The surgical burden:

How to prevent a crisis in perioperative medicine

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Three major issues are at the forefront of the current surgical burden in the United States: patients are given too little responsibility for their health, the aging population has a desire for functional recovery, and too few specialists and registered nurses are trained in anesthesia and perioperative medicine. This combination of factors has led to an imbalance of supply and demand for perioperative care.

This article will focus on the preoperative evaluation as a means to improve efficiencies in perioperative care that result in desirable outcomes while decreasing the institutional costs associated with surgery.

REASONS FOR THE BURDEN

Too little patient responsibility

Patients currently accept too little responsibility for their own health, in part because physicians have not motivated them adequately to stay healthy. An example is the poor rate of control of hypertension in the United States; only 34% of patients diagnosed with hypertension are able to achieve adequate blood pressure control.[1] Achieving more optimal control is hypothesized to require the same process changes involved in the optimal preventive maintenance of a car:

- Removal of inconvenience and cost (eg, free pills delivered through the mail)
- Ability to monitor and setting of ideal goals (eg, blood pressure measurement device for home use and accountability via wireless transmission of results)
- Emotional attachment (to one's body) and education from the "mechanic" (physician or nurse) that emotionally grabs the patient as to the importance of the health goal.

Aging population

Meanwhile, the population is aging and people desire functional recovery. Yet this desire comes at a price: medical care expenditures increase threefold for every extra decade of life.[2,3]

Imbalance in need and supply

The imbalances in need and supply that contribute to the surgical burden are numerous. Few institutions in the United States have perioperative assessment or preoperative anesthesia consultation and evaluation facilities. Across the nation, there are too few critical care beds, nurses, physicians, and health care dollars.

The burden will be compounded by an expected epidemic of diabetes. In 2000, the number of people with diabetes stood at 171 million worldwide; the World Health Organization projects that by 2030, that number will jump to 366 million.[4] Health issues such as diabetes and obesity create a significant cost burden, including the cost of procedures such as bariatric surgery.

AVERTING A CRISIS: PROPOSED SOLUTIONS

One proposed solution to address the surgical burden is to implement bypass processes in which the healthiest patients are excluded from routine preoperative evaluation. Although this approach may be acceptable at the level of an individual institution, in my opinion it is unacceptable from a societal perspective because the perioperative period is an ideal time to motivate patients to adopt healthier behaviors.

Another potential solution is to work with other providers such as nurse practitioners and medical assistants to gather patient information. The use of information systems is enhancing medical care, but ultimately the most significant factor to minimize the surgical burden will be to make patients healthier.

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TABLE 1
Cost-benefit analysis of the preoperative visit

Costs of a preoperative visit	**Minutes**	**Dollars**
Physician time	20	67.00
Paperwork/computer time	10	5.00
Secretary scheduling	20	3.00
Facility costs*	40	16.00
Total cost		**91.00**
Benefits of a preoperative visit	**Time savings**	**Dollar savings**
Avoided laboratory costs†	—	27.00
Reduction in operating room time‡	8 min	64.00
Reduction in cancellations§	—	9.00
Reduction in hospital stay¶	0.33 days	105.00
Total cost savings		**205.00**
Net savings per patient		**$114.00**

*Based on $1 million cost, 8-year depreciation, and 60 patients/day.
†Based on $100 charge paid at 30%, less $3 for unspecified costs.
‡At $8.00/minute.
§Calculated as 2% of (60 min × [cost per hour ÷ minutes per hour]).
¶At $950/day paid at 30%.
Modified from Fischer[5] based on personal communications with Stephen P. Fischer, MD.

Preoperative clinic: Savings to the institution

In 1996, researchers at Stanford University assessed the cost-benefit ratio of the preoperative visit and found that it resulted in a net savings of $114 to the institution (Table 1).[5] The savings did not appear in the preoperative clinic's balance sheet; rather, they were realized by the entire institution as a result of a reduction in hospital days, fewer cancellations, and minutes saved in the operating room. This finding reinforces the benefit of implementing this type of program on an institution-wide basis rather than in an independent internal medicine clinic or an anesthesia preoperative clinic.

New paradigms in patient evaluation

The American Society of Anesthesiologists (ASA) Task Force on Preanesthesia Evaluation issued its Practice Advisory for Preanesthesia Evaluation in 2002, which has generated some new ideas about patient evaluation.[6] The advisory focuses on the timing of the evaluation, the choice of tests, and a recommendation that no tests beyond a physician evaluation be ordered for patients undergoing minimally invasive surgical procedures as long as the patient's primary care physician judges that he or she cannot further optimize the patient's condition.

TABLE 2
When to perform the preoperative evaluation: American Society of Anesthesiologists advisory

Surgical invasiveness	**Severity of disease**	**Timing**
High	Any	Prior to day of surgery
Any	High	Prior to day of surgery
Not high	Low	On or prior to day of surgery

Adapted from reference 6.

Serum albumin levels. The ASA advisory recommends that albumin levels be obtained for all patients. Serum albumin levels are highly predictive of postoperative mortality.[7] An albumin level of 1.9 g/dL or less is associated with a 6-month mortality greater than 50%, regardless of the absence or presence of other risk factors. If a patient cannot achieve an albumin level greater than 2.1 g/dL with alimentation (either oral or hyperalimentation), discussion about end-of-life care and related issues is in order.

Procedure invasiveness. The ASA also recommends that if surgery is highly invasive, or the patient's disease is severe, the patient should be seen prior to the day of surgery. The advisory states that patients who do not fall into those categories can be bypassed for a preoperative evaluation (Table 2).[6] Seeing these patients in advance may still have value, however, to encourage them to adopt healthier lifestyle choices. Patients are rarely more motivated to adopt healthy behaviors than when they come in before an operation.

The data support preoperative laboratory testing only with highly invasive procedures. With moderately invasive procedures, the benefit of laboratory tests is unclear. No data demonstrate that preoperative laboratory tests are of value with minimally invasive procedures. Because of the quality of anesthesia and perioperative care, noninvasive procedures such as a colonoscopy are not much riskier than getting a haircut.

One of the largest studies evaluating medical testing and noninvasive procedures was conducted in patients undergoing cataract surgery. Schein et al[8] studied 18,189 patients undergoing cataract surgery to determine whether routine medical testing (electrocardiography, complete blood count, and measure-

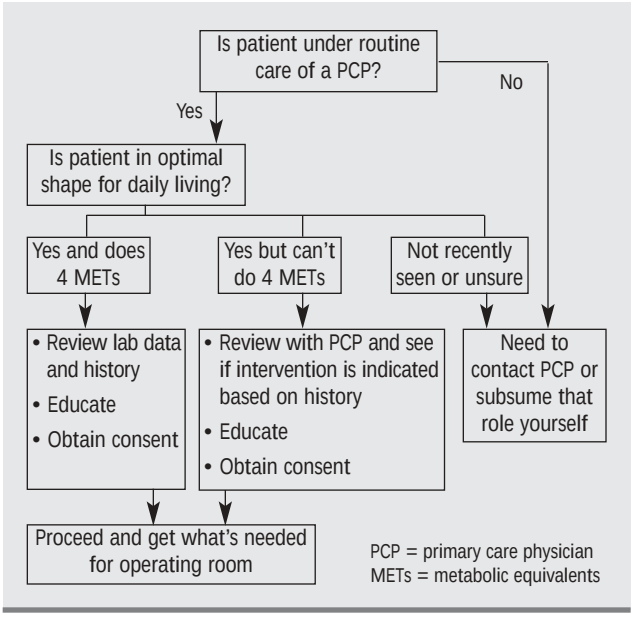

FIGURE 1. Algorithm for the preoperative evaluation of patients undergoing minor surgery. Management relies on whether the patient is in optimal shape for daily living and on his or her exercise intensity as measured in metabolic equivalents.

ment of serum levels of electrolytes, urea nitrogen, creatinine, and glucose) is associated with a reduction in intraoperative and postoperative medical complications. All patients received a physical examination and their medical histories were recorded, whether or not they received the medical tests. There were no significant differences in the rates of intraoperative events, postoperative events, hospitalizations, or deaths between patients who underwent routine testing and those who did not. Lira et al[9] obtained similar results and concluded that it is more efficient not to request preoperative tests for patients undergoing cataract surgery unless indicated by patient history or physical examination.

These study results should not be extrapolated to mean that no laboratory tests are ever needed for patients undergoing noninvasive surgery. Rather, they indicate that no laboratory tests are necessary if the patient's primary care physician has seen the patient and determined that he or she cannot further optimize the patient's condition. The underlying message is that preoperative assessment is best performed by physicians rather than by laboratory tests.

'RULE OF THREES'

Following the "rule of threes" should ensure that no important component of the preoperative evaluation is overlooked. This rule states that three aspects in each of three evaluation areas—the physical examination, the acute history, and the chronic history—are judged important in the evaluation. These aspects relate to nonsurgical procedures as well as to surgery.

Physical examination

Airway evaluation is the first key aspect of the physical examination, since airway problems during anesthesia are a leading cause of morbidity and increased cost.

Cardiovascular health is the second important aspect, and includes blood pressure, heart rate, and pulses.

Patient satisfaction is the third key component and is predicated on the notion that patients expect the physician to do certain things during the examination, and if the physician doesn't, patients can lose faith in the physician and the institution. For example, patients expect to have a stethoscope applied to their chest, even though a history of lung disease or symptoms is more meaningful than applying a stethoscope. Patients may lose confidence in the system, however, if the physician doesn't apply the stethoscope, and this unmet expectation risks degrading the patient's perception of the overall quality of care.

Acute history

Exercise tolerance. The first key aspect of the acute history demonstrated to be of value is exercise tolerance (ie, can the patient do 4 metabolic equivalents [METs] of activity, which is equal to climbing two flights of stairs or walking more than four blocks without stopping?). An inability to perform 4 METs of activity should arouse suspicion of congestive heart failure or coronary disease.

The METs criterion comes primarily from two studies. The first, by Reilly et al,[10] found that the complication rate for noncardiac surgery in 600 elderly patients nearly doubled if they were able to do less than 4 METs vs 4 METs or more of activity (20.4% vs 10.4%, respectively; $P < .001$). Those results were replicated by Sgura et al.[11] Eleven other studies have verified that the 4-MET rule can be used to predict complication rates in vascular surgery, bariatric surgery, and other forms of surgery.

An algorithm that incorporates patients' level of activity in METs (Figure 1) can be useful in determining the recommended level of preoperative evaluation for patients undergoing minor surgeries or procedures.

Medications. The second key consideration is medications, including supplements, and why they are being taken.

Acute problems. The third aspect focuses on acute problems and when the patient last saw a physician.

Chronic history

The three important aspects of the chronic history are the history of hospitalizations and surgeries, family history, and social history.

ECONOMIC CONSIDERATIONS

Approximately 33 million surgeries are performed each year in the United States, at an annual cost of $450 billion.[12] These numbers and costs will only rise in the years ahead, owing to the aging population and growing surgical burden discussed above.

Because of this huge volume of patients who undergo surgery, the preoperative evaluation, when considered across the full population of surgical patients, constitutes one of the single most expensive aspects of US medicine. Nevertheless, the preoperative evaluation saves economic resources in the long run, as demonstrated by the Stanford University study discussed above.[5] Even greater cost savings could be realized, as up to 40% of preoperative testing currently performed by many institutions could be eliminated without significantly increasing the risk of adverse outcomes.[13,14]

Selective ordering of tests

Unnecessary laboratory tests can be eliminated by considering whether the patient's condition and the proposed therapy or corrective procedure warrant a specific laboratory test. In a trial of 3,866 patients, Charpak et al[15] established and implemented a protocol at a teaching hospital in Paris, France, for selective ordering of preoperative chest radiographs, based on the patient's clinical status, medical history, and scheduled surgery. Five internists, four anesthesiologists, and three surgeons agreed on the protocol, and 11% of the tests were still ordered without indication. Unfortunately, 42% of the indicated tests also weren't ordered.

New pathways may be necessary

Deming and Juran said it best for the automobile industry in the 1960s when they attributed repeated breakdowns in productivity and accuracy to the system, not the worker. Likewise, if unnecessary tests are still being ordered and appropriate tests are not despite the efforts of internists, surgeons, and anesthesiologists to educate themselves, then something is wrong with the system of preoperative evaluation and a new system is needed.

Examples of new systems-based solutions are emerging. For instance, clinicians at the University of Chicago found that use of an interactive system that suggests appropriate tests for patients after the patient enters his or her personal medical data safely eliminated 81% of glucose testing costs and more than 50% of overall testing costs (personal communication). Another example involves radical retropubic prostatectomy (RRP), which has traditionally required a 5-day hospital stay. Alternate clinical pathways for RRP were initiated at the University of Chicago and included epidural anesthesia with or without spinal anesthesia followed postoperatively by intramuscular methadone, acetaminophen, and ibuprofen for pain control. Mean hospital stay was reduced from 4.9 days to slightly more than 1 day without a change in satisfaction with analgesia or overall satisfaction, and the readmission rate declined.[16,17]

PHARMACOLOGIC PROPHYLAXIS

A few simple pharmacologic measures instituted preoperatively can result in a substantial reduction in perioperative risk. Following is a brief introduction to the use of these therapies in the preoperative setting, each of which will be explored in greater depth in subsequent articles in this supplement.

Beta-blockers

The first large study focusing on prophylactic beta-blocker use prior to surgery was the Multicenter Study of Perioperative Ischemia (McSPI),[18] which demonstrated that preoperative beta-blocker use reduced the risk of postoperative myocardial ischemia. This study and others support the preoperative use of beta-blockers in patients with risk factors undergoing noncardiac surgery.

Aspirin

Routine discontinuation of aspirin therapy prior to noncardiac surgery is being questioned, given that the McSPI database demonstrated that taking a single aspirin daily for 3 days prior to surgery reduces the risk of adverse outcomes in cardiac surgery patients.[19] Two other ongoing studies are assessing the effect of aspirin prior to surgery on outcomes following cardiac surgery and vascular surgery.

Statins

Giving a statin prior to high-risk, highly invasive surgery can decrease the perioperative risk, even if therapy begins as little as 3 days prior to surgery.[20,21]

Immunizations

Immunizations against pneumococcus and influenza have been shown to decrease the length of hospital stays and decrease readmission rates over a 6-month period.[22]

SUMMARY

Preoperative patient evaluation can minimize the surgical burden and help prevent a crisis in perioperative medicine. Relieving the surgical burden involves a shift from practicing medicine to practicing preventive care in the preoperative environment, as well as motivating patients to adopt healthier behaviors over the long term.

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