A novel running annuloplasty suture technique for robotically assisted mitral valve repair

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Longer operative times necessary for robotic mitral valve (MV) repair have in part slowed its adoption. A significant portion of operative time is dedicated to placement of the annuloplasty ring, which is usually anchored with individual mattress sutures that require time-consuming instrument tying. We have developed an alternative technique

using running annuloplasty sutures that requires fewer steps than conventional techniques and could reduce operative times. We sought to compare the safety and effectiveness of this novel running annuloplasty suture technique with the conventional interrupted annuloplasty suture technique.

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OPERATIVE TECHNIQUE

All patients underwent MV repair by triangular leaflet resection and insertion of a flexible annuloplasty band (Cosgrove Edwards, Edwards Lifesciences, Irvine, CA). For the interrupted suture technique, ten to twelve 2-0 braided polyester sutures are used to secure the annuloplasty ring in the standard fashion. For the running suture technique, three 2-0 braided polyester sutures (Ticron, Covidien, MA) are used to secure the annuloplasty ring as follows. After the ring is introduced into the left atrium, the first suture (16 cm in length) is passed through the ring, through the right trigone, and then back through the ring. The suture is

FIGURE 1. Schematic diagram of running annuloplasty suture technique. A, First suture is tied at the right trigone and run clockwise. B, Second suture is tied at the mid-portion of the annulus and the tail is tied to the first suture. C, Second suture is run clockwise. D, Third suture is tied at the left trigone and the tail is tied to the second suture.

TABLE 1. In-hospital outcomes by annuloplasty suture technique

Variable	Interrupted (n = 50) Median (CL*)	Running (n = 50) Median (CL*)	P
Operative times			
Procedure (wheels in to wheels out)	412 (344–490)	374 (325–451)	.01
Cardiopulmonary bypass	139 (109–180)	107 (91–151)	.0003
Aortic occlusion	100 (75–133)	81 (62–110)	.0008
Variable	Interrupted (n = 49†) No. (%)	Running (n = 49†) No. (%)	P
Postoperative MR severity			
None	44 (90)	42 (86)	.9
1+	4 (8)	6 (12)	
2+	1 (2)	1 (2)	

MR, Mitral regurgitation; CL, confidence limit. *Confidence limits are equivalent to 15th and 85th percentiles for consistency with ± 1 standard deviation. †Postoperative MR severity was missing for 1 patient in each cohort.

then tied down and run clockwise to the midportion of the ring (Figure 1, A). The second suture (14 cm in length) is then passed through the ring, through the midportion of the annulus, and then back through the ring. This second suture is tied down, and the tail is used to secure the first suture (Figure 1, B). The second suture is then run clockwise to the left trigone (Figure 1, C). The third suture (9 cm in length) is passed through the ring, through the left trigone, and then back through the ring. This third suture is tied down, and the tail is used to secure the second suture (Figure 1, D).

CLINICAL SUMMARY

From January 2008 to July 2008, 100 patients with mitral regurgitation (MR) caused by myxomatous degeneration underwent attempted robotic MV repair by posterior leaflet resection and annuloplasty; patients who underwent additional chordal procedures were excluded. Interrupted annuloplasty sutures were used in the first 50 consecutive patients, and running annuloplasty sutures were used in the second 50 consecutive patients. MV repair was achieved in all patients. Median procedure time (wheels in to wheels out) was reduced by 38 minutes in patients with running annuloplasty sutures (Table 1). The use of running annuloplasty sutures resulted in a significant reduction of median cardiopulmonary bypass time (32 minutes less) and median aortic occlusion time (19 minutes less) (Table 1). There were no deaths or in-hospital reoperations for failed repair. Postoperative MR grades were similar between groups (Table 1).

DISCUSSION

Various methods have been used to secure prosthetic annuloplasty rings in robotically assisted MV repair.^{1,2} Rings typically are secured with 10 to 12 interrupted sutures or nitinol U-clips, with operative times that substantially exceed those of MV repairs performed through complete sternotomy or conventional minimally invasive approaches.^{1,2}

Our technique takes advantage of the increased dexterity of robotic instruments, which permits the use of running sutures for the placement of the annuloplasty band. The use of 3 sutures of different lengths to secure the annuloplasty ring is the empiric result of attempts to expedite the process of annuloplasty through reductions in suture material exchange, time-consuming knot tying, and assistance from the bedside surgeon. We believe the use of 2 running sutures and 1 anchoring suture presents the optimal mix of fixation and fewest steps. Running a single suture the entire length of the annulus would provide 1 less independent point of fixation and require a longer suture that is more difficult to maneuver in the small atrial cavity. On the other hand, using more than 2 running sutures unnecessarily increases the number of steps.

CONCLUSIONS

The running annuloplasty suture technique we describe decreases operative times without sacrificing short-term outcomes. The significant reduction in cardiopulmonary bypass and aortic crossclamp times as a result of this technique makes operative times for robotic surgery comparable to those of conventional approaches^{3–5} and could lead to greater adoption of robotically assisted MV repair in the future.

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