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IDEAS AND INNOVATIONS

Breast

A Novel Dissection Method of the Internal Mammary (Thoracic) Artery: Anastomotic Vessel of the DIEP Flap

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Summary: Deep inferior epigastric perforator flaps are commonly used for breast reconstruction using autologous tissue. For such free flaps, the internal mammary artery provides stable blood flow as the recipient for anastomosis. We report a novel dissection method of the internal mammary artery. First, the perichondrium and costal cartilage of the sternocostal joint are dissected with electrocautery. Then, the incision on the perichondrium is extended along the cephalic and caudal ends. Next, this C-shaped superficial layer of perichondrium is elevated from the cartilage. The cartilage is incompletely fractured with electrocautery, with the deep layer of perichondrium intact. Then, the cartilage is completely fractured by leverage and removed. The remaining deep layer of perichondrium is incised at the costochondral junction and shifted aside, revealing the internal mammary artery. The preserved perichondrium creates a rabbet joint to protect the anastomosed artery. This method not only enables a more reliable, safer dissection of the internal mammary artery, but also allows reusage of the perichondrium as underlayment in the setting of anastomosis, and coverage for the incised rib edge, protecting the anastomosed vessels. *(Plast Reconstr Surg Glob Open 2023; 11:e4960; doi: 10.1097/GOX.0000000000004960; Published online 24 April 2023.)*

INTRODUCTION

Latissimus dorsalis and abdominal skin flaps such as deep inferior epigastric perforator (DIEP) are commonly used for breast reconstruction using autologous tissue. The internal mammary artery and dorsal thoracic artery are often used as the recipient in anastomosis for free flaps. Although the internal mammary artery requires removal of the costal cartilage, it provides stable blood flow. We report a novel technique for a more reliable dissection of the internal mammary artery.

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METHODS

First, the procedure starts by dissecting the sternal attachment of the pectoralis major muscle. Then, the surrounding soft tissue is dissected, revealing the perichondrium of the third costal cartilage, which are general methods for dissection up to this point. Our original method starts from here, providing seven points for a more reliable dissection of the internal mammary artery:

1. Incision at the sternocostal joint using electrocautery: First, the perichondrium and costal cartilage at the sternocostal joint are dissected using electrocautery (Fig. 1, green line). The sternocostal joint becomes ossified with age, and the boundary, indistinct. Compared with using a scalpel, electrocautery not only allows hemostasis, but also creates a larger, wedge-shaped defect in the cartilage for incomplete fracture.
2. C-shaped incision of the superficial perichondrium: Using electrocautery, the incision on the superficial perichondrium is extended laterally along the cephalic and caudal ends to the costochondral joint, creating a C-shaped incision (Fig. 1: yellow line).

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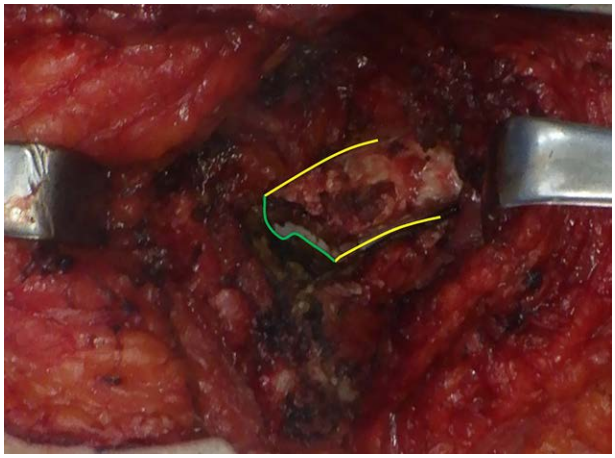

Fig. 1. Dissection of the third costal cartilage. The green line indicates the wedge-shaped incomplete fracture of the sternocostal joint. The yellow lines indicate the cephalic and caudal incision of the perichondrium.

Surgical smoke is often produced here, recommending the use of suction for a better view.

3. Dissection between the superficial perichondrium and costal cartilage: The perichondrium is elevated from the cartilage with an elevator, creating a C-shaped perichondral flap (Fig. 2). Because of the prior use of electrocautery, dissection is easier to perform.
4. Incomplete fracture of the costal cartilage using electrocautery: Next, the costal cartilage at the costochondral junction is incompletely fractured using electrocautery (Fig. 2, Fig. 3: yellow line). Electrocautery allows hemostasis and a broad wedge-shaped dissection of the cartilage. To avoid damage of the internal mammary artery, it is necessary to keep the incision at least 2 cm apart from the sternocostal joint.
5. Removal of costal cartilage by leverage: Dissection of the cartilage from the deep layer of perichondrium is performed. This dissection is facilitated due to the former incomplete fracture of the cartilage creating space between the perichondria. Next, using the principle of leverage, the cartilage is completely fractured and removed (Figs. 2, 4). (**See Video 1 [online]**, which displays removal of the costal cartilage by leverage. Prior incomplete fracture of the costal cartilage by electrocautery reduces the difficulty.)
6. Rabbet joint forming incision of the perichondrium. The deep layer of perichondrium is incised at the costochondral joint. This incision allows the superficial and deep perichondrium to create a rabbet joint. (**See figure, Supplemental Digital Content 1,** which displays the C-shaped incision of the superficial perichondrium. Incision of the deep perichondrium at the costochondral joint. The shape of the perichondral flaps resembles a rabbet joint. **http://links.lww.com/PRSGO/C527**.)
7. Dissection of the internal mammary artery by separating from the deep perichondrium: By pulling the incised deep perichondrium upward, the internal mammary artery can be easily found. The preserved perichondrium allows for protection of the anastomosed vessels from the incised cartilage edge. (**See figure, Supplemental Digital Content 2,** which displays elevation of the deep perichondrium and anastomosis of the internal mammary artery. The rabbet joint offers protection of the anastomosed vessels from the incised edge of costal cartilage. **http://links.lww.com/PRSGO/C528**.)

Takeaways

Question: Is there a safe and reliable method for removal of the costal cartilage and dissection of the internal thoracic artery?

Findings: Our method includes incomplete fracture of the costal cartilage and reusage of the superficial and deep layer of perichondrium, used to protect the anastomosed vessels.

Meaning: We presented a systematic approach for a safe and reliable dissection of the internal thoracic artery.

DISCUSSION

The first report of usage of the internal mammary artery for anastomosis is in 1947, when Longmire used the artery for esophageal reconstruction.[1] The first case of breast reconstruction was reported by Harashina et al[2] in 1980. In 2012, a review reported that there was an 87%-91% chance of finding a large perforator artery between the first and second costal cartilages. Also, there was a 71.5% chance of the internal mammary artery flowing between the two veins, a 22.5% chance of flowing medially, and a 6% chance of flowing laterally to the veins.[3] There is a 95% chance of the internal mammary artery flowing laterally to the vein under the second costal cartilage,[4] and in this

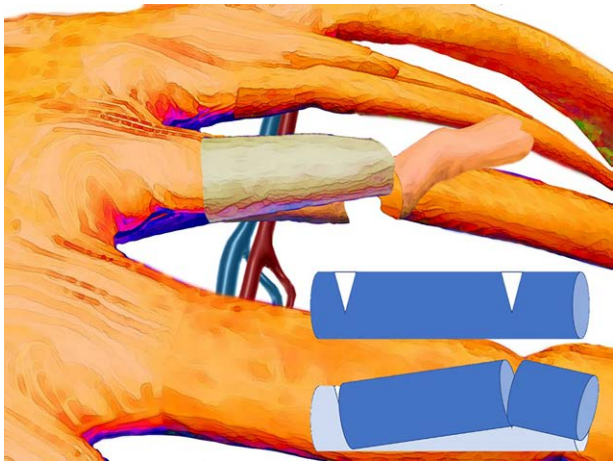

Fig. 2. Dissection and elevation of the superficial perichondrium. Removal of the costal cartilage using a wedge-shaped incision and incomplete fracture.

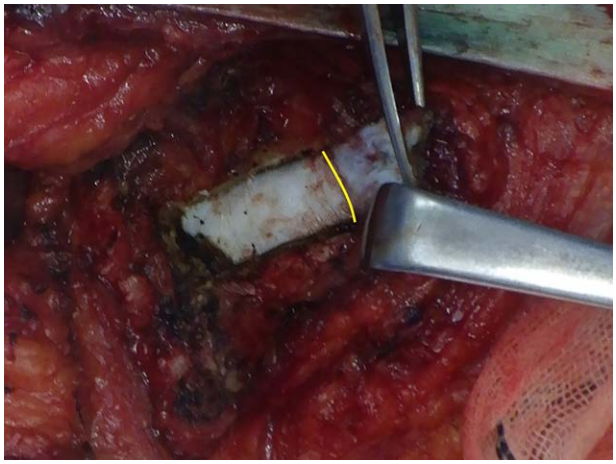

Fig. 3. Incomplete fracture of the costal cartilage. The yellow line indicates the costochondral junction, the lateral site for the fracture.

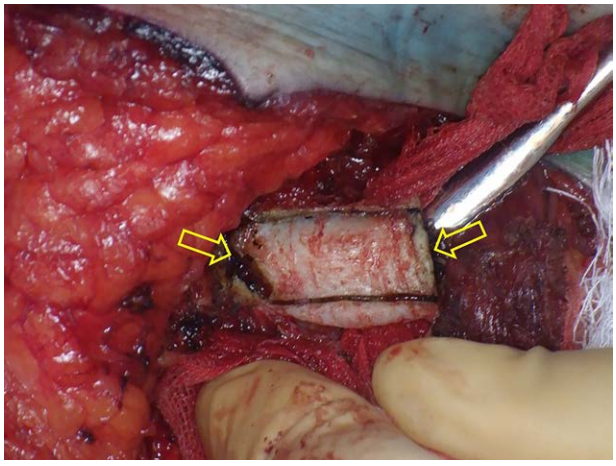

Fig. 4. Complete fracture and removal of the costal cartilage. The yellow arrow points to the prior incomplete fracture of the costal cartilage.

pattern, usually only one vein exists. Since the internal mammary artery runs between the transverse thoracic muscle and intercostal muscle when it reaches the third intercostal space, removal of the third rib for anastomosis is reasonable.

Conventionally, the perichondrium has been incised in an H- or T-shape, then the costal cartilage removed using Luer bone rongeur forceps, and the deep layer of perichondrium removed.[5] However, Luer bone rongeur forceps are sometimes difficult to insert in patients of smaller stature, such as Asians, because they have narrower costal cartilage. We believe another advantage of using a freer over a rongeur is that we can remove the costal cartilage as a block, which can be preserved for later nipple reconstruction. Also, from the author's experience, dissection using the freer is faster than using the rongeur.

There are reports of methods without removing the costal cartilage,[6] but this technique seems very difficult. Also, all reports we have found removed the perichondrium. Our method preserves both the superficial and deep perichondrium to form a rabbet joint, which is also used as a background sheet to facilitate anastomosis and as covering for the incised edge of the costal cartilage, protecting the anastomosed vessels. We also expect costal cartilage regeneration to some degree in the long term[7,8] but have not had the opportunity to confirm this.

There are reports of hospitals involving breast reconstruction performing on average two to three DIEP procedures per day,[9] so a safe and reliable technique for internal mammary artery dissection is integral. Our unique technique for the removal of costal cartilage and reuse of perichondrium allows for a safe dissection of the internal mammary artery and protection of the anastomosed vessels using the rabbet joint.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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