aortic injury. Helical CT scanning is an ideal diagnostic method for aortic injury because of its relatively low cost compared with aortography, its almost universal availability in emergency departments, and its lack of operator dependence. In addition, at most trauma centers, CT scanning is already an integral part of the diagnosis and management of serious blunt injury, with patients typically undergoing simultaneous CT scanning of other areas of the body to evaluate potential injuries. The overall diagnostic accuracy for helical CT scanning in the setting of blunt aortic injury exceeds 99%, and the positive and negative predictive values meet or exceed those of aortography. Patients without direct helical CT evidence of blunt aortic injury require no further evaluation. Aortography should be reserved for indeterminate helical CT scans. Such a strategy helps to substantially reduce the morbidity and cost of unnecessary aortograms for blunt aortic injury.

The force from rapid deceleration that is sufficient to tear the aorta often leads to injuries of other organs as well. Associated injuries are present in more than 90% of patients with aortic transection, and 24% of these patients require a major surgical procedure before aortic repair. The extremely high death rate of acute blunt rupture of the thoracic aorta has led surgeons in the past to repair the tear as quickly as possible. However, this form of management results in high rates of death and complications, often because of associated injuries in other organs.

Patients with traumatic rupture of the aorta fall into two broad categories. About 5% are hemodynamically unstable or deteriorate within 6 hours of admission. These patients require emergent surgical correction because without intervention mortality exceeds 90%. The second group, 95% of patients, are hemodynamically stable at the time of presentation, allowing time for a work-up and staging of any intervention. Mortality in this group is as low as 25% and is rarely the result of free rupture if the blood pressure is controlled. In the past decade, the philosophy of managing traumatic rupture of the aorta in this subgroup of patients has changed to emphasizing blood pressure control and assessing the need for emergent repair against the risks of operation. Prospective studies have demonstrated the value of initial antihypertensive therapy to allow delayed repair of blunt aortic injury in patients with severe coexistent injuries to other organ systems. In a substantial number of cases, associated injuries or comorbidities make the risks of immediate surgical repair prohibitive.

The current indications for considering delayed aortic repair include trauma to the central nervous system, contaminated wounds, respiratory insufficiency from lung contusion or other causes, body surface burns, blunt cardiac injury, tears of solid organs that will undergo nonoperative management, and retroperitoneal hematoma, as well as age older than 50 years and the presence of medical comorbidities. Patients with significant neurologic, pulmonary, or cardiac injuries have better outcomes if their confounding pathologic condition can be ameliorated before thoracotomy.

Penetrating Cardiac Injuries

Penetrating cardiac injuries are frequently the result of physical violence leading to bullet and knife wounds. Similar wounds may result from the inward displacement of bone fragments or fractured ribs due to blunt chest wall injury. Iatrogenic injuries may occur during placement of central venous catheters and wires.

With traumatic perforations, the right ventricle is the most frequently involved chamber, considering its anterior location in the chest. It is often associated with pericardial laceration. Symptoms are related to the size of the wound and the nature of the concomitant pericardial injury. If the pericardium remains open, extravasated blood drains freely into the mediastinum and pleural cavity, and symptoms are related to the resulting hemothorax. If the pericardial sac limits blood loss, pericardial tamponade results. In this situation, treatment includes emergent pericardiocentesis followed by emergent surgical closure of the wound. Small penetrating wounds to the ventricles that are not associated with extensive cardiac damage have the highest rate of survival. Late complications include chronic pericarditis, arrhythmias, aneurysm formation, and ventricular septal defects.

CARDIAC SURGERY

Coronary Artery Bypass Grafting

Despite the effectiveness of current medical therapy for the treatment of coronary artery disease, many patients require revascularization. Coronary artery bypass grafting (CABG) is an effective means of reducing or eliminating symptoms of angina pectoris. CABG may improve survival in certain subgroups of patients, including patients with angina refractory to medical therapy, patients with greater than 50% stenosis of the left main coronary artery, and patients with severe three-vessel coronary artery disease associated with left ventricular dysfunction. In addition, patients with two-vessel coronary artery disease in which a severe stenosis (>75%) is present in the proximal left anterior descending artery appear to benefit from CABG even if left ventricular function is normal.

Standard CABG is performed through a median sternotomy incision with cardiopulmonary bypass (CPB) and cardioplegic arrest. Operative mortality is 1% or less in stable patients with normal left ventricular function; the incidences of perioperative MI and stroke range from 1% to 4%. An increase in adverse events is associated with advancing age, female gender, short stature, diabetes, unstable angina or recent MI, and severely reduced left ventricular function. Overall survival at 10 years is about 80%, with recurrent or progressive angina occurring in about 50% of patients.

Long-term success of surgery is dependent on the type of conduit used during the surgery (saphenous vein versus internal mammary artery grafts) and the progression of atherosclerotic disease in the native and graft vessels. The internal mammary artery is particularly resistant to atherosclerotic disease and has a patency rate of about 90% at 10 years. In comparison, venous grafts are subject to closure both during the immediate postoperative period (usually secondary to technical factors) and months to years after surgery (secondary to intimal hyperplasia and progression of atherosclerosis). As a result, only 50% of venous grafts are patent 7 to 10 years after CABG.

The major predictor of development of atherosclerotic disease in the surgically placed bypass grafts is the ability of patients to control their risk factors for the development of atherosclerotic disease generally after surgery, particularly cigarette smoking,