgery [22,23]. This benchmarking is also good as a possible quality indicator among different ambulatory surgical centers.

How to reduce unanticipated admission and return hospital visits: anesthetic aspects

Tailoring anesthetic technique to the surgical procedure to minimize pain, postoperative nausea and vomiting and somnolence is important. For example, using the multimodal approach for antiemetic prophylaxis, such as combining 5HT₃ antagonists with dopamine receptor antagonists like metoclopramide can help [14].

Orkin defined value-based care as 'the best outcome achievable at a reasonable cost' [24 p. 91] and Rudkin [25] expressed this definition mathematically as:

$$\text{Value} = \text{Quality}/\text{Cost}$$

At first glance this relationship may appear to be satisfied by use of cheap older drugs in ambulatory anesthesia. Lubarsky *et al.* [26] did such a study in which they instituted strict pharmaceutical guidelines using older cheaper drugs. They found similar discharge times compared with newer drugs and concluded that using cheaper drugs was cost effective. The delay in emergence of 3 min per case, however, may lead to a reduction in cases done per day and may not be acceptable as this increases overall cost and a reduction in value. Use of new drugs, which are more expensive than standard alternatives, must be balanced against their potential for decreasing perioperative morbidity and therefore encouraging early discharge [27].

Minimizing the use of opioids and using appropriate antiemetic drugs will reduce the incidence of nausea and vomiting [6,28–30]. Where indicated, total intravenous anesthesia with propofol promotes emesis free recovery [31]. Droperidol has been shown to be more cost effective than ondansetron for prophylaxis in patients at high risk for postoperative nausea and vomiting [32]. Avoiding a general anesthetic by performing regional blocks or using local anesthesia also promotes emesis free recovery and provides good pain control [6,28–30]. Careful attention to pain management using the multi-

modal analgesia technique will help to reduce pain-related problems [33]. Adequate fluid therapy could also promote a complication free recovery [34]. Use of new and appropriate anesthetic drugs may be a cost-effective choice to reduce anesthetic complications, reducing unanticipated admission due to nausea, vomiting and pain.

Patient education

Improved patient communication and education could reduce the number of patients with no escorts requiring admission. In one study, up to 19% of unanticipated admissions were due to social reasons [10]. Bleeding caused up to 23% of unanticipated admissions [8] and up to 41% of return hospital visits and readmissions [7]. Most of these cases were minor and could be avoided with better patient education. Providing phone contact with ambulatory surgical facilities to enable patients to receive advice will help to reduce readmission and return hospital visits.

Conclusion

Increasing numbers of surgical procedures are being done in the ambulatory setting. The rates of unanticipated admission, return hospital visits and readmission after ambulatory surgery remain low. The main causes of unanticipated admission are bleeding, pain, more extensive surgery than anticipated and nausea and vomiting. Readmissions to hospital are mainly due to surgical complications. Minimally invasive surgery skills used in the ambulatory setting are cost effective. Prevention of nausea and vomiting and postoperative pain with the multimodal approach will further reduce the incidence of unanticipated admission and readmission.

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