
Tricuspid Valve Repair Technique

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Tricuspid valve repair has become much more common based on data from the Society of Thoracic Surgeons database. For many years, we were taught that pulmonary hypertension, and therefore tricuspid regurgitation, would resolve following successful mitral valve surgery, but more

recent reports indicate oftentimes this is not the case, and even tricuspid annular dilation (with mild tricuspid regurgitation) may lead to late significant tricuspid regurgitation if it is untreated at mitral valve surgery. In this article, we illustrate a straightforward tricuspid valve repair for “functional” tricuspid regurgitation. The annulus is dilated, but there is no prolapse of the valve leaflets, no damage from permanent pacemaker wires, and no other structural leaflet abnormality caused by endocarditis, rheumatic valve disease, or carcinoma. Those are unusual causes of tricuspid regurgitation, and more complex to repair, and a variety of different techniques need to be employed in those situations. We hope that infrequent users of tricuspid valve repair benefit from reviewing this article and learning this straightforward technique.

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Dr. McCarthy reports consulting fees for Edwards and Abbott. In addition, he is the inventor of, and receives royalties for, the MC3 device.

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Operative Technique

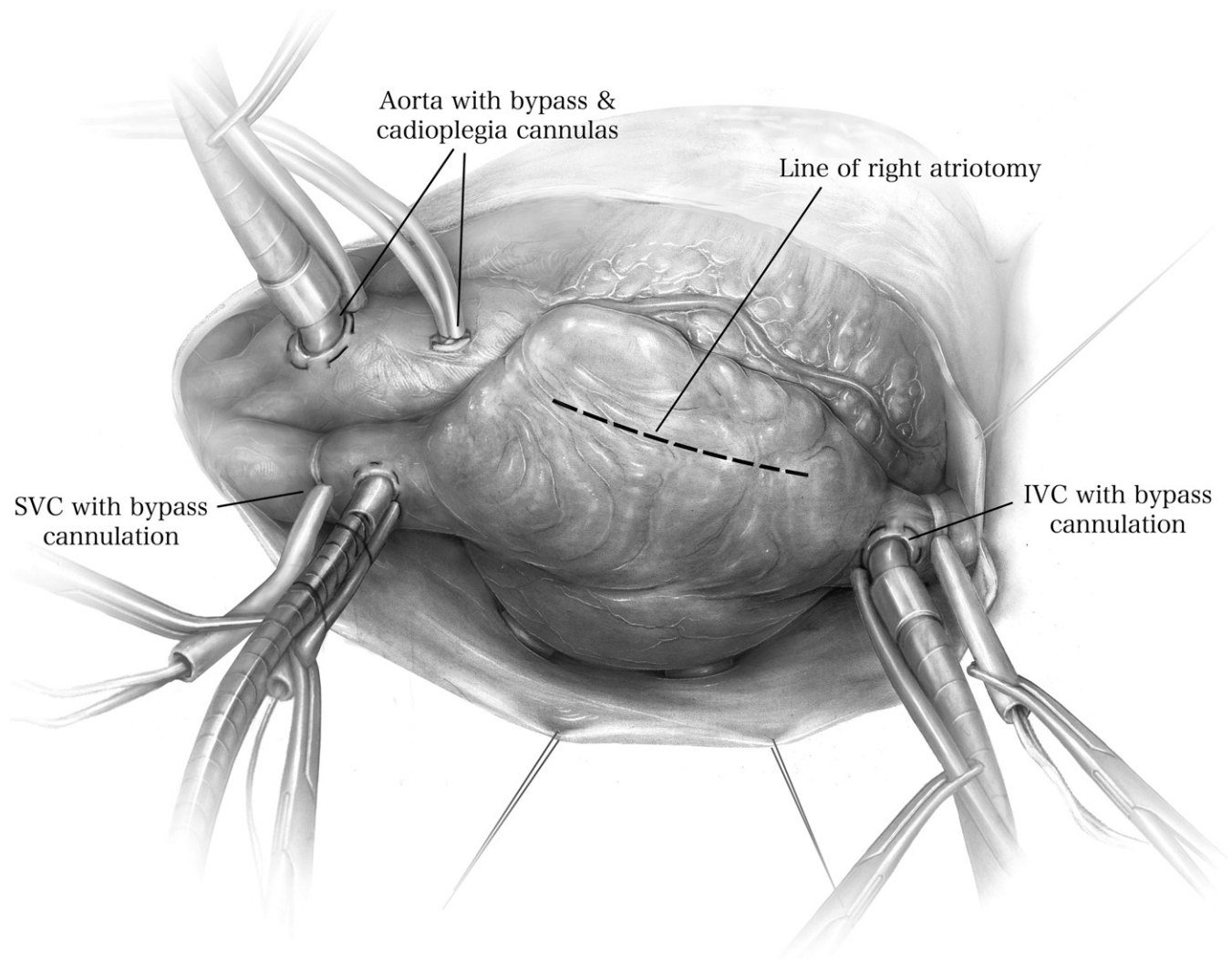


Figure 1 Tricuspid surgery is most often performed following mitral valve surgery and/or coronary artery bypass. Typically, we perform those operations with the cross-clamp on and then remove the aortic cross-clamp to perform the tricuspid surgery. Care must be taken to ensure that there is no patent foramen ovale or any possible source for a right-to-left shunt during right-side beating heart surgery. The right atriotomy is made approximately in the mid right atrium, which leaves a large amount of atrial wall under the self-retaining retractor blades. IVC = inferior vena cava; SVC = superior vena cava.

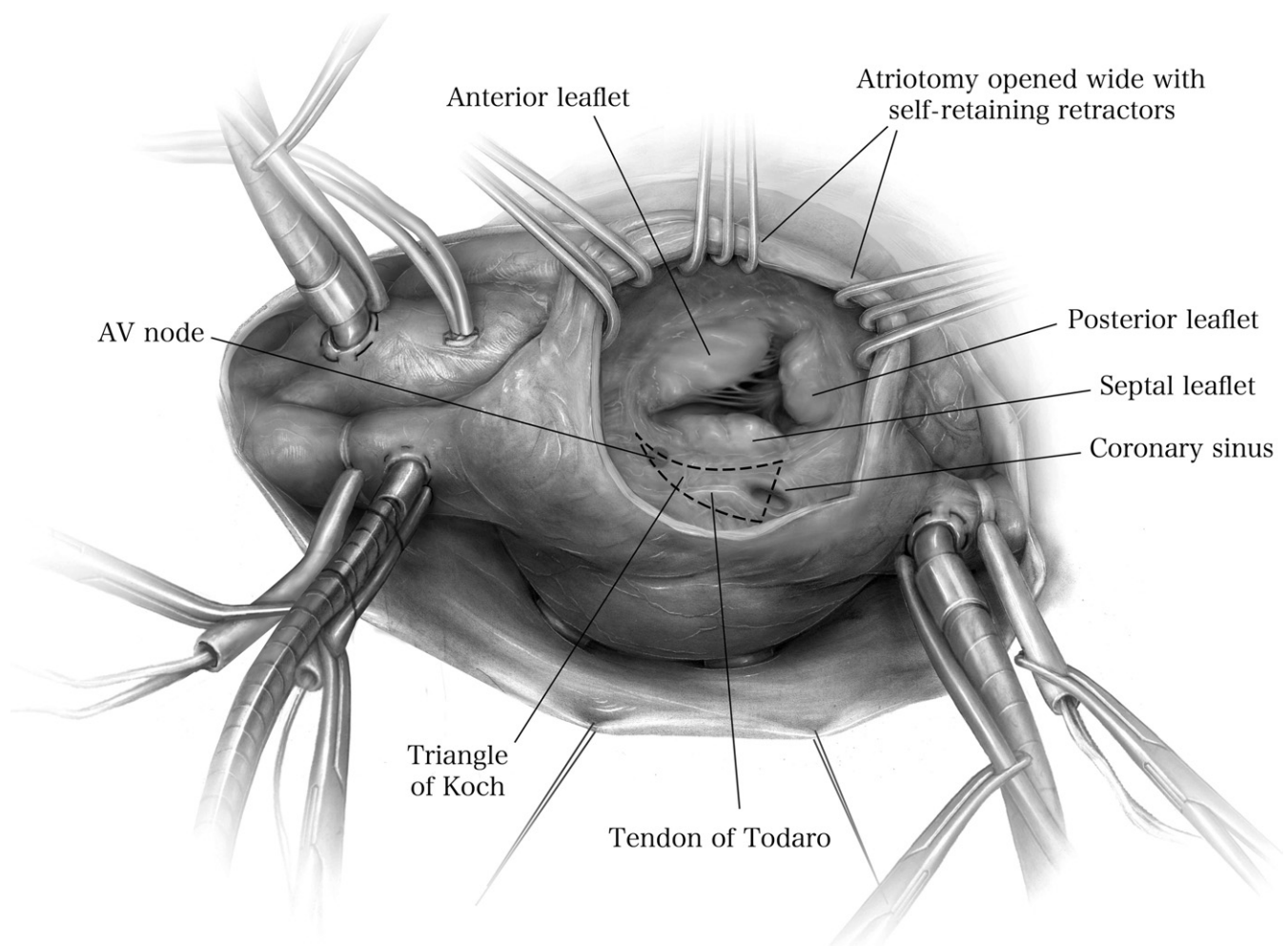


Figure 2 Typically, 3 blades of the self-retaining retractor are placed: 1 pulling inferiorly that exposes the posterior leaflet; 1 up and to the left that exposes the anterior leaflet; and another midway in between. Tricuspid exposure is usually excellent. Care should be taken to identify the appropriate anatomy. The “Triangle of Koch” is bound by the tricuspid valve and the tendon of Todaro. The base of the triangle is the coronary sinus. At the apex of the triangle is the atrioventricular (AV) node, which is adjacent to the commissure between the anterior and septal leaflets. With the cross-clamp off, the surgeon may also see a bulge from the aortic root near the anterior leaflet just above the commissure.

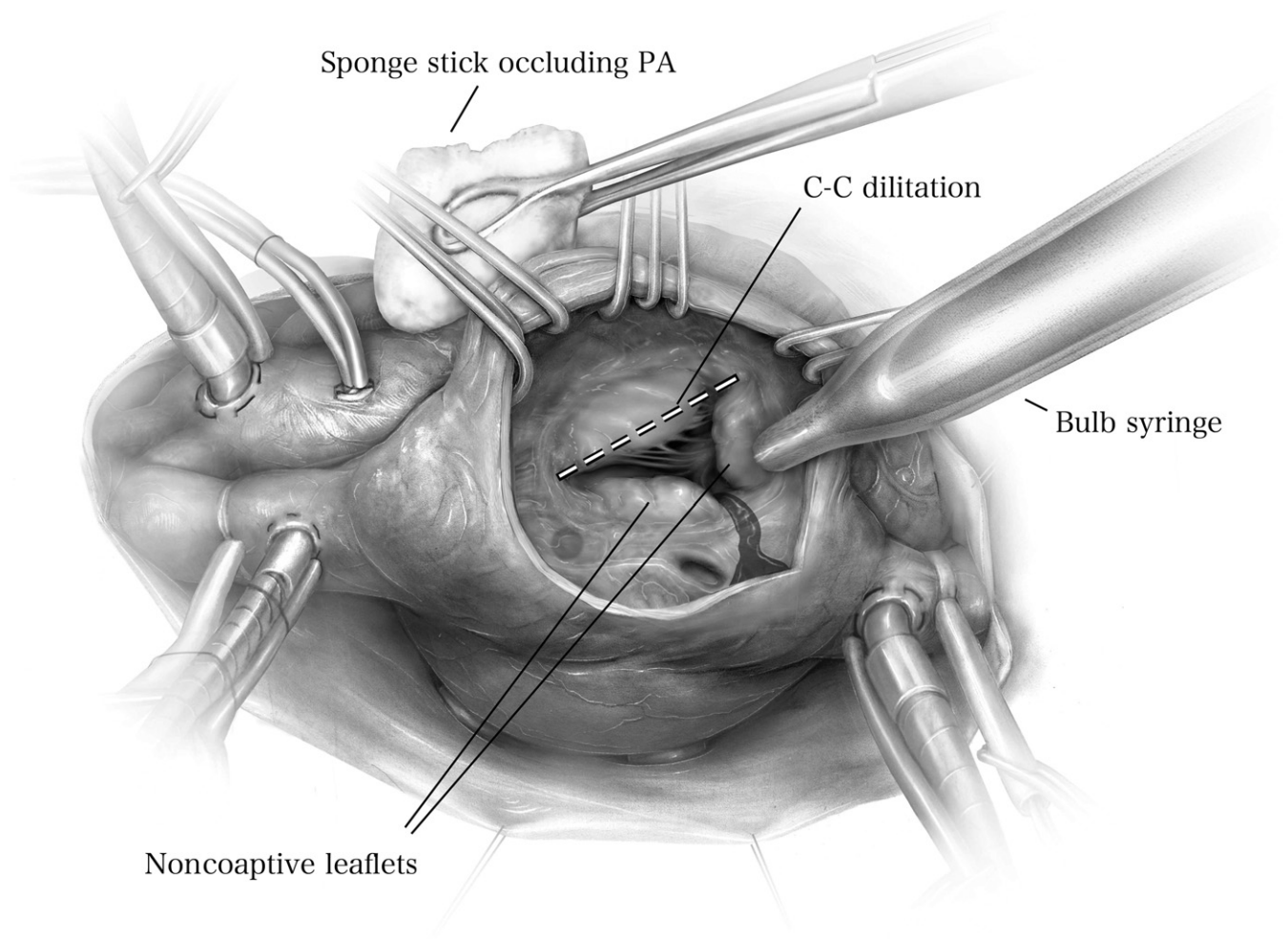


Figure 3 In our experience, the commissure-to-commissure dilation (anteroseptal to anteroposterior) averages 45 ± 8 mm. Unlike the mitral valve that can easily be tested, because the aorta is clamped and the left ventricle can be pressurized using a bulb syringe with saline, it is more difficult to test the tricuspid valve. Typically, we use a sponge stick to compress the pulmonary artery, which facilitates visualization of the tricuspid regurgitation jet. The leaflets should be thoroughly inspected as well. C-C = commissure-commissure; PA = pulmonary artery.

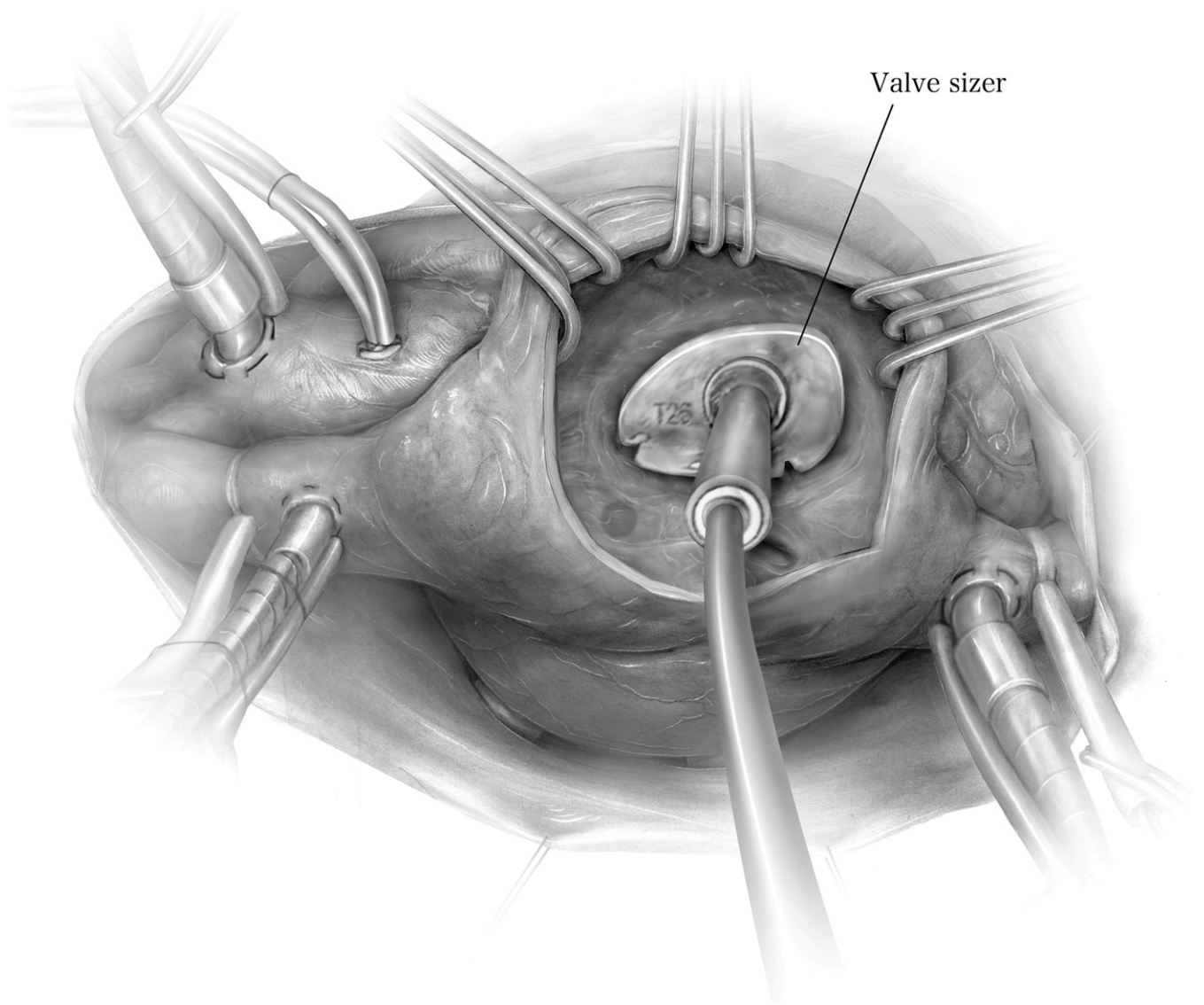


Figure 4 At Northwestern, 95% of patients receive a 26- or 28-mm rigid tricuspid ring, and therefore, “downsizing” is routine. Classically, ring sizing is performed by measuring the distance from the anteroseptal to posteroseptal commissures and/or using the surface area of the anterior leaflet. However, results using routinely downsized rings have been very favorable without creating tricuspid stenosis.

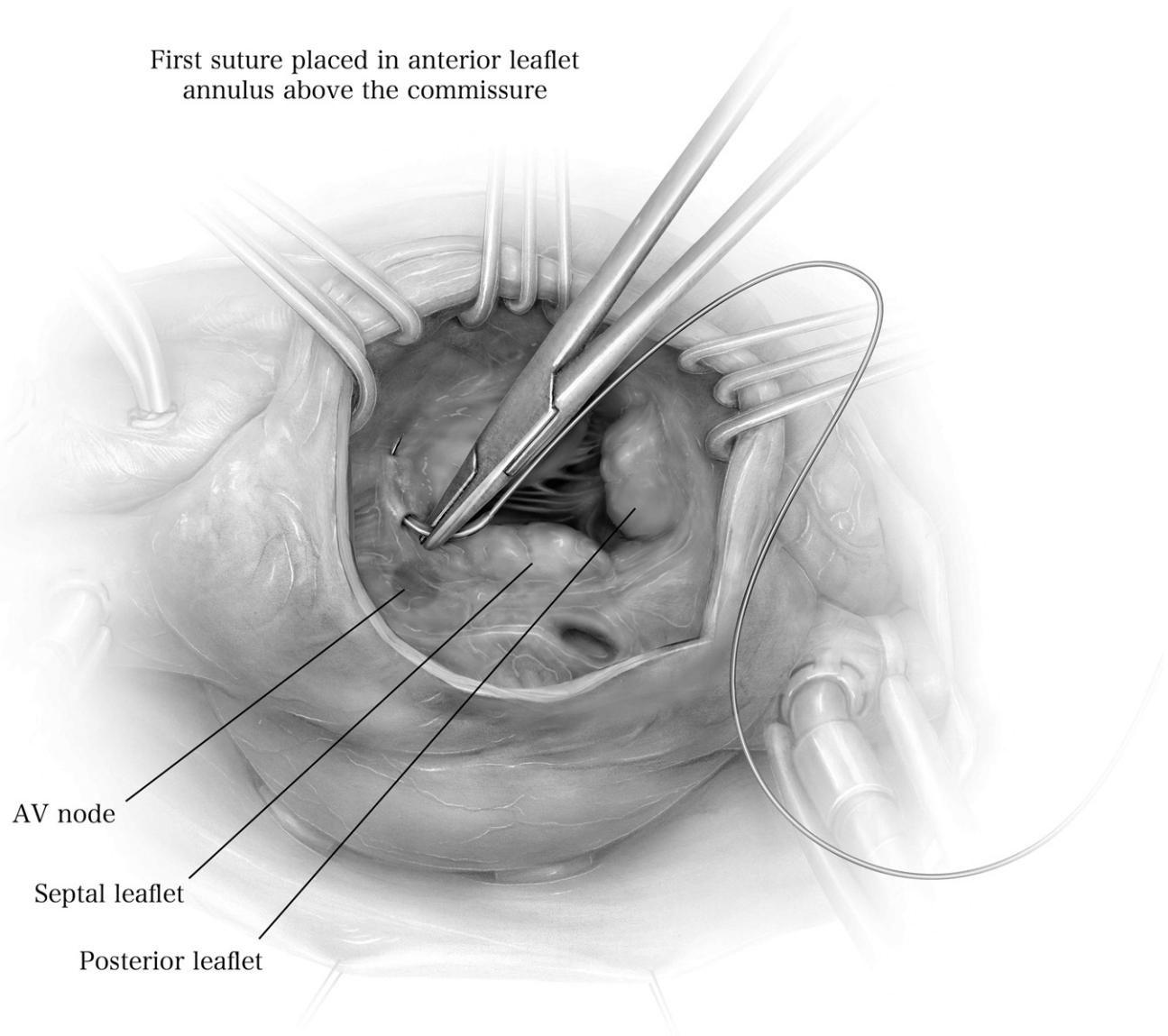


Figure 5 Suturing starts along the anterior leaflet, just superior to the commissure, approximately 1 cm away from the atrioventricular (AV) node. The tricuspid annulus is not as distinct as the mitral annulus, and one must be careful not to accidentally place a suture into the leaflets. The suture is 2-0 Ticron. The first suture is placed along the noncoronary sinus of the aortic root, and care must be taken not to place the suture too deep, because it could cause bleeding from the aortic wall.

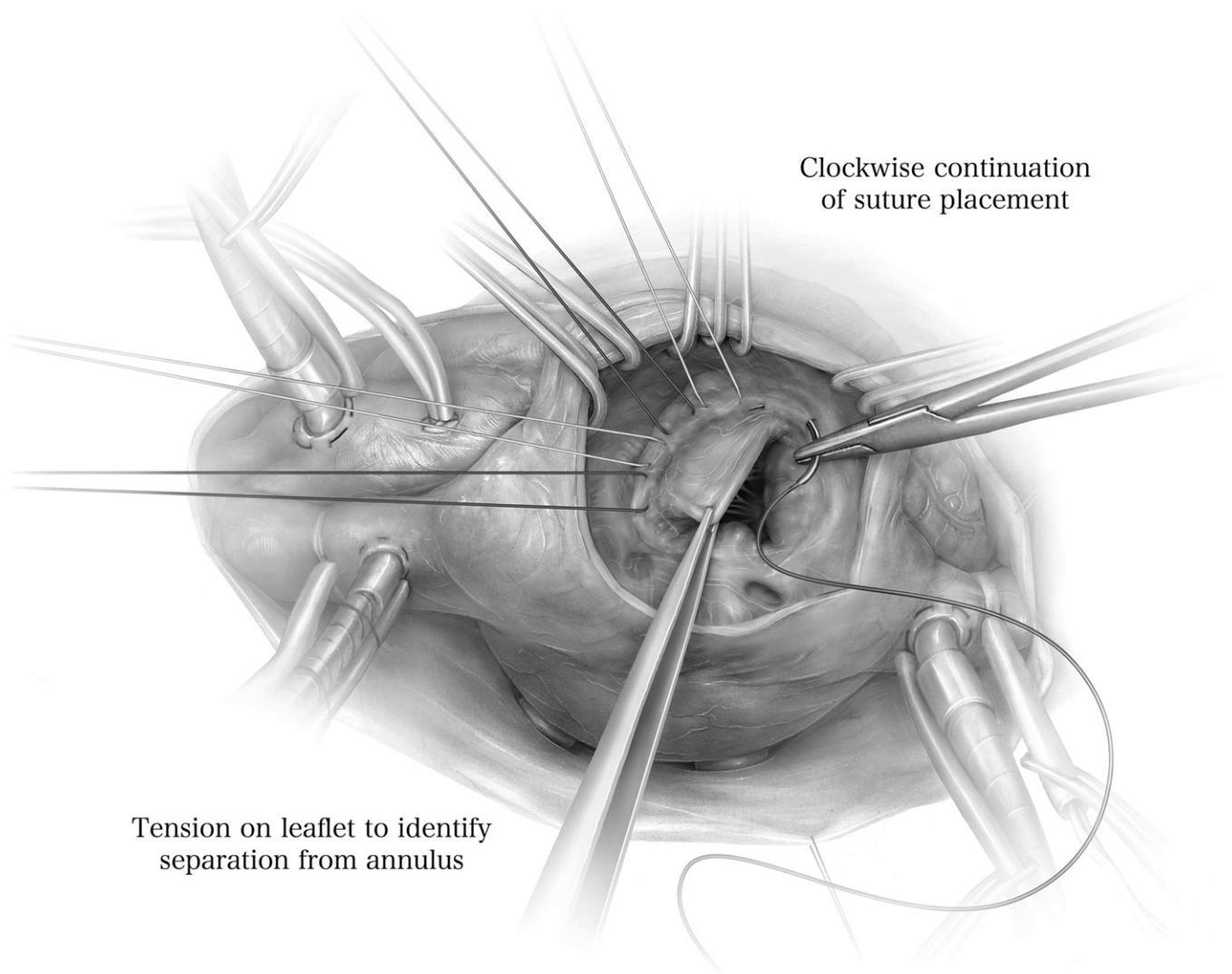


Figure 6 Suturing proceeds clockwise. The first 3 sutures are typically placed forehand, and the next 3 to 4 sutures are typically placed backhand, before returning to forehand along the septal leaflet. Applying tension on the anterior leaflet with a forceps may make the location of the annulus more distinct.

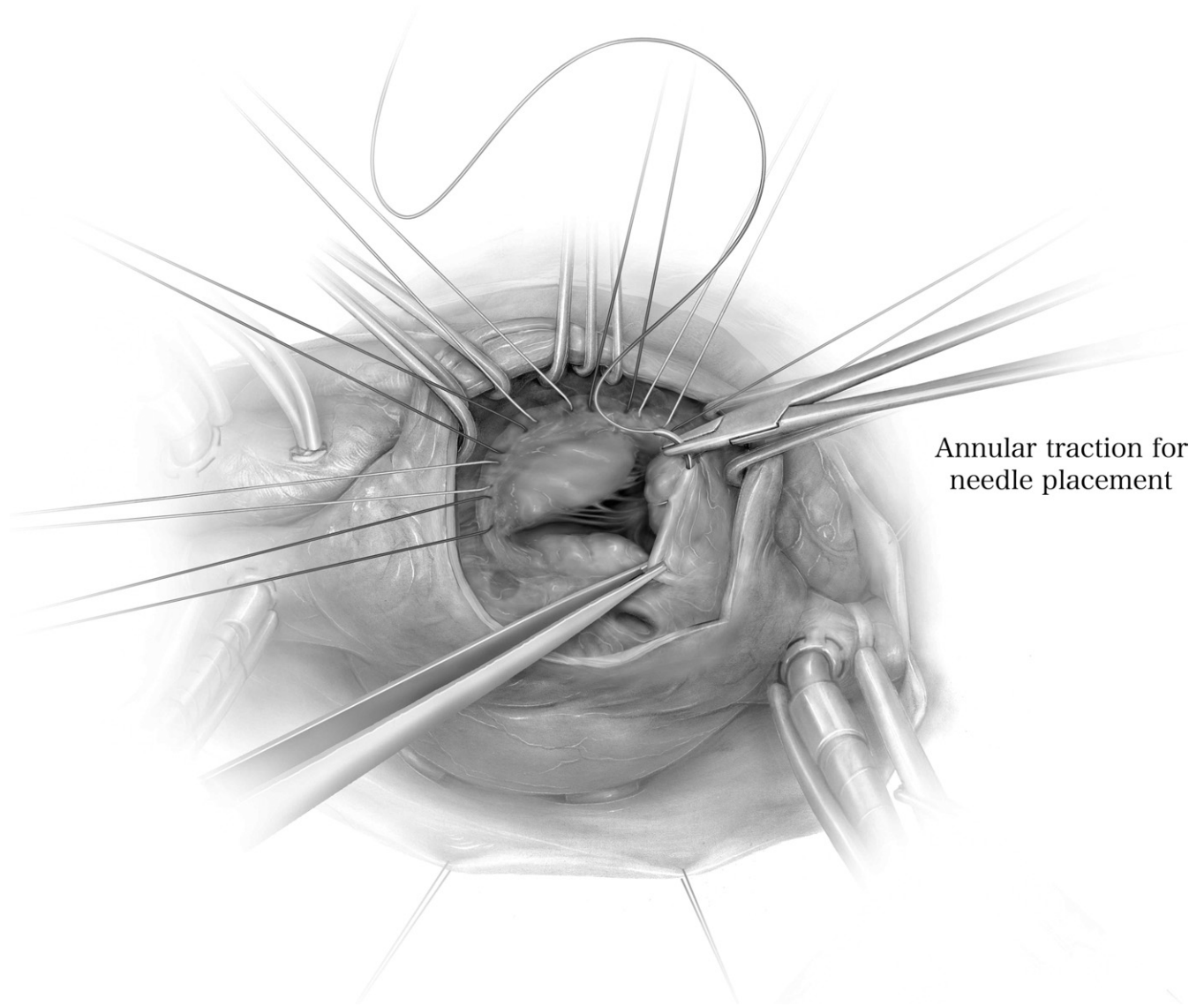


Figure 7 Along the posterior leaflet, a suture is marked with a different clamp than the prior and subsequent sutures so that when orienting the ring it is easy to align the widest portion of the ring with the middle of the posterior leaflet. Traction on the annulus with forceps may also facilitate identification of the annulus and make suture placement easier. The final suture is placed just to the left of the coronary sinus and ends at the mid septal leaflet.

Sutures placed in prosthetic ring in same order as they were placed in annulus

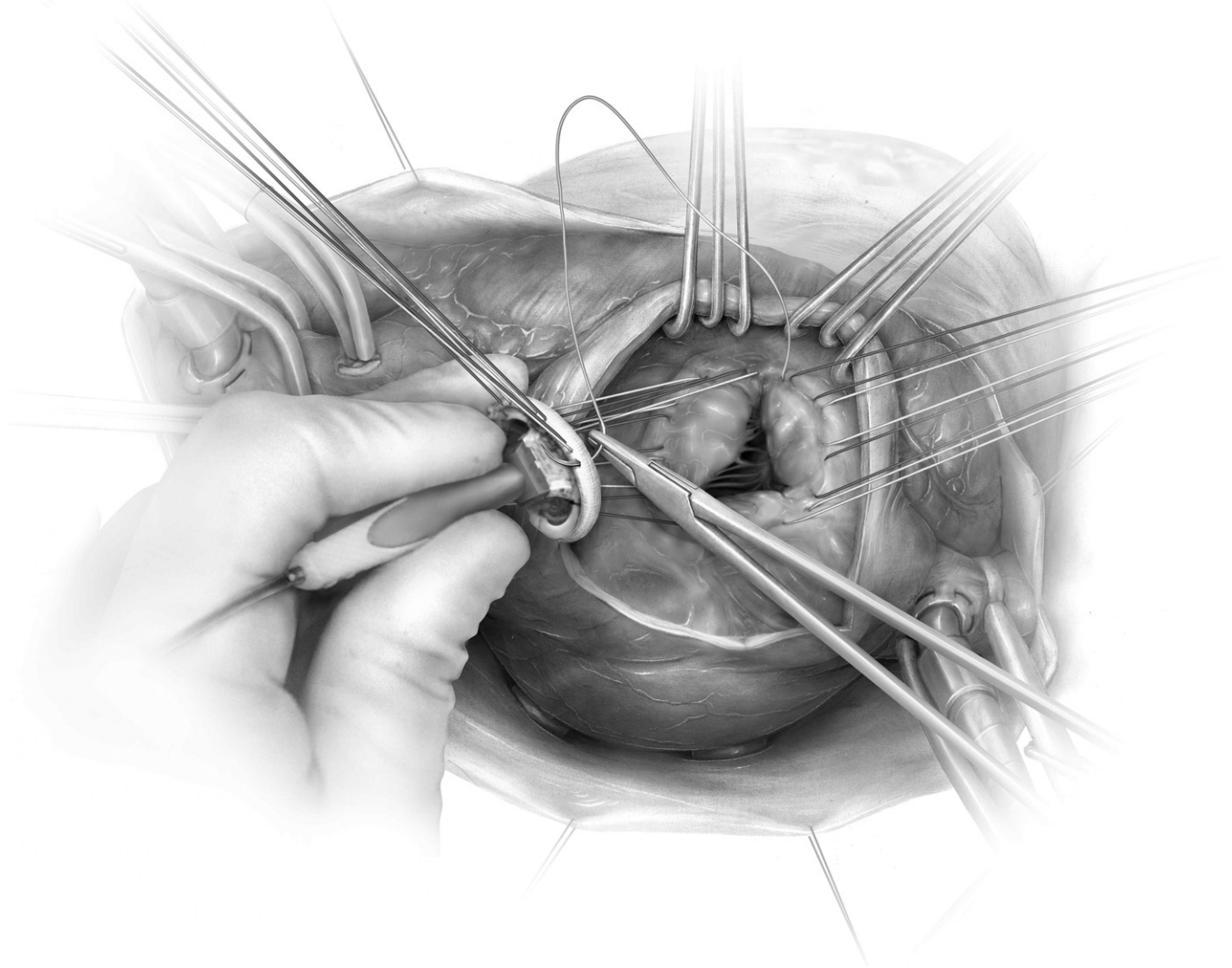


Figure 8 Typically, 10 to 12 sutures are placed around the annulus. The sutures are passed through the sewing ring of the tricuspid ring. While placing the sutures, care is taken to align the suture position with the proper location on the ring. Because the sutures are being placed while the heart is beating, one may note heart block if the suture is placed too close to the AV node and this suture should be removed immediately.

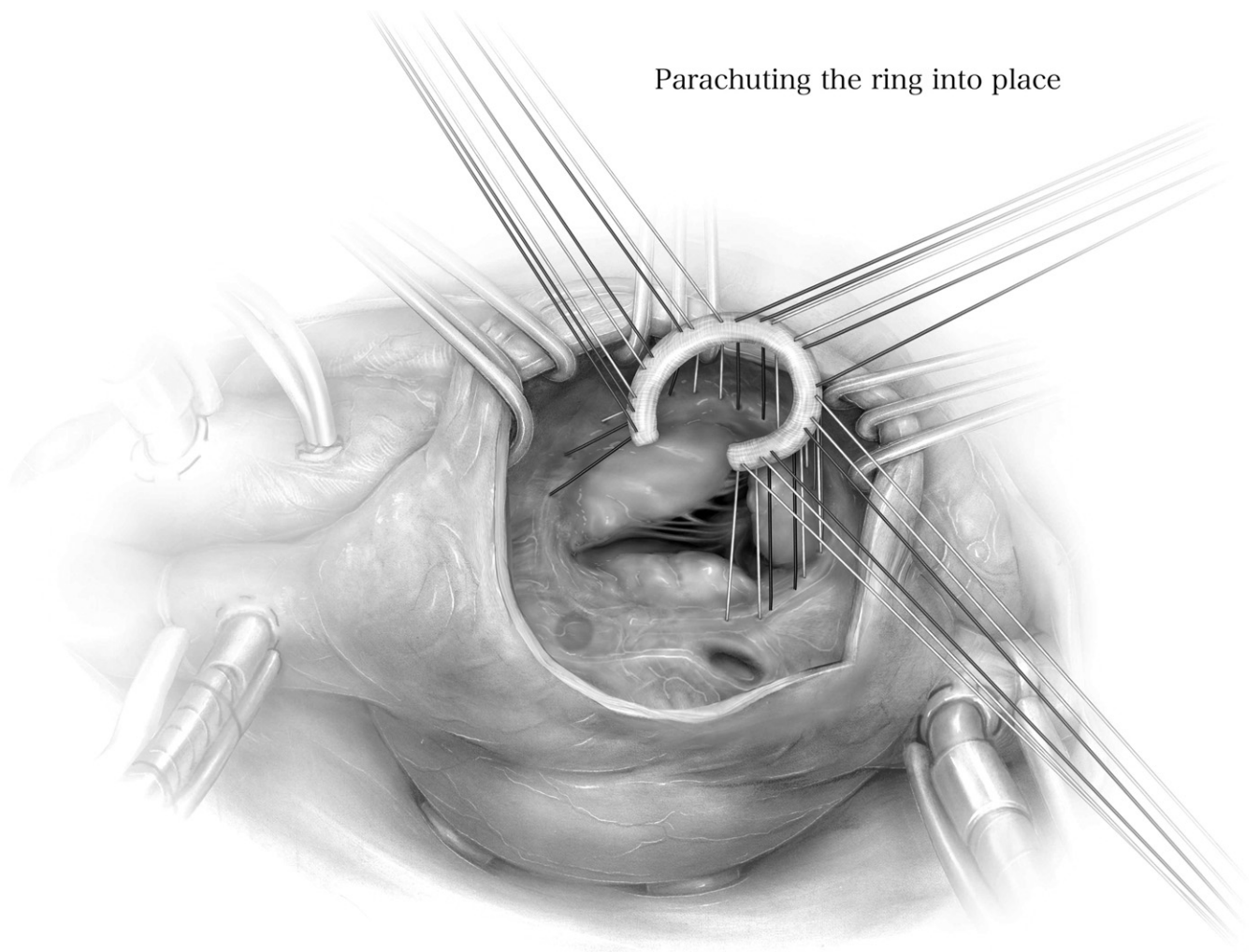
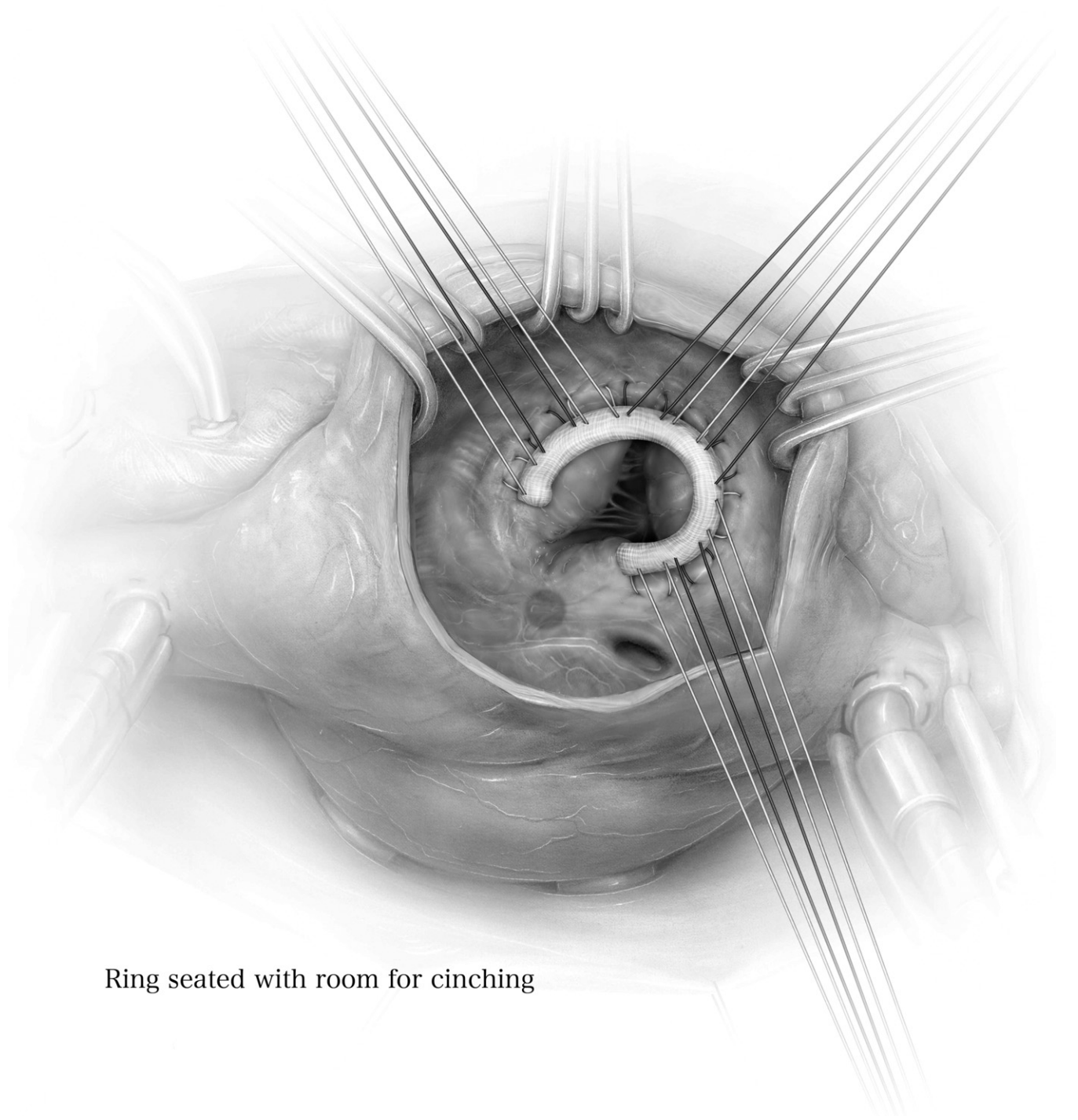


Figure 9 Because the annulus is typically 44 mm and the ring is typically 28 mm, there is significant downsizing and tension on the sutures. Care must be taken to gently parachute the ring into place while gathering the annular tissue to the ring to avoid dehiscence.



Ring seated with room for cinching

Figure 10 After securely seating the ring, there is no tension on the sutures and the annulus has been significantly reduced in diameter.

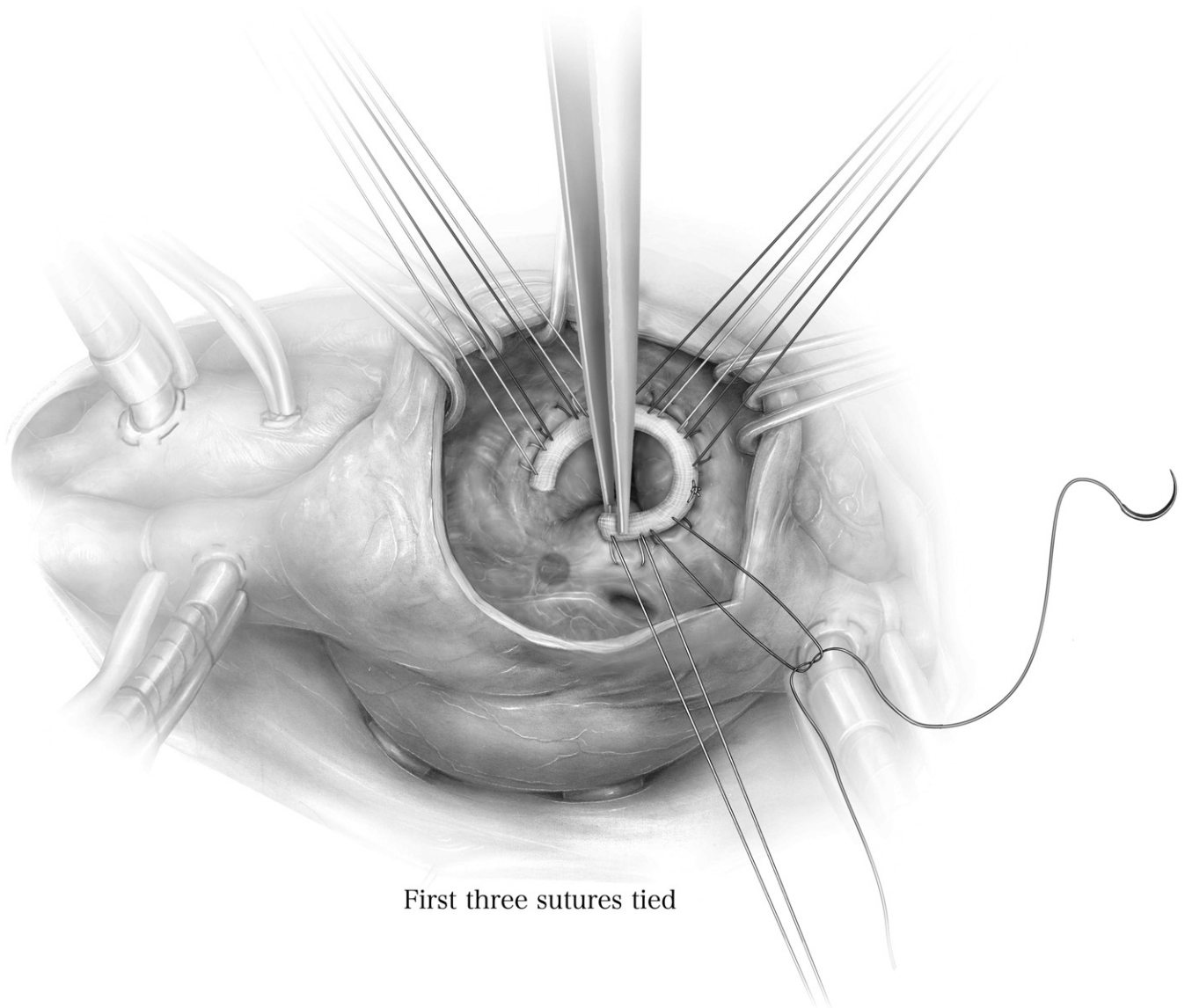


Figure 11 Typically the 3 sutures along the septal leaflet are tied first while an assistant holds this portion of the ring against the annular tissue. The septal portion of the annulus has the most solid structure, and therefore, these sutures are the most secure.

Clockwise continuation of knot tying

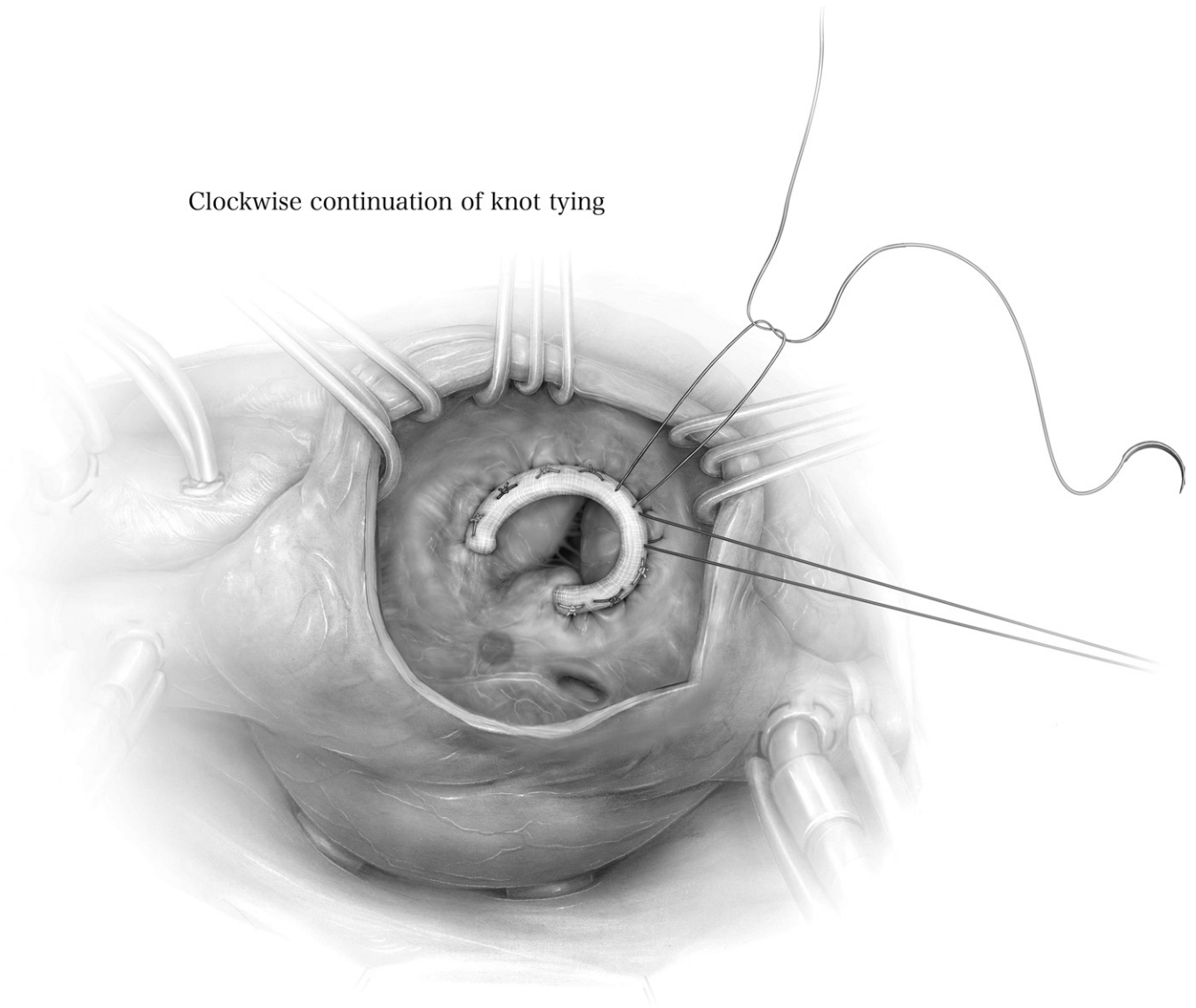


Figure 12 After the 3 septal leaflet sutures are tied, the suture at the antero-septal commissure is tied, and the rest of the sutures are tied clockwise. Note that the discontinuous aspect of the ring corresponds to the location of the AV node.

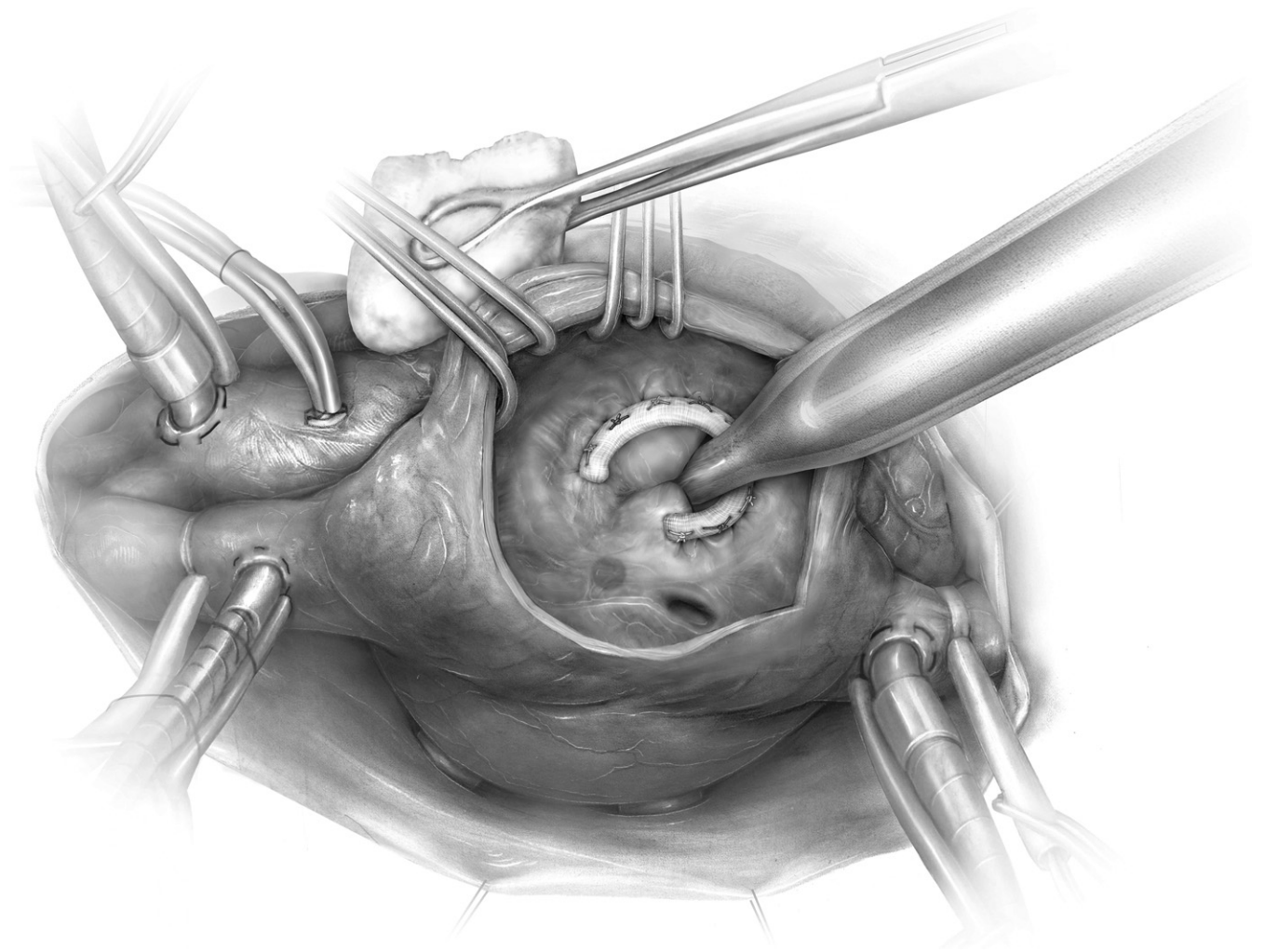


Figure 13 The pulmonary trunk is compressed with a sponge stick again, while the RV is filled with saline, to demonstrate valve competence.

Atriotomy closed with continuous suture

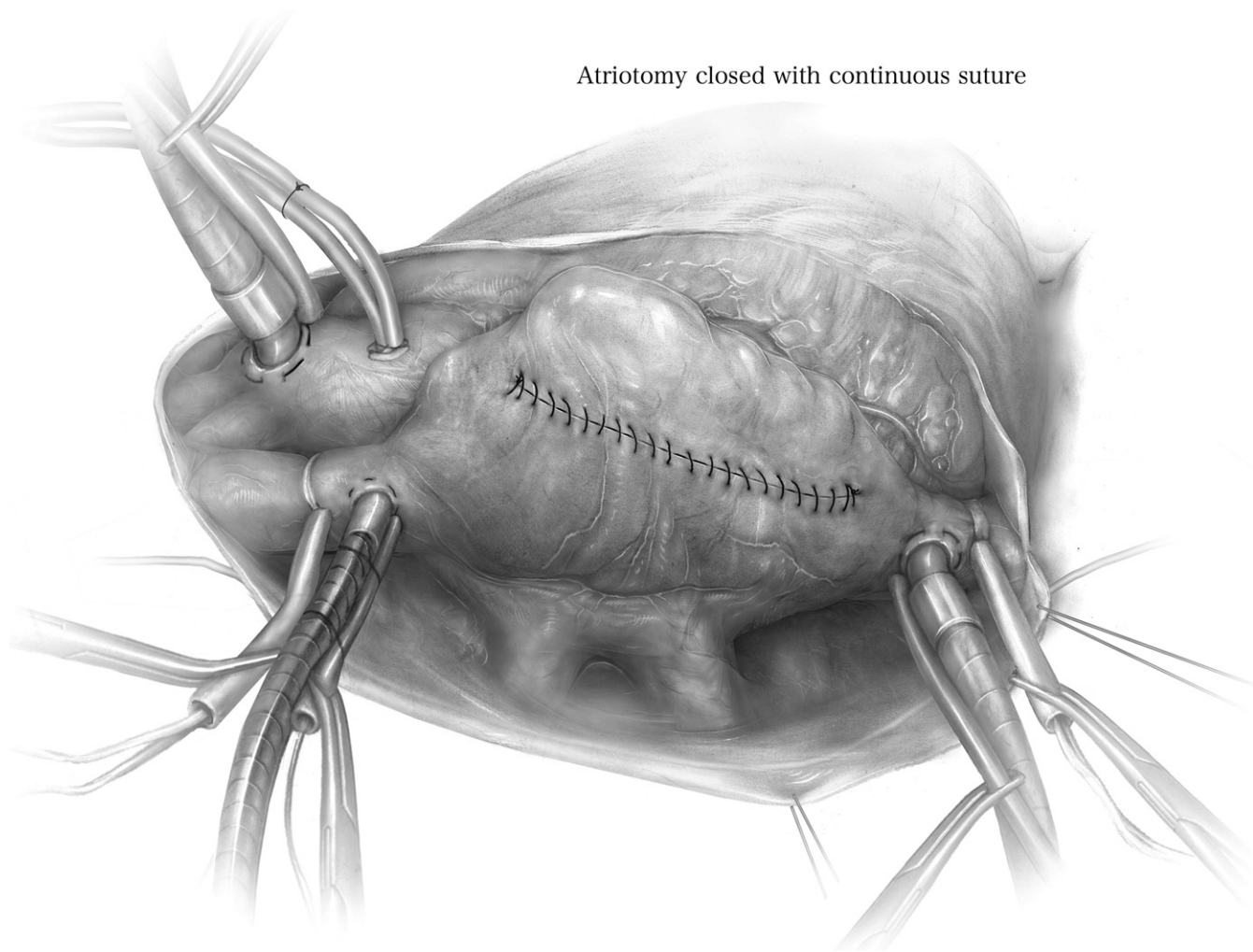


Figure 14 The atriotomy is typically closed in 2 layers, while ventilation is resumed. Transesophageal echocardiogram is used to assess the valve in every case. Because the cross-clamp has been off (typically for 20 minutes), the patient is ready to be weaned from bypass as soon as the atriotomy is closed, and the echo can be used to confirm no residual tricuspid regurgitation.

Conclusions

Tricuspid valve repair is a technically straightforward procedure with good results, in particular, for patients with a dilated annulus not associated with extensive tethering of

the valve leaflets or permanent pacing wires that cross over the tricuspid leaflets (or through the leaflets). There are relatively few “pitfalls” that need to be avoided if one keeps in mind the location of the conduction system and the adjacent aortic sinus.