

# A novel technique to rebuild the Valsava sinus in acute type A aortic dissection

**Long Zhao**

Ningbo No 2 Hospital: Ningbo Huamei Hospital University of Chinese Academy of Sciences

**Ruofeng Hong**

Ningbo No 2 Hospital: Ningbo Huamei Hospital University of Chinese Academy of Sciences

**Jianbin Fei**

Ningbo No 2 Hospital: Ningbo Huamei Hospital University of Chinese Academy of Sciences

**Junpeng Li**

Ningbo No 2 Hospital: Ningbo Huamei Hospital University of Chinese Academy of Sciences

**Jianneng Pan**

Ningbo No 2 Hospital: Ningbo Huamei Hospital University of Chinese Academy of Sciences

**Wenyu Yang** (✉ [mgyang21100@sina.com](mailto:mgyang21100@sina.com))

Ningbo No 2 Hospital: Ningbo Huamei Hospital University of Chinese Academy of Sciences

---

## Research article

**Keywords:** aortic dissection, aortic root remodeling, Valsava sinus

**Posted Date:** April 6th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-371186/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

**Background.** There has been many techniques described to preserve the integrity of the aortic root with good outcomes for those with acute type A aortic dissection. However, whether to use these technique in emergency patients presenting with AADA remains controversial.

**Methods.** Between December 2019 and February 2021, 11 patients underwent aortic root partial repair using a button technique.

**Results.** The postoperative echocardiography 1 month after operation showed mild regurgitation in 7 cases and moderate regurgitation in 2 cases. Two patients died because of low cardiac outflow. Temporary neurological dysfunction was observed in one patient and hoarseness occurred in one patient.

**Conclusions.** Our partial aortic root remodeling operation is very easy to operate and has a good short-term effect. It might be a useful strategy for acute type A aortic dissection in patients with one or two Valsalva sinuses affected.

## Background

There has been many techniques described to preserve the integrity of the aortic root with good outcomes for those with acute type A aortic dissection(AADA)[1][2]. Complete removal of diseased tissue, excellent hemostasis, and avoidance of lifelong anticoagulation are advantages for patients with morphologically unimpaired valves. However, whether to use this technique in emergency patients presenting with AADA remains controversial[2]. For those with one or two sinuses involved, partial aortic root remodeling techniques have been described using different kinds of patches[3][4], but long running suture lines and the stiffness of the reconstructed sinuses could jeopardize hemostasis, which may lead to rethoracotomy. We modified the partial aortic root remodeling technique by using U-stitches to close the false lumen and rebuild the integrity of the aortic root.

## Methods

Median sternotomy and extracorporeal circulation were used in all patients. Cardiopulmonary bypass was established by femoral artery and bicaval cannulation. Selective cerebral perfusion was performed during circulatory arrest in all patients. Cardioplegic solution was injected through the coronary orifices to achieve cardiac arrest and the sinuses of Valsalva were inspected carefully. Only non-coronary sinus and/or right-coronary sinus were/was involved and without gross structural defect, aortic valve insufficiency as a result of commissural detachment and an acute root ectasia due to the false lumen distended by perfusion pressure were selected for the button technique.

After removing blood and clots in the proximal false lumen, the detached aortic commissures were sutured to the aortic wall using 4–0 polypropylene sutures with pledges to suspend the aortic valves, then the dissected sinuses were sutured to the aortic wall using intermittent U-stitches(4–0 polypropylene

sutures with Polyester pledgets on both the inner and outer sides of the root) perpendicularly to the longitude of the aorta, just like buttons keep the cloth together. The first U-stitch was put at the central line of the sinus to make sure the intima and adventitia were evenly distributed(Fig. 1), sometimes more stitches were needed to distribute the intima and adventitia evenly to make sure there was no distortion at the sinus, especially when the adventitia was enlarged by the perfusion pressure. It is important to put the stitches one by one from the nadir of the dissected sinus to the sinotubular junction which was sutured with a Dacron tube using “sandwich” technique subsequently(Fig. 2). Circulatory arrest was then achieved when rectal temperature drop to 18°C and the aortic clamp was removed. Selective arch vessels were perfused and the dissected aortic tissue that contained an intimal tear was resected and then distal graft-to-aortic anastomosis was completed. In 4 patients, an elephant trunk-type extension into the proximal descending aorta was used.

## Patients And Results

11 patients(7 males, 4 females) with AADA underwent surgeries using button remodeling technique during December 2019 and February 2021 in our hospital. 5 of them received total aortic arch replacement, 4 patients received Hemiarch replacement. The mean age was  $46 \pm 15.1$  years, ranged from 21 to 74 years. Two of them were in a preoperative state of cardiac tamponade with signs of hypotension and cardiogenic shock. The degree of aortic regurgitation(AR) was evaluated by echocardiography and judged as mild in 7 and moderate in 3, respectively. One patient has an aberrant right subclavian artery(RSA) which was derived from the distal of the left subclavian artery(LSA) and encircled the trachea and esophagus dorsally. None of the patients had Marfan syndrome. The cardiopulmonary bypass time was 175–359 (mean  $275.09 \pm 61.60$  min); aortic cross-clamp time was 124–264 min (mean  $196.45 \pm 42.52$  min); and selective cerebral perfusion was 35–90 min (mean  $61.18 \pm 15.25$  min). Two in-hospital deaths occurred because of low cardiac outflow postoperatively. Temporary neurological dysfunction was observed in one patient and hoarseness occurred in one patient. The grade of the aortic incompetence in survivors is shown in Table 1.

Table 1  
Aortic incompetence in survivors (no. of patients)

	aortic incompetence		
	Mild	Moderate	Severe
Before surgery	6	3	0
1 month after surgery	7	2	0

## Discussion

Acute type A aortic dissection is an emergency situation that needs to be treated immediately. Valve-sparing aortic root replacement(VSRR) is advised rather than composite graft replacement when the

valve architecture is fundamentally normal[5][6]. The common VSRR mainly includes aorta root remodeling(Yacoub operation) and reimplantation(David's operation). But prolonged operation times for valve reconstruction and the demanding technique applied under emergency condition may confer additional risk upon unstable patients who might benefit more from a short and simple operation[2], especially for those who do not require replacement of all sinuses. The most frequently affected sinus of Valsalva is the non-coronary sinus, followed by the right and left in that order[7]. Urbanski described a remodeling technique by resecting the distorted sinus and sewing a tear-drop shaped patch with a running suture to the annulus[8], however, the deep suture line is likely to bleed using this technique. Liang-Wan Chen proposed a technique using three teardrop-shaped patches suture inside the sinuses as neointima and then *in situ* connect coronary buttons to the small holes created in the corresponding patches[9], but it's a time consuming operation and not easy to handle for a tyro.

We suggest a new remodeling technique to close the false lumen and rebuild the integrity of the Valsalva sinuses by several horizontal U-stitches with pledges on both the inner and outer side of the aortic wall after removing the blood clot. The interlaced U-stitches provided excellent hemostasis and restrained the enlargement of the sinuses postoperatively. The geometry of the sinuses remained the same as preoperative and the function of the aortic valves was unaffected, which was proved by the echocardiography 1 month after operation. In recent operations, we improved the button technique by anastomosing the sinotubular junction with a Dacron tube after removing the blood clots and suspend the dissected commissures, then suture the dissected sinuses, in this way we can maintain the structure of the aortic root better.

## Conclusion

Our partial aortic root remodeling operation is very easy to operate and has a good short-term effect. It might be a useful strategy for acute type A aortic dissection in patients with one or two Valsalva sinuses affected.

## List Of Abbreviations

AADA: acute type A aortic dissection

RSA: right subclavian artery

LSA: left subclavian artery

VSRR: Valve-sparing aortic root replacement

## Declarations

**Ethics approval and consent to participate:** The technique protocol was established, according to the ethical guidelines of the Helsinki Declaration and was approved by the Human Ethics Committee of Hwa

Mei Hospital, University of Chinese Academy of Sciences; Ningbo Institute of Life and Health Industry, University of Chinese Academy of Sciences. Written informed consent was obtained from individual or guardian participants.

**Consent for publication:** All authors have read this manuscript and would like to have it considered exclusively for publication in Journal of Cardiothoracic Surgery.

**Availability of data and materials:** None of the material related to this manuscript has been published or is under consideration for publication elsewhere, including the internet.

**Competing interests:** none.

**Funding:** none.

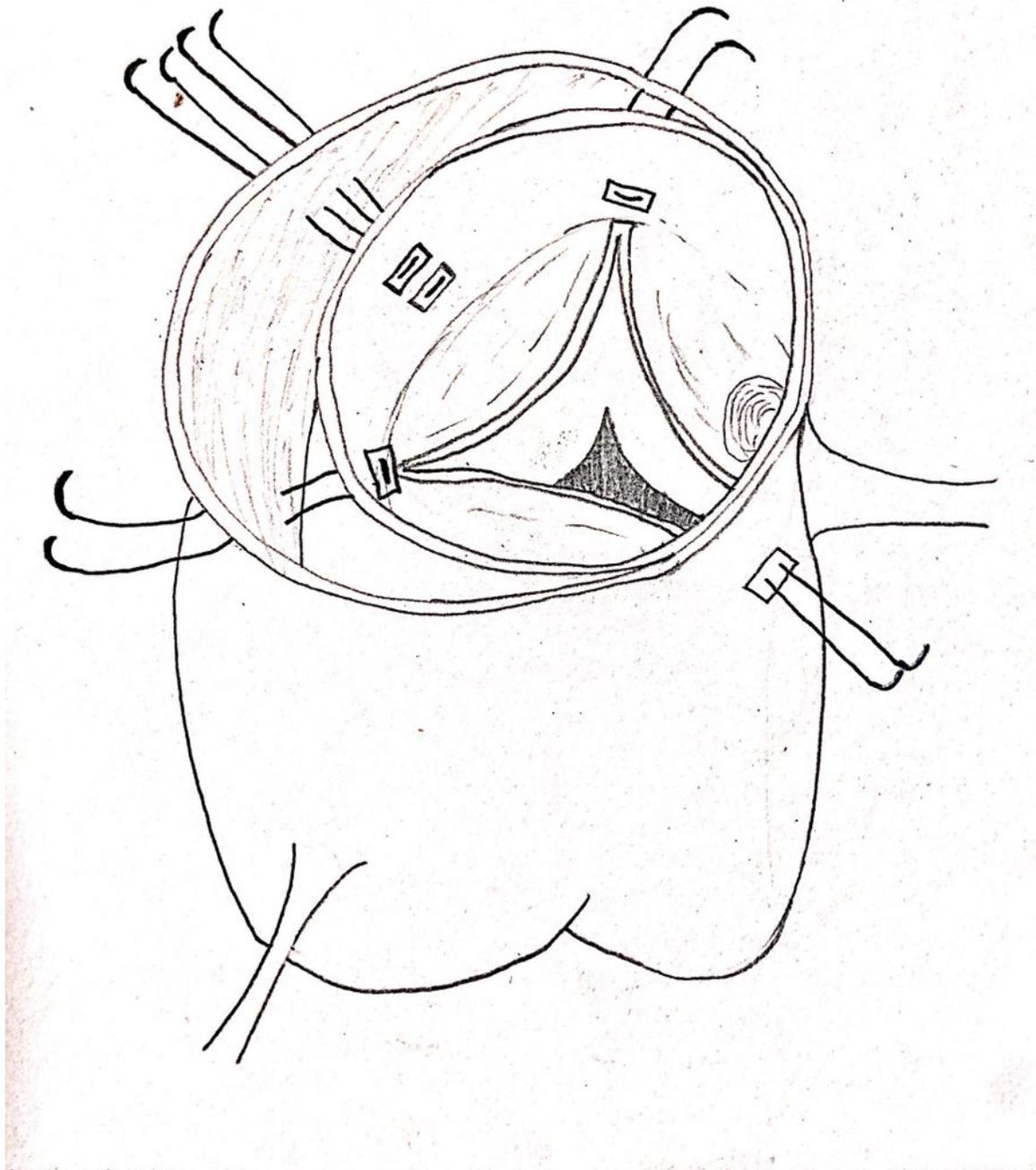
**Acknowledgements:** none.

**Authors' contributions:** Wenyu Yang contributed to the design and performing of the technique; Jianneng Pan contributed to the postoperative management; Jianbin Fei contributed to the CPB management; Long Zhao performed the data analyses and wrote the manuscript; Ruofeng Hong and Junpeng Li helped perform the analysis.

## References

1. TP TPGG, F FLL, HJ NNNN, DDAA. HJSS: Valve-preserving operation in acute aortic dissection type A. *The Annals of thoracic surgery* 2000(5):1460–1465.
2. K KKK TTOO, C RRSS. CHH, M MKK, RG RGLL, A AHH: Evolving strategies for treatment of acute aortic dissection type A. *Circulation*. 2004;11(Suppl 1):II243–249.
3. Komiya T, Tamura N, Sakaguchi G, Kobayashi T. Modified partial aortic root remodeling in acute type A aortic dissection. *Interact Cardiovasc Thorac Surg*. 2009;8(3):306–9.
4. Urbanski PP, Zhan X, Frank S, Diegeler A. Aortic root reconstruction using new vascular graft. *Interact Cardiovasc Thorac Surg*. 2009;8(2):187–90.
5. David TE. An aortic valve-sparing operation for patients with aortic incompetence and aneurysm of the ascending aorta. *J Thorac Cardiovasc Surg* 1992, 103.
6. Sarsam M. Remodeling of the aortic valve annulus. *J Thorac Cardiovasc Surg* 1993, 105.
7. David TE, Feindel CM, Bos J. Repair of the aortic valve in patients with aortic insufficiency and aortic root aneurysm. *Journal of Thoracic Cardiovascular Surgery*. 1995;109(2):345–52.
8. Urbanski PP. Valve-sparing aortic root repair with patch technique. *Ann Thorac Surg*. 2005;80(3):839–43.
9. Chen LW, Wu XJ, Li QZ, Dai XF. A modified valve-sparing aortic root replacement technique for acute type A aortic dissection: the patch neointima technique. *Eur J Cardiothorac Surg*. 2012;42(4):731–3.

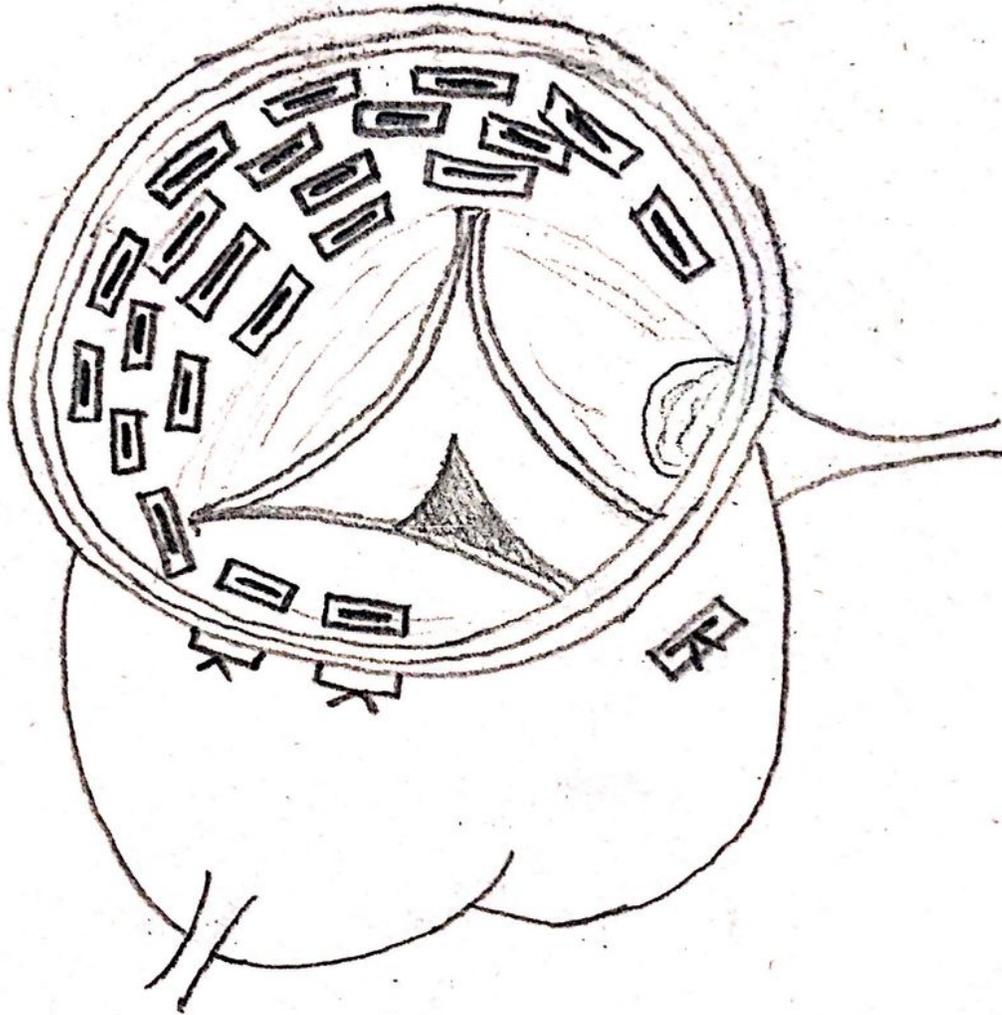
# Figures



**Figure 1**

After removing blood and clots in the proximal false lumen, the detached aortic commissures were sutured to the aortic wall using 4-0 polypropylene sutures with pledgets to suspend the aortic valves. The

first two U-stitches were put at the central line of the sinus to make sure the intima and adventitia were evenly distributed.



**Figure 2**

More stitches were used one by one from the nadir of the dissected sinus to the sinotubular junction.