ORIGINAL ARTICLE

Cancellation of elective operations on the day of intended surgery in a Hong Kong hospital: point prevalence and reasons

CH Chiu 趙俊雄
Anna Lee 李煥坤
PT Chui 徐寶堂

Objective To determine the point prevalence of elective surgical case cancellations and the reasons.

Design Cross-sectional study.

Setting Teaching hospital, Hong Kong.

Patients Operating theatre records of elective surgery cancellations from 1 January 2009 to 31 December 2009 were retrospectively reviewed.

Main outcome measures Cancellation of scheduled elective surgery on the day of surgery and the corresponding reasons.

Results Of 6234 cases scheduled, 476 were cancelled, which yielded a point prevalence of 7.6%, with a 95% confidence interval of 7.0-8.3%. The highest number of cancellations occurred in patients scheduled for major general surgical procedures (n=94, 20%), major urological procedures (n=64, 13%), major orthopaedic surgery (n=38, 8%), and ultra-major cardiothoracic surgery (n=29, 6%). The most common category for cancellation was facility (73%), followed by work-up (17%), patient (10%), and surgeon (1%). No available operating room time due to overrun of the previous surgery was the most common reason for case cancellation (n=310). Compared to general surgery, the odds of no available operating time was significantly less in orthopaedics (odds ratio=0.26; 95% confidence interval, 0.17-0.39), otolaryngology (0.25; 0.13-0.46), neurosurgery (0.36; 0.16-0.70), paediatrics (0.53; 0.31-0.87), gynaecology (0.18; 0.11-0.29), ophthalmology (0.19; 0.07-0.41), and dentistry (0.10; 0.00-0.60).

Conclusions Case cancellations were mainly due to facility factors, such as no operating room time being available. The odds of having no operating room time available varied between surgical specialties.

New knowledge added by this study

- The point prevalence of case cancellation on the day of intended surgery was 7.6%.
- Case cancellations were mainly due to no operating room time available, with rates varying between different surgical specialties.

Implications for clinical practice or policy

- Quality improvement strategies are needed to reduce same-day cancellation of surgical procedures.
- Implementation of an integrated preoperative preparation system may significantly decrease the rate of same-day–intended surgery case cancellations.

Key words
Appointments and schedules; Efficiency, organizational; Operating rooms; Quality improvement; Surgical procedures, elective

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Department of Anaesthesia and Intensive Care, The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, Hong Kong
CH Chiu, MPhil
A Lee, PhD, MPH
PT Chui, MB, BS, FANZCA

Correspondence to: Prof Anna Lee
Email: annalee@cuhk.edu.hk

Introduction

Unanticipated cancellation of elective surgery decreases operating theatre efficiency if operating theatre time is not utilised. Cancelled surgeries are also inconvenient to patients, physicians, and staff, lead to decreased patient satisfaction and diminished staff morale.[1] Case cancellation results in wasted investigations and blood cross-matching, leads to delayed patient care, and can potentially affect the overall clinical outcome.

One of the difficulties in interpreting the rate of case cancellation on the day of surgery is the range of reasons given: patient-related factors, inadequate work-up, non-

香港一所醫院於手術當天取消選擇性手術的比率及原因

目的 探討取消選擇性手術的比率及原因。

設計 橫斷面研究。

安排 香港一所教學醫院。

患者 回顧研究2009年1月1日至12月31日期間，取消選擇性手術的手術室紀錄。

主要結果測量 於手術當天取消選擇性手術的比率及原因。

結果 研究期間共有6234項已預約手術，其中476項（7.6%）最終被取消（95%置信區間：7.0-8.3%）。最多被取消手術的範疇有大型普通外科手術（94例，20%）、大型泌尿手術（64例，13%）、大型骨科手術（38例，8%）、超大型心胸外科手術（29例，6%）。取消手術最普遍的原因是與場地有關（73%），其次是檢查（17%）、病人本身（10%）、外科醫生（1%）。取消手術最主要原因是由於之前的手術逾時，導致沒有手術室時間（310例）。與普通外科手術比較，以下各專科因沒有手術室時間而須取消手術的機會率明顯較低：骨科（比數比=0.26；95%置信區間：0.17-0.39）、耳鼻喉科（0.25；0.13-0.46）、腦外科（0.36；0.16-0.70）、兒科（0.53；0.31-0.87）、婦科（0.18；0.11-0.29）、眼科（0.19；0.07-0.41）、牙科（0.10；0.00-0.60）。

結論 取消手術的主要原因是基於場地問題，例如沒有手術室時間。各專科手術沒有手術室時間的可能性都有差異。

availability of hospital beds or operating room time, and lack of staff.[2] Results from a randomised controlled trial,[3] cohort studies[4,5] and before-and-after studies examining the impact of implementing a preoperative preparation system[6-8] have consistently yielded significant reductions in the rate of case cancellations on the day of surgery. The introduction of an integrated preoperative preparation system was associated with an absolute reduction in the point prevalence of cancellations on the day of surgery of about 2 to 7%.[5,7] These systems were also associated with patients being better prepared for surgery than those not undergoing such preoperative out-patient clinic assessments/consultations.[9] A previous case-control study of cancellations on the day of surgery due to inadequate preparation showed that children attending an anaesthesia-run, preoperative out-patient clinic were three times less likely to have their operation cancelled than those not undergoing such a consultation (odds ratio [OR]=3.18; 95% confidence interval [CI], 1.32-7.63).[10]

In Hong Kong, most elective surgery cases are booked and worked up preoperatively by individual surgical specialty teams who look after their own operating theatre lists, rather than through a centrally organised and integrated preoperative preparation system. Surgeons often underestimate the time needed to perform a procedure and their ability to fit the procedure into the theatre time available.[11] However, the point prevalence and the reasons for same-day, elective surgical case cancellations in Hong Kong remain unknown. The objective of this study was to determine these parameters with a view to providing insight into specific areas that warranted improvement.

Methods

After obtaining approval from the Joint Chinese University and New Territories East Cluster Clinical Research Ethics Committee, surgical case cancellation data were collected from the Prince of Wales Hospital for the year 2009 (1 January to 31 December inclusive). The Prince of Wales Hospital has 11 operating theatres, of which two are allocated for emergency surgery. Elective operating lists begin at 08:00h and are required to be finished by 16:30h. In the event both emergency theatres are occupied, any new emergency procedure is performed in an elective theatre by cancelling elective cases. Major and ultra-major surgical cases are operated upon early on the lists, to allow completion of the list by 16:30h. Cases are cancelled at about 16:00h if the corresponding procedure has no reasonable prospect of being completed by 17:00h.

This was a retrospective cross-sectional study of all types of elective surgical procedures (except obstetric procedures). Procedures that did not require the presence of an anaesthetist were excluded. One of the authors collected the data about cancellations of elective surgery from the scheduled operating lists, operating theatres case log books, and patient medical records. A cancelled case was defined as a scheduled elective surgery that was cancelled on the day of surgery after the release of the operation list at 14:00h on the previous day. When a cancellation occurred, as a routine theatre staff outlined the main reason for the cancellation in the operating theatre log book. The collected data included the number of scheduled cases, number of cancellations, the reasons, and the surgical specialty. The magnitude of the surgery was classified as 'Minor' (eg hysteroscopy), 'Intermediate' (eg inguinal hernia repair), 'Major' (eg transurethral resection of the prostate), and 'Ultra major' (eg coronary artery bypass graft) as defined by the Hong Kong Government Gazette.[12] Reasons for cancellation were recognised as belonging to one of six categories (Appendix), and no single cancellation could be assigned to more than one category.

The overall cancellation rate was calculated from the total number of cancellations divided by the total number of scheduled cases. The cancellation rate by surgical specialties was reported as mean

and 95% CI by the Wilson method using Confidence Interval Analysis software 2.1.2 (Trevor Bryant, University of Southampton, UK) and compared using Chi squared analysis. The association between cancellation categories and magnitude of surgery was examined using Chi squared analysis. The OR and 95% CI were estimated for the likelihood of no theatre time for the various types of specialties against a reference group (general surgery) using Chi squared analysis. Analyses were conducted using the Statistical Package for the Social Sciences (Windows version 15.0; SPSS Inc, Chicago [IL], US). The level of significance was set at P<0.05.

Results

There were 5758 elective surgical cases performed that required anaesthesia during 2009; 476 cases (298 males and 178 females; mean [standard deviation] age of 52 [23] years) were cancelled. Therefore, of the 6234 procedures booked, the point prevalence of case cancellations was 7.6% (95% CI, 7.0-8.3%). Some specialties were more susceptible to cancellation rates (Fig 1). In all, 81 (17%) of case cancellations occurred for ultra-major procedures, 308 (65%) for major procedures, 79 (17%) for intermediate procedures, and 8 (2%) for minor procedures. There was a significant association between surgical specialty and cancellation rates (P<0.001); the highest occurred in those having major general surgical procedures (n=94, 20%) and major urological procedures (n=64, 13%), major orthopaedic surgery (n=38, 8%), and ultra-major cardiothoracic surgery (n=29, 6%).

Of the 476 case cancellations, the reason for cancellation was documented in 464 (Table 1). The most common category for cancellation was facility (73%), followed by work-up (17%), patient (10%), and surgeon (1%). There were no cancellations due to a lack of anaesthesia staff. Nine acute emergency cases took precedence over elective cases, when both emergency theatres were occupied (Table 1). There were significant differences in the distribution of cancellation categories between surgical specialties

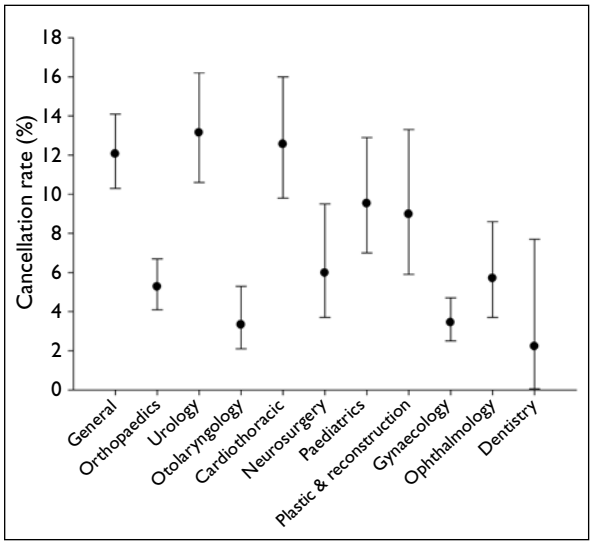

FIG 1. Case cancellation rates by surgical specialties
The mean cancellation rate for all specialties combined was 7.6% (95% confidence interval [CI], 7.0-8.3%). Error bars indicate 95% CI

TABLE 1. Frequency of cancellations according to category (n=476)

Categories	Cancellation reasons*	No.
Patient	Patient refused or gave no consent	22
	Preoperative instructions not followed or patient not instructed adequately	7
	Patient cancelled and had procedure performed elsewhere	1
	Patient was a no-show, no contact from patient	15
	Subtotal	45 (10%)
Work-up	Anaesthesia work-up needed	23
	Abnormal test	3
	Change in medical status	41
	Change in treatment plan	10
	Subtotal	77 (17%)
Facility	Equipment broken or not available	1
	No intensive care unit beds	14
	No operating time	310
	Emergency case	9
	Weather/natural disaster	3
	Subtotal	337 (73%)
Surgeon	Surgery staff not available	5 (1%)

* No detailed reasons provided in 12 cases

TABLE 2. The likelihood of no available operating time (odds ratio and 95% confidence interval) by surgical specialty*

Surgical specialty	Scheduled	No. (%) of cancelled cases	Odds ratio (95% confidence interval)	P value†
General (reference)	1102	110 (10.0)	1.00	-
Orthopaedics	1147	32 (2.8)	0.26 (0.17-0.39)	<0.001
Urology	521	45 (8.6)	0.85 (0.58-1.24)	1.000
Otolaryngology	478	13 (2.7)	0.25 (0.13-0.46)	<0.001
Cardiothoracic surgery	426	36 (8.5)	0.83 (0.54-1.25)	1.000
Neurosurgery	262	10 (3.8)	0.36 (0.16-0.70)	0.005
Paediatrics	362	20 (5.5)	0.53 (0.31-0.87)	0.067
Plastic and reconstruction surgery	227	14 (6.2)	0.59 (0.31-1.06)	0.593
Gynaecology	1116	22 (2.0)	0.18 (0.11-0.29)	<0.001
Ophthalmology	338	7 (2.1)	0.19 (0.07-0.41)	<0.001
Dentistry	89	1 (1.1)	0.10 (0.00-0.60)	0.007

* 166 Case cancellations due to other reasons not included
† Bonferroni-corrected for multiple comparisons with the reference specialty

(Fig 2, P<0.001). There were no patient-related reasons for case cancellations in otolaryngology, neurosurgery, and dental procedures. Among children scheduled for surgery, an upper respiratory tract infection was the main reason for cancellations related to work-up (n=8, 2%). The distribution of cancellation based on category did not vary according to the magnitude of surgery (P=0.23).

The most common reason for case cancellations was no available operating room time due to overrun of previous surgery, which varied significantly between specialties (P<0.001). Compared to general surgery, the odds of no available operating time were significantly lower in orthopaedics, otolaryngology, neurosurgery, gynaecology, ophthalmology, and dentistry (Table 2).

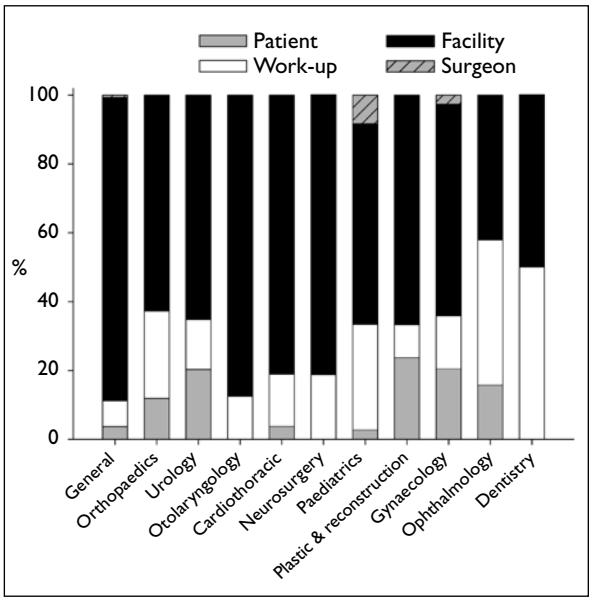

FIG 2. Type of case cancellation reasons by surgical specialties (see Appendix for definitions)

Discussion

The elective case cancellation rate on the day of surgery is an indicator of operating theatre efficiency.[13] Although there is no consensus on the acceptable case cancellation rate when defining efficient operating theatres, less than 5% is generally recommended.[13] In New South Wales, Australia, the benchmark for booked patient cancellations on the day of surgery (for any reason) was less than 2%, cancellation due to a medical condition was set at less than 1% and for patients not attending on the day of surgery it was less than 0.5%.[14] Our point prevalence of case cancellations approaching 8% in 2009 suggests that our perioperative system was inefficient. Using Australian key performance indicators, our cancellation rate due to inadequate work-up of 1.2% was unacceptable, but our 0.2% rate for patients not attending on the day of surgery was acceptable.

Facility was the category most commonly accounted for cancellation of elective surgical cases in 2009. The most common reason under this category was no operating room time (n=310) due to overrun of previous surgery. In specialties where facility factors were a common reason for cancellation, it may be that the lists were intentionally over-booked to increase the likelihood of all the cases being done, while carrying the risk that cases could be cancelled at 16:00h, if they were unlikely to be concluded by 17:00h. A previous study estimated that over-booking a list was common (50%) due to waiting list pressures and to avoid any perception that the surgical team was not hardworking.[15]

Strategies to reduce the rate of case cancellations due to cases overrunning the allocated time may improve overall operating room efficiency. Many tasks such as room turnover time, on-time start of the first case of the day, set-up of anaesthesia equipment,

and collection of supplies and case carts can be performed in parallel with increases in operating room efficiency.[16,17] Based on computerised historical operating theatre management data, overbooking can be minimised by taking surgeon, anaesthesia, patient, and facility factors into account and using statistical methods to estimate the amount of time allocated to each procedure. These parameters can be regarded as a means of monitoring the efficiency level of operating theatres.[16-21]

In our study, some specialties with long complex cases (general surgery, urology, and cardiothoracic) were more likely than others to have insufficient operating theatre time for booked cases, even though they had been scheduled early during the list. As in Schofield et al's study,[22] our cardiothoracic cancellation rate was over 8% and was mainly due to facility factors (no operating time and no postoperative bed). However, our otolaryngology case cancellation rate due to insufficient operating theatre time was low (2.7%) compared to Schofield et al's study (21%).[22] This may be due to differences in the duration and number of complex otolaryngological procedures, patient characteristics, surgical booking systems, and the study methodologies.

For cancellations related to inadequate work-up, narrative data (the 'real' story) about each cancellation are worth considering. The narrative data reflects the complexities of hospital processes, and can be engaging and informative. For internal management, the narrative data, rather than the cancellation rate, are more likely to be an effective guide to quality improvement efforts. For example, "a 53 year old male with ascites, scheduled to have diagnostic laparoscopy, was cancelled by the anaesthetist, because an echocardiogram could not be arranged in time" (through the cardiology department). This was to exclude the presence of pericardial effusion, and illustrated limited in-patient cardiology support for pre-anaesthetic assessment. This description therefore highlights possible areas for improvement in accordance with classical "Kaizen" quality-improvement principles.[23]

The main limitation of this study was that it was retrospective, though the reasons for cancellation were documented adequately in 94% of the cases. We did not record the estimated time at booking and actual time taken for elective surgery for each surgeon. A previous study showed that those who underestimated the time needed for operations by an average of more than 10 minutes had a cancellation rate of 11%, compared to 6% for those who over-estimated the time needed (P<0.001).[21] Whether this observation can be applied to our institution requires a further study to compare each surgeon's estimated length of procedure time at the time of drawing up the operating list against the actual time taken.

Despite the above, our results suggested that quality-improvement strategies are necessary in those specialties susceptible to case cancellations due to facility factors, so as to maximise the completion of surgical operating lists. Implementation of an integrated preoperative preparation system may significantly decrease the rate of same-day–intended surgery case cancellations.[24] Recent work on defining the performance of each team during surgical operating lists confers combined efficiency (maximising theatre utilisation, minimising overruns and hence cancellations) and improve productivity.[25] The implications of applying this methodology to prospectively collected routine data may lead to better management of waiting lists[25] and more objective resource allocation. For example, the Pay for Performance (P4P) diagnosis-related case-mix model was recently introduced in 2009-2010, to measure the performance of each hospital within one of the seven geographical cluster.[26] In this model, there are incentives to promote productivity and quality. In its first year of implementation, the P4P model was associated with a reduction in the mean length of stay per episode of 7%.[26] In conclusion, case cancellations were mainly due to no operating room time being available, with the rates varying between surgical specialties.

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APPENDIX.

Classification of case cancellation reasons using the Argo et al's criteria[2]

Case cancellation reason	Examples
Patient	Patient non-appearance and patient refusal to sign consent form, preoperative instructions not followed
Facility	Administrative errors, equipment malfunction, staff shortage, no operating room time, and no postoperative intensive care beds available
Work-up/medical condition change	Inadequate cardiovascular, pulmonary, and/or procedure-specific work-up, and acute change in medical condition
Surgeon	Unavailability of surgeons
Anaesthesia	Unavailability of anaesthetists
Miscellaneous	(Reasons not in above categories)