

## Preoperative Testing Prior to Elective Surgery

**Before elective surgery**, patients often have routine screening such as electrocardiogram (ECG), chest x-ray (CXR) and blood chemistry workup to identify potential complications. The notion that this information makes surgery safer is appealing, yet a growing body of research and expert opinion indicates that for patients having low-risk surgical procedures, routine testing is not beneficial. Studies have shown that it may detect abnormalities, but the significance in patients without symptoms is uncertain, nor is there evidence to support using tests as a baseline for comparison in the event of complications.

Preoperative testing is likely influenced by non-clinical factors. With considerable pressure on hospitals to reduce length of stay, preoperative patient evaluation is often conducted at outpatient clinics where pre-specified algorithms that are insensitive to particular patient and procedure characteristics may direct testing. Medico-legal concerns may also prompt testing despite the fact that results are not always reviewed before surgery, thereby actually increasing legal liability.

Scientists at the Institute for Clinical Evaluative Sciences (ICES) examined patterns of chest radiography and electrocardiography prior to common low- and intermediate-risk elective surgical procedures in Ontario acute-care hospitals.

### **METHODS**

Records of selected inpatient and outpatient surgical procedures in Ontario from April 1, 2000 to March 31, 2002 were obtained from the Canadian Institute for Health Information (CIHI) discharge abstracts database and same-day surgery files. A total of 523,596 patients undergoing 673,402 surgical procedures was studied.

Procedures were selected on the basis of high volumes and relatively low perioperative anesthetic and surgical risk (see Table 1). To reduce variability from small volumes, data for institutions with fewer than 100 cases of a procedure in a given year were excluded.

Test information was obtained from Ontario Health Insurance Plan (OHIP) claims for all ECGs and CXRs obtained during the four weeks preceding a procedure.

Length of hospital stay (LOS) was assessed as a crude measure of outcome for inpatient procedures. If preoperative testing averts post-operative complications by altering case selection or directing appropriate preventive care, an association between higher hospital testing rates and shorter LOS

would be expected.

The cost associated with ECG and CXR preoperative testing was estimated for fiscal 2000/01 and 2001/02 from direct charges to OHIP based on claims data. Not captured in this analysis were payments through independent health facilities and alternative physician reimbursement, and costs for tests that may have investigated abnormalities from initial tests.

### **RESULTS**

**Frequency:** Preoperative testing was not common in patients below age 44, but was for approximately 50% of patients over age 45. When the testing rates analysis was adjusted for procedure, institution, teaching status and patient characteristics (age, sex, comorbidity score and neighbourhood income quintile), each factor remained a significant predictor.

Figure 1 shows the frequency of procedures and associated preoperative testing. There was considerable variation in testing rates across low-risk procedures. Despite strong evidence that preoperative tests provide no value for cataract surgery, its testing rates were the highest of the low-risk procedures. This may, in part, reflect the older patient age. Considerable variation was also observed among hospitals delivering the same procedures.

**Length of stay:** This varied significantly with age group, sex, comorbidity index, socioeconomic status, surgical procedure and hospital type. After adjusting for these factors, preoperative testing was not associated with a shorter LOS, and in the multivariate model, LOS was shorter for patients who did not undergo testing (relative LOS 0.968, 95% CI 0.959, 0.978). Given that the Charlson score may be a relatively insensitive measure of comorbidity, tested patients may have differed from untested patients in ways that contributed to LOS but were not adequately controlled for in the multivariate model.

**Cost:** A total of \$2,888,149 was spent on 308,757 preoperative ECGs during the study period. More than 85,000 tests were performed for patients at low perioperative risk (below age 60 and no comorbidity) and nearly 7,000 were performed for patients at very low perioperative risk (under age 40 and no comorbidity). Elimination of routine ECG in these low-risk groups represents a savings of \$834,917 (29%) over two years.

**Table 1.** Frequency and preoperative testing rates for select low- to intermediate-risk procedures in Ontario, 2000–2002

Low-Risk (Outpatient) Procedures			Intermediate-Risk (Inpatient) Procedures		
Procedure	Frequency	Preoperative Testing (%)	Procedure	Frequency	Preoperative Testing (%)
Cystoscopy	234,295	17.5	Hysterectomy	34,440	56.7
Cataract removal & lens replacement	181,047	64.6	Total hip/knee replacement	31,789	89.6
Knee arthroscopy	53,563	46.0	TURP	8,864	89.8
Local breast excision	17,523	53.1			
Laparoscopic cholecystectomy	26,755	57.6			
D&C	39,995	46.1			
Tooth extraction	23,196	25.9			
Carpal tunnel release	21,398	28.5			
<b>Overall Low-Risk Procedures</b>	<b>597,772</b>	<b>39.8</b>	<b>Overall Intermediate-Risk Procedure</b>	<b>75,093</b>	<b>74.4</b>

**The rate of preoperative CXRs was 13.4%: 95,466 tests prior to 713,226 low-risk procedures at a cost of \$2,729,553.** Patients without comorbidity, regardless of age, accounted for nearly 74%. Elimination of routine CXR in this group would have saved \$2,017,185 in the two-year period.

#### DISCUSSION AND IMPLICATIONS

Despite numerous guidelines recommending a reduction in routine testing before low- and intermediate-risk surgery and good evidence to support its safety, preoperative CXRs and ECGs are frequently conducted in Ontario hospitals. Testing rates are not fully explained by differences in patient characteristics or operative risk. Moreover, hospitals with high testing rates did not achieve better outcomes measured by LOS for inpatient procedures.

Eliminating diagnostic testing on the basis of conservative age and comorbidity criteria would reduce expenditures, though savings would be modest within the overall health-care budget as individual tests are relatively inexpensive. For institutions with higher testing rates, more significant savings would be achieved. The analysis did not include

direct costs to the healthcare system or indirect costs to patients from downstream tests resulting from an initial CXR or ECG showing unanticipated abnormalities.

This analysis demonstrates that routine CXR and ECG are frequently ordered even for very low-risk procedures such as cataract extraction. During the study period, some of the best evidence to support the elimination of routine testing without compromising patient safety was just emerging. Moreover, practice patterns suggest that factors other than research evidence may influence utilization. Hospitals with high rates will need to examine care models that promote unwarranted test ordering, and those with uniformly low rates of testing may provide useful insights into how practice change can be achieved.

#### About the Author

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