CONFIGURING THE GRAFTS

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A. PREPARING COMPOSITE GRAFTS

Arterial grafts allow for total arterial revascularization of the ischemic myocardium in "T" or "Y" configurations. Even when combined with saphenous vein (SV) grafts, they provide an advantage to surgeons by eliminating the need for partial clamping during the proximal anastomoses of the aorta, thus preventing undesired cerebrovascular events. Careful selection of eligible patients and the application of refined surgical techniques are crucial to achieve optimal results.

In the preparation of composite grafts, the left and right internal thoracic arteries (LITAs/RITAs), radial artery (RA), and SV should be prepared as much as possible without a pedicle, skeletonized, and away from surrounding tissues. Standard monopolar electrocautery or ultrasonic cautery can be used for preparing arterial grafts, particularly useful in minimizing thermal damage during skeletonized graft preparation. To achieve maximum graft length, the entire internal thoracic artery (ITA) segment between the subclavian artery and the distal bifurcation should be released. After heparinization, LITA is prepared as a free graft from the distal end, while RITA is separated from both proximal and distal ends. Care should be taken to avoid damage to the right phrenic nerve, considering its close proximity to the posterolateral side of RITA.

The pericardial sac is opened, and the phrenic nerve is protected by ensuring that it remains 2 to 3 cm away as LITA is brought to the sac, checking for any kinks or torsion. The level at which the end-side anastomosis to LITA will be performed needs to be determined during this stage. The optimal location is the area corresponding to the upper part of the left atrial appendage and the posterolateral edge of the main pulmonary artery.

To perform this delicate anastomosis, the lower surface of LITA, covered with endothoracic fascia, is fully exposed. To prevent torsion of LITA and provide a more stable area for anastomosis, 6/0 polypropylene sutures passing through the perivascular tissue are used to fix the inferior surface with the surgeon-facing side. Leaving a slightly larger amount of perivascular tissue around the artery in the section that reaches the second intercostal space can facilitate this stage. Before starting, fixing the hand using a port-guided technique allows for more precise wrist movements. Subsequently, an 8 to 10-mm arteriotomy is made on the inferior surface of LITA, and the free graft's end is sutured to LITA using 8/0 polypropylene stitches, completing the anastomosis from the distal to the proximal edge from adventitia to lumen. The absence of anastomotic stenosis is a crucial factor determining the success of the technique. Bulldog clamps are used to check for any bleeding from the flow or anastomosis or branches. This stage is completed without transitioning to distal anastomoses in off-pump cases or cannulation for cardiopulmonary bypass.

The choice between "T" and "Y" configurations for anastomosis depends on the surgeon's preferred technique, experience with the targeted vessels and sequential anastomoses, the necessity of arteriotomies distal to the coronary artery, and the preference for the diameter differences between anastomosed vessels. The preference for Y-shaped configurations for RITA and RA grafts and a

more vertically oriented T-shaped configuration for SV grafts is mainly based on factors such as ensuring sufficient flow without creating a stenosis on this line and avoiding excessive flow or steal phenomenon caused by a large anastomosis. While this configuration allows anastomosis to left anterior descending artery (LAD) and diagonal branches for LITA, the anastomosed RITA, RA, or SV grafts extend to the lateral wall of the left ventricle (obtuse marginal arteries) and even to the posterior descending artery (PDA), facilitating total revascularization. However, due to lower long-term survival rates observed with configurations extending to PDA, it is recommended to limit composite grafts to the left-sided vessels. Another crucial point is the sequential order of anastomoses from proximal to distal after completing LAD (obtuse margin and then PDA) and ensuring that the free graft is anchored to the epicardium with 6/0 polypropylene to prevent torsion.

B. POSITIONING AND ANGLING

"T" and "Y" Graft

The main trunk is usually LITA, and the graft anastomosed to the end-side is RITA, RA, SV grafts, or the 4 to 5 cm end part of the LITA. While LAD is bypassed with LITA, other grafts are anastomosed to the lateral and posterior wall coronary arteries (Figure 7.1a). If LITA, even when skeletonized, cannot reach the anastomosis site in LAD, anastomosis is made to the circumflex marginal branch, and the free graft is anastomosed as the end-side to LAD (Figure 7.1b).

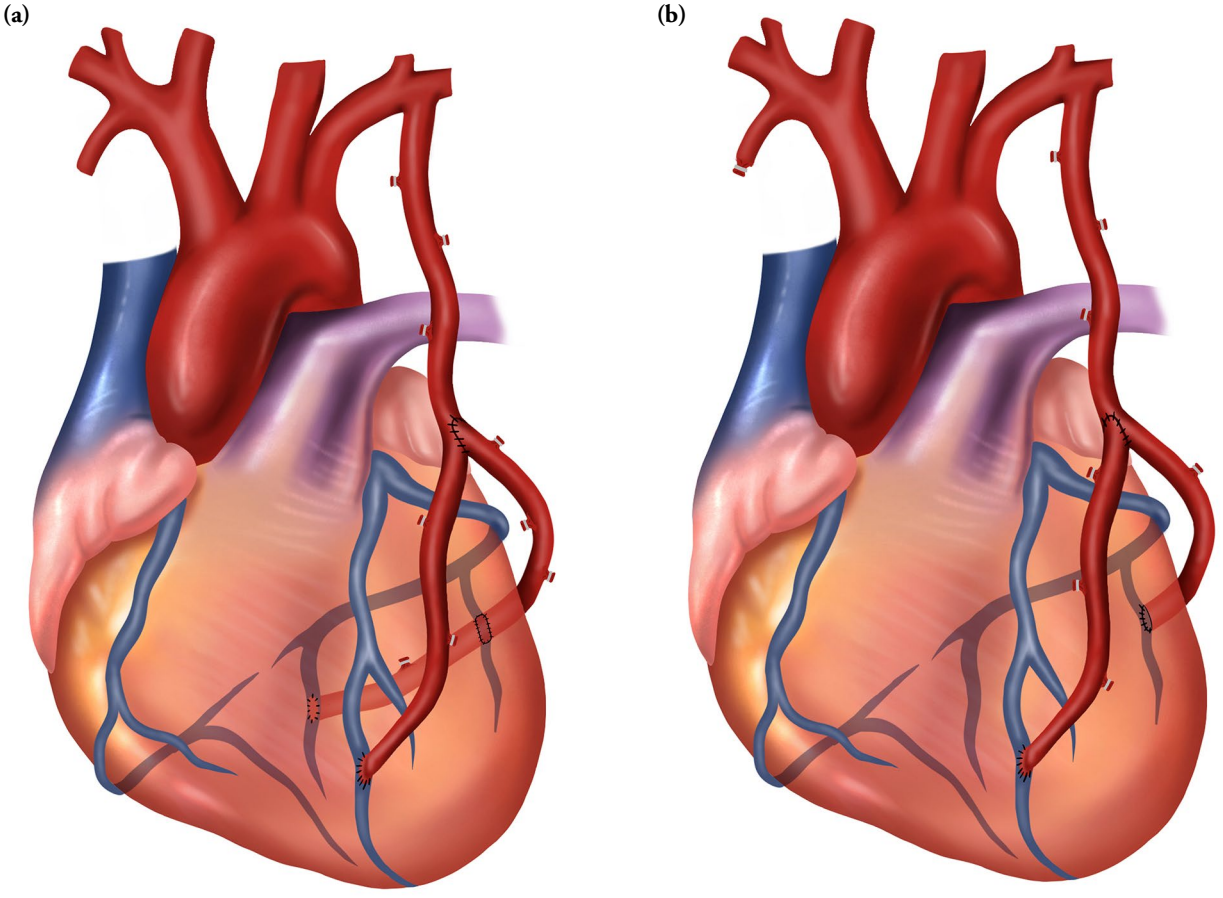

Figure 7.1. **(a)** T graft. **(b)** Y graft.

Reverse "T" and "Y" Graft

The pedicled RITA forms the main trunk and is anastomosed to LAD, while the Y graft is completed with RA, LITA, or SV grafts and bypasses the obtuse marginal branch. This configuration is preferred, if there is damage or insufficient flow in the proximal part of LITA. It is easy to apply in off-pump coronary artery bypass grafting (CABG), and removing the distal two-third of RITA is sufficient. The T-shaped grafts, particularly those created for lateral wall revascularization, have a tendency to cause less kinking than the Y-shaped grafts (Figure 7.2).

"I" Graft

The goal of this graft is to extend its length. Distal LITA or RA *in situ* is end-to-end anastomosed to RITA. The goal is to allow RITA to easily reach the distal part of the posterior descending artery (Figure 7.3a). The RITA or RA is anastomosed to LITA. If LAD does not need to be bypassed, the main goal is to extend the graft to the lateral and posterior wall (Figure 7.3b).

"Π" (Pi) Graft

This configuration is a trifurcated graft formed by two end-side anastomoses. After free RITA is anastomosed to LITA (classical T graft), another free graft, for instance, distal LITA or RITA portions, is re-anastomosed to the side graft (RITA) (Figure 7.4a), or the main trunk LITA (Figure 7.4b). Similarly, it is possible to use the right-sided version with RITA and RA or SV grafts.

"Ψ" (Psi) Graft

The LITA is used as an *in situ* graft, while the free second graft is anastomosed in an end-to-side fashion from the middle to LITA. The distal ends of the second graft are bypassed to the target vessels. Sequential bypasses can also be performed (Figure 7.5a).

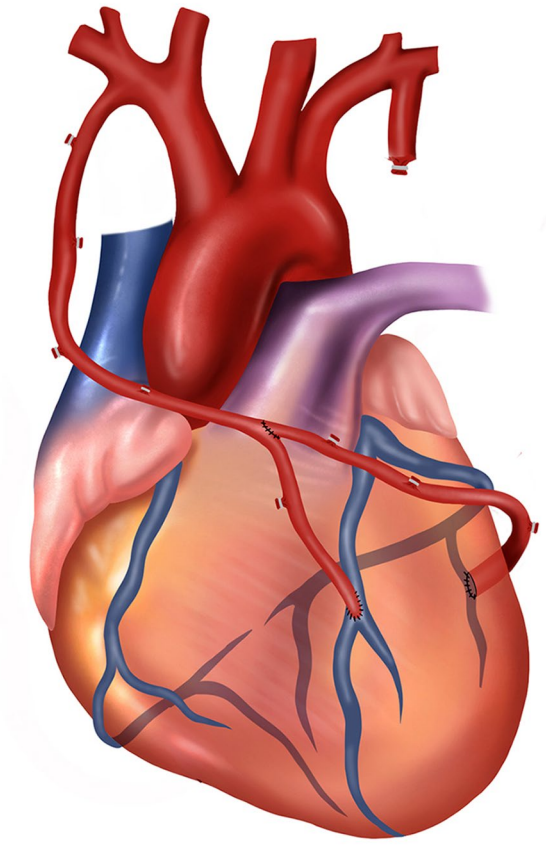

Figure 7.2. Reversed T or Y graft.

"K" Graft

In this configuration, the second graft is anastomosed in an end-to-side fashion from the middle, while the distal parts complete the revascularization of the target vessels (Figure 7.5b).

Carefully performing the refined techniques described above will allow for higher long-term patency rates of the target vessels in patients and reduce the occurrence of undesired events, providing the opportunity to achieve more favorable outcomes.

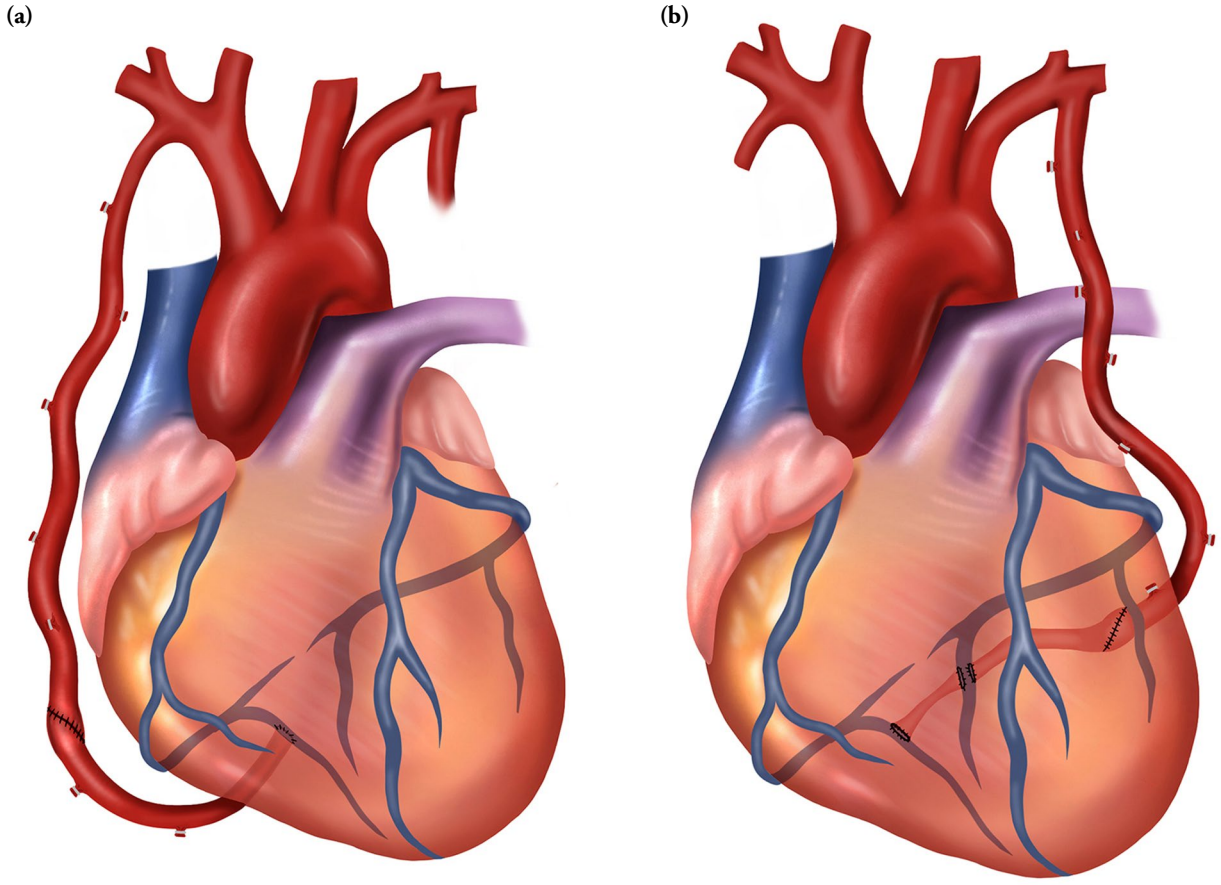

Figure 7.3. **(a)** I graft. **(b)** I graft.

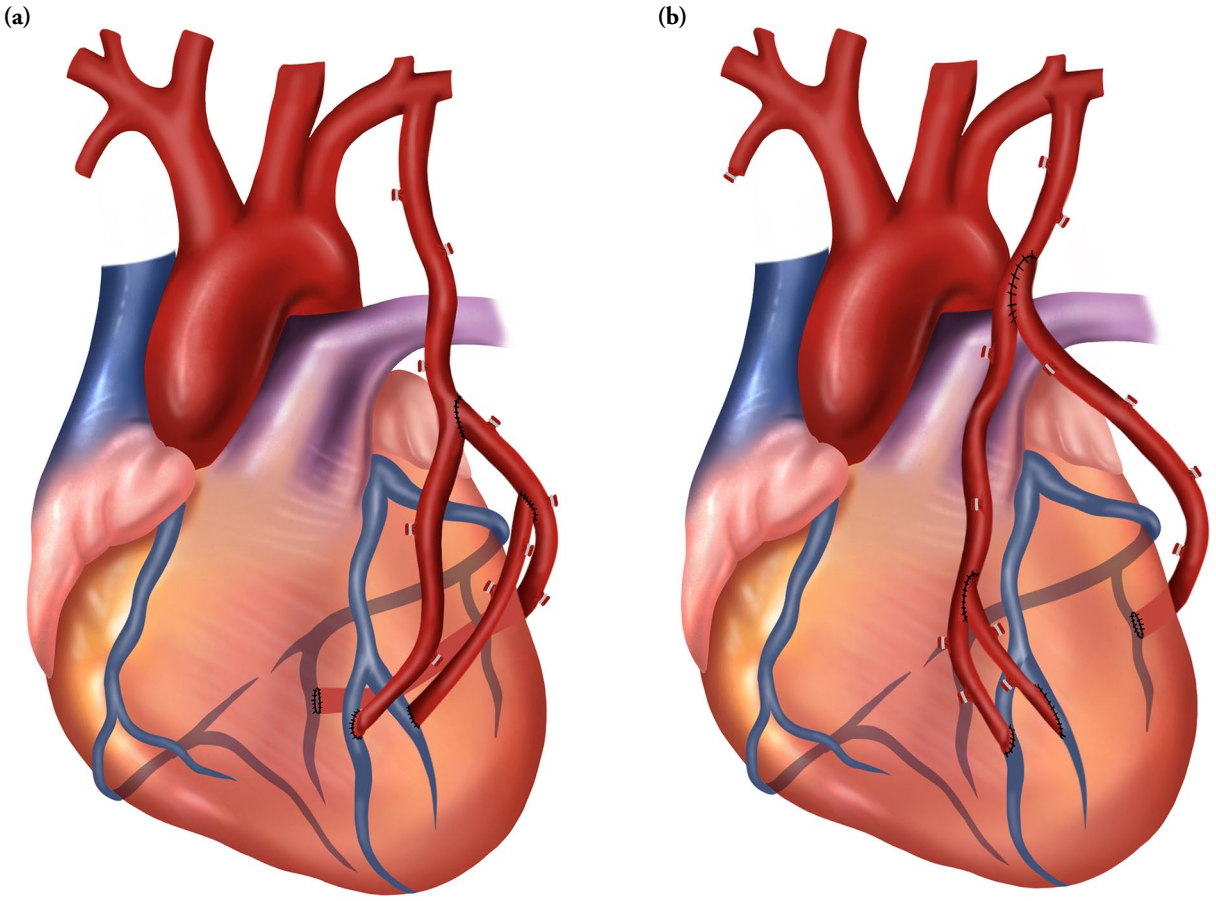

Figure 7.4. **(a)** Pi "∏" graft. **(b)** Pi "∏" graft.

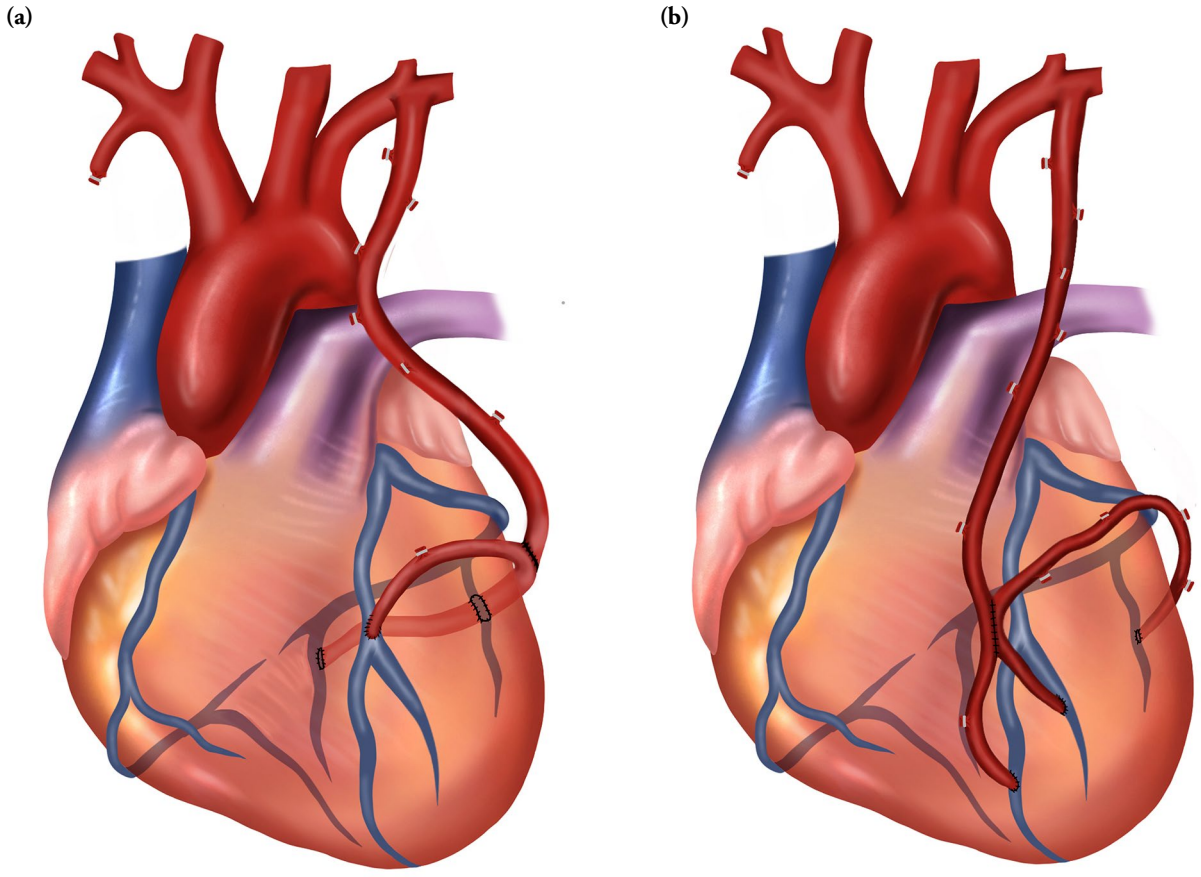

Figure 7.5. **(a)** "Ψ" (PSI) graft. **(b)** K graft.