opment of intraoperative bradycardia.[S8.1.1-6–S8.1.1-8] In the setting of non-cardiac surgery, intraoperative bradycardia is most commonly attributable to SND and only rarely attributable to worsening atrioventricular conduction.[S8.1.1-1,S8.1.1-8,S8.1.1-15] Certain surgical procedures such as carotid artery endarterectomy or stenting have been associated with periods of bradycardia.[S8.1.1-3,S8.1.1-9–S8.1.1-12] Additionally, critical periods during surgery such as abdominal insufflation during laparoscopic surgeries or manipulation of regions innervated by the trigeminal nerve have been reported to be associated with bradycardia.[S8.1.1-13,S8.1.1-14] In a study of 30 patients undergoing carotid angioplasty and stenting who underwent prophylactic transcutaneous pacing because of a high risk for angioplasty-related bradycardia, temporary transcutaneous pacing was used in 23 patients and was effective for eliminating bradycardia in all patients.[S8.1.1-2] However, routine placement of transcutaneous pacing pads in patients solely for the presence of conduction disorders does not provide additional benefit.[S8.1.1-15]

2. Although complete heart block can occur in the setting of pulmonary artery catheter placement in a patient with underlying LBBB, the incidence is low.[S8.1.1-4,S8.1.1-5] Several studies have reported increased risk of ventricular arrhythmias with temporary pacing.[S8.1.1-16,S8.1.1-17] Prophylactic transvenous pacing is not recommended, but the clinician should consider the likelihood of complete heart block if a pulmonary artery catheter is required for intraoperative monitoring and be prepared to manage this complication with rapid initiation of transvenous pacing or immediate transcutaneous pacing if sustained rate support is required.

8.1.2. Postoperative Bradycardia and Conduction Disorders After Cardiac Surgery

The risks of bradycardia after cardiac surgery are largely related to the type of cardiac surgery and the anatomical relationship to the conduction system. Because of this, this section has been subdivided by specific cardiac surgeries and conditions: coronary artery bypass, open valve surgery, including aortic, tricuspid and mitral valves, transcatheter aortic valve placement; congenital heart surgery; heart transplant, surgical myectomy, alcohol septal ablation, and postsurgical sequelae of medical AF treatment. Recovery of atrioventricular conduction after surgery occurs in approximately 12% to 13% of patients within 6 months and depends on the surgery, preoperative conduction abnormalities, presence of endocarditis, and whether transient postoperative atrioventricular conduction is observed[S8.1.2-1,S8.1.2-2] (Online Data Supplement 46).

8.1.2.1. Coronary Artery Bypass

Recommendations for Pacing After Isolated Coronary Artery Bypass Surgery
Referenced studies that support recommendations are summarized in Online Data Supplement 47.

COR	LOE	Recommendations
I	B-NR	1. In patients who have new postoperative SND or atrioventricular block associated with persistent symptoms or hemodynamic instability that does not resolve after isolated coronary artery bypass surgery, permanent pacing is recommended before discharge.[S8.1.2.1-1–S8.1.2.1-9]
IIa	B-NR	2. In patients undergoing isolated coronary artery bypass surgery, routine placement of temporary epicardial pacing wires is reasonable.[S8.1.2.1-5,S8.1.2.1-10,S8.1.2.1-11]
IIb	C-EO	3. In patients undergoing coronary artery bypass surgery who will likely require future CRT or ventricular pacing, intraoperative placement of a permanent epicardial left ventricular lead may be considered.

Synopsis

The incidence of conduction defects after isolated coronary artery bypass graft has ranged from 2% to 58% and has been related to factors such as chronic degenerative disease of the heart, direct surgical damage to the conduction system, myocardial ischemia or inadequate myocardial protection. Advances in surgical practice may be decreasing the incidence of conduction defects but have been unable to eliminate it in any series.[S8.1.2.1-1–S8.1.2.1-4,S8.1.2.1-6–S8.1.2.1-9,S8.1.2.1-12]

Recommendation-Specific Supportive Text

1. The frequency with which patients develop conduction abnormalities needing permanent pacing after isolated coronary artery bypass surgery has varied and may be decreasing over time.[S8.1.2.1-1–S8.1.2.1-7,S8.1.2.1-9,S8.1.2.1-12] If conduction abnormalities resulting in symptomatic bradycardia are already present preoperatively, they will generally not resolve with coronary artery bypass grafting.[S8.1.2.1-8] In part to help facilitate postoperative recovery (eg, moving out of the intensive care setting, ambulation and the initiation of anticoagulation when necessary), patients in whom new onset SND or advanced primary atrioventricular block develops and does not improve should undergo permanent pacer placement after isolated coronary artery bypass surgery. Specific timing of pacemaker implant has not been formally studied and will always depend on the individual clinical situation but 5 to 7 days after surgery is reasonable.[S8.1.2.1-1]