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Gore-Tex Band Ring Tricuspid Valve Annuloplasty: A simple technique

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Abstract:

Background:
Functional Tricuspid regurgitation (FTR) is a frequently related with valve and congenital heart diseases. Tricuspid valve replacement or tricuspid valve repair (De Vega annuloplasty or ring annuloplasty) are the usual approaches used to correct the tricuspid valve regurgitation. The ring annuloplasty repair is favored by the surgical teams. We are going to report the technique of tricuspid annuloplasty using a handmade Gore-Tex band, providing a simple, reproducible, and cost-effective solution. We are going to present the steps of this technique and describe three classical cases of functional tricuspid regurgitation as follows: 1) redo mitral valve surgery with tricuspid annuloplasty, 2) combined mitral and aortic stenosis with tricuspid annuloplasty, and 3) large ASD with tricuspid annuloplasty.
The use of Gore-Tex annuloplasty in tricuspid valve repair demonstrated excellent early results in these complex cases. It proved to be a reliable, efficient and non-expensive solution for TR management, leading to favorable postoperative outcomes with minimal residual TR and improved functional status. Further studies with large cohorts are necessary to confirm the long-term efficacy of this technique in diverse clinical scenarios.

Introduction:

Functional Tricuspid regurgitation (FTR) is a significant clinical concern that impacts patients with both acquired and congenital valvular heart diseases. Secondary to these primary diseases, it often leads to right heart failure, reduced quality of life, and increased mortality if not adequately addressed. When TR reaches moderate to severe levels, it often requires surgical management [1]. The complexity of managing TR increases when it is associated with other heart valve diseases or congenital abnormalities.

Repairing the tricuspid valve using ring annuloplasty or De Vega suture are the usual used techniques. Among these techniques, ring annuloplasty ring has emerged as a preferred option due to its effectiveness and durability. Achieving stabilization of the tricuspid valve annulus is a key determinant for favorable early and long-term outcomes, both in terms of valve durability and clinical results, surpassing those achieved with the De Vega technique [2-4]. In the technique detailed below, we present a straightforward tricuspid valve repair using a handmade Gore-Tex band, we created from a vascular prosthesis, which effectively replicates the functional and anatomical benefits of a manufactured annuloplasty ring.

Our handmade Gore-Tex annuloplasty technique (same as the manufactured ring annuloplasty) is indicated for the treatment of functional tricuspid regurgitation (TR), particularly in cases associated with:
- Annular dilatation secondary to right ventricular enlargement
- Left-sided valvular lesions (mitral or aortic pathology)
- Pulmonary hypertension
- Congenital heart disease (e.g., Ebstein's anomaly, atrial septal defect with TR)
- Degenerative TR, when commercial/manufactured rings are unavailable

This technique is especially valuable in resource-limited settings or when a non-rigid annuloplasty approach is desirable. Among its advantages, handmade Gore-Tex annuloplasty offers a low-cost alternative to commercial rings, preserves annular flexibility, an important feature for the low-pressure right-sided cardiac system and is easily performed in most cardiac surgery environments due to its short learning curve and reproducibility. However, the technique also presents certain limitations, including less standardized sizing compared to rigid or semi-rigid rings, potentially variable long-term durability depending on patient selection and surgical technique, and a risk of under- or over-correction of the annulus if the band sizing is not accurate.

Surgical technique

1. Principle

This method mimics the effect of a flexible ring annuloplasty using expanded polytetrafluoroethylene (ePTFE, Gore-Tex) vascular graft material. It aims to:

- Reduce annular diameter
- Restore leaflet coaptation
- Maintain flexibility in the tricuspid annulus

2. Preparation

Patient Setup and Exposure

- Approach: Median sternotomy
- Cardiopulmonary bypass (CPB): Bi-caval cannulation
- Aortic cross-clamping: Usually if concomitant left-sided procedures are performed; otherwise, may proceed on a beating heart using caval snares
- Right atriotomy: Performed along the atrioventricular groove
- Exposure: Stay sutures provide visualization of the tricuspid valve
- Saline test: Initial hydraulic testing may confirm annular dilatation and severity of TR

3. Step-by-Step Surgical Technique

Step 1: Identification of the Tricuspid Annulus

- Begin by identifying the true tricuspid annulus from the anteroseptal to the postero-septal commissure.
- Avoid suturing the septal annulus to preserve the conduction system near the AV node and His bundle.

Step 2: Placement of Annular Sutures

- Sutures are placed along the entire circumference of the annulus, excluding the septal segment.
- Placement is similar to mitral valve repair: full-thickness, deep bites into fibrous tissue.
- U-shaped mattress sutures are passed through the annulus and will be anchored to the Gore-Tex band.

Step 3: Preparing the Gore-Tex Band

- A Gore-Tex vascular graft is folded longitudinally. (A picture of a typical vascular graft used is shown in Figure 1 and the band folding is shown in Figure 2.)

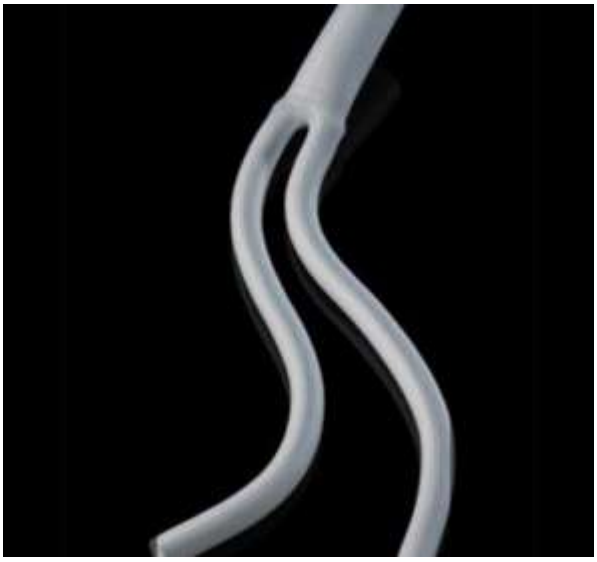

Fig. 1. Example of a vascular graft used to obtain the band

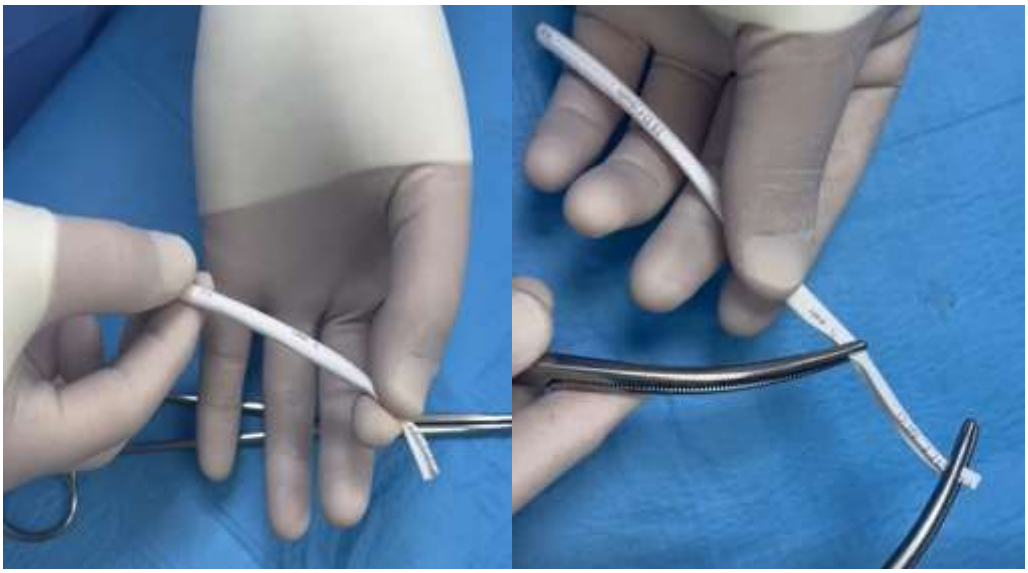

Fig. 2. Longitudinal band folding and stabilization

- The band is stitched along its length to prevent fraying.
- Band sizing rule: The total length of the Gore-Tex band should be approximately half the measured length of the annular suture line, excluding the septal segment.
  In practical terms:
  For every unit length of suture placed in the annulus, the corresponding length of the band should be about half. This ensures adequate annular reduction without causing stenosis.

Step 4: Anchoring the Band

- The Gore-Tex band is parachuted down using the pre-placed annular mattress sutures. (The band parachuting is shown in Figure 3).

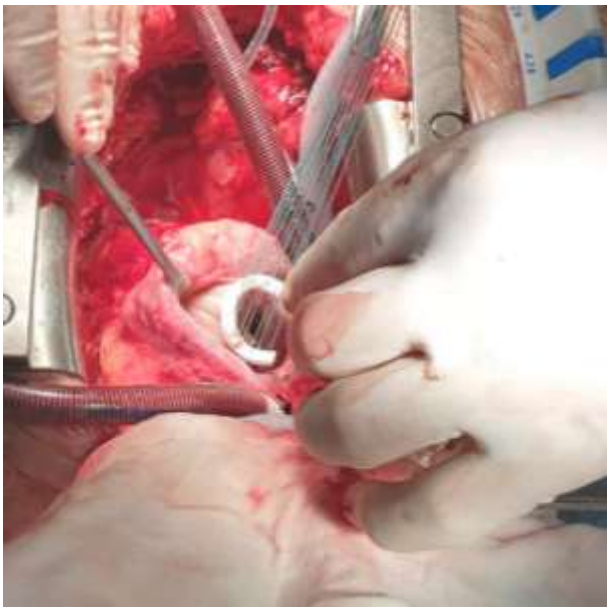

Fig. 3. Band parachuting to the annulus.

- Ensure the band lies evenly along the annulus and does not impinge on the septal area.
- Tie each suture securely (at least 7–8 knots recommended, as Gore-Tex is slippery). The image of the band after knot tying is shown in Figure 4.

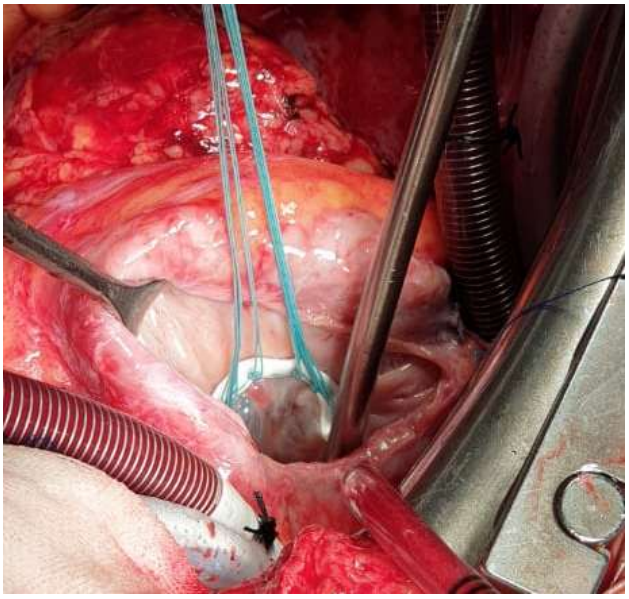

Fig 4. Placed annular Gore-tex band.

Step 5: Annular Reduction

- To avoid over-reduction and prevent tricuspid stenosis, place two fingers (index and middle) together through the tricuspid orifice during band tying.
- The fingers should move freely after knot tying, ensuring a patent valve area.

Step 6: Competence and Tension Test

- Perform a hydraulic test by injecting saline into the right ventricle.
- Confirm:
- Adequate leaflet coaptation
- No regurgitation
- Absence of stenosis
- Adjust the tension if needed before cutting the sutures.

Step 7: Final Assessment

After weaning from CPB, conduct a transesophageal echocardiography (TEE) to:
- Evaluate residual TR
- Confirm leaflet mobility
- Exclude tricuspid stenosis

The following cases illustrate the versatility of the Gore-Tex band ring technique in treating TR while addressing underlying primary pathologies.

Case 1: Redo Mitral Replacement and gore tex band ring Tricuspid Annuloplasty
This patient, a 59-year-old female, had a history of post-commissurotomy mitral stenosis,15 years ago which led to significant tricuspid regurgitation.
The patient underwent redo mitral surgery, and access to the heart was gained via a median sternotomy under general anesthesia. After establishing cardiopulmonary bypass, the heart was arrested with cardioplegia. The mitral valve was replaced with and a mechanical prosthesis carefully implanted. The tricuspid valve was assessed next, revealing severe regurgitation due to an enlarged annulus. The repair was performed using Gore-Tex band ring. Post-operative echocardiography revealed minimal residual tricuspid regurgitation (1+), and the new mitral prosthesis functioned well. The patient recovered smoothly and was discharged after eight days, with marked improvement in her functional status.

Case 2: Mitral and Aortic valve replacement and Tricuspid valve repair
This 71-year-old female presented with severe mitral stenosis, aortic stenosis, and significant tricuspid regurgitation. Her clinical presentation included symptoms of heart failure and reduced exercise tolerance.

Following general anesthesia, a median sternotomy was performed to gain access to the heart. After the patient was placed on cardiopulmonary bypass, cardioplegia was administered to arrest the heart.

The aortic valve, which was heavily calcified, was replaced with a mechanical prosthesis (SJM Regent Nr. 19). Next, the severely stenosed mitral valve was excised, and a new mechanical mitral prosthesis (SJM Masters Nr. 29) was implanted.

Finally, the tricuspid valve was accessed through the right atrium. Given the degree of tricuspid regurgitation, a Gore-Tex band annuloplasty ring was used to repair the tricuspid regurgitation.

After the surgery, the patient showed minimal residual tricuspid regurgitation (1+), with excellent function of both the mitral and aortic prostheses. The patient's recovery was uneventful, and she was discharged after seven days.

Case 3: Closure of large ASD with pericardial patch and Tricuspid valve repair Annuloplasty

A 44-year-old female was diagnosed with large atrial septal defect (ASD), and severe tricuspid regurgitation. She presented with progressive dyspnea and signs of right heart failure.
The patient underwent the intervention under general anesthesia and through median sternotomy. Cardiopulmonary bypass was established, and the heart was arrested using cardioplegia.

After addressing the congenital anomaly, closure of ASD with pericardial patch, the tricuspid valve was evaluated. Given the patient's severe tricuspid regurgitation, we used a Gore-Tex band annuloplasty ring to manage the tricuspid regurgitation. The right atrium was carefully closed, ensuring there was no further regurgitation.

The post- op echocardiography showed no residual shunt and minimal tricuspid regurgitation. Pulmonary pressures decreased significantly, and the patient was discharged after 7 days in stable condition.

Discussion:

Tricuspid regurgitation (TR) is a significant clinical concern in patients with valvular heart diseases, particularly in those with concomitant mitral, aortic, and congenital defects. The usual annuloplasty techniques, such as De Vega suture annuloplasty and ring annuloplasty, have long been utilized in the repair of functional TR. Among these techniques, ring annuloplasty ring has emerged as a preferred option due to its effectiveness and durability. The stabilization of tricuspid valve annulus is one of the most critical steps related to good early and long term results in terms of patency and clinical results over De Vega technique [2-4]. We have used the De Vega suture technique for years, primarily due to the unavailability of commercial tricuspid annuloplasty rings in our clinic

Guenther et al. [2] in their study of 717 consecutive patients undergoing tricuspid valve surgery found that ring annuloplasty provided better long-term survival and lower rates of reoperation when compared to De Vega suture annuloplasty. The ring group had a 98.4% freedom from reoperation at 10 years, while the De Vega suture group had 87.9% freedom from reoperation.

Tang et al. [3] highlighted that annuloplasty ring placement is an independent predictor of both long-term survival and event-free survival.

Studies such as Parolari et al. [4] and Khorsandi et al. [5] have shown that ring annuloplasty provides better long-term freedom from TR recurrence compared to suture annuloplasty. available data suggest that rigid rings provide enhanced protection against recurrent TR at follow-up and contribute to improved early survival. Khorsandi et al., which selected 14 studies from a total of 306 reviewed according to a structured protocol .The findings strongly support the use of ring annuloplasty over the De Vega technique for moderate-to-severe TR, particularly in terms of lower TR recurrence rates necessitating reoperation and improved long-term survival underscoring the critical role that stabilization of the TV annulus plays as a preventive measure against long-term repair failure.

Building upon the evidence supporting ring annuloplasty over suture techniques, we developed and implemented a handmade tricuspid annuloplasty technique using a Gore-Tex band, fashioned from a vascular prosthesis. This approach is designed to mimic the functional and anatomical benefits of commercial ring annuloplasty, offering a flexible yet stable support to the dilated annulus. One of the key advantages of this method is its simplicity, cost-effectiveness, and accessibility, particularly in settings where commercial rings are unavailable. Unlike manufactured annuloplasty rings, the Gore-Tex band can be easily tailored to the patient's anatomy and secured with sutures, making it both affordable and accessible. To our knowledge, this specific technique has not been previously reported in the literature by other authors.

Our surgical team applied this method in a cohort of ten patients to assess its feasibility and outcomes in terms of early valve competence and longer-term durability, as evaluated by echocardiographic follow-up. The results were promising, demonstrating that the Gore-Tex band annuloplasty is a reproducible and effective alternative, providing stable annular remodeling and durable repair with minimal resource demands [6].

Chang et al. [7] reported a technique that is similar to ours, utilizing autologous pericardial strips for tricuspid annuloplasty following the same principles and with good results. This study provides a close analogy in terms of stabilizing the tricuspid annulus. Their results demonstrated the efficacy of pericardial strips in reducing TR recurrence and improving survival.

Conclusion:

The Gore-Tex band annuloplasty technique can be an effective and reliable approach for repairing functional tricuspid valve regurgitation. This technique offers a cost-effective and reproducible alternative especially in settings where the tricuspid rings are not available. Large studies are warranted to confirm the long-term advantages of this technique in comparison to other established methods.

Refrences:

1. Corrigendum to: 2017 ESC/EACTS Guidelines for the management of valvular heart disease, *European Heart Journal*, Volume 39, Issue 21, 01 June 2018, Page 1980, https://doi.org/10.1093/eurheartj/ehx636
2. Thomas Guenther, Domenico Mazzitelli, Christian Noebauer, Ina Hettich, Peter Tassani-Prell, Bernhard Voss, Ruediger Lange, Tricuspid valve repair: is ring annuloplasty superior?, *European Journal of Cardio-Thoracic Surgery*, Volume 43, Issue 1, January 2013, Pages 58–65, https://doi.org/10.1093/ejcts/ezs266
3. Tang GH, David TE, Singh SK, Maganti MD, Armstrong S, Borger MA: Tricuspid valve repair with an annuloplasty ring results in improved long-term outcomes. Circulation. 2006, 114:I577-81. 10.1161/CIRCULATIONAHA.105.001263
4. Parolari A, Barili F, Pilozzi A, Pacini D: Ring or suture annuloplasty for tricuspid regurgitation? A meta analysis review. Ann Thorac Surg. 2014, 98:2255-63. 10.1016/j.athoracsur.2014.06.100
5. Khorsandi M, Banerjee A, Singh H, Srivastava AR: Is a tricuspid annuloplasty ring significantly better than a De Vega's annuloplasty stitch when repairing severe tricuspid regurgitation?. Interact Cardiovasc Thorac Surg. 2012, 15:129-35. 10.1093/icvts/ivs070
6. Dumani S, Dibra L, Likaj E, Mehmeti A, Ibrahimi A, Rruci E, Llazo S, Veseli A, Beca V, Refatllari A, Veshti A. Tricuspid Annuloplasty Using a Handmade Gore-Tex Band: A Retrospective Study, Case Series, and Literature Review. Cureus. 2025 Mar 12;17(3):e80474. doi: 10.7759/cureus.80474.
7. Chang BC, Song SW, Lee S, Yoo KJ, Kang MS, Chung N: Eight-year outcomes of tricuspid annuloplasty using autologous pericardial strip for functional tricuspid regurgitation. Ann Thorac Surg. 2008, 86:1485-92; discussion 1493. 10.1016/j.athoracsur.2008.07.007