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## REVIEW ARTICLE

Routine Preoperative Tests in Low-Risk Surgery. What About Adherence to Clinical Guidelines?

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## ABSTRACT

In 2002, the American Heart Association guidelines established that routinary preoperative studies in low-risk patients (ASA I and II) are unnecessary. This fact has been supported by many other publications after that. However, the medical adherence to these recommendations in clinical practice is low. The aim of this review is to identify the reasons associated with a poor guideline's adherence.

Articles published between 2002 and 2022 reporting data on "preoperative test", "routine preoperative test", and "low-risk surgery" were identified through a computerized literature research using Pubmed, Scopus, Medigraphic and Cochrane databases and by selecting all of the articles related to adherence to clinical guidelines. The full text of relevant articles was reviewed by all authors.

This review found that some of the causes of the limited adherence to clinical guidelines are: lack of awareness regarding current recommendations or lack of familiarity with them; physician attitudes about the guidelines (including outcome expectancy, lack of agreement, poor motivation to modify previous practice, question efficacy); and environmental labor factors of medical institutions, including lack of communication among the consultants involved in the perioperative care, and medicolegal concerns and fear of litigation.

Hence, in order to propose effective alternatives to improve guidelines adherence, this review discuss some of the main reasons why in clinical practice there is still a poor compliance to surgical preoperative guidelines, even when more than 20 years have passed since the concept of routinary preoperative studies in low risk patients was eliminated by a myriad of clinical guidelines and medical associations.

INTRODUCTION

At the end of the 19th century, indications about preoperative test in ambulatory low-risk surgeries started being subject to debate. Are preoperative tests necessary? To which patients should physicians order preoperative tests? In which cases are electrocardiograms and chest radiographies useful? These and other questions were discussed by experts and after evidence were available, several guidelines were published. According the ASA Task Force on Preanesthesia Evaluation, a routine test was defined as a test ordered in the absence of a specific clinical indication or purpose<sup>1</sup>.

Nowadays, there is a wide variety of evidence which supports that routine preoperative tests in otherwise healthy patients will very seldomly cause a change in patient's perioperative management<sup>2,3</sup>, and international anesthesiology and cardiology societies have issued guidelines<sup>1,4-7</sup> in which they advise against the need to routinely order preoperative tests in healthy individuals who will undergo low-risk surgery. Table 1 Table 1. Guidelines recommendations to request preoperative testing for elective surgery on low-risk patients

Test	Guideline 2014 ACC/AHA <sup>4</sup>	Guideline 2016 NICE <sup>7</sup>	Guideline 2018 ESA <sup>6</sup>	Guideline 2022 ESC <sup>5</sup>
Chest radiographs	Not included	Do not routinely offer chest X-rays before surgery	Not recommend routine preoperative (1C)**	Not included
HbA1C	Not included	Not routinely In patients with diabetes if they have not been tested in the last 3 months	In patients with know diabetes mellitus (2A) ** In patients obese (2C)**	In patients with diabetes or disturbed glucose metabolism(1B)***
Blood glucose testing	Not included	Not included	In patients with know diabetes mellitus (2A) ** In patients obese (2C)**	Not included
Hemogram	Not included	Not included	In patients obese (2C)**	In patients scheduled for intermediate- to high-risk (1B)***
Platelet count	Not included	Not included	May have a prognostic value and can be used in the evaluation (2A)**	Not included
Electrocardiogram	Preoperative resting 12-lead electrocardiogram is not useful for asymptomatic patients undergoing low-risk surgical procedures (3B)*	Not routinely Patient with: a heart murmur and any cardiac symptom (including breathlessness, pre-syncope, syncope or chest pain) or signs or symptoms of heart failure	In patients obese (2C)**	Patient with a family history of genetic cardiomyopathy (1C)*** Patient with cardiovascular disease (2C) *** Age ≥65 years before intermediate- and high-risk (1C)***
Echocardiographic	In patient with pathology valvular if there has been either 1) no prior echocardiography within 1 year or 2) a significant change in clinical status or physical examination since last evaluation (1C)*	Patient with signs or symptoms of heart failure after ordering resting electrocardiogram	Not included	Patient with a family history of genetic cardiomyopathy (1C) *** Patient with a newly detected murmur and symptoms or signs cardiovascular disease (1C)***
Exercise stress testing for myocardial ischemia and functional capacity	Patients with elevated risk (2bB)* Routine screening with noninvasive stress testing is not useful for patients at low-risk for noncardiac surgery (3C)*	Not included	Not included	Stress imaging is not recommended routinely in non-cardiac surgery (3C)***
Test of coagulation	Not included	Not routinely	In addition to detailed history taking, laboratory tests can be used to improve identification of coagulation disorders (2C)**	Not included

Serum creatinine	Not included	Not routinely	Using calculated GFR instead of serum creatinine in patients with impaired renal function undergoing non cardiac procedures (2B)**	Not included
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2014 ACC/AHA, Guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery; 2016 NICE, Guidelines Routine preoperative tests for elective surgery; 2018 ESA, Pre-operative evaluation of adults undergoing elective noncardiac surgery Updated guideline from the European Society of Anesthesiology; 2022 ESC, Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery Developed by the task force for cardiovascular assessment and management of patients undergoing non-cardiac surgery of the European Society of Cardiology Endorsed by the European Society of Anesthesiology and Intensive Care; GFR, glomerular filtration rate; HbA1c, glycated hemoglobin; \* Class of recommendation and Level of evidence<sup>8</sup>; \*\*Grade of Recommendation According to Guyatt et al. 2011<sup>9</sup>; \*\*\* Class of recommendation and Level of evidence<sup>5</sup>.

The rate of false positive results increases the need to order further tests and generates a medicolegal responsibility if such abnormal tests are not followed up <sup>10</sup>. It has been estimated that 10-50% of asymptomatic patients may have an abnormal chest x- ray <sup>11</sup> and an abnormal echocardiography result can be found in 25% of them <sup>1</sup>. It has also been reported that abnormal preoperative tests can cause excessive anxiety in patients and delay in surgical procedures <sup>7</sup>.

It is well demonstrated that the cost of preoperative exams is high. It is calculated that every year \$18 billion (U.S.) are spent on preoperative tests <sup>12</sup> and that the cost of routine preoperative testing can be 2.55 times greater than when a selective approach for ordering preoperative tests is used, especially in low-risk surgeries <sup>13</sup>.

Even though guidelines are based on high level evidence, medical institutions and associations have failed to implement them widely, due to several facts <sup>3</sup>. This review aims to describe the reasons that have been found for such failure even when the evidence to avoid unnecessary preoperative tests has existed in the medical literature for more than twenty years.

## METHODS

A computerized bibliographic research of the literature was carried out in Pubmed, Embase, Cochrane and Medigraphic databases, using the keywords "preoperative tests", "routine

preoperative tests" and "low-risk surgery", obtaining a total of 1,658 articles that met with the characteristics of being original articles, published between the years of 2002 to 2022.

The summaries of all these were reviewed, and the most relevant for the purpose of this article were filtered, grouping them by the topic of the main content.

Finally, those original articles which specifically focused on the causes of low adherence/non-adherence to the clinical guidelines of preoperative tests in low-risk surgeries were delimited, resulting in 5 selected articles.

The main causes of low adherence to the preoperative guidelines were identified and grouped after a full review of the chosen articles by all the authors.

## RESULTS

After the analysis and discussion of the articles retrieved, we considered that the multiple and diverse reasons identified in the literature, can be classified in three main domains: inadequate physician knowledge, physician attitudes about the guidelines and environmental factors affecting the interest to follow-up the guidelines. This classification was also proposed by Hand et. al <sup>14</sup>

1. Inadequate physician knowledge. Nowadays, medical practices and medical knowledge evolves quickly. Technologies and web access permit diffusion over the world, but most physicians do not have time to keep up with the ever-increasing amount of information <sup>15</sup>. The lack of familiarity or the lack of awareness regarding current recommendations <sup>14,16-18</sup> is an evident obstacle to try following guidelines.

In 23 semi structured interviews, including anesthesiologist, general surgeons, orthopedic surgeons, primary care physicians and nurse administration, Brown et al. <sup>18</sup> identified that the interviewees have mixed opinions about the necessity of preoperative tests. Some feel preoperative tests are beneficial, others are ambivalent about preoperative tests in their practice, and many believe there is considerable unnecessary testing. All these discordants opinions show a lack of awareness of their institutional policy or even the existence of the policy. Evenmore, only one anesthesiologist cited correctly a guideline, as a reference used on decision making about preoperative testing. Many interviewees

recognized that they had not reviewed the data recently<sup>18</sup>.

In another article, including 16 interviews from Ontario's surgeons and anesthesiologists, 93% of them are aware of guidelines, but they "can't recite you any specific guidelines", or they "can't tell you specifically."<sup>19</sup>

Katz et al.<sup>20</sup> compared the correct indication of preoperative test in four hypothetical cases between anesthesiologist and other specialist, as otorhinolaryngology and gynecologist. Interestingly, anesthesiologists did it better than others, maybe because their criteria and knowledge of which one is really useful in clinical practice is closer to guidelines.

## 2. Physician attitudes about the guidelines.

Once the knowledge barrier has been overcome, a second obstacle can exist. Physician attitudes about the guidelines, including outcome expectancy, lack of agreement with the contents, poor motivation to modify previous practice, or question efficacy, are behaviors described in literature<sup>14,16</sup>. Also, ingrained habits are an important reason for the continued use of routine preoperative testing<sup>18</sup>.

Trying to convince physicians to discontinue or abandon a current medical practice is harder than to implement a new one. This phenomenon known as medical reversal has been referred to since a long time ago by different authors<sup>21-24</sup> and shows the human reticence to change and preference to practice tradition<sup>17</sup> instead of new evidence.

According to Farquhar et al, some physicians find that evidence-based guidelines are impractical and rigid and reduce their autonomy. For many physicians, trials that use surrogate end points and short-term outcomes are not sufficiently compelling to make them abandon current practice.

Even when most anesthesiologists and surgeons were motivated to reduce ordering unnecessary tests, there was still a report of a gap between their motivation and practice, associating this with a behavioral regulation according to Theoretical Domains Framework used by Patey et. al.<sup>19</sup> to identify techniques to develop intervention.

## 3. Environmental labor factors

Hospital environment is an important factor to achieve a correct indication of preoperative laboratories. Lack of communication among the consultants involved in the perioperative care of the patient and the assumption that other specialties would require the test, contributed to order unnecessary preoperative tests<sup>17,18,20</sup>. Primary care physicians assumed surgeon's will need it, and surgeons believed anesthesiologists will<sup>18</sup>.

Lack of protocols or standardized institutional tools for preoperative testing (if they don't exist) result in unnecessary test ordering by physicians with the intention to avoid delay or cancellation of the surgeries<sup>18,20</sup>.

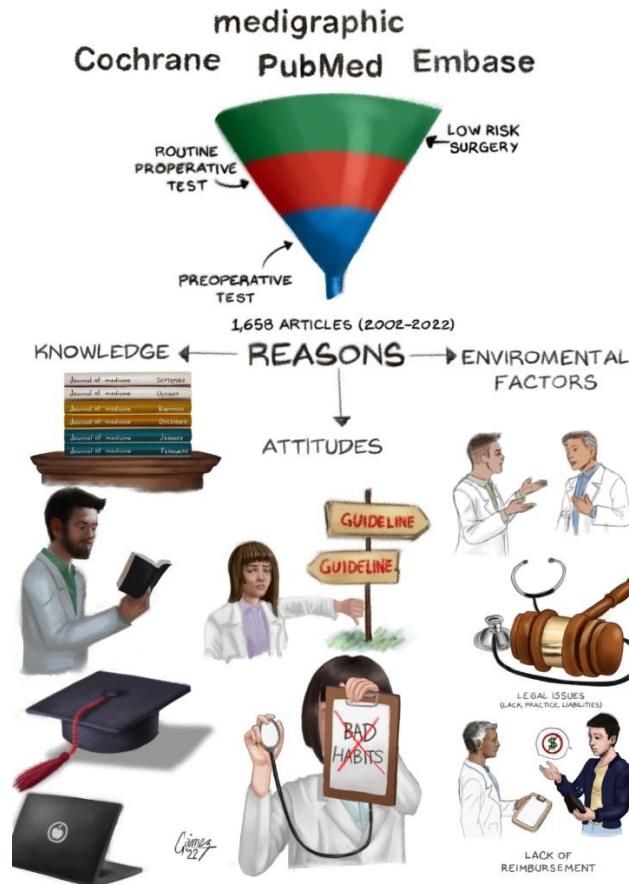
As Patey et al<sup>19</sup>, pointed out, after performing 16 interviews to anesthesiologist and surgeons, some clinicians assumed "there is nothing in my clinic environment that influences whether I order test or not" and "the lack of clarity about who is responsible for routine test ordering appears to lead to a propensity to order tests 'just in case' they are expected by another colleague."

Medicolegal concerns and fear litigation are also mentioned by surgeons, primary care physicians, anesthesiologists, and nurse administrators<sup>18,20</sup>. Routine preoperative testing can actually increase risk of liability.

No less important than fear litigation is a defense practice. Ries et al.<sup>25</sup> conducted 17 semi structured interviews to Australian physicians of different clinical fields, but all of them involved in 'Choosing Wisely campaign', with the aim to explore the psychosocial drivers to hedging-type defensive practice. Hedging-type behavior is considered when clinicians provide tests, procedures, referrals and other interventions 'just in case' they may reduce legal or reputational risks<sup>26</sup>.

All participants included in Ries et.al<sup>25</sup> study, perceived defensive practice as a problem and a contributor to low value care. This behavior is motivated by a physician's desire to avoid criticism or scrutiny from a range of sources. Censure from their professional peers can be a more potent driver than perceived legal consequences.<sup>19,25</sup> (Image 1)

**Image 1.** Schematic illustration of the reasons for poor adherence to preoperative guidelines.



## DISCUSSION

Guidelines which advise against the need of routine preoperative tests in low-risk surgeries were issued by several medical societies more than 20 years ago<sup>16</sup>.

In 2002, the American Society of Anesthesiology Task Force on Preanesthesia Evaluation<sup>27,28</sup>, concluded that “tests intended to discover a disease or disorder in an asymptomatic patient do not make an important contribution to the process of perioperative assessment and management of the patient by the anesthesiologist”.

Nevertheless, in contemporary medical practice these guidelines are not followed. The aim of this review was to find the reason for such phenomena, with the final purpose of suggesting approaches to solve this issue.

Besides the small benefit brought to patients and physicians by ordering routine preoperative tests and the huge economic burden to the healthcare system, there are other aspects to consider, such as the global carbon footprint generated by the health system. The surgical procedures are responsible for a quarter of all hospital emissions. Urgent responsible environmental actions, including

the avoidance of unnecessary preoperative tests, are needed to stop climate change<sup>29</sup>.

According to the Association of American Medical Colleges, hospitals and laboratories emit 4.4% of the world’s greenhouse gas emissions and are responsible for more than 5 million tons of waste each year<sup>30</sup>. This is the reason why a way to contribute to the reduction of the amount of emissions is to request laboratory tests accurately following the environmental policy proposed by Lopez et. al.<sup>31</sup> “audits should be undertaken with the aim to reduce unnecessary testing by removing outdated tests and rejecting unnecessary test requests”.

The main reasons for poor compliance to guidelines identified by this review were grouped in three main domains:

1. Inadequate physician knowledge.
2. Physician attitudes about the guidelines.
3. Environmental labor factors.

The end purpose of identifying the substantial barriers remaining to decrease the inappropriate use of preoperative testing is to suggest approaches to resolve this issue.

Some authors agree<sup>18</sup> that if all pre-operative testing was conducted by anesthesiologists and took

the ordering out of the hands of the surgeons, unnecessary routine testing could be reduced.

Law education and knowing the basic principles around it, would be helpful to avoid misperceptions or wrong ideas about legal procedures<sup>25</sup>. For example, in areas of controversy, physicians generally believe that erring on the side of more testing is more defensible in court<sup>32</sup>. But there is considerable legal risk for not appropriately managing an abnormal test result<sup>18</sup>.

A health labor environment is fundamental to achieve good communication between physicians, and to diminish the fear of being criticized by colleagues when unnecessary preoperative tests are avoided<sup>25</sup>. Also, specialists need to know and agree with the internal politics and guidelines of their hospitals, and collaborate, when necessary, in building up and renewing old statements. If clinicians feel they are following local norms by not ordering unnecessary tests, they will be confident to do it.

Besides education, interventions are required to incorporate lasting changes in the healthcare system. To implement a standardized preoperative investigational approach in order to reduce unnecessary testing before surgeries was recently propose by Shahid et al<sup>17</sup>. In a previous paper, almost a decade ago, our group showed a negative predictive value of 95.8% (CI 95.34-96.42%) for a standardized questionnaire to determinate the need of preoperative laboratory testing in young, clinical healthy patients for elective surgery<sup>33</sup>.

Electronic<sup>34</sup> and written instruments have been developed to help in the selection of tests during preoperative consultation. A "prescription system"<sup>35</sup> or "decision support tool"<sup>14</sup> to improve adherence to published guidelines have helped to reduce the number of unnecessary preoperative tests without increasing the number of needed test erroneously not ordered.<sup>14,33-35</sup>

Some initiatives have been created to address the issue of unnecessary medical actions, including preoperative tests. Choosing Wisely is a campaign started in 2012 by the American Board of Internal Medicine Foundation together with Consumer Reports. It has the objective to avoid unnecessary medical tests, treatments, and procedures<sup>36</sup>. Since its beginning, more than 80 specialty societies worldwide have joined the campaign. They have created a catalog of tests and treatments which they consider "overused" and have published more than 500 recommendations labeled as "clinicians and patients should discuss"<sup>37</sup>. Part of these recommendations include preoperative tests and concur with current guidelines<sup>1,4,5,7</sup> in the needless practice to order preoperative tests in low-risk surgeries<sup>12</sup>.

The previously mentioned guidelines have been published by developed countries' associations. Controversy about the pertinence of applicability of these suggestions in low- or medium-income countries persist. Preoperative tests could be the only opportunity to access health services in developing countries, and the only chance to identify undiagnosed comorbidities which impact the postoperative outcomes, such as diabetes mellitus, hypertension, HIV, among others. Besides, a meta-analysis showed that anesthetic-related mortality was two to three times higher in developing countries than in developed countries<sup>38</sup>. A prospective study performed in a surgery unit in Ivory Coast<sup>39</sup>, reported abnormal hemoglobin findings in 35% of 201 patients, abnormal WBC count in 11.1%, and abnormal platelets in 15.3%. Surgery was delayed after a preoperative evaluation in 39 patients (19.4%), but this abnormal routine test results were responsible of the delay in only 3 patients (1.4%), which is concordant with cancelation rate in American studies<sup>1</sup>.

Similar findings were reported from a hospital from Karachi, Pakistan<sup>40</sup>. Routinary test (hemoglobin, random blood sugar, serum creatinine, blood urea nitrogen, serum sodium, potassium, chloride, bicarbonate and chest X-ray) indicated in 216 patients (without any symptoms associated with undiagnosed comorbidities) before surgery were evaluated. Hemoglobin was anormal in 31.5% of patients, but only in one case an action was taken. The rest of abnormal findings did not modify the surgical plan.

In India, Mantha et al<sup>28</sup>, applied an automatized questionnaire (HealthQuiz) to 123 patients before elective neurosurgery. This electronic instrument indicated which tests were necessary to perform in each patient according to their clinical history. They compared the frequency of abnormal results for tests indicated or non-indicated from the HealthQuiz and changes in patient care. Preoperative routinary test in this hospital included 11 differents test (hematocrit, total, and differential white blood cell count; blood sugar; blood urea nitrogen, serum creatinine, sodium, and potassium; chest radiograph; electrocardiogram; and the enzyme-linked immunosorbent assay for antibodies to HIV). Fasting blood sugar was abnormal in 6 patients for whom HealthQuiz did not recommend the test. Perioperative insulin therapy was instituted in 4 patients to manage diabetes mellitus. With these findings, the authors suggest that routine preoperative screening for diabetes mellitus may be beneficial, but longer studies are needed.

Researchers in countries with high prevalence of HIV, have shown benefit to include routinely HIV tests before a surgery. From a public health point

of view, the presurgical screening for HIV may be beneficial in endemic countries, by contributing in the fight against the disease<sup>39</sup>. Also, postoperative complications (as infection and additional surgical procedures) in untreated HIV-positive patients had been reported higher than in seronegative patients (OR, 3.2; 95% CI, 1.7–5.8;  $P < .0001$ ), in accordance to CD4 cell count<sup>41</sup>, being this an important reason to considered a potential benefit to order HIV preoperative test in high prevalence countries.

According to Pal et. al<sup>40</sup>. “the rationale behind preoperative testing can be categorized into: a) screening of patients to detect asymptomatic medical conditions; b) evaluation of existing medical conditions; c) baseline measurements and d) identification of patients at increased risk of adverse perioperative outcome”. Following this logic, preoperative evaluation may represent an opportunity to screen for diseases such as diabetes mellitus or HIV, to initiate early treatment and to prevent long-term complications, especially in countries where routine preventive care is rare and disease prevalence is high. Selected tests would be useful to diagnose diseases that required treatment before non-urgent surgery, but larger studies are needed to evaluate the cost and clinical impact of this strategy in developing countries.

Some authors<sup>40</sup>, have proposed the following preoperative tests in patients living in developing countries: hemoglobin and creatinine (a normal serum creatinine result should be accepted to represent normal electrolytes). Routine chest X-rays should be done only in patients above 55 years of age. The Guidelines for Perioperative Care in Elective Abdominal and Pelvic Surgery at Primary and Secondary Hospitals in Low– Middle-Income Countries propose that in addition to clinical cardiorespiratory assessment, patients should be screened for smoking, alcohol usage, hypertension, diabetes and anemia, and have a nutritional assessment, preoperative HIV testing in countries with high HIV/AIDS prevalence and delirium screening<sup>42</sup>.

This review is not free of limitations. All the articles included consist of semi-structured interviews. This is a common data collection method in qualitative research in a healthcare context. It has some advantages over structured interviews, such as the flexibility to ask follow-up questions, and the possibility to acquire comparable and reliable data<sup>43</sup>, but also has their downsides.

One of the disadvantages of this type of data collection is the risk of research bias, including observer bias, social desirability bias and Hawthorne effect<sup>43</sup>. As interviews are performed to participants from the same environment, it can lead to similar opinions<sup>19</sup> and the results could be not generalized. Also, the answers given by different specialists to hypothetical patient cases in closed questions questionnaires, could not always accurately reflect the actions they would execute in practice<sup>20</sup>. The personal perception of the problem may not reflect the real dimension of it in practice, and it could affect the type of intervention needed to solve it<sup>16</sup>.

Even if interview studies are required in the stages of exploration in research, it is essential to create research designed to establish which of all these factors can be the key to changing practice.

## CONCLUSION

This review identified reasons for physicians not to follow practice guidelines in order to select appropriate preoperative studies. Reasons are classified in three main domains: inadequate physician knowledge, physician attitudes about the guidelines and environmental labor factors. Although qualitative semi structured studies cannot be generalized to all medical settings, these findings are useful to plan how to improve guideline adherence and to design future research.

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