ZHealth Publishing eLearning Coding Series

2019 - CPT Coding for Coronary Artery Bypass Grafts

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Topics Covered:

Introduction

Coronary artery bypass grafting (CABG) involves bypassing a section of a coronary artery that is restricting or preventing blood flow to distal coronary arteries. It can involve any of the major coronary arteries (left main, left anterior descending, left circumflex, and right coronary) as well as their branches. Most CABG surgeries are performed via a median sternotomy, but robotic CABG via small incisions may also be performed in select patients. This module is restricted to *open* bypass procedures. Cardiopulmonary bypass (also called the heart-lung machine) is usually initiated, which allows arrest of the heart during the critical anastomosis of the grafts to the native arteries. Cardiopulmonary bypass involves placement of cannulae in the aorta for arterial inflow/perfusion, as well as the right heart for venous return.

The cardiopulmonary bypass machine collects the blood and removes C02, and the oxygenator adds oxygen to the blood and allows it to be cooled or heated during the procedure. Vents are placed, as well as a cannula, for administration of cardioplegic solution to arrest the heart. After the bypasses are completed, the aortic cross-clamp is removed, and after rewarming the heart, the patient is disconnected from cardiopulmonary bypass with removal of the cannulae. Temporary pacing wires, mediastinal tubes, and chest tubes are usually placed prior to closure of the sternum.

In some patients, "beating heart" or "off pump" bypass surgery is performed. This technique does not require cardiopulmonary bypass or arrest of the heart. Studies indicate this technique may have less morbidity, as small emboli that can occur during cardiopulmonary bypass are averted. The challenge is exposure and anastomosis of grafts to a beating heart. Special positioners and tissue stabilizers are required to limit motion of a small area of the heart where the anastomosis is performed.

Regardless of the approach, coronary artery grafting is performed to bypass blood flow around a critical stenosis or occlusion of coronary vessels. Arterial grafting usually involves the use of the internal mammary artery. It requires takedown of the internal mammary artery from the chest wall as a pedicle flap, and only requires a distal anastomosis beyond the blockage(s). Alternatively, the radial artery may be harvested from the arm and used as an arterial graft requiring two anastomoses (the aorta proximally and the coronary artery beyond the blockage). Saphenous vein grafting requires harvesting of the saphenous vein from the leg(s) via either an open technique or via endoscopic harvest technique (less morbidity). The saphenous vein graft is anastomosed to the coronary artery beyond the disease and then anastomosed proximally to the aorta via a punch aortotomy. The saphenous vein graft(s) are marked proximally at the origin to the aorta for future localization during coronary angiography.

The grafts may be placed in a variety of ways, including a Y configuration to two vessels. A graft may be anastomosed side-to-side to a vessel before terminating in a distal vessel beyond a blockage with an end-to-side anastomosis (sequential graft). If significant plaque is encountered at the anastomotic site, it may require removal via an endarterectomy. Some patients have difficulty separating from the cardiopulmonary bypass machine for various reasons, including cardiogenic shock from an acute myocardial infarction. They may require placement of an intra-aortic balloon assist device or ventricular assist device for hemodynamic support.

Bypass Grafting

Coronary artery bypass grafts are performed using an internal mammary artery (arterial conduit) or an artery or a vein that is harvested from another part of the patient's body. When an arterial conduit is used, the internal mammary artery's origin is left intact; it remains a branch of the subclavian artery. Only the distal aspect of the artery is altered. Once the artery is freed from surrounding tissue, a distal anastomosis is created with the coronary artery beyond the stenosis that is being bypassed.

When an artery or vein is transplanted from another anatomical site, there are two anastomoses – a proximal anastomosis to the aorta and a distal anastomosis to the coronary artery beyond the stenosis that is being bypassed. The harvesting of the vessel to be used for the bypass is usually performed by an assistant at surgery concurrently with the opening of the chest by the surgeon.

The codes for performing coronary bypass grafts are specific to the number of vessels bypassed and the type of vessel used for the graft (artery and/or vein). Often it is a combination of two codes.

Codes for Bypass Grafting with a Vein Only

- **33510** – Coronary artery bypass, vein only; single coronary venous graft
- **33511** – Coronary artery bypass, vein only; 2 coronary venous grafts
- **33512** – Coronary artery bypass, vein only; 3 coronary venous grafts
- **33513** – Coronary artery bypass, vein only; 4 coronary venous grafts
- **33514** – Coronary artery bypass, vein only; 5 coronary venous grafts
- **33516** – Coronary artery bypass, vein only; 6 or more coronary venous grafts

Codes for Bypass Grafting with an Artery

- **33533** – Coronary artery bypass, using arterial graft(s); single arterial graft
- **33534** – Coronary artery bypass, using arterial graft(s); 2 coronary arterial grafts
- **33535** – Coronary artery bypass, using arterial graft(s); 3 coronary arterial grafts
- **33536** – Coronary artery bypass, using arterial graft(s); 4 or more coronary arterial grafts

Add-On Codes for Bypass Grafting with a Vein When There Is Also an Arterial Bypass Graft

- **33517** – Coronary artery bypass, using venous graft(s) and arterial graft(s); single vein graft (List separately in addition to code for primary procedure)
- **33518** – Coronary artery bypass, using venous graft(s) and arterial graft(s); 2 venous grafts (List separately in addition to code for primary procedure)
- **33519** – Coronary artery bypass, using venous graft(s) and arterial graft(s); 3 venous grafts (List separately in addition to code for primary procedure)
- **33521** – Coronary artery bypass, using venous graft(s) and arterial graft(s); 4 venous grafts (List separately in addition to code for primary procedure)
- **33522** – Coronary artery bypass, using venous graft(s) and arterial graft(s); 5 venous grafts (List separately in addition to code for primary procedure)
- **33523** – Coronary artery bypass, using venous graft(s) and arterial graft(s); 6 or more venous grafts (List separately in addition to code for primary procedure)

Harvesting of Vessels for Grafting

- **35500** – Harvest of upper extremity vein, 1 segment, for lower extremity or coronary artery bypass procedure (List separately in addition to code for primary procedure)
- **35572** – Harvest of femoropopliteal vein, 1 segment, for vascular reconstruction procedure (eg, aortic, vena caval, coronary, peripheral artery) (List separately in addition to code for primary procedure)
- **35600** – Harvest of upper extremity artery, 1 segment, for coronary artery bypass procedure (List separately

in addition to code for primary procedure)
- **33508** – Endoscopy, surgical, including video-assisted harvest of vein(s) for coronary artery bypass procedure (List separately in addition to code for primary procedure)

Venous Graft Only

If only venous grafts are being utilized for the bypass procedure, report a code from the 33510-33516 range. Select the code that is specific to the number of vessels bypassed. This is determined by counting the number of coronary artery anastomoses performed, as one vein can be grafted to more than one coronary artery. Do not count the anastomosis to the aorta, only the coronary artery anastomoses.

Harvesting of a saphenous vein to be used for bypass is included in codes 33510-33516. Harvesting of other veins (e.g., upper extremity vein) is not bundled. Harvesting of an upper extremity vein is reported separately with code 35500. Harvesting a femoropopliteal vein is reported separately with code 35572. If endoscopy is utilized to assist in harvesting of any vein, to include the saphenous vein, it is reported separately with code 33508.

There are no dedicated CPT codes to describe coronary bypass grafting performed robotically. Use the codes listed above. The physician may consider appending a -22 modifier (unusual procedural service) to the bypass codes if there is more work involved or reporting unlisted code 33999 for the robotic bypass surgery.

Arterial Graft

If the bypass graft procedure is utilizing an artery for the conduit, report a code from the 33533-33536 range. Select the code that is specific to the number of coronary artery vessels arterial bypass vessels are anastomosed to. If an internal mammary artery is used for bypass, all activities to prepare the internal mammary artery are included in the bypass code.

If an upper extremity artery is selected as the vessel to use for the graft instead of an internal mammary artery, harvesting the upper extremity artery is reported separately with code 35600. Code 35600 is reported with codes 33533-33536.

If the procedure involves a combination of artery and vein bypass grafts, report the arterial code (33533-33536) for the number of bypasses performed with an artery, as well as an add-on code for the number of bypasses performed using a vein (33517-33523).

Opening and closing the chest are included in the bypass graft codes. Do not report additional codes for pericardial closure (any method, including placement of a patch) when the pericardium was opened to perform a coronary bypass. Do not report codes for sternal closure (any method, including plates) when the sternum is closed following the bypass procedure.

Example 1

INDICATION: Patient with a 50 to 60% lesion in his mid-right coronary artery.

PROCEDURE:
1. Coronary artery bypass grafting with placement of a saphenous vein graft to the distal right coronary artery.
2. Temporary cardiopulmonary bypass.
3. Deep hypothermic circulatory arrest.
4. Endoscopic vein harvest.

DESCRIPTION OF PROCEDURE: After informed consent was obtained, the patient was taken to the operating room and placed in the supine position. After the induction of general anesthesia, the usual monitoring devices were placed, including a TEE probe. A full evaluation was performed. This revealed that the patient had severe left ventricular hypertrophy with relatively preserved LV systolic function. Pulmonary artery catheter was placed. The patient's pulmonary artery pressures were in the 40s. Prophylactic antibiotics were

administered. The patient was sterilely prepped and draped. A timeout was performed to identify the patient and the procedure. Endoscopic vein harvesting was then used to harvest the greater saphenous vein from the left thigh. The vein was of good caliber and quality and was prepared in the usual fashion.

A median sternotomy incision was made, and the pericardium was opened. Systematic heparin was administered. A spot on the ascending aorta was then identified proximal to the pericardial reflection, and a single 2-0 Ethibond pursestring stitch was placed. A 22 French DLP arterial cannula was then placed into the ascending aorta, and this was connected to the arterial limb of the bypass circuit. A standard 3-stage venous return cannula was placed into the right atrium via the appendage and connected to the venous limb of the bypass circuit. A retrograde cardioplegia catheter was placed in the coronary sinus via the right atrium. Full cardiopulmonary bypass was then established at 2.4 liters per minute per meter squared flow, and systemic cooling was initiated. A left ventricular vent was placed through the right inferior pulmonary vein and the left ventricle for decompression. The aorta was then circumferentially mobilized. It was mobilized off the pulmonary artery. The aorta was then cross-clamped, and the heart was arrested with antegrade followed by retrograde cardioplegia. Attention was directed towards coronary bypass grafting. The distal main right coronary artery was dissected before its bifurcation and opened. It was grafted in an end-to-side fashion with a segment of greater saphenous vein using running 7-0 Prolene. The proximal aspect of this vein was then connected to the cardioplegia delivery apparatus, and intermittent doses of cardioplegia were given down the right coronary vein graft for right ventricular protection. The graft was then trimmed, and an anastomosis was constructed to the native aorta using a running 5-0 Prolene after creation of a punch aortotomy. Flow was reestablished and the aortic arch deaired. A clamp was then placed on the graft; flow was reestablished, and systemic rewarming was initiated. The patient was weaned off cardiopulmonary bypass satisfactorily. Drains were left in the mediastinum and both pleural spaces. The sternum was reapproximated.

Code(s): 33508, 33510

One artery was bypassed (the right coronary artery). A saphenous vein graft was used for the bypass. Code 33510 describes a single vessel bypass using a vein. The saphenous vein harvesting is included in the code 33510. The use of an endoscope to guide harvesting of the vein is reported separately with code 33508.

Example 2

INDICATION: Coronary artery disease.

PROCEDURE:
1. Coronary bypass graft x3 using LIMA to LAD, SVG to PDA and diagonal.
2. Endoscopic vein harvest.

DESCRIPTION OF PROCEDURE: Informed consent was obtained. The patient was taken to the operating room. Timeout was done. The patient was identified. Appropriate preoperative antibiotics were given. He was anesthetized and intubated. Intra-arterial and venous monitoring lines were placed. He was then prepped and draped. An adequate length of saphenous vein was harvested from the left leg using endoscopic vein harvest. All side branches were doubly clipped. The patient was prepared with gentle hydrostatic dilatation. The subcutaneous tissue and skin were closed using continuous absorbable suture. The sternum was opened in the usual fashion. The left internal mammary artery was dissected from the pedicle in the usual fashion. All side branches were doubly clipped. The patient was systemically heparinized. Pericardium was suspended in the usual fashion. Aortic and atrial cannulation stitches were placed. The patient was then cannulated and placed on cardiopulmonary bypass. Stable on bypass, the aorta was cross-clamped and the heart arrested using a combination of antegrade and retrograde cardioplegia. The PDA was dissected and an arteriotomy made beyond the stenosis. End-to-side anastomosis between a segment of vein graft and that vessel was done using continuous 7-0 Prolene suture. We measured the appropriate vein graft length. A proximal aortotomy was fashioned. A proximal anastomosis was

completed using continuous 6-0 Prolene suture. We then repositioned the heart. The diagonal leg from the trifurcation disease was dissected open. End-to-side anastomosis between a segment of vein graft and that vessel was done using continuous 7-0 Prolene suture. We then repositioned the heart. The distal LAD was dissected and an arteriotomy created. The distal IMA was spatulated. End-to-side anastomosis between the IMA and that vessel was done using continuous 7-0 Prolene suture. After this was done, we then repositioned the heart. The proximal aortotomy was fashioned, and the second saphenous vein graft proximal anastomosis was completed using continuous 6-0 Prolene suture. The heart resumed a spontaneous rhythm with reperfusion. The right atrial and right ventricular pacing wires were placed. A left pleural and two pericardial tubes were placed. After the patient was reperfused and rewarmed, the patient was weaned from cardiopulmonary bypass without difficulty. Decannulation was carried out. The patient was given a full dose of protamine, which was tolerated well. Hemostasis was achieved in the mediastinum. Sternum was reapproximated with #6 stainless steel wire. Presternal fascia, subcutaneous tissue, and skin were closed using continuous absorbable suture.

Codes: 33508, 33518, 33533

The following vessels had bypass grafts anastomosed to them: posterior descending artery (saphenous vein), diagonal leg from the trifurcation disease (saphenous vein), and distal LAD (LIMA). There was one arterial bypass, which is reported as the base procedure with code 33533. The two saphenous vein bypass procedures are reported with add-on code 33518. The saphenous vein harvesting is included in code 33518. The use of an endoscope to guide harvesting of the vein is reported separately with code 33508.

Other Surgical Procedures Performed at Time of Coronary Artery Bypass Grafting

There are other procedures that are sometimes performed at the same time as coronary bypass grafting.

- **33140** – Transmyocardial laser revascularization, by thoracotomy; (separate procedure)
- **33141** – Transmyocardial laser revascularization, by thoracotomy; performed at the time of other open cardiac procedure(s) (List separately in addition to code for primary procedure)
- **33202** – Insertion of epicardial electrode(s); open incision (eg, thoracotomy, median sternotomy, subxiphoid approach)
- **33257** – Operative tissue ablation and reconstruction of atria, performed at the time of other cardiac procedure(s), limited (eg, modified maze procedure) (List separately in addition to code for primary procedure)
- **33258** – Operative tissue ablation and reconstruction of atria, performed at the time of other cardiac procedure(s), extensive (eg, maze procedure), without cardiopulmonary bypass (List separately in addition to code for primary procedure)
- **33259** – Operative tissue ablation and reconstruction of atria, performed at the time of other cardiac procedure(s), extensive (eg, maze procedure), with cardiopulmonary bypass (List separately in addition to code for primary procedure)
- **33530** – Reoperation, coronary artery bypass procedure or valve procedure, more than 1 month after original operation (List separately in addition to code for primary procedure)
- **33572** – Coronary endarterectomy, open, any method, of left anterior descending, circumflex, or right coronary artery performed in conjunction with coronary artery bypass graft procedure, each vessel (List separately in addition to primary procedure)

Transmyocardial laser revascularization (TMR) is performed to create channels in the arterio-luminal sinusoids that connect directly with the left ventricular cavity, using a high-powered laser to increase blood supply to the myocardium. TMR may be performed "off" cardiopulmonary bypass; however, most TMR procedures are performed with the patient on cardiopulmonary bypass. Therefore, it is appropriate to use code 33140 or 33141 to report TMR performed either on-pump or off-pump. Code 33140 has a "separate procedure" designation, so it would not be reported with any procedure performed in the same surgical field, such as coronary bypass. Code 33141 is reported when TMR is performed in the same operative session

as coronary bypass.

Epicardial leads are sometimes placed during coronary bypass surgery for possible future use. The placement of epicardial lead(s) is reported separately with code 33202.

An endarterectomy may be needed to clear the atherosclerotic plaque from an artery where the graft will be anastomosed. Add-on code 33572 is reported per vessel that an endarterectomy is performed on. It may only be reported in conjunction with codes 33510-33523 and 33533-33536.

Report code 33257 if limited tissue ablation and reconstruction of the atria is performed in the same session as coronary bypass. Report code 33258 if extensive tissue ablation and reconstruction of the atria is performed in the same session as coronary bypass without cardiopulmonary bypass; report code 33259 when performed with cardiopulmonary bypass. Do not submit these codes for a simple ligation or resection of the left atrial appendage performed at the time of coronary artery bypass, which is included. There must be reconstruction also performed.

Coronary artery bypass grafting may be complicated by prior open heart surgery. There may be scar tissue that must be transected to get to the operative field. To address this extra work, code 33530 is reported separately when the reoperation is over a month beyond the original surgery. Code 33530 is only reported with codes 33510-33536.

While outside the scope of this module, also separately report any heart valve repair or replacement, repair of a post-infarct ventricular septal defect, resection of a ventricular aneurysm, other surgical ventricular restoration procedures, and/or resection of left atrial myxomoma.

Example 3

INDICATION: The patient presents with severe arrhythmias with V-tach and ventricular fibrillation. He underwent ablation, and this was eventually controlled. Cardiac catheterization was done, which showed that a previously placed RIMA to the right coronary artery was occluded. He has also had a stent to the right coronary in the past. He has an anomalous right coronary. The diagonal graft was patent. Given these findings, we elected to re-do the graft to the right coronary. He was not a candidate for unroofing because of the previous stenting. Intraoperatively, he has diffuse disease of the main right coronary, and for this reason I grafted the posterior descending branch. At the end of the procedure, after the initial dose of protamine, he had a severe episode of hypotension. It was unclear whether this was a protamine reaction or not. It was treated with multiple inotropes and eventually responded. The remaining dose of protamine was given without significant event. He returned to the ICU in stable but critical condition.

PROCEDURE:

1. Right axillary artery cannulation.
2. Re-do sternotomy.
3. Endoscopic vein harvest.
4. Coronary bypass grafting x1 with saphenous vein graft to the posterior descending branch of the right.

DESCRIPTION OF PROCEDURE: After informed consent was obtained, the patient was taken to the operating room and placed in supine position. Chest, legs, and arms were prepped with DuraPrep and sterile drapes applied. Saphenous vein was harvested from the right leg using endoscopic technique. During this time, a sternal incision was made. The sternum was opened with oscillating saw. It should be noted prior to this that the patient had axillary artery cannulation with a 10 mm Hemashield graft. Adhesions were taken down sharply. Retractor was placed in the right atrium, and aorta was exposed. Cannulation sutures were placed. The patient was heparinized and cannulated including antegrade and retrograde cardioplegia needles. The patient was placed on bypass. Cross-clamp was applied, and cardioplegia was delivered. There was prompt arrest of the heart. The right coronary was dissected out. It was noted that the main right coronary was diffusely diseased. The posterior descending branch was then dissected out and opened. The vein was prepared. End-to-side

anastomosis was performed. Aortotomy was made and extended with a 4 mm punch. Proximal anastomosis was made with 5-0 Prolene suture in running fashion. The aorta was deaired and cross-clamp removed. After adequate deairing and reperfusion, the patient was weaned from bypass, which he tolerated well. Protamine was administered and cannulae removed. Cannulation sites were oversewn. Two chest tubes were placed. The sternum was closed with number 7 sternal wires. Subq and skin were closed in layers. Dressings were placed. The patient tolerated the procedure well and returned to the ICU in stable condition.

Code(s): 33508, 33510, 33530

The patient had a previous bypass surgery performed longer than a month before the current surgical procedure. Code 33530 is reported for the additional work of taking down adhesions. Only one artery was bypassed (the right coronary artery). A vein was used, so code 33510 is reported. The harvesting of the vein is included in code 33510. The use of an endoscope to guide harvesting of the vein is reported separately with code 33508.

Example 4

INDICATION: Patient with symptomatic angina and a cardiac catheterization showing significant multi-vessel coronary artery disease. His right coronary artery is occluded. The posterior descending is filled in by collaterals. The LAD is diffusely diseased as well. There are significant stenoses affecting the circumflex marginal branch as well as the first diagonal.

He has a history of varicosities in the right lower extremity, but none in the left. He is admitted to the hospital at this time for coronary bypass surgery.

PROCEDURE: Coronary artery bypass grafting x3 with left internal mammary artery harvest and left thigh endoscopic saphenous vein harvest as well as a left anterior descending artery endarterectomy with greater saphenous vein patch angioplasty:

1. Saphenous vein graft to the right posterolateral branch.
2. Saphenous vein graft to the OM2 branch of the circumflex.
3. Left internal mammary artery to the LAD vein patch angioplasty after LAD endarterectomy.

DESCRIPTION OF PROCEDURE: Informed consent was obtained from the patient. He was identified and taken to the operating room and placed in the supine position, and general anesthesia was induced without difficulty. Because of the question of conduit availability, I had checked his left radial artery Allen test, both clinically and with the pulse oximeter, and his radial appeared to be usable. We therefore prepped and draped it out separately in case his left thigh greater saphenous vein was not usable.

Standard monitoring lines were placed, including a transesophageal echo probe and a Swan-Ganz catheter.

His pulmonary pressures were normal. The transesophageal echo demonstrated normal left ventricular function. He had mild aortic sclerosis but no stenosis and no other significant structural abnormalities. One unit of autologous blood was harvested and transfused back at the completion of the case, and 2 grams of Ancef were given as preoperative antibiotic, after which we performed sterile prep and drape. I then started with the median sternotomy. The left pleural space was opened widely, and the left internal mammary artery was dissected down from the chest wall. This proved to be an excellent caliber and quality mammary that was of good size and had high-grade flow.

Simultaneously, a length of what ultimately and somewhat surprisingly proved to be a completely normal and good quality greater saphenous vein was harvested via an endoscope from the left thigh, which gave us two good lengths. The side branches of the vein were double clipped, and the leg wound was irrigated and closed.

The patient was heparinized and responded normally to heparin after which the pericardial well was created. His chest was relatively deep and his heart was large and it was immediately apparent on palpating his LAD that he had a completely calcified LAD that was going to be problematic. I could feel his circumflex to be calcified as well, as were the targets on the inferior wall of

his heart.

The ascending aorta was of normal length and caliber and without any palpable abnormalities. I went ahead and opened the pleural space to facilitate the exposure of the circumflex system. Cannulation sutures were placed in the ascending aorta and in the right atrial appendage. The aorta was cannulated with a soft flow arterial cannula and a triple stage venous cannula was inserted after which retrograde autologous priming was performed and the patient was placed on cardiopulmonary bypass.

An antegrade cardioplegic needle was inserted and the cross-clamp was applied after I evaluated the targets. Again, I was very concerned about his LAD. There were really no soft spots at all on the LAD other than very far out near the apex. The posterior descending artery was heavily calcified but I felt that I could see a posterolateral branch that was potentially graftable. The circumflex had spotty calcification and ultimately proved to be his best target.

The cross-clamp was applied and the heart was arrested with antegrade cold blood cardioplegia and I rotated up the inferior wall of the heart. As noted, the posterior descending artery was completely calcified but immediately adjacent to it was a posterolateral branch which, while calcified, had a soft spot in its mid aspect and it was a reasonable target there. I therefore opened the posterolateral branch and a saphenous vein graft was sewn down with a running 7-0 Prolene suture, after which we had excellent runoff and no leaks. Cardioplegia was administered and this graft was routed up across the acute margin of the heart and along the anterior surface of the right ventricle. The saphenous vein graft anastomosis was performed to the ascending aorta with a running 6-0 Prolene suture, after which another dose of cardioplegia was administered.

Next, I rotated up the left side of the heart and found the second circumflex marginal branch. There was actually a first circumflex marginal which was visible, but it was completely calcified and ungraftable. The second circumflex marginal, though a bit smaller, appeared to be graftable because the calcification was more intermittent. This vessel was opened and proved to be a good recipient vessel at about 1.8 to 2 mm and a separate saphenous vein graft was sewn down with a running 7-0 Prolene suture, after which we had excellent runoff and no leaks. With the patient rewarming, a dose of cardioplegia was given and then that proximal anastomosis was created to the ascending aorta with a running 6-0 Prolene suture.

Next, the left internal mammary artery was brought through a buttonhole placed in the left side of the pericardium above the phrenic nerve and I explored the LAD. I went at the junction of the middle and distal third and this was the only area where there was even a remote hope of grafting the vessel and there was a small area that was soft. I therefore opened the LAD. Unfortunately, as I tried to pass the needle at the heel and the toe, the needle really would not even pass. This was clearly going to be problematic. The vessel began to delaminate and I felt that it was reasonable at this point to simply proceed on with an eversion endarterectomy proximally and distally and graft the LAD onto a vein patch. I therefore performed an eversion LAD endarterectomy getting a good endpoint all the way out to the apex including a very distal septal branch in the proximal aspect, extended back well up into the proximal LAD and we had a surprisingly good result with nearly a complete cast of the LAD. I gave cardioplegia and we had good flow forward.

I then used the remaining bit of greater saphenous vein to sew a greater saphenous vein patch over this relatively long endarterectomy site as a vein graft angioplasty, followed by another dose of cardioplegia. I then made the anastomosis between the left internal mammary artery and this greater saphenous vein patch angioplasty to the LAD with a running 7-0 Prolene suture. We had good visible flow with good runoff distally. The patient began to have spontaneous sinus rhythm with a cross-clamp in place. I deaired the ascending aorta and removed the root vent and that site was oversewn with a 5-0 Prolene suture and then the cross-clamp was removed. The patient regained a normal sinus rhythm and weaned quickly and easily from cardiopulmonary bypass with no EKG changes and entirely normal looking TEE with normal wall motion everywhere, most specifically in the anterior wall.

At this point, I was extremely pleased with the result that we had. He tolerated protamine well. He came off bypass with no inotropes and in fact was requiring nitroglycerin. Two 28 French mediastinal chest tubes were inserted, 19 French Blake drains were present in

each pleural space.

I oversewed the aortic cannulation site with a 5-0 Prolene suture. Hemostasis looked good. The graft geometry looked good and I closed the pericardium with interrupted 0 Vicryl sutures after which the sternum was reapproximated with a combination of single and double stainless steel wires and the wound was then irrigated and closed in multiple layers of absorbable suture.

Code(s): 33508, 33518, 33533, 33572

There were two vessels bypassed using the saphenous vein graft; the right posterolateral branch of the posterior descending coronary artery and the OM2 branch of the circumflex coronary artery. There was one vessel bypassed using the left internal mammary artery - the left anterior descending coronary artery. The base procedure code is based on the number arteries bypassed with an arterial graft. Code 33533 describe one vessel bypassed with an arterial graft. The saphenous vein grafts are reported with add-on code 33518 which describes the two venous bypass grafts that were performed. The use of an endoscope to guide harvesting of the vein is reported separately with code 33508. An endarterectomy was performed on the left anterior descending artery to accommodate the anastomosis with the left internal mammary artery and is reported separately with code 33572. The patch angioplasty is included in the endarterectomy procedure.

Example 5

INDICATION: A seventy-two-year-old male with multiple medical problems to include COPD, CHF, and diabetes presents with crescendo angina and borderline troponins. Coronary angiography revealed severe, complex distal left main/proximal left anterior descending coronary artery disease, as well as a severe stenosis in the mid right coronary artery. The patient has also been going into frequent atrial fibrillation that has been poorly tolerated hemodynamically.

PROCEDURE: Radial arterial line, Foley catheter, central line, and Swan-Ganz catheter are placed. After general anesthesia, the patient is prepped and draped. The saphenous vein from the leg is harvested with an endoscopic technique. Median sternotomy is performed and the thymic remnant is divided. The left pleural space is entered and the left internal mammary artery is taken down as a pedicle graft. Cardiopulmonary bypass is established with a two-stage venous cannula in the right atrium and an arterial cannula in the distal descending aorta. The aorta is cross-clamped and cardioplegia is delivered, arresting the heart. The left anterior descending coronary artery beyond the stenosis is a good target, and the LIMA is anastomosed end-to-side to the LAD. The SVG is then anastomosed to the right coronary artery beyond the stenosis. A punch is used to create an aortotomy in the proximal ascending aorta where the proximal SVG is anastomosed to the aorta. A modified left atrial Maze procedure is performed with a radiofrequency ablation device. The aortic cross-clamp is removed after twenty minutes of warm beating heart time with the patient easily separating form the cardiopulmonary bypass. The cannulae are removed. Two mediastinal drains and a left pleural chest tube are placed. Temporary pacing wire is placed, followed by reapproximation of the pericardium and closure of the sternum with surgical steel wires. The subcutaneous tissues are closed, followed by skin staples. The patient tolerates the procedure well and is transferred to the ICU.

Code(s): 33257, 33508, 33517, 33533

A single bypass graft was performed with an arterial conduit (left anterior descending) and reported with code 33533. The saphenous vein was harvested using endoscopic guidance (33508). The saphenous vein was used to graft as single coronary artery (right coronary artery), reported with code 33517. A modified Maze procedure was also performed. It is reported separately with code 33257.

Intra-Aortic Balloon Assist and Ventricular Assist Device Placement

Sometimes intra-aortic balloon assist or ventricular assist devices are placed to provide hemodynamic support. They may be placed at a previous encounter, when the coronary artery disease is diagnosed, or may be placed during the bypass encounter if the patient has trouble weaning off the cardiopulmonary bypass machine. There are several codes to describe placement of these devices:

- **33967** – Insertion of intra-aortic balloon assist device, percutaneous
- **33968** – Removal of intra-aortic balloon assist device, percutaneous
- **33970** – Insertion of intra-aortic balloon assist device through the femoral artery, open approach
- **33971** – Removal of intra-aortic balloon assist device including repair of femoral artery, with or without graft
- **33973** – Insertion of intra-aortic balloon assist device through the ascending aorta
- **33974** – Removal of intra-aortic balloon assist device from the ascending aorta, including repair of the ascending aorta, with or without graft
- **33975** – Insertion of ventricular assist device; extracorporeal, single ventricle
- **33976** – Insertion of ventricular assist device; extracorporeal, biventricular
- **33977** – Removal of ventricular assist device; extracorporeal, single ventricle
- **33978** – Removal of ventricular assist device; extracorporeal, biventricular
- **33979** – Insertion of ventricular assist device, implantable intracorporeal, single ventricle
- **33990** – Insertion of ventricular assist device, percutaneous including radiological supervision and interpretation; arterial access only
- **33991** – Insertion of ventricular assist device, percutaneous including radiological supervision and interpretation; both arterial and venous access, with transseptal puncture
- **34812** – Open femoral artery exposure for delivery of endovascular prosthesis, by groin incision, unilateral (List separately in addition to code for primary procedure)

An intra-aortic balloon assist device, often termed aortic balloon pump, consists of a balloon mounted on a catheter, which is generally inserted into the aorta through the femoral artery in the leg, however other access sites may be used. The balloon is placed in the descending aorta. At the start of diastole, the balloon inflates, augmenting coronary perfusion. At the beginning of systole, the balloon deflates; blood is ejected from the left ventricle, increasing the cardiac output by as much as 40 percent and decreasing the left ventricular stroke work and myocardial oxygen requirements. In this manner, the balloon supports the heart indirectly.

The balloon is inflated with helium, an inert gas that is easily absorbed into the bloodstream in case of rupture. Inflation of the balloon can be triggered by the patient's electrocardiogram, their blood pressure, a pacemaker (if they have one), or by a pre-set internal rate. The balloon pump is sometimes placed following a cardiac catheterization when the heart needs support until the CABG can be performed. It may also be placed during the CABG procedure.

A ventricular assist device (VAD) is placed when there is heart failure and the device is needed to partially or completely replace the function of the failing heart. It can be placed in one ventricle or both, depending on the heart failure. The blood is pumped by the VAD from the left ventricle into the aorta; taking over the work the failing ventricle can no longer perform. The pump may be implanted (intracorporeal) or reside outside the body (extracorporeal). It can be placed via an open approach (33970 – 33979), or percutaneously (33990 – 33991). When performed via an open chest approach, the conduit is surgically attached to the wall of the ventricle and to the wall of the aorta. When performed via a percutaneous approach, catheters are placed in the ventricle(s) and aorta via a peripheral artery.

Use code 33990 for implantation of a percutaneous VAD that requires only an arterial approach, such as the Impella device. Code 34812 is reported separately if an open femoral access (cutdown) is required to deliver the device.

Use code 33991 for implantation of a percutaneous VAD that requires both arterial and transseptal venous catheter placements, such as the Tandem Heart device. Do not use code 33990 or 33991 if the device is implanted using the open surgical field during coronary artery bypass. Code 33990 and 33991 are only for percutaneous placement. Report code 33975 or 33976 when a VAD is implanted via an open surgical approach with the pump residing outside of the body. Code 33975 describes attaching the device to a single ventricle; code 33976 describes attachment to both ventricles. Report code 33979 for a totally implanted system (intracorporeal).

Removal of a ventricular assist device (codes 33968, 33971, 33974, 33977, and 33978) is not reported separately when performed at the same session as insertion.

Example 6

INDICATION: Patient is a 71-year-old female with progressive symptoms of congestive heart failure on maximal medical management who had previously undergone coronary artery bypass surgery. Her vein graft to the right coronary artery was occluded, but her left IMA to LAD was patent.

PROCEDURE: After satisfactory induction of general anesthesia, the patient was positioned supine and prepped and draped in a sterile fashion. A reoperative median sternotomy was performed. The substernal tissues were sharply divided, and when this was accomplished, the oscillating saw was utilized to open the sternum. Then a self-retaining retractor was inserted, and gradually the mediastinum was dissected free exposing the aorta and right atrium. Simultaneously the right greater saphenous vein was harvested endoscopically and was a very good conduit.

Next the mediastinal dissection continued, and when it was completed, the patient was heparinized and cannulated via the ascending aorta distally, and SVC, and IVC. After satisfactory ACT, a normothermic cardiopulmonary bypass was instituted. The rest of the mediastinal dissection continued. I encircled the ascending aorta, which was soft and noncalcific. Left internal mammary artery graft was identified without injury and encircled as well. The ascending aorta was then clamped. The caval tapes were snared. The heart was arrested with antegrade cardioplegia as the left IMA was occluded temporarily for the time of cross-clamping. Retrograde CP was delivered every 20-25 minutes as needed until the cross-clamp was removed.

Next the posterior descending artery was exposed. It was a disappointingly small vessel but free of calcification. It was grafted with a reverse segment of saphenous vein, and a proximal anastomosis was created to the ascending aorta.

When all this was completed, the cross-clamp was removed, and cardiac activity resumed. The heart appeared vigorous. After the rhythm stabilized, the patient was very slowly weaned from cardiopulmonary bypass with the help of inotropic support. At this point, there appeared to be reasonable hemodynamics as well as reasonable hemostasis in the suture lines. The patient was decannulated, and protamine was begun. She then experienced a significant amount of prolonged hypotension which was somewhat difficult to treat but did respond to medical management. Therefore, an intra-aortic balloon pump was inserted via the right common femoral artery using a modifier Seldinger technique under echocardiographic guidance. With the balloon properly positioned, the patient's blood pressure improved somewhat, but she still required significant doses of vasopressor agents.

Over time, with volume replacement, the patient's hemodynamics stabilized and we were able to stay off bypass permanently. Blood products and factor VII were administered. A ventricular pacing wire and mediastinal and pleural drains were inserted.

After a considerable time resolving the coagulopathic bleeding, hemostasis finally became acceptable, and the

patient's incision was closed in a routine fashion. A sterile bandage was applied and she was transported to the CTS ICU in critical but stable condition with the IABP.

Code(s): 33508, 33510, 33530, 33967

The patient had previous bypass surgery, so code 33530 is reported for the reoperation. A saphenous vein was harvested (bundled) using endoscopic guidance (33508). The saphenous vein was anastomosed to the posterior descending artery to bypass the right coronary artery (33510). The patient became hypotensive so an intra-aortic balloon was placed via a percutaneous method (33967).

Summary

Coding coronary artery bypass grafts is quite simple. Codes 33510-33516 are reported when only a vein is used as a bypass vessel. The code selected is based on the number of coronary arteries or branches that vein grafts are anastomosed to. These codes are not used if an artery is also used as a bypass graft.

If an artery, either an internal mammary artery or a peripheral artery, is used as a bypass vessel, codes 33533 -33536 are reported based on the number of coronary arteries or branches that graft arteries are anastomosed to.

Use add-on codes 33517-33523 to report the number of coronary arteries and branches that veins are anastomosed to in addition to use of an artery as a graft vessel.

Harvest of a saphenous vein by an open method is bundled. Harvest of all other veins and arteries are reported separately. The use of endoscopic guidance to harvest any vein that will be used for bypass, to include the saphenous vein, is reported separately with code 33508.

If the patient had previous open heart surgery over one month prior to the current bypass procedure, reoperation is reported separately with code 33530.

Coronary bypass graft procedures become much more complex when other procedures are performed at the same time, such as valve replacements and repair, intra-aortic balloon pump and ventricular assist device implantation, endarterectomy, etc. Careful attention to all details of the surgery is required to capture all appropriate procedure codes.