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Research Paper

Evaluation of choosing wisely recommendations on preprocedural cardiovascular testing

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ABSTRACT

Study objective: The Choosing Wisely (CW) initiative currently has multiple recommendations focused on avoiding preprocedural testing in asymptomatic patients prior to low-risk surgery. The purpose of this study was to measure the potential impact of the CW recommendations as they relate to preprocedural testing prior to cataract surgery.

Design: Retrospective cohort study.

Setting: Single academic medical center.

Participants: Patients undergoing cataract surgery from 01/02/2018 to 12/31/2018.

Interventions: N/A.

Main outcome measures: Prevalence of preprocedural testing in elevated versus low cardiac risk patients as defined by the Revised Cardiac Risk Index (RCRI).

Results: Of a total 909 patients, 90 (9.9%) had some form of preprocedural testing ordered; testing was more common among elevated risk (n = 50/315, 15.9%) compared to low-risk patients (n = 40/594, 6.7%; p < 0.0001). Of the tests ordered, 9 were abnormal (4 in the low-risk cohort, 5 in the elevated risk cohort). ECGs were the vast majority of tests ordered (n = 88/90). No stress test orders or periprocedural adverse cardiovascular (CV) events were observed. Anesthesiology clinicians ordered 95.6% of preprocedural testing. "Routine" was the justification given for the substantial majority of tests ordered in both cohorts (90% low-risk, 86% elevated risk).

Conclusion: Our investigation confirms that cataract surgery has exceptionally low rates of postprocedural CV events. In contemporary practice, preprocedural CV testing for cataract surgery is not highly prevalent, rarely abnormal, and also not well justified by ordering clinicians. Our results may be considered as justification for revisions of some CW recommendations to potentially target higher prevalence areas of low-value care.

1. Introduction

The Choosing Wisely (CW) initiative encourages doctors and patients to question certain healthcare practices in order to minimize overuse and maximize quality of care. This is done through lists of five specific tests, treatments, or services that are considered low-value within a respective medical specialty [1]. A number of national medical specialty societies have released CW lists identifying preprocedural testing in asymptomatic patients undergoing low-risk surgical procedures as low-value [2,3]. One list, published in 2012 and revised in 2019, includes

two recommendations to avoid electrocardiogram (ECG) screening and imaging in the low-risk preprocedural setting [4].

While the CW is a laudable goal and a step in the right direction towards furthering the conversation between physician and patient on costs and value in healthcare, the program is not without limitations. Some societies have been criticized for listing low prevalence clinical situations, focusing their recommendations on other specialties, or declining to reflect on well-known areas of low-value care within their own specialty [5]. Relatively few investigations have been conducted evaluating whether individual CW recommendations are impactful.

Abbreviations: CAD, Coronary Heart Disease; CHF, Congestive Heart Failure; CKD, Chronic Kidney Disease; CV, Cardiovascular; CW, Choosing Wisely; ECG, Electrocardiogram; HTN, Hypertension; RCRI, Revised Cardiac Risk Index.

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Cataract surgery is known to have a low rate of perioperative cardiovascular (CV) events, morbidity, and mortality [6]. Additionally, routine medical testing prior to cataract surgery has not been shown to meaningfully increase the surgery's safety, making such testing low-value [7]. We conducted this investigation to measure the potential impact of the CW recommendations as they relate to preoperative testing prior to cataract surgery.

2. Methods

We conducted a retrospective cohort study using data from our integrated data repository. We identified patients who underwent cataract surgery between 1/1/2018 and 12/31/2018 by searching for Current Procedural Terminology (CPT) codes 66982 and 66984. Data were extracted from the medical records of patient in a single, tertiary care academic medical center by manual extraction. No automated software was used. If multiple records were found, only the first record of cataract surgery that presented chronologically was included for each respective patient; subsequent cataract surgery occurrences for a patient were excluded. The investigation was focused on cataract surgery to reduce heterogeneity of the study population and because this particular surgery is among the procedures with the lowest CV risk to better highlight any patterns of care related to preoperative CV testing. A contemporary cohort was studied to demonstrate whether or not CW recommendations continue to be relevant for this population.

The primary outcome of this investigation was to compare the prevalence of CV testing among patients of low and elevated cardiac risk undergoing cataract surgery in contemporary practice. Secondary outcomes included prevalence of abnormal preoperative CV testing, prevalence of serial testing, and occurrences of perioperative CV events. We also evaluated rates of testing performed by specialties that provide preoperative assessments including: Ophthalmology, Anesthesiology, Cardiology, and Primary Care.

Data was collected and stored in a secure online REDCap database [8]. The integrated data repository provided the patient's respective medical record number and date of surgery. Each patient chart was analyzed in our electronic health records to collect baseline characteristics including age, sex, coronary artery disease (CAD), congestive heart failure (CHF), stroke, diabetes, chronic kidney disease (CKD), and hypertension (HTN). Patients were stratified into low-risk and elevated risk cohorts based on the Revised Cardiac Risk Index (RCRI). The RCRI algorithm is based on six risk factors: high-risk type of surgery, history of CAD, history of CHF, history of cerebrovascular disease, insulin dependent diabetes mellitus, and preoperative serum creatinine >2.0 mg/dL [9]. Patients with zero of the six aforementioned RCRI risk factors were classified as low-risk (RCRI = 0). Patients with one or more of these RCRI risk factors were classified as elevated risk (RCRI>0). Cataract surgery does not meet one of the six RCRI risk factors (high-risk type of surgery), therefore patients in this study could have between zero to five RCRI risk factors [9]. Unless a patient's chart explicitly stated a reasoning for ordering the preoperative test or had a relevant diagnosis code, the preoperative test was categorized as "routine." The study design was approved by our institutional review board who waived the requirement for informed consent. Data was analyzed using SPSS version 27 (IBM, Armonk NY). Comparisons between cohorts were compared using the chi-square test with a significant difference pre-defined as alpha <0.05.

3. Results

This study included 909 patients: 43.2% males (n = 393), 56.8% females (n = 516). Table 1 outlines the baseline characteristics and risk factors possessed among the study population. The most common CV risk factor was hypertension (n = 573; 63.0%); however, hypertension is not included in the RCRI algorithm as one of its six risk factors. Fig. 1 illustrates the frequency of preoperative testing ordered among

Table 1
Baseline characteristics and risk factors.

	RCRI = 0		RCRI > 0		p-value	OR	95% CI
	n	%	n	%			
Female	357	60.1	159	50.5	0.006	0.68	0.51–0.89
CAD	0	0	145	46.1	NA	NA	NA
CHF	0	0	75	23.8	NA	NA	NA
Stroke	0	0	78	24.8	NA	NA	NA
Diabetes	0	0	142	45.1	NA	NA	NA
CKD	0	0	29	9.2	NA	NA	NA
HTN	307	51.7	266	84.4	<0.0001	5.08	3.60–7.16

CAD, coronary heart disease.
CHF, congestive heart failure.
CI, confidence interval.
CKD, chronic kidney disease.
HTN, hypertension.
OR, odds ratio.
RCRI, revised cardiac risk index.

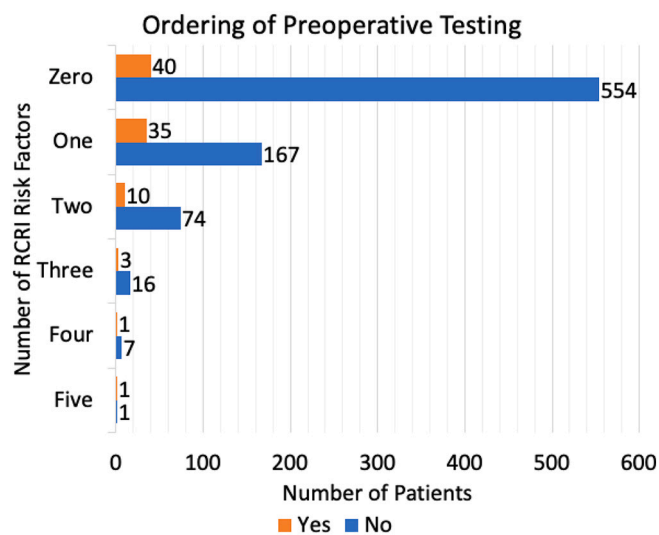


Fig. 1. Frequency of pre-operative testing being ordered and stratified by the number of RCRI risk factors a patient possessed.

patients stratified by number of RCRI risk factors. As the number of RCRI risk factors increased, the number of patients progressively decreased. The majority of patients possessed zero RCRI risk factors and made up 65.3% (n = 594) of patients in this study.

The most common preoperative test conducted in our study was an ECG. In the cohort of low-risk patients, ECGs (n = 40) were exclusively ordered and in the cohort of elevated risk patients (greater than or equal to one RCRI risk factor), ECGs (n = 48) and transthoracic echocardiograms (n = 2) were ordered (Table 2). Of these preoperative tests ordered, 4 displayed abnormal results in the low-risk cohort and 5 displayed abnormal results in the elevated risk cohort (Supplementary Table 1). Testing cascades were only observed in two patients (0.03%) in the low-risk cohort and none were observed in the elevated risk cohort. Postoperative adverse events occurring within seven days after the cataract surgery encounter, such as acute myocardial infarction, ventricular tachycardia, ventricular fibrillation, or death, were absent in both low-risk and elevated risk cohorts.

In regard to the specialty conducting the ordering of such preoperative testing, Anesthesiology, was overwhelmingly the primary specialty performing orders, followed distantly by Cardiology. Of the 40 patients in the low-risk cohort who had a preoperative test ordered, 39 (97.5%) were ordered by Anesthesiology and 1 (2.5%) by Cardiology.

Table 2
Frequency of preprocedural cardiac testing modalities ordered and outcomes.

	RCRI = 0		RCRI > 0		p-value	OR	95% CI
	n = 594		n = 315				
	n	%	n	%			
Any test	40	6.7	50	15.9	<0.0001	2.61	1.68–4.06
ECG	40	6.7	48	15.2	<0.0001	2.49	1.60–3.88
Transthoracic echo	0	0	2	0.6	NA	NA	NA
Exercise treadmill	0	0	0	0	NA	NA	NA
Nuclear stress	0	0	0	0	NA	NA	NA
Stress echo	0	0	0	0	NA	NA	NA
Cardiac CT	0	0	0	0	NA	NA	NA
Outcomes							
Abnormal test	4	0.67	5	1.6	0.134	3.177	0.75–13.38
Adverse event	0	0	0	0	NA	NA	NA
Testing cascade	2	0.34	0	0	NA	NA	NA

CI, confidence interval.

CT, computed tomography.

ECG, electrocardiogram.

Echo, echocardiogram.

OR, odds ratio.

RCRI, revised cardiac risk index.

Similarly, of the 50 patients in the elevated risk cohort who had a preprocedural test ordered, 47 (94%) were ordered by Anesthesia and 3 (6%) by Cardiology.

Reasoning for order of the preprocedural test displayed similar rates between the two RCRI cohorts with “routine” being the most common reasoning, followed by concerns regarding past medical history. Majority of patient charts did not specifically state the reason a test was ordered. In the low-risk cohort, 36 tests (90%) were categorized as “routine,” 3 tests (7.5%) as concerns of past medical history, and 1 test (2.5%) as active symptoms for the reasonings for ordering. In the elevated risk cohort, 43 tests (86%) were categorized as “routine,” and 7 tests (14%) as concerns of past medical history for the reasonings for ordering.

4. Discussion

In our cohort study of patients undergoing cataract surgery, we observed that the prevalence of preprocedural CV testing was low with more testing performed among patients with elevated risk of peri-procedural CV events as compared to patients with low-risk. ECG was the most common test ordered and no patients were evaluated with noninvasive ischemia or coronary anatomical imaging.

One of our primary goals with this investigation was to determine the rate of preprocedural CV testing to comment as to whether CW recommendations on preprocedural testing are impactful. Preprocedural ECGs were performed on roughly 10% of the entire cohort; although whether 10% is a high or low rate of testing is a question that lies very much in the eye of the beholder. A study evaluating provider attitudes on myocardial perfusion imaging found that most providers believed having 0% to 5% of tests rated as inappropriate would be an acceptable level [10]. Although the optimal preprocedural testing rate cannot be easily defined, findings of an institutional rate as high as 88.8% for ECGs is understandably quite difficult to justify [11]. Overall, previous literature poorly characterizes what a permissible level of low-value preprocedural testing should be. We suggest that a rate of 10% is a reasonable rate, as long as certain aberrant patterns are not present. For example, it would not be an acceptable rate if majority of the tests are being ordered by a single clinician and therefore skewing the data. Additionally, such a rate would not be acceptable if all preprocedural tests were clustered in a limited time period. Such patterns did not exist in our cohort but should be considered to put such a rate in context.

ECG is perceived as harmless because it has essentially zero risk and low cost. One potential adverse effect of such tests is initiating a testing cascade. In our study, we observed a negligible amount of such cascades where one preprocedural test led to increased subsequent testing. Two testing cascades were observed out of the study's total 909 patients. In a prior study evaluating preprocedural testing in Medicare beneficiaries prior to cataract surgery, 11.3% received a preprocedural ECG before cataract surgery. Unlike our study, 15.9% of the patients receiving a preprocedural ECG were noted to have at least 1 potential cascade event [12]. Incidental findings resulting in such cascades are undesirable not only due to financial burden on the healthcare system, but as well as adverse psychological and physical impacts on patient. Additionally, there is a lost opportunity cost for both patient and provider's time spent on further investigations [13].

Investigations that evaluated low-risk surgery cohorts preceding the release of the CW campaign in April 2012 outlined high prevalence rates of preprocedural testing. A study evaluating preprocedural medical testing in Medicare patients undergoing cataract surgery in 2010 and 2011 revealed 53% of beneficiaries underwent at least one preprocedural test [14]. Additionally, a study evaluating patients undergoing endoscopy, ophthalmologic surgery and other low-risk procedures from 2008 to 2013 in Ontario, Canada found that ECGs were performed prior to 31% of procedures [11]. However, a degree of institutional variation in preoperational testing rates was also noted, with the frequency of preprocedural ECGs ranging from 3.4% to 88.8%. Of note, CW was launched in Canada in 2014, one year after the evaluated cohort in the previously mentioned study. Together, these studies and our findings suggest that the rate of preprocedural CV testing has decreased over time. This was also the result of a recently published study evaluating the frequency of preoperative cardiac stress testing prior to intermediate risk surgeries, including total hip and knee arthroplasty, found an overall rate of 10.4% with an annual decline in frequency from 2006 to 2017 [15]. These trends could be due to the CW program, reimbursement factors, research on preprocedural test utility, adoption of newer practices by clinicians, or some combination of the above.

A limitation of this study includes the lack of diversity in low-risk surgeries evaluated. Cataract surgery is not the only low-risk procedure and larger study of contemporary practices needs to be performed to fully evaluate the prevalence of such testing among preprocedural patients at large. The retrospective design of this study limits our analysis to medical documentation, which is variable depending on the detail provided by the medical provider.

5. Conclusions

Our investigation captures a snapshot of preprocedural CV testing prior to cataract surgery in contemporary practice and reveals that such testing is not highly prevalent. Although our study revealed higher rates of testing in the elevated risk cohort, preprocedural testing was still only seen in a minority of patients, regardless of one's risk factors. The results provided by the cohort evaluated in this study suggest some evidence that certain CW recommendations may potentially not continue to be highly prevalent issues and could potentially consider targeting other areas of low-value care upon future revisions of such recommendations.

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CRedit authorship contribution statement

Keval Patel: Investigation, Writing - Original Draft.

David Winchester: Conceptualization, Investigation, Writing - Review & Editing.

Declaration of conflicting interest

The author has no conflicts of interest to disclose. The views

expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States Government.

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