Moreover, mortality during the first postoperative year (3% versus 14%, $P = .005$) and two years (10% versus 21%, $P = .019$) was also reduced. Cardiovascular event-free survival during the two-year follow-up was improved by the perioperative administration of atenolol (68% versus 83%, $P = .008$). This study is important because it provides a simple, safe, inexpensive therapy for preventing perioperative myocardial ischemia and also reducing mortality. Before this study, risk factor identification followed by coronary revascularization was the only option. Patients who were found to require coronary revascularization before a noncardiac operation incur the risk of two operations rather than a single one. Now a medical regimen can reduce the morbidity and incidence of cardiac death that can be associated with noncardiac surgical procedures.

Who should receive prophylactic perioperative β-blockade? Any patient who is already on β-blockade therapy should continue to receive it. In addition, any patient qualifies who has known coronary artery disease as shown by a previous myocardial infarction, typical angina, or atypical angina with electrocardiographic changes indicating ischemia in response to exercise or scintigraphic evidence of a myocardial perfusion defect. Moreover, any patient qualifies who is at risk for coronary artery disease because of previous or current vascular operations or the presence of at least two of the following risk factors (in addition to male sex): age 65 years or older, hypertension, current smoking, serum cholesterol level of 6.20 mmol per liter (240 mg per dl), or diabetes mellitus. Who should not be given prophylactic perioperative β-blockade? Anyone with a known sensitivity to β-blockers, acute congestive heart failure, acute bronchospasm, third-degree heart block without a pacemaker, a heart rate below 55 beats per minute, or a systolic blood pressure below 100 mm of mercury should not receive this therapy. Care should be taken when administering it to patients with a history of asthma.

What types of operations qualify for prophylactic perioperative β-blockade? All patients scheduled to undergo a major noncardiac operation requiring general anesthesia and a hospital stay qualify. It is unclear if patients scheduled for minor operations should receive this therapy.

How long does a patient need to be on prophylactic perioperative β-blocker therapy? Patients were administered atenolol for seven days postoperatively. Episodes of myocardial ischemia are most frequent during the first 48 hours postoperatively, but can continue for at least seven days. The optimum duration of therapy is unknown, but seven days should be considered a minimum. Furthermore, patients with a known history of coronary artery disease may benefit from indefinite β-blockade.

What drug should be used? Atenolol was chosen because it was a long-acting drug that had proven efficacy in preventing death after myocardial infarction. Other drugs such as metoprolol tartrate have similar efficacy. It is unclear if a short-acting drug such as esmolol hydrochloride would have similar effects. Notably, the use of esmolol would increase the cost and complexity of administration. How should the drug be administered? An intravenous dose of atenolol of 5 to 10 mg should be administered 30 minutes before the surgical procedure while monitoring the blood pressure and heart rate. A second dose of 5 to 10 mg of intravenous atenolol should be administered postoperatively. If the patient is not to take food or liquids orally, intravenous administration should be continued twice a day. Once the patient is able to take oral medications, oral atenolol, 50 or 100 mg, with the dosage guided by the heart rate and blood pressure, can be used. It is important to continue administering the β-blocker for a full seven days postoperatively. It is unclear if an oral dose of atenolol given in the immediate preoperative period will be adequately absorbed in time to provide optimal protection.

The difficulty with adopting prophylactic perioperative β-blockade for patients at risk for perioperative cardiac morbidity and mortality will be the postoperative administration of the drug. This therapy requires prolonged β-blockade to prevent postoperative myocardial ischemia. It will be important to convince our surgical colleagues to continue this therapy into the postoperative period. The clinical practice of avoiding postoperative β-blockade so that tachycardia can guide volume replacement is clearly detrimental to the long-term survival of patients at risk for cardiac morbidity. Controlling hemodynamics during the operative and postoperative period is critical to avoiding perioperative cardiac morbidity and death.

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REFERENCES

Eagle KA, Brundage BH, Chaitman BR, Ewy GA, Fleisher LA, Hertzer NR, et al. Guidelines for perioperative cardiovascular evaluation for noncardiac surgery. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Committee on Perioperative Cardiovascular Evaluation for Noncardiac Surgery. Circulation 1996; 93:1278–1317

Mangano DT, Layug EL, Wallace A, Tateo I, for the Multicenter Study of Perioperative Ischemia Research Group: Effect of atenolol on mortality and cardiovascular morbidity after noncardiac surgery. N Engl J Med 1996; 335(23):1713–1720

'Practice Guidelines for Blood Component Therapy' Summarized

DESPITE THE DECREASING potential for blood components to transmit viral disease, remaining concern (and concern regarding other possible complications: transfusion reactions, the transmittal of bacterial or parasitic diseases, immunosuppression, and cost) has prompted several professional societies and governmental organizations and regulatory bodies to produce "guidelines," "strategies," and "practice parameters." These documents have not addressed the specific needs of anesthetized patients, however. The American Society of Anesthesiologists responded to this need by convening a task force in 1994 that produced an evidence-based document, "Practice Guidelines for Blood Component Therapy." The panel included community- and university-based anesthesiologists, representatives from other specialty organizations, and a methodologist. After review of the rele-

vant English-language literature as of mid-1994, the task force graded the evidence based on a standardized system and recommended the following for adult surgical and obstetric patients. The task force emphasized that "transfusion decisions should be based on sound physiologic principles and a comprehensive assessment of the patient's risk factors" (page 742).

Erythrocyte Transfusion

• Erythrocyte transfusion is rarely indicated when the hemoglobin concentration is greater than 100 grams per liter (10 grams per dl) and is usually indicated when it is less than 60 grams per liter (6 grams per dl).

• Its use should be based on the patient's risk for complications of inadequate oxygenation (cardiac or pulmonary reserve; hemodynamic indices; rate and magnitude of actual and anticipated blood loss; oxygen consumption, as affected by disease states, temperature, sepsis, muscular activity, and drugs administered; atherosclerotic disease) when the hemoglobin concentration is 60 to 100 grams per liter (6 to 10 grams per dl).

• The use of a single "transfusion trigger" for all patients is not recommended.

• The task force encouraged measures to decrease blood loss and methods to avoid allogeneic transfusion—for example, preoperative autologous donation, hemodilution.

In an accompanying editorial, it was suggested that whole blood be transfused in preference to packed red cells when blood loss of one blood volume is anticipated or occurs.

Platelet Transfusion

• Prophylaxis for major surgical procedures is rarely indicated when thrombocytopenia is due to increased platelet destruction. It is rarely indicated when thrombocytopenia is due to decreased platelet production when the platelet count is 100×10^9 per liter or more and is usually indicated when the platelet count is less than 50×10^9 per liter. Prophylaxis should be based on the risk of bleeding (site of operation: ability to control hemorrhage and the local consequence of bleeding) for platelet counts of 50 to 100×10^9 per liter.

• Therapy should be instituted only in patients with microvascular bleeding: surgical and obstetric patients usually require platelet transfusion if the platelet count is less than 50×10^9 per liter and rarely require platelet transfusion if it is 100×10^9 per liter or more. The transfusion of platelets for patients with platelet counts of 50 to 100×10^9 per liter should be based on the risk of additional bleeding. Vaginal deliveries may be undertaken in patients with platelet counts of less than 50×10^9 per liter. Platelets may be administered to patients with known platelet dysfunction and microvascular bleeding.

Indications for Fresh Frozen Plasma

Fresh frozen plasma is indicated for the urgent reversal of warfarin sodium therapy, the correction of known coagulation factor deficiency(ies) for which specific factor concentrate(s) is not available, the correction of microvascular bleeding in the presence of an elevated (>1.5 times mean normal) prothrombin time (PT) or partial thromboplastin time (PTT), and the correction of microvascular bleeding due to coagulation factor deficiency in patients tranfused more than one blood volume and when the PT and PTT cannot be measured in a timely manner.

Cryoprecipitate Transfusion

Cryoprecipitate transfusion is recommended for prophylaxis in nonbleeding perioperative or peripartum patients with congenital fibrinogen deficiency or von Willebrand's disease that is unresponsive to desmopressin acetate, for bleeding patients with von Willebrand's disease, and for the correction of microvascular bleeding in massively transfused patients with fibrinogen concentrations of less than 0.8 to 1.0 grams per liter (80 to 100 mg per dl) (or when fibrinogen concentrations cannot be measured in a timely manner). It would appear that this last circumstance is likely to result in multiple factor deficiencies with a concomitant need for large intravascular volume replacement and thus would usually be treated with fresh frozen plasma.

These "guidelines" differ from those in previous documents in several ways. They were produced with a specific evidence-based methodology. They allow for a greater latitude of professional judgment than do some other guidelines, and they recognize the urgency and imperatives that sometimes accompany the need for therapy during surgical or traumatic blood loss.

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REFERENCES

American Society of Anesthesiologists Task Force on Blood Component Therapy. Practice guidelines for blood component therapy. Anesthesiology 1996; 84(3):732–747

Weiskopf RB. More on the changing indications for transfusion of blood and blood components during anesthesia. Anesthesiology 1996; 84: 498–501