

# Chapter 12. Costal Bone and Cartilage Harvest

- **Indications:** The rib is a useful graft donor site in that it allows the surgeon to harvest bone and cartilage through the same incision.
- **Markings:** The bone within the rib is found more laterally, while the cartilage is found more medially (Figure 12-1). The point where the transition occurs can generally not be appreciated by simple palpation over the skin. Any incision over the chest may be cheated medially or laterally to accommodate the surgeon's needs (primarily bone-lateral, primarily cartilage-medial). In women, an incision just inferior to the inframammary fold (IMF) allows access to the rib while preserving aesthetics; however, this location may need to be modified based on other factors. In men, the incision can be placed at the IMF as well or directly over the rib to be harvested. It is preferable to mark the length of the incision smaller than the desired graft length. The laxity of the chest skin allows the incision to be moved over the rib in all directions allowing dissection through a shorter incision. If necessary, the incision can always be lengthened.
- **Cartilage harvest approach:** The incision (about 5 cm in length) is made in the skin and carried down through the soft tissues to the periosteum of the ribs. Rectus muscle may be encountered and need to be divided or retracted medially before reaching the periosteum or perichondrium. The junction between the bone and cartilage may be identified by gently pressing a pointed

cautery tip or #11 blade into the rib. The cartilaginous portion will be softer, the bony portion more brittle. A definite transition point should not be difficult to identify. Dissection should continue either medial or lateral to the transition point, depending upon the type of graft that is needed. Some surgeons prefer to leave the perichondrium on the cartilage and dissect in a plane just superficial to it, others prefer to dissect beneath the perichondrium. At one end of the dissection margin, the rib is carefully encircled, cognizant that the pleura is immediately adjacent to the undersurface of the rib (Figure 12-2). A needle tip set on 10-15 provides good exposure while cauterizing and keeping the dissection dry. This dissection begins at the superior and inferior edges of the rib and proceeds posteriorly toward the pleura for a distance about two-thirds the thickness of the rib. At this point, the surgeon should be at a safe distance from the pleura but should have a good view to initiate a dissection under the deep aspect of the rib with a periosteal elevator (Figure 12-3). Once the rib is circumferentially dissected, a Doyen retractor or malleable elevator is placed under the rib, and then a scalpel can be used to cut down on the rib while protecting the underlying pleura with a malleable retractor. After transection of the cartilage, the medial end can be gently lifted, exposing the tissue deep to the rib and allowing further dissection under direct vision.

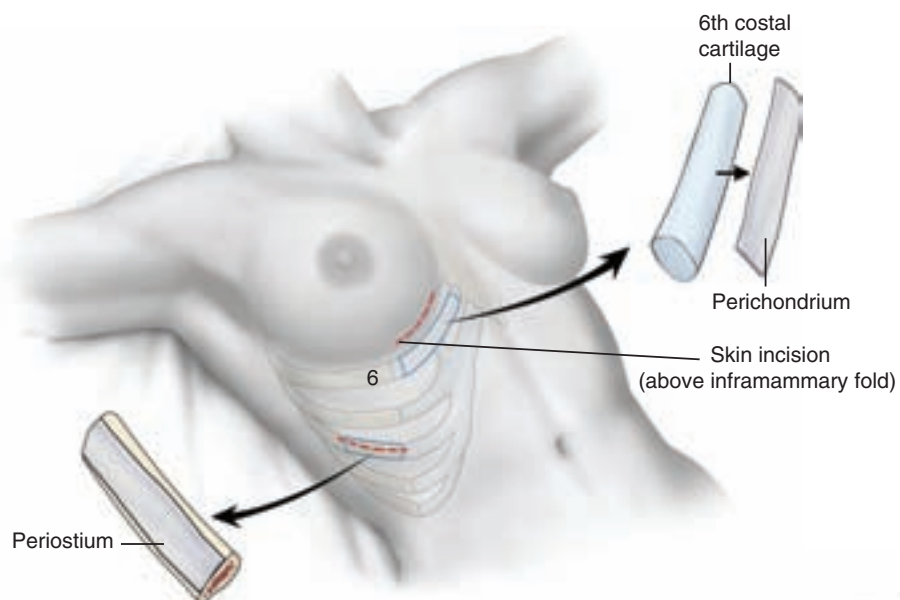


Figure 12-1. Possible sites of rib harvest for cartilage and/or bone graft.

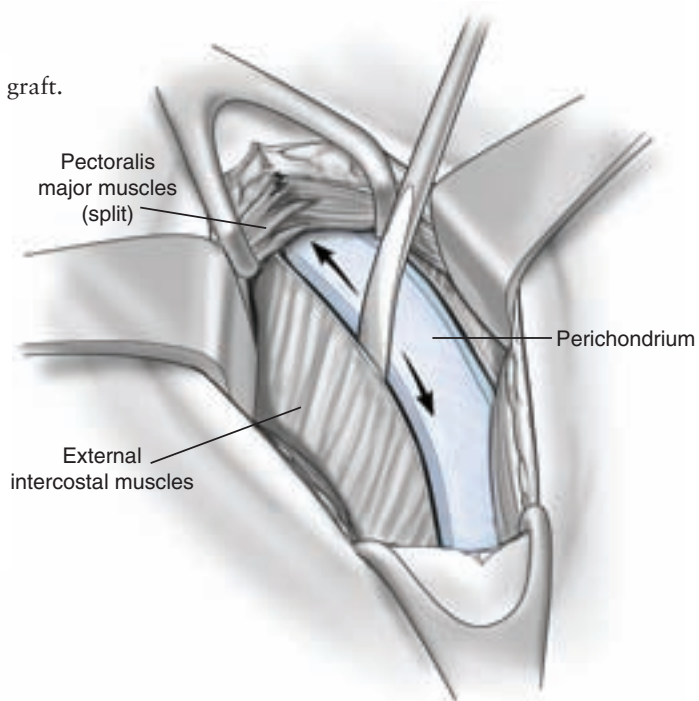


Figure 12-2. Exposure of the rib off surrounding soft tissues.

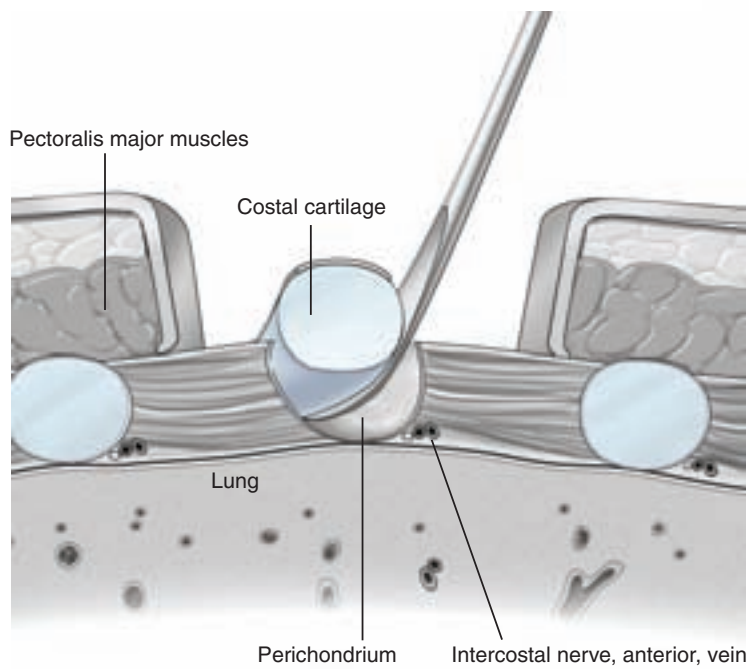


Figure 12-3. Careful circumferential dissection of the costal cartilage.

- *Cartilage warping*: Cartilage grafts are prone to warping to various degrees. The extent and duration of active warping after harvest vary in the literature. However, some warping does occur and the majority occurs within the first hour after carving. Some basic principles can minimize the complications associated with cartilage warping. The perichondrium should be removed and the graft should be taken from a central portion of the rib. The straightest portion of the rib should be used and balanced carving should be done to equalize the intrinsic forces acting on the graft. Given that the majority of warping occurs within the first hour after manipulation, the graft should be carved early and set aside so that the degree and shape of the warping can be assessed prior to placement.<sup>1,2,3</sup>
- *Bone harvest approach*: The approach to the osseous rib is as above but slightly more lateral. After circumferential dissection of the osseous rib, the soft tissues may be further dissected laterally with a curved Doyen periosteal elevator. This is more effective for bone than it is for cartilage. The bony ends of the segment to be harvested may be cut with a saw or bone cutters but care should be taken to protect the deeper tissues with a malleable retractor. Once a free end is identified, it is helpful to place dry gauze around the end to pull the rib medially. This medial traction allows the Doyen elevator and the rib cutter to reach farther posteriorly facilitating harvest of adequate bone. Continuous irrigation is employed if a saw is used to cut the bone. There is no need to replace a single resected rib (or portion of cartilage) with filler material. Any divided muscle should be reapproximated and a drain can be left. The skin and soft tissues are closed in layers.
- *Pneumothorax*: Harvest should be careful to avoid injury to the underlying pleura and lung. Prior to closure, the wound should be filled with saline during a Valsalva maneuver and observed for air bubbles. An initial rush of bubbles may arise from trapped air pockets within the wound itself; however, a steady stream of bubbles indicates parenchymal damage to the lung requiring an indwelling chest tube. If no steady stream of air is detected but the pleura has been violated, any air will need to be removed from the pleural cavity. A small-gauge red rubber catheter is placed through the injured pleura and connected to suction to evacuate the air. The pleura is repaired around the catheter with a purse-string suture. While increasing

inspiratory pressure from the ventilator (Valsalva maneuver), the catheter is removed as the suture is tightened. The wound may again be filled with saline or water and the presence of air noted.

- *Postoperative management*: A gauze and semioclusive dressing can be placed over the incision. It is advisable to obtain a postoperative chest X-ray in the recovery room to identify the presence of any air in the pleural space. If the pleural cavity was inadvertently entered, the patient should be observed and serial chest X-rays obtained to either rule out or follow any postoperative pneumothorax.
- *Pitfalls*:
  - Dissect carefully around the rib to avoid injury to the pleura. Deeper dissection should be done under direct vision with the rib retracted out of the wound as much as possible.
  - Cartilage warping may occur weeks after placement compromising the symmetry of the final result.
  - If harvesting costochondral graft, take care to avoid injury to the costochondral junction.
- *Tips*:
  - The initial dissection of the rib should proceed on top of the rib to minimize bleeding from the costal vessels, which travel on the inferior aspect of the rib.
  - In a patient who has undergone previous rib harvest, one should use the same scar if there is a palpable rib within range of the incision.
  - Postoperative pain control may be achieved with a pain pump to deliver a continuous low dose of local anesthetic.
  - Older patients will have calcified cartilage, requiring a more medial dissection to obtain usable cartilage. A limited CT scan of the sternum with axial images (and coronal reformatting) of the sternum and costochondral junctions is useful in determining the degree and extent of chondral calcification.<sup>4</sup>
  - It is helpful to remove only the cartilage necessary for grafting. If the superior 75% is harvested leaving the inferior 25% intact, a contour deformity of the donor site can be minimized.
  - Leftover cartilage can be banked subcutaneously in the rib incision for future use. If the rib is not necessary for future surgery, it can be removed under local anesthesia in the office. If, however, it is necessary for a revision, the patient is spared a second painful rib harvest.

## REFERENCES

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3. Gunter JP, Clark CP, Friedman R. Internal stabilization of autogenous rib grafts in rhinoplasty: A barrier to cartilage warping. *Plast Reconstr Surg.* 1997;100:161.
4. Marin VP, Landecker A, Gunter JP. Harvesting rib cartilage grafts for secondary rhinoplasty. *Plast Reconstr Surg.* 2008;121:1442.