Elimination of Preoperative Testing in Ambulatory Surgery

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BACKGROUND: Preoperative testing has been criticized as having little impact on perioperative outcomes. We conducted a randomized, single-blind, prospective, controlled pilot study to determine whether indicated preoperative testing can be eliminated without increasing the perioperative incidence of adverse events in selected patients undergoing ambulatory surgery.

METHODS: One thousand sixty-one eligible patients were randomized either to have indicated preoperative testing or no preoperative testing. In the indicated testing group, patients received indicated preoperative testing: a complete blood count, electrolytes, blood glucose, creatinine, electrocardiogram, and chest radiograph according to the Ontario Preoperative Testing Grid as per current practice, whereas in the no testing group, no testing was ordered. The investigators, data collectors, and patient outcome reviewers were blinded to the group assignment. The primary outcome measures were the rate of perioperative adverse events and the rates of adverse events within 7 and 30 days after surgery.

RESULTS: Patients' age, gender, American Society of Anesthesiologists status, type of surgery, and anesthesia were similar between the two groups. There were no significant differences in the rates of perioperative adverse events and the rates of adverse events within 30 days after surgery between the no testing group and the indicated testing group. Hospital revisits ≤7 days were higher in the indicated testing group ($P < 0.05$). None of the adverse events were related to the indicated testing or no testing.

CONCLUSIONS: This pilot study showed that there was no increase in the perioperative adverse events as a result of no preoperative testing in our study population. A larger study is needed to demonstrate that indicated testing may be safely eliminated in selected patients undergoing ambulatory surgery without increasing perioperative complications.

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Ambulatory surgery accounts for 65–70 percent of all surgery. The costs of preoperative testing are substantial. In the United States this is estimated at more than $18 billion.[1] The costs saving in health care can be significant if preoperative testing is to be eliminated in ambulatory surgery.

A number of observational studies have been conducted to investigate the effectiveness of preoperative testing in ambulatory surgery.[2,3] A retrospective study in Mayo Clinic showed that 4% (160 of 3782) of the patients who underwent ambulatory surgery had abnormal testing results.[2] No association was found between postoperative adverse events and any testing abnormality. No change in perioperative care management was attributed to the abnormal testing results. In 2002, the "Practice Advisory" of the American Society of Anesthesiologists (ASA) concluded that "routine" preoperative testing does not make a valuable contribution to preoperative evaluation while "indicated" testing may help perioperative management decision making.[4]

An indicated test is one that is required by specific clinical features or preexisting medical conditions.[4] For patients undergoing ambulatory surgery, even indicated testing may be unnecessary in healthy patients, as suggested by a number of case series studies.[2,3,5,6] In 2004, a survey of anesthesiologists showed that the current preoperative testing practices in ambulatory surgery are widely disparate, and 40% of anesthesiologists had no concerns about eliminating preoperative testing.[7]

In 2000, Schein et al.[8] published the results of a multicenter, randomized, controlled trial (RCT) studying the impact of eliminating preoperative testing on postoperative outcome in cataract surgery. There was no difference in postoperative adverse events or death, which were identical at 3.1 per 100 operations in the testing and no testing group. Similar to those underlying cataract surgery, patients undergoing ambulatory surgery may be at low risk of perioperative morbidity and mortality.[9–12] Therefore, preoperative

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testing may be unnecessary not only in cataract surgery but also in ambulatory surgery. However, patients having ambulatory surgery may have higher perioperative risk than those having cataract surgery. Patients with preexisting medical diseases are having many different types of surgery on an ambulatory basis. No RCTs of the effectiveness of indicated preoperative testing in ambulatory surgery have been done. Although Schein et al. showed that adverse outcomes did not increase if preoperative testing in cataract patients was eliminated, it remains unknown whether this finding can be applied to selected patients undergoing ambulatory surgery.[8] The hypothesis of this study is that there is no significant difference in the incidence of perioperative adverse outcomes between patients with indicated preoperative testing and no testing.

METHODS

Patients and Randomization

This study was a single blinded, pilot RCT conducted at Toronto Western Hospital, an affiliated hospital of University of Toronto. Inclusion criteria were patients scheduled to undergoing orthopedic, plastic, general, urology, ophthalmologic (excluding cataract), or spinal surgery who were older than 16 yr and were scheduled to be discharged home on the same day. Exclusion criteria were patients undergoing ambulatory cardiovascular, thoracic, neurosurgical or cataract surgery, or any of the following medical conditions: i) myocardial infarction (MI) within 3 mo, previous heart surgery or angioplasty; ii) angina, Canadian Cardiovascular Class (CCS) 3, angina on walking <1 flight of stair or two blocks; CCS 4, angina with activities of daily living, including at rest; iii) dyspnea, CCS 3 shortness of breath <1 flight of stair or two blocks, CCS 4 shortness of breath with activities of daily living, including at rest; iv) arrhythmias; v) history of coagulopathy or blood disorder (leukemia, lymphoma, von Willebrands disease, hemophilia, platelet disorder); vi) history of significant anemia; vii) history of significant liver disease (cirrhosis, acute or chronic hepatitis); viii) history of significant renal disease (chronic renal failure, known renal impairment); ix) any other new or worsening medical condition that would warrant medical testing even if surgery was not planned; x) any preoperative testing during 30 days before enrollment; xi) prior enrollment in this trial. Patients who were foreign residents or who could not speak English were also excluded.

The study was approved by Institutional Ethics Board. A list of patients with scheduled ambulatory surgery was obtained from the surgeon's office. Within 30 days before surgery, patients were referred to the preoperative clinic for registration of ambulatory surgery. At the preoperative clinic, all patients were screened for their eligibility for the study by a research anesthesiologist (S.V.). Each eligible participant was randomly assigned to the indicated testing or no testing group after written informed consent. A computer-generated randomization list was produced in strata according to age (16–39, 40–59, ≥60 yr). Preoperative evaluations were performed by anesthesiologists independent of the study.

In the indicated testing group, patients received part or all of a panel of tests ordered by surgeons strictly according to the Ontario Preoperative Testing Grid (Appendix A)[13] which was developed by the Ontario Preoperative Task Force, Guidelines Advisory Committee.[13] Hospitals in Ontario have adopted these guidelines for indicated preoperative testing for both inpatient and ambulatory surgery. The preoperative testing in this study included complete blood count (CBC), electrolytes, creatinine, blood glucose, electrocardiogram (ECG), or chest radiograph. In the no testing group, no preoperative testing was performed. The indicated testing that was originally ordered for the patients by the surgeons according to the Ontario Preoperative Testing Grid was cancelled. Sickle cell screening, coagulation tests, and pregnancy tests were not studied in this protocol. For patients with diabetes, blood glucose was measured on the day of surgery, regardless of the group assignment.

Noncompliance, i.e., "crossover," meant that a patient in the no testing group chose to take some tests (or full tests) after randomization and *vice versa*; a patient in the indicated testing group chose not to take any test. Crossover might have resulted from either patients or anesthesiologists after randomization to the indicated testing or no testing groups. When the anesthesiologist disagreed with the group assignment for patients to the no testing group, he or she could proceed and order tests based on their own clinical judgment. Crossover status was determined according to the information about preoperative tests that was recorded in the surgical chart on the day of surgery.

Data Collection and Outcomes

Baseline and preoperative patient data were collected with the use of standardized medical history questionnaires at the time of enrollment at the preoperative clinic by the research anesthesiologist (S.V.). In the indicated testing group, patients had testing: CBC, electrolytes, creatinine, blood glucose, ECG, or chest radiograph, according to their specific indications. The indicated preoperative tests of patients who were assigned to the no testing group were cancelled and were not done. Data regarding the perioperative adverse events and treatments were obtained by chart abstraction from the computerized hospital charts. At 7 days after surgery, a telephone interview was conducted to collect data on adverse events during the first week. A research nurse (L.Y.) blinded to study group assignment was responsible for the interview. If initial patient contact failed, subsequent follow-up

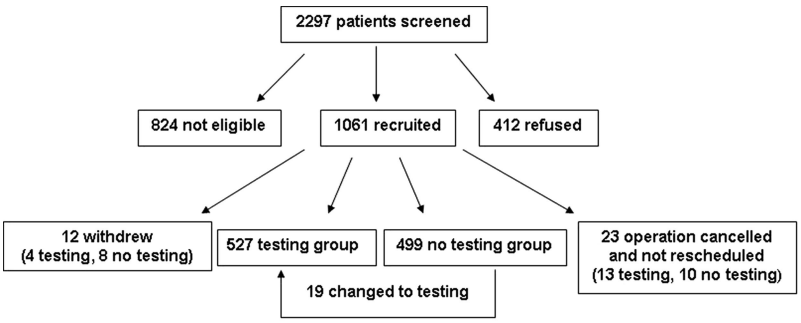

Figure 1. Enrollment of patients and randomized assignment to testing group and no testing group.

was attempted until the patient was successfully interviewed. In the event of loss to follow-up (e.g., out of country), a proxy (e.g., a family member of the patient) was approached. Data on readmission, number of visits to physicians or death within 30 days after surgery were also obtained through computerized hospital records.

The primary outcome measures were severe adverse events occurring within 7 and 30 days after surgery. This included MI, myocardial ischemia, cardiac arrest, congestive heart failure, arrhythmia, hypertension, hypotension, stroke, transient ischemic attack, respiratory failure, hypoglycemia, diabetic ketoacidosis, nonketotic hyperosmolar syndrome, and sudden unexpected death. Standard definitions for these adverse events were provided to the data abstractor (L.Y.) (Appendix B). Other outcomes that were studied are: operation room delays/cancellations, delayed discharge, unanticipated admission and readmission at 7 and 30 days, respectively (Appendix B). The cost of tests, defined as charges by the laboratory, ordered per operation was also documented.

During the study, investigators and data abstractor or patient outcome interviewer were blinded to whether patients received the indicated testing or no testing. When they reported that an event had occurred, the relevant documents were reviewed by two anesthesiologists to determine whether they met the standard definition of adverse event. The two anesthesiologists (F.C., D.W.) were not informed of study group assignment and had no access to preoperative testing data. They made a clinical judgment whether a preoperative test was likely to have affected the probability of the event's occurrence or its severity.

A literature review indicated that there were three large prospective trials of adverse outcomes in ambulatory surgical patients.[14–16] In 6914 ambulatory surgical patients, Duncan et al.[14] found an incidence of 3.93% cardiorespiratory events. Osborne and Rudkin[15] found a 6.7% incidence of cardiorespiratory events in 6000 ambulatory surgical patients. Chung et al.[16] found an incidence of 4.33% cardiorespiratory events in 17,639 ambulatory surgical patients. Based on these three studies, a sample size of 10,000 per arm would have 90% power to reject a 1% increase in rate of adverse outcomes in the no testing group with a Type 1 error of 0.05.

Statistical Analysis

Data were analyzed as intention-to-treat. Patients remained in the groups to which they were initially assigned, regardless of tests they actually received. A frequency distribution of sociodemographic characteristics and risk factors were presented in the no testing and indicated testing group. Statistical difference in the distribution was determined using χ^2 test. Analysis of adverse events rate was performed for each period according to the treatment initially received (no testing versus indicated testing). For a combined rate of severe adverse events, events were counted on a per patient basis. In this case, all the severe events were given the same weight. A 95% confidence interval of the relative risk was calculated to compare the risk of occurring adverse event in the no testing group to the risk in the indicated testing group. All analysis was performed using SAS 9.1 (Cary, NC).

RESULTS

Patient Characteristics

Patients scheduled to undergo ambulatory surgery (2297) were screened for 2 yr (Fig. 1). Eight hundred twenty-four patients were not eligible (31%). Among the ineligible patients, most did not speak English (25%), had blood work from a family doctor (12%), or MI within 3 mo, angina Grade 3 and 4, or dyspnea Grade 3 and 4 (34%). Eligible patients (1061) were randomly assigned either to the no testing group or the indicated testing group. Twelve patients were withdrawn (no testing versus indicated testing: 8 vs 4) mostly due to a change from ambulatory to inpatient surgery. Four patients in the no testing group were withdrawn by surgeons because of new diseases and one patient in the indicated testing group withdrew from the study himself. A similar number of patients changed their minds and did not proceed with surgery (no testing versus testing: 1.9% vs 2.4%).

Among the enrolled patients, 499 (49%) and 527 (51%) patients were in the no testing group and the indicated testing group, respectively. Nineteen crossover cases occurred by switching from the no testing to the indicated testing group due to the anesthesiologist's request. ECG was the most common request that was ordered for 18 patients because of age and history

Table 1. Demographic Data

	No testing		Testing	
	N (499)	Percent	*N* (527)	Percent
Gender				
Female:Male	211:288	42.3:57.7	223:304	42.3:57.7
Age group				
16–39	70	14.0	73	13.8
40–59	254	50.9	269	51.0
≥60	175	35.1	185	35.1
ASA				
I	144	28.9	134	25.4
II	297	59.5	327	62.0
III	58	11.6	66	12.5
Preexisting disease				
Coronary artery disease	26	5.2	25	4.8
Hypertension	138	27.7	167	31.7
Arrhythmia	4	0.8	6	1.1
TIA-CVA	5	1.0	4	0.8
COPD/asthma	39	7.8	35	6.6
Obesity	27	5.4	45	8.5
Diabetes mellitus	82	16.4	79	15.0
Thyroid disease	38	7.6	43	8.2
Liver disease	3	0.6	1	0.2
Renal disease	1	0.2	5	1.0
Neurologic disease	24	4.8	21	4.0
Bleeding disorders	0	0.0	2	0.4
Other disease	89	17.8	89	16.9
Surgery				
Orthopedic	124	24.8	128	24.3
General surgery	58	11.6	48	9.1
Plastic	100	20.0	109	20.7
Ophthalmology	133	26.6	139	26.4
Urology	42	8.4	45	8.5
Spinal surgery	39	7.8	33	10.8
Neurosurgery	3	0.6	1	0.2
Anesthesia				
General	252	50.5	276	52.4
Regional	72	14.4	88	16.7
Spinal	10	2.0	8	1.5
General + regional	11	2.2	9	1.7
Monitored anesthesia	154	30.9	146	27.7

ASA = American Society of Anesthesiologists; CVA = cerebrovascular accident; TIA = transient ischemic attack; COPD = chronic obstructive pulmonary disease.

of hypertension. According to the intention-to-treat analysis, these patients were treated as no testing.

In both groups, 85% of patients were older than 40 years. Most patients were ASA I or II status (no testing versus indicated testing: 88% vs 87%) (Table 1). Twelve percent of patients in each group were ASA III. Sixty-four percent in each group had preexisting diseases. Hypertension and diabetes were the two main preexisting diseases. Orthopedic, general, plastic, and ophthalmologic surgery accounted for 81% of the surgery for both groups. More than 50% of patients had general anesthesia in both groups. There was no statistically significant difference in gender, age, ASA status, preexisting diseases, type of surgery, and anesthesia between the two groups.

Primary Outcomes

There were no significant differences in the rates of intraoperative and postoperative adverse events between the indicated testing and the no testing groups before patient discharge. For 30 days after discharge, the rate of revisits, including visiting family doctors, emergency, and readmission to hospitals was not significantly different between the two groups. The rate of 7-day revisits to hospitals was higher in the indicated testing group versus the no testing group (5.1% vs 2.2% $P < 0.05$) (Table 2). There was no readmission to the ward within 7 days. For both groups, readmission accounted for 17% of hospital revisits for 8–30 days.

Intraoperative adverse events were mostly associated with cardiovascular and respiratory diseases, such as dysrhythmia and hypertension (Table 3). More adverse events occurred postoperatively rather than intraoperatively. They were mainly related with prolonged postanesthesia care unit stay, e.g., inadequate pain control, nausea/vomiting or prolonged recovery time.

The main reasons that patients revisited the hospital after discharge were severe pain, infection, and other medical problems (Table 4). For the 7 days for hospital

Table 2. Intraoperative and Postoperative Adverse Events Within 30 Days

	No testing (n = 499) n (%)	Testing (n = 527) n (%)	Relative risk (95% CI)[a]
Intraoperative event	7 (14.0)	7 (13.3)	1.0 (0.4–3.0)
Postoperative event[b]	16 (32.1)	21 (39.8)	0.8 (0.4–1.5)
Unanticipated admission	7 (14.0)	12 (22.8)	0.6 (0.2–1.6)
Others	9 (1.8)	9 (1.7)	1.0 (0.4–2.6)
Hospital revisits (≤7 d) event	11 (22.0)	27 (51.2)	0.4 (0.2–0.9)
Readmission	0 (0)	0 (0)	
Other visits	11 (22.0)	27 (51.2)	0.4 (0.2–0.9)
Hospital revisits (8–30 d)[c] event	11 (22.0)	16 (30.4)	0.7 (0.3–1.6)
Readmission	2 (4.0)	3 (5.7)	0.7 (0.1–4.2)
Other visits	10 (20.0)	14 (26.6)	0.8 (0.3–1.7)

[a] The relative risk was ratio of the risk of developing adverse events in no testing group to the risk in testing group.

[b] Events that occurred before discharge.

[c] One patient had more than one visit, but counts as one event for one patient.

CI = confidence interval.

Table 3. Diagnoses Associated with Intraoperative and Postoperative Adverse Events

	Intraoperative event		Postoperative event[a]	
	No testing (499)	Testing (527)	No testing (499)	Testing (527)
Cardiovascular				
Dysrhythmia	1	2	1	0
Hypertension	1	0	1	2
Hypotension	0	0	0	1
Respiratory/Airway				
Hypoxemia	0	1	0	1
Laryngospasm	2	0	0	0
Bronchospasm	1	0	0	0
Difficult Intubation/Intubated on arrival	1	3	0	1
Others				
Inadequate pain control	0	0	3	5
Nausea/vomiting	0	0	4	3
Urinary retention	0	0	1	1
Dizziness	0	0	1	2
Drowsiness	0	0	0	1
Other[b]	1	1	7	8

[a] One adverse event was associated with more than one disease.

[b] During intraoperative period, one case was upper lip abrasion for no testing, the other one was hemorrhage for testing group; During postoperative period, events were related to prolonged recovery time or social reasons.

revisits, severe pain accounted for 25% in the no testing group versus 53% in the indicated testing group. The other medical problems included allergic reaction, recurrent disk hernia, wound dehiscence, and further surgery.

Table 5 shows the rate of perioperative adverse events before discharge from hospital according to the baseline medical status. There were no significant differences in the rates of adverse events when data were stratified by ASA, or preexisting disease. Hypertension and diabetes were the two most common preexisting diseases related to adverse event (Table 5). The indicated testing and the no testing groups had a similar frequency distribution in surgery delay and cancellation, but none was related to medical reasons.

Among 19 patients who crossed-over, three patients had adverse events. Two patients were admitted because of bleeding at the surgical site. In addition, one patient visited a medical clinic because of severe pain 7 days later.

In the indicated testing group, 11.5% (188 of 1632) of the tests were abnormal, 70 abnormal hematology or biochemistry results, and 118 abnormal ECGs. These abnormal tests were expected because of heart disease or diabetes. No association was found between perioperative adverse events and abnormal testing results. No change in perioperative care was attributed to the abnormal testing results except for one patient with atrial flutter with variable atrioventricular block. He was referred to a cardiologist and no treatment or delay of surgery was needed. In the indicated testing group, five patients had adverse events; two had dysrhythmia, two had a hypertensive period, and one had a hypotensive episode. All five had a normal preoperative ECG.

Costs and Saving

A similar number of preoperative tests were ordered for the no testing group and the indicated

Table 4. Reasons for Hospital Revisit[a]

	7 d		30 d	
	No testing (499)	Testing (527)	No testing (499)	Testing (527)
Severe pain	3	17	2	6
Bleeding	1	3	0	2
Infection	2	9	6	2
Urine retention	1	2	0	0
Other related medical problem	5	1	5	8

[a] One patient may have more than one reason to visit hospital.

Table 5. Rates of Intraoperative and Postoperative Adverse Events According to Baseline Medical Status

	Intraoperative adverse events		Postoperative adverse events	
Baseline medical status	No testing *n* (%)[b]	Testing *n* (%)[b]	No testing *n* (%)[b]	Testing *n* (%)[b]
ASA				
I	0	0	2/144 (13.9)	6/134 (44.8)
II	6/297 (20.2)	4/327 (12.2)	11/297 (37.0)	13/327 (39.8)
III	1/58 (17.2)	3/66 (45.4)	3/58 (51.7)	2/66 (30.3)
Preexisting disease[a]				
Hypertension	4/138 (29.0)	1/167 (6.0)	8/138 (58.0)	8/167 (47.9)
TIA-CVA	0	1/4 (250)	0	0
COPD/asthma	0	0	1/39 (25.6)	1/35 (28.6)
Obesity	1/27 (37.0)	0	1/27 (37.0)	3/45 (66.7)
Diabetes mellitus	3/82 (36.6)	1/79 (12.6)	6/82 (73.2.0)	0
Thyroid disease	1/38 (26.3)	2/43 (46.5)	3/38 (78.9)	3/43 (70.0)
Renal disease	0	1/5 (200)	0	0
Neurologic disease	0	2/21 (95.2)	1/24 (41.7)	1/21 (47.6)
Other disease	1/89 (11.2)	0	4/89 (44.8)	5/89 (56)
No disease	0	0	1/163 (6.1)	7/183 (38.2)

[a] One event might be associated with more than one preexisting disease.

[b] Denominators are the numbers of operations in each subgroup provided in Table 1.

ASA = American Society of Anesthesiologists; CVA = cerebrovascular accident; TIA = transient ischemic attack; COPD = chronic obstructive pulmonary disease.

Table 6. Costs of Preoperative Testing

Tests	No testing group no. tests ordered and cancelled[a]	Testing group no. tests ordered and done
CBC	382	405
Electrolytes	297	301
Creatinine/urea	252	246
Blood glucose	170	176
ECG	421	423
Radiograph	77	81
Total	1,599	1,632
Saving/costs	$18,938	$19,470

[a] Including 41 tests done by patients who were original in no testing group but were changed to testing group.

CBC = complete blood count; ECG = electrocardiogram.

testing group (Table 6). Nineteen patients were changed from the no testing to the indicated testing group, and 41 tests were conducted. In the no testing group, 1558 tests were ordered and cancelled for 480 patients resulting in a total saving of Canadian $18,447 or $38.50 per patient.

DISCUSSION

No RCT concerning the effectiveness of indicated preoperative testing in ambulatory surgery has been published. A literature review indicated that the studies were mostly retrospective chart reviews or case series of healthy patients.[2,3,5,6] In this study, we randomized our ambulatory surgical patients to either indicated testing or no testing. This pilot RCT showed that there were no significant differences in the rates of perioperative adverse events and 30-day hospital revisits between patients who underwent the indicated testing versus those with no preoperative testing before ambulatory surgery. There was no perioperative death. In the no testing group, none of the adverse events was associated with no preoperative testing.

The rate of intraoperative adverse events was very low (testing versus no testing: 1.3% vs 1.4%). The rate of postoperative adverse events before discharge was higher (testing versus no testing: 4% vs 3.2%). Most of the adverse events were not serious, and were not related to any significant cardiovascular events, respiratory failure, or life-threatening diseases. Consistent with previous studies, these results demonstrated that ambulatory surgery is low risk.[9–11,17]

There was no significant difference in the rate of adverse events when complication data were stratified according to ASA status and preexisting diseases. In both the indicated testing and the no testing groups, patients who developed perioperative complications

had preexisting diseases. Hypertension and diabetes are the two coexisting diseases most likely associated with perioperative adverse events. This finding is in agreement with a prospective study of 17,638 ambulatory surgical patients that showed several preexisting diseases such as hypertension, obesity, smoking, asthma, and gastroesophageal reflux were more likely to be associated with perioperative adverse events.[16]

In the literature, the prevalence of abnormal testing results varied widely, and rarely led to significant changes in perioperative management. It has been shown that an abnormal rate of CBC was less than 3% in surgical patients[18–20] but increased to more than 10% in later studies.[21–24] Abnormal findings as high as 75% are common on preoperative ECG.[25–27] Abnormal preoperative chest radiographs ranged from 10% to 50%.[27–29] However, the results influenced management in <5% of cases. Moreover, 30% to 60% of abnormalities discovered on preoperative testing were never investigated before surgery.[30] In general, most patients had testing performed before surgery with little time for correction.[23] The lack of correlation between the abnormal results and the clinician's response suggested that abnormalities reported were minor.[22]

The decision regarding a patient's fitness for surgery may be accurately predicted on the basis of history and clinical examination.[31–33] In patients with false-positive findings, preoperative testing itself may bring more harm than benefit, leading to a cascade of investigations, cancellation or postponement of the planned surgery.[34,35]

By eliminating the indicated testing in ambulatory surgery, the economic implications may be substantial. Since the publication of Schein et al.'s[8] study suggesting no preoperative testing in cataract surgery, centers have adopted this policy with substantial savings.[36] In this study, the saving was Canadian $38.50 per patient. Eliminating preoperative testing in ambulatory surgery could mean large savings in the cost of health care.

One of the limitations of this study was its sample size of 1061 patients. To ensure 90% power to reject a 1% increase in rate of adverse events for the no testing group with a Type 1 error of 0.05, a sample size of 20,000 patients would be needed. From the results of this preliminary study, a large multicenter study is justified to demonstrate that preoperative testing may not be necessary in ambulatory surgical patients. The next important criticism is the use of the Ontario Preoperative testing grid to determine testing. This grid is a local, rather than a globally accepted, tool for determining the appropriate need and type of tests to perform preoperatively in ambulatory surgical patients. It, however, is a reasonable representation of the type of testing done for ambulatory surgical patients. This study had strict exclusion criteria with 22.5% of screened patients excluded due to medical reasons. For example, patients having MI within <3 mo before surgery, or angina CCS 3 and 4 were excluded. Therefore this study is not applicable to all ambulatory surgical patients.

To our knowledge, this is the first report of a RCT concerning eliminating preoperative testing in ambulatory surgical patients. Its strength includes ascertaining perioperative adverse events during the study period. This pilot study showed that there was no increase in perioperative adverse events with no preoperative testing in our study population. A larger study is needed to demonstrate that preoperative testing may be safely eliminated in selected patients undergoing ambulatory surgery without increasing perioperative complications.

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APPENDIX A: Ontario Preoperative Testing Grid[13]

Test (adapted from GAC)	Criteria for tests
Complete blood counts	Patient >60 yr of age, anemia suspected
Electrolyte/creatinine	Currently taking diuretics, renal disease, diabetes
Blood glucose	Diabetes
PT/PTT	Currently on anticoagulants, coagulopathy, chronic liver disease
Sickle cell screening	Patient of African or Caribbean origin
ECG	All patients >45 yr of age, cardiac history or hypertension
Chest radiograph	Pulmonary disease, heavy smokers

Cardiovascular disease include patients who have or have had:

- Previous heart surgery
- A history of heart problems
- Rheumatic heart disease
- A known heart murmur
- Chest tightness/chest pain/angina/or heart attack
- Heart beat irregularities or arrhythmias
- Congestive heart failure
- High blood pressure
- Peripheral vascular disease (i.e., carotid artery disease, aortic aneurysm, or lower limb arterial disease)
- SOB at two blocks on a flat grade or two flights of stairs

Pulmonary disease includes patients who have or have had:

- Chronic bronchitis or emphysema
- Smoking history of >20 pack years (defined as number of packs × number of years)
- Pulmonary fibrosis
- Pulmonary hypertension or previous pulmonary embolism
- Previous lung cancer—Hx of TB
- Cystic fibrosis or bronchiechtasis
- Chest wall or back deformity
- Morbid obesity or sleep apnea
- Asthma only if there is a smoking history of any length
- SOB at two blocks on a flat grade or two flights of stairs

Renal disease includes patients who have or have had:

- Chronic renal failure
- Known renal impairment
- Recurrent urinary tract infections
- Recurrent kidney stones

Liver disease includes patients who have or have had:

- Excessive alcohol intake
- Acute or chronic hepatitis
- Previous history of jaundice or unclear etiology
- Cirrhosis

APPENDIX B: Definition of Adverse Events

Adverse event	Definition
Myocardial infarction	The evolving changes in the ST-T segment, new Q waves, or both on an electrocardiogram; symptoms of ischemia plus abnormal serum levels of cardiac enzymes; or symptoms of ischemia plus left bundle branch block
Myocardial ischemia	New or more severe chest pain diagnosed as ischemia and requiring treatment
Congestive heart failure	New pulmonary edema on a chest radiograph or a diagnosis of congestive heart failure
Clinically significant arrhythmia	New or worsening disturbance of heart rhythm requiring new treatment or a change in treatment
Clinically significant hypertension	Increase in systolic pressure to ≥200 mm Hg or diastolic pressure to ≥110 mm Hg with new antihypertenisve treatment or a change in treatment required
Clinically significant hypotension	A decrease in systolic pressure <90 mm Hg with treatment required
Transient ischemic attack	Abrupt onset of a focal neurologic deficit lasting <24 h and resulting from cerebrovascular ischemia
Respiratory failure	Need for mechanical ventilation
Hypoglycemia	Blood glucose level low enough to require intravenous dextrose
Diabetic ketoacidosis	Hyperglycemia with an increase in the anion gap, metabolic acidosis, and serum or urinary ketones
OR delays or cancellations	Delays/cancellations in OR due to false-positive preoperative testing or additional testing required by anesthesiologist in the no testing group
Unanticipated admission	Ambulatory surgery patient was admitted to the hospital instead of being discharged home. Reasons for unanticipated admission, medical, surgical, anesthesia, and social reasons were collected
Revisits within 7 d and within 30 d	Revisits include visiting family doctors, emergency, and readmission to hospital within 7 and 30 d of ambulatory surgery. Medical, surgical, and anesthesia reasons are documented
Other new or worsening medical problem requiring treatment with specific medication or procedure	

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