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This article is intended as an overview of preoperative assessment and is aimed at all health-care professionals interested in the topic, including general practitioners, surgeons, anesthetists, residents and any others involved in the assessment process.

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An event-free surgical procedure and post-operative period depends to a large extent on the preoperative assessment. The assessment determines the type of surgery to be performed, the type of anesthesia to be administered, and the degree of risk to the patient.
A preoperative assessment must take into account three inter-related factors: the type of surgery to be performed; the type of anesthesia to be administered; and the specific characteristics of the patient.

**Determining The Type of Surgery**

The first step is assessing the degree of urgency of a surgical procedure. Some emergency situations may not allow for a full series of tests. In such instances, the purpose of the preoperative phase is limited to stabilizing the patient as much as possible before surgery and foreseeing any potential complications in order to plan appropriate post-operative care.

Conversely, non-emergency surgery, even on short notice, involves different considerations. Any medical condition that can influence a surgical procedure or its outcome must be clearly identified before surgery.

There is an inherent risk in any type of surgery. High-risk operations include major emergency surgery, cardiac surgery, aortic surgery, major vascular surgery and any prolonged operations that involve blood loss or a major volemic imbalance (risk of cardiac mortality or infarction > 5%). Intraperitoneal, intrathoracic, orthopedic, prostatic and or throino-laryngologic surgery, as well as cartoid endarterectomy, involve a moderate risk (risk < 5%). Low-risk operations include endoscopic and superficial surgery, as well as cataract and breast surgery (risk < 1%).

The purpose of a preoperative assessment in the case of low- or moderate-risk surgery is to identify high-risk patients, who require treatment to lower their risk factors. The assessment is guided by anticipating the primary potential complications (cardiac, pulmonary, thromboembolic) that can prevail at the post-operative stage, as well as certain complications that are more specifically associated with the surgery being performed (e.g., atelectasis or pulmonary superinfection in upper-abdominal surgery, thromboembolic disorders during orthopedic or neurosurgical procedures, or calcium disorders during parathyroidal surgery). High-risk surgery involves a more thorough systemic evaluation because of the inherent risk factors.
Selecting The Type of Anesthesia

On the basis of the abundant body of available data, there is no clear proof that epidural anesthesia or rachialgesia is preferable to general anesthetic from the perspective of cardiac risk. On the contrary, in certain situations (e.g., patients with aortic stenosis), general anesthetic may be preferable. Despite certain contradictory findings, however, it appears that the risk of pulmonary complications may be reduced with an epidural or rachialgesia. Local or regional anesthesia (e.g., axillary blocks, femoral blocks, etc.), when viable, may diminish the overall risk, as long as the target body part is sufficiently anesthetized to block the systemic neurohormonal response to the surgery itself.

In most cases, the risk involved with general anesthetic is low (one death for every 200,000 hours of anesthesia) and should not significantly influence the choice of anesthetic. Rather, it should be a joint decision made by the patient, the surgeon and the anesthetist, taking into account the preference of each in light of the specific surgery being performed.

Being Aware of Specific Patient Characteristics

The patient questionnaire and the physical examination are at the heart of the global preoperative risk-assessment process. During the assessment, it is important to:

- Take a thorough medical and surgical history;
- Inquire about all medication (i.e., recent use of steroids, cardiopulmonary drugs, immunosuppressive agents, etc.);
- Note any personal or family history of thromboembolic disorders, hemorrhagic diathesis and any problems related to anesthesia;
- Conduct a full review of cardiac and pulmonary systems;
- Inquire about use of certain substances, such as tobacco, recreational drugs and alcohol, as well as problems of withdrawal; and
- Note any allergies (i.e., drugs, latex, etc.).

During the physical examination, vital signs (weight and blood pressure), a cardiopulmonary examination (including detection of carotid bruit and any signs of cardiomyopathy), as well as a general examination that takes into account the questionnaire findings, may bring to light anomalies linked to significant perioperative risk factors (e.g., aortic stenosis).

There is no consensus regarding the preoperative assessment of asymptomatic patients whose medical history or physical examination indicates the absence of disease or risk factors. Nevertheless, it is generally recommended that an electrocardiogram (ECG) be taken for males over 40 years of age and for females over 50 years of age. A basic biochemical work-up (i.e., basic blood profile, electrolytes, creatinine and glucose) should be performed for patients 65 or over, or for patients who are to undergo major surgery. A urinalysis should be performed if the use of urologic instrumentation is foreseen. Pulmonary x-rays are not essential, except as an initial point of comparison in the case of surgery with a risk of pulmonary complications. A pregnancy test should be considered for female patients of child-bearing age.

According to the type of surgery planned, the preoperative assessment could also include other tests, such as a coagulogram, which is suggested for neurosurgery and cardiac or vascular surgery.

When a patient presents with specific diseases or significant risk factors, the preoperative assessment should be carried out accordingly. Similarly, if a patient is taking a specific medication, certain tests may be important (e.g.,
Preoperative Assessment

Cardiac Assessment

Cardiac complications are the main cause of perioperative morbidity and mortality. Various risk factors are known to compound the risk, such as age, presence of coronary artery disease and heart failure. Two recently published consensus reports clarify how preoperative cardiovascular assessments should be conducted with patients who are to undergo noncardiac

electrolytes and creatinine if the patient is taking diuretics; or dosage tests of certain drugs, such as digitalis, theophylline and anticonvulsants).5

The preoperative assessment is an excellent opportunity to conduct a check-up or to complete appropriate medical follow-up, as well as to make new diagnoses and reassess treatments and their suitability.

### Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Points, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary artery disease</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction &lt; 6 months earlier</td>
<td>10</td>
</tr>
<tr>
<td>Myocardial infarction &gt; 6 months earlier</td>
<td>5</td>
</tr>
<tr>
<td>Canadian Cardiovascular Society angina classification</td>
<td></td>
</tr>
<tr>
<td>Class III</td>
<td>10</td>
</tr>
<tr>
<td>Class IV</td>
<td>20</td>
</tr>
<tr>
<td>Alveolar pulmonary edema</td>
<td></td>
</tr>
<tr>
<td>Within 1 week</td>
<td>10</td>
</tr>
<tr>
<td>Ever</td>
<td>5</td>
</tr>
<tr>
<td>Suspected critical aortic stenosis</td>
<td>20</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td></td>
</tr>
<tr>
<td>Rhythm other than sinus or sinus plus atrial</td>
<td>5</td>
</tr>
<tr>
<td>Premature beats on electrocardiogram</td>
<td>5</td>
</tr>
<tr>
<td>&gt; 5 premature ventricular contractions on electrocardiogram</td>
<td></td>
</tr>
<tr>
<td>Poor general medical status, defined as any of the following:</td>
<td>5</td>
</tr>
<tr>
<td>PO2 &lt; 60 mm Hg, PCO2 &gt; 50 mm Hg, K+ level &lt; 3 mmol/L, blood urea nitrogen level &gt; 50 mmol/L, creatinine level &gt; 260 µmol/L, bedridden</td>
<td></td>
</tr>
<tr>
<td>Age &gt; 70 years</td>
<td>5</td>
</tr>
<tr>
<td>Emergency surgery</td>
<td>10</td>
</tr>
</tbody>
</table>

Action according to total number of points:
- 0 to 15 (Class I): if the patient is undergoing nonvascular surgery, no further testing is required.
- 20 to 30 (Class II) or over 30 (Class III): determine the nature of the risk and treat if possible; if not, cancel the procedure.

ECG = electrocardiogram; PO2 = partial pressure of oxygen; PCO2: partial pressure of carbon dioxide; K+ = potassium

surgery. Common features of these reports include the classification of patients according to individual risk factors and the recommendation that the assessment be supplemented by paraclinical tests (e.g., exercise stress test; methoxy-isobutyl-isonitril [MIBI]/persantine).

Certain general principles apply. Very low-risk patients or patients requiring emergency surgery need not undergo another preoperative investigation. This is also the case for patients who have undergone revascularization within the past five years and those who have been assessed within the past two years and have shown no clinical changes since their assessment. Patients whose coronary or valvular condition is unstable, or who suffer from arrhythmia or ventricular dysfunction, should be stabilized before any surgery. After an infarction, a waiting period of at least six weeks is required before any non-emergency surgery is performed. The guidelines for any investigations (e.g., coronary angiography) or treatment (e.g., angioplasty or bypass) should be the same in the preoperative phase as they would be under normal circumstances. The effectiveness of preoperative revascularization has never been proven to diminish global patient mortality outside of normal indications.

There are, nevertheless, significant differences between two consensus studies. The assessment of the functional category as a predictor of cardiac events plays an important role in the report of the American College of Cardiology/American Heart Association Task Force. In the report of the American College of Physicians (ACP), this concept is considered secondary, as the data tend to demonstrate that the functional category and, more specifically, stress testing, are not predictive of cardiac morbidity in the preoperative phase. The ACP report states that patient assessment is centered on various basic clinical findings (Table 1). Stress tests should be used only to confirm the presence of coronary disease in light of the apparent symptoms (i.e., atypical chest pain in patients at risk of coronary artery disease or typical chest pain without coronary artery disease), or to assess the need for postinfarction stratification if an ECG reveals a silent infarct.

In the absence of contraindications, the perioperative use of beta-blockers up to seven days following surgery would seem to reduce mortality and major cardiac events up to two years after surgery. Patients likely to benefit from beta-blockers are those who have been diagnosed with coronary artery disease or those at risk of coronary artery disease, as determined by the presence of two or more of the following risk factors: age 65 or over, arterial hypertension, diabetes, tobacco use or total cholesterol higher than 6.2 mmol/L.

The empirical use of calcium-channel blockers or nitrates, however, has never proven effective under such circumstances. It is recommended that medication not be discontinued in the perioperative period if the basic indications are clear, and that it be continued at the usual dosage. The risk of an atrioventricular block must be taken into consideration, however, if beta-blockers are added as a preventive measure in the regimen of patients taking diltiazem or...
### Table 2

**Indications For Cardiac Conditions Associated With Endocarditis**

#### Prophylaxis Recommended

- **High-risk category**
  - Prosthetic cardiac valves, including bioprosthetic and homograft valves
  - Previous bacterial endocarditis
  - Complex cyanotic congenital heart disease (e.g., single ventricle states, transposition of the great arteries, tetralogy of Fallot)
  - Surgically constructed systemic pulmonary shunts or conduits

- **Moderate-risk category**
  - Most other congenital cardiac malformations (other than above and below)
  - Acquired valvar dysfunction (e.g., rheumatic heart disease)
  - Hypertrophic cardiomyopathy
  - Mitral valve prolapse with valvar regurgitation and/or thickened leaflets

#### Prophylaxis Not Recommended

- **Negligible-risk category**
  - Atrial septal defect
  - Surgical repair of atrial septal defect or ventricular septal defect after more than six months
  - Mitral valve prolapse without valvar regurgitation
  - Previous coronary artery bypass graft surgery
  - Cardiac pacemaker (intravascular or epicardial) or implanted defibrillator
  - Physiologic heart murmur without significant valvar dysfunction

#### Prophylaxis Recommended (for patients with high- and moderate-risk cardiac conditions)

- Invasive or traumatic dental procedures
- ORL procedures that involve the respiratory mucosa
- Bronchoscopy with a rigid bronchoscope
- Sclerotherapy for esophageal varices
- Esophageal stricture dilation
- Endoscopic retrograde cholangiography with biliary obstruction
- Biliary tract surgery
- Surgery that involves the intestinal mucosa
- Transrectal biopsy
- Prostatic surgery
- Cystoscopy
- Urinary catheterization if infection is present
- Urethral dilation
- Vaginal hysterectomy
verapamil. In such instances, replacing these medications with dihydropiridine or discontinuing their use in order to allow for the safe introduction of a beta-blocker should be considered.

In the presence of valvulopathy, prophylactic antibiotic therapy may be indicated, depending on the type of surgery to be performed (Table 2).  

In patients with severe hypertension (systolic blood pressure [BP] > 180 mm Hg or diastolic BP > 110 mm Hg), it is important to try to achieve better control over BP before surgery—e.g., via nifedipine per oral surgery (not sublingually), clonidine per oral surgery or captopril—although medication will not reduce operative risk significantly.

**Pulmonary Assessment**

A review of the topic of preoperative pulmonary assessment was published recently. Numerous post-operative pulmonary complications, such as pneumonia, bronchial spasms and atelectasis, may be associated with a significant rate of morbidity. Risk factors for these complications have

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**Table 2 (cont.)**

**Indications For Cardiac Conditions Associated With Endocarditis**

<table>
<thead>
<tr>
<th>Prophylaxis Not Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Nontraumatic dental procedures</td>
</tr>
<tr>
<td>• Shedding of primary teeth</td>
</tr>
<tr>
<td>• Bronchoscopy with a flexible bronchoscope</td>
</tr>
<tr>
<td>• Tympanostomy tube insertion</td>
</tr>
<tr>
<td>• Transesophageal echocardiography</td>
</tr>
<tr>
<td>• Endoscopy of the upper digestive tract with or without biopsy</td>
</tr>
<tr>
<td>• Laparoscopy</td>
</tr>
<tr>
<td>• Cesarean section</td>
</tr>
<tr>
<td>• Tubal ligation</td>
</tr>
<tr>
<td>• IUD insertion or removal</td>
</tr>
<tr>
<td>• Cardiac catheterization</td>
</tr>
<tr>
<td>• Urethral catheterization in uninfected tissue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prophylaxis Debatable (not formally recommended)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Vaginal delivery without complications</td>
</tr>
<tr>
<td>• Therapeutic abortion</td>
</tr>
<tr>
<td>• Uterine dilation and curettage</td>
</tr>
</tbody>
</table>

been identified. They include cardiothoracic or upper-abdominal surgery (increased risk in proximity of the diaphragm), tobacco use, obesity and the presence of a chronic pulmonary disease (e.g., chronic obstructive lung disease or inadequately controlled asthma). Identifying a pulmonary disease may help reduce perioperative morbidity through optimization of preoperative pulmonary functions (although no definitive evidence exists). Hypoxemia at rest (partial pressure of CO$_2$ < 60) and chronic CO$_2$ retention constitute major factors that point to the need for a more detailed investigation. Aggressive preoperative treatment with bronchodilators and, if necessary, intravenous antibiotics, steroids or theophylline may improve the patient’s condition. Postoperative incentive spirometry is a simple and low-cost means of reducing pulmonary risk.

To ensure the effectiveness of this measure, however, the patient must be instructed properly and incentive spirometry must be carried out for five minutes every hour. Pain control or the use of a pressure-demand breathing apparatus also may help the patient. The patient must stop smoking eight weeks before surgery for maximum effectiveness of the intervention.

**Patients on Antiplatelet Agents or Anticoagulants**

Many cardiac or vascular patients are treated with acetylsalicylic acid (ASA), ticlopidine, clopidogrel or warfarin. It is recommended that use of ASA and clopidogrel be discontinued seven days before non-emergency surgery, and that ticlopidine be discontinued 10 to 14 days prior to surgery. Anticoagulants must be discontinued 96 hours before surgery in most cases, except when the risk of bleeding is slight (e.g., skin surgery or ophthalmic surgery). Pre- and post-operative use of heparin may be required if there is a high risk of thrombosis, as in the case of patients who have experienced a thromboembolism within the past three months, who have a Björk-Shiley valve, or who present with three or more of the following risk factors: atrial fibrillation, left-ventricular dysfunction under 30%, hypercoaguability, a mechanical prosthesis or a history of thromboembolism. With a prosthetic mitral valve, a single risk factor alone is sufficient to consider the use of heparin. In such cases, heparin therapy should be initiated once the international normalized ratio (INR) is less than 2.0, and discontinued six hours before surgery. It should be resumed within 24 hours of surgery until a therapeutic INR is obtained.

**Patients With Endocrine Disorders**

**Diabetes**

Insulin is usually required perioperatively if the patient normally takes insulin (Type 1 or 2 diabetes), or is being treated with oral hypoglycemics and requires major surgery. It is not needed for patients whose diabetes is kept under control through diet, regardless of the type of surgery, or for diabetics who require minor surgery and whose condition is under control.
When necessary, intravenous insulin (with perioperative adjustments in dosage every two hours in light of capillary glycemia) may be administered simultaneously with a 5% dextrose solution, 100 cc/h (or the equivalent), as of the morning of surgery. When diabetes is well under control through diet, dextrose solution should be avoided during surgery. If oral hypoglycemics are being used successfully to control diabetes, they should be discontinued 36 hours before surgery and resumed with the first meal following surgery. Regular post-operative monitoring for capillary glycemia is required, even if the patient is not given insulin.

Adrenal functions
It is recommended that a perioperative steroid supplement be prescribed if the patient has been administered 5 mg or more of prednisone or the equivalent for one month, or 20 mg or more per day for five days, within the past year. Hypocorticism can be averted if serum cortisol levels are above 550 nmol/L or if an adrenocorticotropic hormone (ACTH) test is normal. Perioperative steroid supplements should be administered as follows:

1. For minor surgery (e.g., hernia), the requirement is the equivalent of 25 mg hydrocortisone (5 mg prednisone) on the day of surgery.
2. For intermediate surgery (e.g., cholecystectomy, colon resection, prosthesis), the hydrocortisone requirement varies between 50 mg and 75 mg per day for one to two days—e.g., 10 mg to 15 mg prednisone, followed by 50 mg to 75 mg intravenously (IV) in a single or fractioned dose (three doses of 25 mg per day IV [i.e., one dose per eight hours]).
3. For major surgery (e.g., cardiac or vascular), the hydrocortisone requirement varies between 100 mg and 150 mg per day for two to three days—e.g., 50 mg hydrocortisone IV every eight hours for a period ranging from 48 to 72 hours.

Adrenal functions should be monitored according to post-operative progress.

Prophylaxis in the Presence of Thromboembolic Disorder
A thromboembolic disorder can have disastrous post-operative consequences. A recent consensus study determined which patients should receive prophylactic therapy. The criteria are as follows (according to the specific situation):
**Risk Categories for General Surgery**

- Low risk: people up to 40 years of age undergoing minor surgery, with no risk factors;
- Moderate risk: people 40 years of age or over, or those who undergoing major surgery, but not presenting with any risk factors;
- High risk: people over age 60, without risk factors, or people 40 to 60 years of age with one of the following risk factors: obesity, varicose veins, immobilization, taking estrogen, heart failure, etc.; and

- Very high risk: patients with a history of thromboembolic disorder, neoplasia, hypercoaguability, multiple trauma, concussion of the spinal cord, etc.

**Suggested Prophylaxis Before General Surgery**

- Low risk: no prophylactic therapy other than early mobilization;
- Moderate risk: subcutaneous heparin (5000 units two hours before surgery and every 12 hours subsequently) or low-molecular-weight heparin (LMWH), intermittent pneumatic compression, or an elastic stocking in addition to mobilization;
- High risk: subcutaneous heparin (5000 units two hours before surgery and every eight to 12 hours subsequently) or LMWH or pneumatic compression; and
- Very high risk: pneumatic compression or elastic stocking combined with subcutaneous heparin (adjusted or non-adjusted dose), warfarin or LMWH.

**Orthopedic Surgery**

In the case of a total hip or knee replacement, or surgery for hip fracture, LMWH or warfarin should be prescribed for seven to 10 days.

**Intercranial Neurosurgery**

Apply intermittent pneumatic compression, or administer subcutaneous heparin or LMWH.

In all the above-mentioned types of surgery, which require prophylaxis in the presence of a thromboembolic disorder, the use of estrogens or estrogen derivatives (i.e., hormone replacement therapy, oral contraceptives, tamoxifen or raloxifene) increases the risk of thromboembolic disorder by about three times, regardless of the agent used. There are no statistics, however, on the procoagulant effect of these agents in a perioperative context. A conservative approach would consist of discontinu-
ing these drugs if possible (regardless of the agent) one month before any surgery, and then resuming them once the patient is mobilized (or after the next menstrual cycle, in the case of oral contraceptives). The patient should be informed of the risk of continued use of these agents in the post-operative period.

Patients With Other Chronic Diseases

Various other diseases that are not dealt with in this article should, nevertheless, be taken into consideration in the preoperative assessment (Table 3). (For more information, see the suggested readings section at the end of this article.)

Post-operative Follow-up

Regardless of the quality of the preoperative assessment, complications may occur. Post-operative follow-up, especially of high-risk patients, is important and must focus on the anticipated medical complications, according to the particular characteristics of the patient and the type of surgery involved. Invasive hemodynamic monitoring and intensive care are sometimes required for high-risk patients. Decisions in this regard should be made in collaboration with the surgeon and the anesthetist.

Conclusion

Preoperative assessment is a multifaceted task that involves considerable knowledge of internal medicine. The type of surgery and anesthesia, as well as the patient’s particular characteristics, are the three primary considerations in any preoperative assessment. Despite the recent publication of consensus reports on the topic, many questions remain unanswered and the findings of clinical research are much needed.

References


Suggested Readings