


The Value of Preoperative Laboratory Investigations in Healthy Individuals Undergoing Elective Cataract Surgeries

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Purpose: To evaluate the number of patients with abnormal preoperative laboratory test results and determine the benefits of these tests in healthy individuals scheduled for elective cataract surgeries.

Patients and Methods: This study was conducted at Songklanagarind Hospital, Thailand. The data were collected from January 1, 2020, to August 31, 2021. The results of laboratory investigations, consisting of a complete blood count (CBC), including hemoglobin (Hb), hematocrit (Hct), and platelet count; chest X-ray (CXR); electrocardiography (EKG); and anti-human immunodeficiency virus (anti-HIV), were evaluated and analyzed. Additional management actions and rates of postponement or cancellation of surgeries were also evaluated.

Results: In total, 401 participants were enrolled in this study. The rates of abnormal investigation results were 40.2% for EKG, 15.5% for CXR, 12.7% for Hb, 11.7% for Hct, 2.0% for platelet count, and 0.2% for anti-HIV. The preoperative tests that required additional management and postponement/cancellation of surgeries were CXR (5.5% and 1.7%, respectively), EKG (2.5% and 0.5%, respectively), and anti-HIV (0.2% and 0%, respectively). Moreover, age ≥ 60 years was associated with a significantly higher rate of positive preoperative EKG findings (relative risk, 4.64; $p = 0.017$).

Conclusion: The CBC test was not beneficial as a preoperative laboratory investigation for healthy individuals in any age group who were scheduled for elective cataract surgery. However, EKG, CXR, and anti-HIV test results were valuable. Patients aged ≥ 60 years were at risk of having positive EKG results that could result in cancellation or postponement of surgery.

Keywords: elective cataract surgery, phacoemulsification, pre-operative investigations, electrocardiography

Plain Language Summary

The value of preoperative laboratory investigations in healthy individuals undergoing elective cataract surgeries.

Introduction

Cataract surgery is an ophthalmic surgical procedure practiced worldwide.¹ The operation has a low risk of systemic and local complications even though it is usually performed in older adults.^{2,3} However, most ophthalmologists usually request laboratory investigations prior to surgery, even in healthy patients who have no known systemic conditions.^{1,3} The purpose of routine investigations is to detect abnormal medical conditions,^{2,3} however, it is questionable whether these conditions change perioperative management or preclude patients from surgery.

According to a 2019 Cochrane systematic review of preoperative tests for cataract surgeries, these routine tests did not show beneficial surgical outcomes.^{1,3-6} The investigations also did not reduce the risk of intraoperative and postoperative adverse ocular events.^{1,3-6} Furthermore, one study revealed that the cost of surgeries was 2.55 times higher when preoperative tests were required.⁷ These results raised concerns among many ophthalmologists regarding the value or benefit of such preoperative investigations in healthy patients with cataracts.

Currently, routine preoperative investigations of elective cataract surgeries at Songklanagarind Hospital in southern Thailand show very few positive results and have a low impact on whether the surgeries will be conducted or canceled. Our study investigations consisted of a complete blood count (CBC), chest X-ray (CXR), anti-human immunodeficiency virus (anti-HIV), and electrocardiography (EKG). The total cost of these investigations per patient was reported to be approximately US\$ 23,⁸ which adds up to approximately US\$ 46,000 for 2000 elective cataract surgeries annually. Therefore, this study was conducted to investigate the incidence and severity of abnormal preoperative laboratory investigation results and the value or benefit of the tests in healthy individuals scheduled for elective cataract surgeries.

Materials and Methods

Study Design

This study was a prospective review of the medical records of patients in Songklanagarind Hospital in southern Thailand from January 1, 2020, to August 19, 2021. Information for this study was obtained by accessing medical records, and no changes were imposed on the routine procedure. Informed consent was waived due to minimal risk, and the study was approved by the Human Research Ethics Committee of Prince of Songkla University. The study protocol followed the tenets of the Declaration of Helsinki. The study has been registered with the Thai Clinical Trials Registry (registration number TCTR20200512004). Patients aged ≥ 18 years without documented underlying diseases who were scheduled for elective cataract surgeries, including phacoemulsification, extracapsular or intracapsular cataract extraction with or without intraocular lens implantation, or scleral fixation under local or topical anesthesia, were recruited. Patients who were scheduled for emergency cataract removal, namely patients with phacomorphic or phacolytic glaucoma and those who underwent cataract surgery combined with other surgeries, such as trabeculectomy or pars plana vitrectomy, were excluded.

Data Collection

The data collected consisted of demographic data (age, sex, diagnosis, and procedures) and the results and severity of preoperative investigations (CBC, CXR, anti-HIV, and EKG). The results of CBC, anti-HIV, and EKG tests were reviewed and evaluated by ophthalmology residents who were responsible for preoperative laboratory evaluation. The results and further management suggestions for preoperative CXR were taken from the official report and interpreted by radiologists.

The preoperative CBC data included patients' hemoglobin (Hb), hematocrit (Hct), and platelet count. On this basis, patients were divided into three groups: normal, nonspecific abnormal, and specific abnormal. The results of the normal group were within the standard hospital reference range. The results of the nonspecific abnormal group were between those of the normal group and those of the specific abnormal group; however, the patients in the nonspecific abnormal group did not require additional management. The results of the specific abnormal group met the threshold for blood transfusion guidelines according to the National Institute for Health and Care Excellence (NICE) guidelines;⁹ therefore, the patients in the specific abnormal group required additional management.

Patients were also divided into the following three groups based on their CXR and EKG results: normal, nonspecific abnormal, and specific abnormal. The normal group had results that were reported as normal or unremarkable. The nonspecific abnormal group had mildly abnormal CXR or EKG reports that did not require any consultation. The specific abnormal group had markedly abnormal CXR or EKG reports that required additional consultation and possible management. The specific abnormal CXR results included reports of tuberculosis (TB) infection, lung mass, lung atelectasis, thyroid mass, aortic aneurysm, and hiatal hernia. The specific EKG results considered abnormal were myocardial infarction, cardiac arrhythmia, bradycardia, prolonged QT, left ventricular hypertrophy, and second-degree atrioventricular block.

The specific abnormal groups of CBC, CXR, and EKG were referred to the internal medicine department for preoperative co-evaluation consultation. The decision to repeat or further investigate the abnormal results was deferred to the consulting internists. The rates and reasons for additional management, surgical postponement, or cancellation were evaluated.

Statistical Analysis

The data were analyzed using the R program version 4.1.0 (The R Group, Vienna, Austria) with EpiCalc software. Continuous demographic data are shown as mean and standard deviation or median and interquartile range. Discrete data, including the number of abnormal tests, number of postponements or cancellations, and number of additional management cases, are shown as frequency and percentage.

Fisher's exact or Pearson's chi-squared test was used to analyze the predictive factors associated with abnormal test results, additional management, and cancellation/postponement of the operation. Statistical significance was set at $p < 0.05$.

Results

Demographic Data

In total, 401 patients were included. Table 1 provides an overview of the patient demographics. The mean age was 64.9 \pm 12.6 years (range, 19–95), and 51.1% of the participants were male. Phacoemulsification was the most frequently performed procedure (92.8%), whereas only 4.7% of the procedures involved extracapsular cataract extraction.

Preoperative Laboratory Results

The CBC test results, including those for Hb, Hct, and platelet count, are shown in Table 2. The mean Hb level in this study was 13.5 g/dL, Hct was 41.0%, and platelet count was 252,000/ μ L. The overall rates of nonspecific abnormal Hb, Hct, and platelet count were 12.7%, 11.7%, and 2.0%, respectively. None of the patients showed any specific abnormal results.

The results of anti-HIV, CXR, and EKG tests are shown in Table 3. Abnormal EKG results were the most commonly noted findings. The overall abnormal EKG rate was 40.2%, which included a specific abnormal rate of 7.2%. Abnormal CXR results were the second most common finding, with a rate of 15.5%. The specific abnormal CXR group had a rate of 7.5%, and the results were divided into suspected TB infection (2.5%) and non-TB (5.0%). The lowest abnormal result was that of anti-HIV test for a single patient who had an inconclusive result.

Effects of Preoperative Investigations on the Management of Patients

Our study results indicated that only 33 of 401 (8.2%) patients required additional management. For example, chest computed tomography is required in patients with suspected lung cancer or TB infection based on CXR results. Exercise stress tests were required in patients with suspected myocardial infarction based on the EKG results. The most common preoperative investigation that required additional management was CXR (22 patients, 5.5%), followed by EKG (10 patients, 2.5%) (Figure 1). Only 1 patient required additional management according to the anti-HIV results, leading to the anti-HIV test being repeated. No additional management was required for any patient based on the CBC results.

Table 1 Patient Demographic Data

Variables	Number (%)
Gender	
Male	205 (51.1)
Female	196 (48.9)
Age	
Mean (SD)	64.9 (12.6)
Median (min–max)	65.7(19.9–95.9)
Age	
<45 years	29 (7.2)
45–59 years	86 (21.4)
\geq 60 years	286 (71.3)

Abbreviation: SD, standard deviation.

Table 2 Results of the CBC Investigations

Variables	Number (%)
Hb (g/dL)	
Normal (12–18)	350 (87.3)
Nonspecific abnormal (≥ 7 – < 12)	51 (12.7)
Specific abnormal (< 7)	0 (0.0)
Hct (%)	
Normal (37–54)	354 (88.3)
Nonspecific abnormal (≥ 21 – < 37)	47 (11.7)
Specific abnormal (< 21)	0 (0.0)
Platelet (/ μ L)	
Normal (150,000–450,000)	391 (98.0)
Nonspecific abnormal ($\geq 100,000$ – $< 150,000$)	8 (2.0)
Specific abnormal ($< 100,000$)	0 (0.0)

Abbreviations: CBC, complete blood count; Hb, hemoglobin; Hct, hematocrit.

Table 3 Results of the Anti-HIV, CXR, and EKG Investigations

Variables	Number (%)
Anti-HIV	
Non-reactive	400 (99.8)
Inconclusive	1 (0.2)
CXR	
Normal	339 (84.5)
Nonspecific abnormal	32 (8.0)
Specific abnormal	30 (7.5)
EKG	
Normal	232 (59.8)
Nonspecific abnormal	128 (33.0)
Specific abnormal	28 (7.2)

Notes: Specific abnormal CXRs included tuberculosis infection, lung mass, lung atelectasis, thyroid mass, aortic aneurysm, and hiatal hernia. Specific abnormal EKG findings included myocardial infarction, cardiac arrhythmia, bradycardia, prolonged QT, left ventricular hypertrophy, and second-degree atrioventricular block.

Abbreviations: HIV, human immunodeficiency virus; CXR, chest X-ray; EKG, electrocardiogram.

We followed up on 33 cases (8.2%) that required additional management. Only 9 of 401 patients (2.2%) had surgery that was canceled or postponed because of their abnormal preoperative investigation results (Table 4 and Figure 2). We found that 1.7% of cataract surgeries were rescheduled or canceled due to abnormal CXR results, followed by 0.5% of the cases due to abnormal EKG results. No surgeries were postponed or canceled owing to CBC or anti-HIV results. Moreover, there were other miscellaneous reasons for cancellation or postponement that did not correlate with abnormal preoperative test results, such as the Coronavirus Disease 2019 pandemic and acute illness.

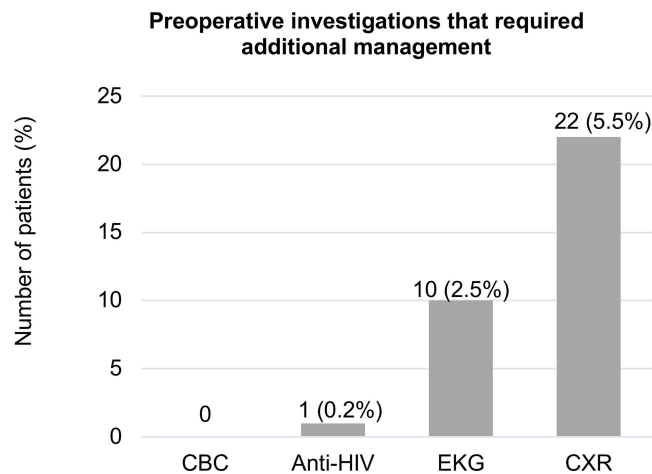


Figure 1 Bar graph shows the number of patients who had abnormal preoperative laboratory results that required additional management.

Risk Factors Associated with Specific Abnormal Preoperative Investigations and Cancellation or Postponement of the Operation

Tables 5 and 6 show the univariate analysis of risk factors associated with specific abnormal preoperative investigations and cancellation or postponement of the operation. The specific abnormal preoperative EKG results were statistically associated with age group; there was a higher prevalence in patients aged ≥ 60 years ($p=0.014$) (Table 5), and the relative risk was 4.64 (95% confidence interval, 1.12–19.19; $p=0.017$). The specific abnormal preoperative CXRs showed no association with sex or age (Table 6).

Discussion

Preoperative medical testing for all types of surgery accounts for approximately US\$ 30 billion in health care costs annually.⁴ Since cataract surgery is commonly performed worldwide, the total cost of routine medical testing before cataract surgery exceeds US\$ 150 million annually.⁴ Copious research has raised questions concerning the value of routine medical testing before elective surgery.⁴

In 2000, Schein et al⁴ published a large randomized controlled trial in which 19,557 patients who were scheduled for cataract surgeries did not undergo preoperative testing or usual care. The results revealed no difference in outcomes between the two groups, and abnormal preoperative test results did not predict outcomes. Their conclusion was reinforced by the 2019 Cochrane review.¹

Table 4 Cancellation or Postponement of Surgery

Variables	Number (%)
Cancellation/Postponement of surgery with reasons	
Yes, due to abnormal preoperative laboratory results	9 (2.2)
Yes, due to other reasons	115 (28.7)
No cancellation/postponement	277 (69.1)
Preoperative investigation that caused cancellation or postponement of the operation	
CBC	0 (0.0)
Anti-HIV	0 (0.0)
EKG	2 (0.5)
CXR	7 (1.7)

Abbreviations: CBC, complete blood count; HIV, human immunodeficiency virus; EKG, electrocardiogram; CXR, chest X-ray.

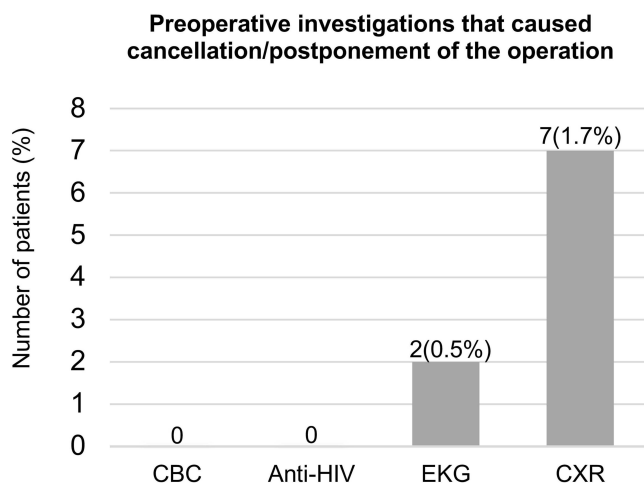


Figure 2 Bar graph showing numbers of patients who cancelled/postponed surgery due to the results of the preoperative investigations.

In 2007, Shah et al¹⁰ evaluated the significance and cost-effectiveness of routine preoperative laboratory investigations in healthy patients who underwent elective ear, nose, and throat surgeries. They found abnormal test results in only 3 of 600 laboratory investigations from a total of 150 patients. Chinachot et al¹¹ also studied the incidence, severity, and factors that led to abnormal preoperative test results among 6280 patients who underwent general anesthesia in Thailand. The study showed that only older adult patients or those with an American Society of Anesthesia score >1 had higher

Table 5 Results of the Univariate Analysis of Risk Factors Associated with Abnormal Preoperative EKG and Cancellation or Postponement of the Operation

Variables	Specific Abnormal Test	Additional Management	Cancellation or Postponement
Gender			
Male	19 (9.6)	7 (3.4)	2 (1.0)
Female	9 (4.7)	3 (1.5)	0 (0.0)
p-value	0.060	0.339	0.499
Age group			
<60 years	2 (2.0)	0 (0.0)	0 (0.0)
≥60 years	26 (9.1)	10 (3.5)	2 (0.7)
p-value	0.014	0.069	1.000

Note: Data are presented as number (%).

Table 6 Results of the Univariate Analysis of Risk Factors Associated with Specific Abnormal Preoperative CXR and Cancellation or Postponement of the Operation

Variables	Specific Abnormal Test	Additional Management	Cancellation or Postponement
Gender			
Male	16 (7.8)	14 (6.8)	5 (2.4)
Female	14 (7.1)	8 (4.1)	2 (1.0)
p-value	0.801	0.227	0.450
Age group			
<60 years	4 (3.5)	4 (3.5)	2 (1.7)
≥60 years	26 (9.1)	18 (6.3)	5 (1.8)
p-value	0.059	0.337	1.000

Note: Data are presented as number (%).

rates of abnormal preoperative investigation results. These two studies seem to demonstrate that laboratory investigations might have no benefit in preoperative evaluations or management of healthy individuals. In 2018, Harder et al¹² published a study on the frequency of abnormal findings on routine CXRs before cardiac surgery in 1136 patients. The reported results showed that 50% of the patients had one or more abnormalities on the CXR, 1.3% needed further analysis, and only 0.2% of the CXR led to postponement of surgery, whereas the surgery was not canceled in any of the patients.

To our knowledge, our study is the first in Thailand to evaluate the benefits of preoperative investigations in healthy patients scheduled to undergo cataract surgery under routine local or topical anesthesia. The CBC results from our study showed that the overall rates of abnormal Hb, Hct, and platelet count were 12.7%, 11.7%, and 2.0%, respectively. However, interestingly, none of the patients met the criteria for blood transfusion according to the NICE guidelines,⁹ therefore, none of the patients required additional management owing to the results of the CBC. This study had a much lower rate of abnormal CBC compared to that in a study by Chinachot et al,¹¹ which reported rates of 38.5% and 45% for abnormal Hb and Hct levels, respectively. The most likely reason is that our study only included healthy individuals who had no underlying systemic disease, which led to a lower rate of abnormal CBC. The overall abnormality rate of EKG was 40.2%, which was much higher than that reported in the previous study.¹¹ The rate of specific abnormalities in the EKG group was 7.2%. That result was associated with the group of patients aged ≥ 60 years, which was comparable with the results of a previous study.¹¹ Two patients had surgical postponement or had the surgery canceled due to the preoperative EKG results. The overall abnormal CXR rate was 15.5%. This was in accordance with the 15.7% reported by Chinachot et al¹¹ but was much lower than the 50% reported by Harder et al.¹² The rate of specific abnormalities in the CXR group was 7.5%, with 5.5% requiring further analysis, and 7 patients (1.7%) either postponed or canceled the surgery. Ten patients (2.5%) were suspected of having TB infection on CXRs. Therefore, a preoperative CXR investigation is justified, especially since TB is endemic in Thailand and easily spreads to other patients and medical personnel. The lowest abnormal result was that of anti-HIV in 1 patient who had an inconclusive result that led to further analysis, but there was no postponement or cancellation of surgery due to the positive result of the anti-HIV investigation.

The results of the study support the hypothesis that some preoperative tests, such as CBC, are not very informative for clinical preoperative evaluations. However, some investigations have benefited from other factors. An anti-HIV test is still necessary in terms of hospital policy. The test is intended as a universal precaution for all medical staff and operating theaters. Moreover, because of the high incidence of TB infections in the country, CXR is essential for evaluating and controlling its spread. The EKG test also has the benefit of detecting heart disease before anesthesia in older adult patients. For these reasons, although our report shows a low incidence of abnormal specific preoperative tests, these three preoperative investigations (CXR, EKG, and anti-HIV) need to be performed.

Some major limitations of this study include (1) the relatively small number of patients, (2) the COVID-19 pandemic that caused a substantial reduction in the study population, and (3) operations under general anesthesia were not included. However, to the best of our knowledge, this is the first study in Thailand to investigate the rates and severity of abnormal preoperative laboratory investigation results in healthy patients scheduled for elective cataract surgeries. This study used routine clinical care at a tertiary care hospital; therefore, the results may be generalized to other types of ophthalmic surgical procedures such as pterygium excision, benign mass excision, and strabismus surgery. In the future, if CBC is no longer included in routine preoperative investigations for healthy patients undergoing cataract surgery, the cost of preoperative investigations in the hospital can be lower by US\$ 1700 each year.

Conclusion

Our study found that the CBC test was not beneficial in preoperative laboratory investigations in any age group of healthy patients who underwent elective cataract surgery. However, EKG, CXR, and anti-HIV tests are valuable. Patients aged ≥ 60 years had a small risk of having positive EKG results that could result in cancellation or postponement of surgery.

Data Sharing Statement

The data that support the findings of this study are available on request from the author, KR (Luknamkanjutha@gmail.com). The data are not publicly available due to the privacy of research participants.

Disclosure

The authors report no conflicts of interest in this work.

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