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Admissions following ambulatory surgery: outcome in seven urban hospitals

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A retrospective review of ambulatory surgery admissions during a 12-month period was undertaken in seven hospital-based ambulatory surgery units to identify variables that contributed to hospital admissions and to make recommendations to reduce avoidable admissions further. Out of 32 457 ambulatory surgery patients, 3.2% were admitted (1042), with a range of 0.9–9.4% across the seven hospitals. When controlling for hospital differences, urological surgery had the highest admission rate (6.1%) compared to other surgical specialities and emerged as a significant predictor of hospital admission (P <0.001, odds ratio 3.9, 95% confidence interval (CI) 3.28–4.56). Both regional and general anaesthesia were significant predictors of admission and had proportionally higher admission rates (4.7 and 4.2% respectively, P <0.05) compared to monitored anaesthesia care (MAC) and local anaesthesia (1.3 and 0.6% respectively, P <0.05). Admission rate was the same for ASA I–III patients. Admissions were regrouped into unavoidable reasons – 58%, potentially avoidable admissions – 23% and avoidable – 16%. Main predictors of avoidable admission were duration of surgery (P <0.001) and female gender (P <0.037). As close to 40% of admissions may be avoidable, efforts toward their reduction should be directed at scheduling cases that are reasonably likely to require extensive surgery on an inpatient or less than 24 h observation basis, and by prioritizing outpatient cases in an integrated operating suite.

Key words: Ambulatory surgery, outcome, continuous quality improvement, hospital admissions

Introduction

As more extensive procedures are performed on an outpatient basis and patients with complex medical problems are considered for ambulatory surgery, management of surgical outpatients should be guided by indicators of outcome and safety[1,2]. Hospital admissions following ambulatory surgery have been used as an important index of outcome. A number of studies both in the US and abroad describe hospital admission rates of 0.09–16%[7–22]. However, variability in reporting mechanisms confounds inferences about outcome. Because previous studies are limited to reports of data from individual facilities, we undertook a multi-centred study in order to report data on a large group of patients over a relatively short time frame. Additionally, previous studies did not attempt to analyse the impact of avoiding admissions. Therefore, the purpose of this investigation was not only to determine the prevalence of post-ambulatory surgery admissions but also to analyse associated causes and contributing factors so that recommendations to further their reduction could be made and to provide a focus for future research.

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Methods

Data

Seven hospital-based ambulatory surgical units in the New York Metropolitan area participated in this study. Data were collected from each hospital for the 12-month period from 1 January to 31 December 1991. Hospital medical records, ongoing quality improve-

ment, and operating room databases were reviewed by the anaesthesiologist from each facility participating in the retrospective review. Each hospital submitted summarized data. Admissions following ambulatory surgery were coded according to the following: reason for admission, anaesthesia type, patient age, gender, American Society of Anesthesiologists' (ASA) physical status classification, surgical service, duration of surgery and length of hospital stay.

Hospital admission was defined as any patient who was not discharged directly from the Ambulatory Surgery Unit (ASU) on the day of surgery. Admissions were divided into medical and non-medical by the following categories (Table 1): Surgical: 1. extensive surgery (not related to complications), 2. bleeding and/or observation for bleeding (not considered under complications), 3. temperature elevation, infection and/or need for intravenous antibiotics, 4. surgical complications at the time of initial surgery (i.e. vascular injury, uterine perforation), 5. additional procedure to be scheduled (i.e. breast biopsy leading to mastectomy), 6. return to the operating room the same day (i.e. bleeding tonsils); Combination of surgical and anaesthetic: 7. nausea and vomiting, 8. pain, 9. urinary retention; Medical: 10. medical observation and/or medical treatment for pre-existing or new onset non-surgical condition; Anaesthetic: 11. anaesthesia complication (difficult intubation, airway complication not related to surgery, suspected aspiration pneumonia), 12. prolonged recovery from anaesthesia (>2 h in PACU); Administrative/social: 13. inappropriately booked procedure (including procedures with high probability of more extensive surgery, i.e. laparoscopy with a possible laparotomy, or arthroscopy with a possible reconstruction), 14. late start in the operating room, 15. no escort, 16. inadequate home support and 17. a Miscellaneous category (reasons either unknown or do not clearly fit into listed category). Reasons for admission were regrouped into three broad categories for purposes of post-hoc recommendations: unavoidable (surgical, medical and anaesthesia complications); potentially avoidable (combination surgical and anaesthetic causes, prolonged anaesthesia recovery); and avoidable admissions (administrative/social). Case data on the avoidable vs. unavoidable admissions were available from three hospitals and were analysed separately.

The seven participating hospitals reflect the broad composition of the integrated ASUs in the Metropolitan New York area. Hospital 1 is a municipal hospital with a predominantly indigent population. Its ASU included late second trimester abortions and excludes paediatric surgery. Hospitals 2, 5 and 6 are tertiary, nonprofit, primary affiliates of medical schools. Hospital 2 excluded paediatric and ophthalmic surgery. Hospitals 3 and 7 are university-affiliated community hospitals. Hospital 4 is a tertiary referral nonprofit university-affiliated cancer centre which excludes ophthalmological and dental cases. It was the only participating hospital with ambulatory operating room suites physically separate from the main operating room. All ASUs except hospital 4 have residency training programmes. Five out of seven hospitals are trauma centres.

Statistical analysis

Data were analysed by χ^2 and multiple logistic regression analysis. Two sets of logistic regression analyses were conducted: The first analysis was conducted to identify predictors of admission in the data on the general ambulatory surgery population, while controlling for differences among hospitals. Variables included surgical service, anaesthesia type and ASA status. The second analysis was conducted on the available case data of only the admitted patients from hospitals 1, 3 and 7, to identify predictors of avoidable admissions. The dependent variable was the category for admission (avoidable or unavoidable). Independent variables included hospital, surgical service, anaesthesia, ASA status, age, gender, duration of surgery and length of stay. The logistic regression entered these variables as main effects as well as two way interaction terms using a forward selection procedure. For all tests, $P < 0.05$ was considered to be significant.

Results

During the 12-month study period 32 457 patients underwent ambulatory surgery in the seven participating hospitals. Of these, 1042 patients were admitted, resulting in an overall admission rate of 3.2%. Interhospital variation and reasons for admission are shown in Table 1. Hospital 1 had the highest admission rate at 9.4% and hospital 4 the lowest at 0.9%. Separate multiple logistic regression analysis for each of the main variables, controlling for hospital differences, identified six significant risk factors for whether a patient could be admitted or not: patients who underwent urological procedures, patients who received general or regional anaesthesia, and ASA I–III patients were more likely to be admitted after ASU than other categories. Odds ratios and their 95% confidence intervals for selected factors, as well as admission rates are presented in Table 2.

Distribution of admissions by category was as follows: unavoidable 58% (surgical, medical and anaesthesia complications), potentially avoidable 23% (combination surgical anaesthetic, prolonged anaesthesia recovery), and avoidable admissions 16% (administrative/social). The most frequent unavoidable reasons were extensive surgery (16.2%) and bleeding (12.4%), with interhospital variation (Table 1). Continued medical observation and medical treatment were the reasons for 10% of admissions. These included arrhythmias, chest pain, suspected myocardial infarction, pulmonary oedema, hypertension and bronchospasm. Only one mortality was reported, which occurred on the fourth postoperative day and was due to a pre-existing medical condition. Unavoidable anaesthetic reasons constituted 8.7% of all admissions and were classified into

Table 1 Frequency and reasons for admission (in %)

	Hospitals	1	2	3	4	5	6	7	Total
	Admissions	120	144	103	23	216	278	158	1042
	Total cases	1280	4202	5049	2605	8549	7763	3009	32 457
	(%)	9.4*	3.4	2.0	0.9*	2.5	3.6	5.3†	3.2
	Surgical								44.8
1	Extended surgery	26.7	8.3	20.4	4.4	10.2	16.2	17.1	16.2‡
2	Bleeding	5.8	18.1	9.7	17.2	15.3	9.7	10.1	12.4
3	iv Antibiotics	14.2	5.6	5.8	4.4	6.9	9.7	2.5	7.9‡
4	Surgical complications	0.8	6.3	3.9	13.0	4.2	7.9	4.4	5.6‡
5	2nd procedure scheduled	2.5	2.8	4.9	4.4	1.9	1.1	1.9	2.3
6	Return to or	0	0	1.9	4.4	0.5	0	0	0.4‡
	Combination surgical and anaesthetic								18.2
7	Nausea and vomiting	2.5	3.5	2.9	0	9.7	4.3	15.2	6.9‡
8	Pain	5	6.3	9.7	0	6.0	7.9	4.4	6.8
9	No void	1.7	3.5	8.7	8.7	2.3	4.3	5.7	4.5
	Administrative								13.7
10	Not ambulatory procedure	3.3	13.2	12.6	13	4.2	7.2	1.9	7.2‡
11	Late or	15.8	2.1	1	13	1.4	5.0	13.3	6.5‡
	Medical								10.0
12	Medical observation	10	7.6	9.7	8.7	10.7	10.4	7.6	10.0
	Anaesthetic								8.7
13	Anaesthesia complication	4.2	2.1	4.9	4.4	2.8	3.2	3.2	3.4
14	Prolonged anaesthesia recovery	1.7	11.1	2.9	0	4.2	5.0	5.1	5.3‡
	Social								2.5
15	No escort	0.8	2.8	1	0	2.3	1.1	4.4	2.1
16	No home support	0	0	0	0	1.4	0	0.6	0.4
	Miscellaneous								2.1
17	Others	5	6.9	0	4.4	0	0	2.5	2.1

*Hospitals 1, 4 different from others ($P<0.05$).
†Hospital 7 different from hospital 2, 3, 5, 6 ($P<0.05$).
‡Interhospital variation ($P<0.05$).

Table 2 Predictors of hospital admission

Variable	*Rate%*	P *value*	*Odds ratio (95% confidence interval)*	
Urology	6.1	<0.001	3.86	(3.28–4.56)
ASA I	2.8	0.022	1.37	(1.04–1.80)
ASA II	2.7	<0.001	1.65	(1.26–2.18)
ASA III	2.8	0.019	1.41	(1.05–1.89)
General anaesthesia	4.2	<0.001	2.65	(2.27–3.10)
Regional anaesthesia	4.7	<0.001	2.47	(1.60–3.07)

complications (3.4%) and prolonged recovery (5.3%). Anaesthetic complications (3.4%) included airway complications and suspected aspiration pneumonia. Only two patients were admitted for suspected aspiration pneumonia. Interrelated surgical and anaesthesia factors included nausea and vomiting (N/V) in 6.9%, pain in 6.8% and inability to void in 4.5% of patients. These were considered potentially avoidable. Administrative/social and non-medical reasons (16%) were considered avoidable admissions and included cases for which the probability of more extensive surgery should have precluded ambulatory surgery (7.2%), cases which had a late start in the operating room (6.5%), patients with no escort (2.1%) and no home support (0.4%).

Results of the stepwise multivariate logistic regression analysis and χ^2s in 396 surgical cases (from hospitals 1, 3 and 7) identified the following three variables as predictors of avoidable admissions: duration of surgery, i.e. longer procedures resulted in more avoidable admissions (P <0.001); female patients had more avoidable admissions (P 0.037 odds ratio 1.53, with a 95% confidence interval (CI) of 1.02–2.29) and the interaction of ophthalmology and/or plastic surgery with longer duration of surgery led to more avoidable admissions (P 0.021). Anaesthesia type, ASA status, age, surgical service and all other interactions among the independent variables did not emerge as significant predictors of avoidable admissions. The surgical procedures that were most frequently admitted, their distribution by anaesthesia type, ASA classification, mean age and length of hospital admission are shown in Table 3. Average age for the admitted population was 44.8 ± 22.28 yr and average length of stay (LOS) after admission was 1.8 ± 2.92 days. Based on available case-specific data of the admitted patients, 62% had a LOS less than 24 h, and admissions were largely for administrative/social reasons and for patients for whom a somewhat prolonged observation period was prudent.

Table 3 Clinical characteristics by surgical procedures

Surgical procedure (n)	*Anaesthesia type*			*ASA type*			*Mean age (yr)*	*Mean LOS (days)*
	GA	*MAC*	*REG*	*I*	*II*	*III*		
Laparoscopy and/or hysteroscopy (64)	64	0	0	46	17	1	31.64 ± 9.2	2.23 ± 1.7
Hernia repair (49)	36	4	9	23	19	7	47.12 ± 21.1	1.76 ± 1.48
Sinus surgery (19)	17	2	0	12	5	2	39.78 ± 17.2	1.42 ± 0.96
D&E (19)	18	0	1	11	6	2	23.47 ± 5.7	2.26 ± 1.8
Breast biopsy (14)	11	2	1	3	5	6	54.35 ± 15.3	4.85 ± 7.1
Haemorrhoidectomy (15)	3	6	6	6	4	5	48.2 ± 18.8	1.60 ± 1.2
Lithotripsy (12)	7	4	1	3	8	1	51.66 ± 19.3	3.1 ± 4.2
Cystoscopy (9)	5	1	3	1	4	4	59.33 ± 16.1	2.44 ± 2.2

Discussion

This study was undertaken not only to determine the prevalence of admissions after ambulatory surgery in a diverse set of metropolitan hospitals but also to identify variables to reduce avoidable admissions further, an aspect that previous outcome studies have not considered. As admission represents an undesirable outcome even if it does not result in increased morbidity or mortality, we sought to examine its causes and evaluate patient and medical speciality characteristics as risk factors. Admissions can be evaluated for utilization by two distinct aspects of patient care: quality control of medical and surgical services, and administrative organization. Although the need to hospitalize a patient after ambulatory surgery is often justified and unpredictable, the ability to keep avoidable admissions to a minimum would result in better utilization of ambulatory surgical and hospital inpatient services.

Studies in the US[4–12], Canada[13–15,22], Europe[16–19] and Australia[20,21] report a rate of admission ranging from 0.09–16%. The diverse nature of the hospitals in our study and the inclusion of more extensive procedures performed on an ambulatory basis in recent years may have contributed to the higher average admission rate (3.2%) than previously quoted for other hospital based units[9]. Our multi-centred study enables us to draw inferences about reasons for admissions from a large group of patients during a short time frame (12 months). Due to the multi-centred nature of this study, room for discrepancy with regard to categorization of the reasons for admission also exists. A few studies[9,18,22] have identified factors that predicted hospital admission. Unlike previous reports, we identified urology (GU) as the only surgical speciality that had a four times greater risk for admission. GU had the highest rate of admission primarily following cystoscopy and transurethral resection of bladder tumours (TURBT) and lithotripsy-related procedures because of extensive surgery and haematuria requiring catheter insertion and further observation. As this finding was independent of the type of anaesthesia administered, surgical procedures remain the stronger determinant of admission. While these GU procedures may be standard for an ASU, we suggest that these procedures be postoperatively admitted to a <24-h observation unit or booked as inpatient admissions.

Our study differed not only in the variables that could predict admission, but also in the analysis of the actual admissions and whether they could be avoided or not. By categorizing admissions as either avoidable or unavoidable, it becomes less important whether they are grouped as either surgical, anaesthetic, or combined surgical and anaesthesia. Therefore, analysis of case data was undertaken to explore some of the relationships observed on the larger population and to identify predictors of whether the admissions were avoidable or not. Accordingly, corrective measures could be taken to reduce the avoidable category further. Duration of surgery, independent of patient or anaesthesia characteristics was identified as a predictor of avoidable admissions. Although no one surgical speciality was singled out in this analysis, procedures such as laparoscopy with a possible laparotomy or arthroscopy with possible reconstruction, are often inappropriately booked as ambulatory procedures. A database of procedure-specific operating times including surgeon profiles, together with administrative processes that actively review and trend admission rates, would assist hospitals in developing guidelines for scheduling these cases or in modifying physician practice patterns. Such evaluations can also be incorporated into quality assessment and improvement programmes[2]. Hospital 1, a very active level 1 trauma centre, had many of its ambulatory cases postponed, causing late starts in the OR. This impacted negatively for the more extensive procedures, resulting in high admission rates. Prioritizing ambulatory cases based on anticipated length of procedure or anaesthesia recovery time, and ideally, providing dedicated ambulatory staff and facilities, is indicated in such settings. The tendency for female patients to be admitted for avoidable reasons most likely relates to the type of surgical procedure, although we could not find other significant interactions. The data further suggests that in integrated hospital ambulatory surgery facilities, better surgical anticipation of the extent of the procedure would result in more appropriate scheduling of procedures. We do not suggest that patients that were admitted should have been discharged instead, rather that within a

hospital-based integrated ASU there is a laxity in scheduling cases, assuming that an integrated facility could easily accommodate ambulatory admissions, if required. Guidelines for ambulatory surgery must be not only cost-effective, but synchronous with quality patient care. Admissions to inpatient beds are disruptive to hospital operations because they frequently postpone scheduled elective admissions and require a number of beds to remain vacant in their anticipation. Furthermore, utilization of nursing personnel and other hospital resources is not cost-effective when minimal patient care is required. This reinforces the need for the establishment of either a distinct <24-h observation unit or extension of nursing coverage to 24 h per day in ambulatory surgery recovery areas. The required nurse/patient ratio can be less stringent in this unit and physician coverage might be provided by the anaesthesia department which is available for emergency surgery. Improved preoperative diagnosis and planning could be remedial in cases where this probability is inherently higher. Further studies focusing on interventions in those areas that are avoidable or potentially avoidable hold promise for reducing unanticipated admissions after ambulatory surgery.

Although patients receiving regional and general anaesthesia had higher admission rates than those receiving MAC and local, anaesthesia type did not independently predict avoidable admissions. Therefore, selection of anaesthesia should be based on factors other than the desire to avoid hospital admission. Admission is more likely a factor of longer and more extensive surgery – a stronger determinant of avoidable hospital admissions than anaesthesia type. Nausea and vomiting have been regarded as common complications following adult[3,9,15] and paediatric[8,19] outpatient surgery, but were the cause of admission in less than 7% of cases in our study, compared to a much higher incidence in earlier studies[5,7,9]. Our observed rate of admission for N/V and pain probably reflects the evolution of ultrashort anaesthetics and newer analgesic modalities that have reduced drowsiness and vomiting and provide better pain control. Comorbid condition, as identified by the ASA classification and age, did not appear to be a risk factor for admission. Contrasted to other studies, where the high admission rate was related to older patients with co-existing diseases[17,20], in our study, ASA III patients had no higher rate of admission than ASA I and II. This again supports our findings that surgical factors are more accurate predictors of admissions. All the facilities participating in our study had some form of preoperative screening, and should have been able to filter out the medically inappropriate patients thus reflecting the stable ASA III and IV patients. We suggest that with continued preoperative screening, admissions for unexpected medical problems or because of anaesthesia-related reasons will remain infrequent. Other factors, such as physician practice patterns may influence avoidable admissions and warrant further evaluation.

Conclusions

We report the prevalence of avoidable and unavoidable admissions following ambulatory surgery. Structurally unavoidable circumstances still account for the majority of hospital admissions following ambulatory surgery and it is unlikely that intensified preoperative screening can significantly reduce this category. As cases of longer duration predict avoidable admissions, efforts must be focused at identifying potentially inappropriate cases. Our data suggests that ASU admissions can be reduced by utilizing <24-h observation areas, by prioritizing ambulatory surgery cases within the integrated operating room, and by preoperatively identifying social issues that may interfere with discharge. As close to 40% of admissions may be avoidable, prospective studies which evaluate the effect of anaesthetic and surgical innovations, as well as risks inherent to specific procedures, could facilitate a substantial reduction in avoidable admissions. Because these reductions may be reflected as an increase in scheduled inpatient admissions, administrative organization, continuous quality improvement and broad-based studies are required to analyse these trends and develop appropriate corrective measures which will enable more efficient utilization of both the ASU and hospital resources. These findings must be shared with reimbursement parties so that selection of procedures and patients accurately reflect safe clinical practice. With the expectation that in the foreseeable future ambulatory procedures will only increase and available healthcare dollars will only decrease, providers must be proactive and foresighted in their resource allocation decisions.

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