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## New ideas - Aortic and aneurysmal

# Suture line reinforcement using suction-assisted bioglue application during surgery for acute aortic dissection

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### Abstract

Bioglue has been widely and variously applied in treating acute aortic dissection according to the pathological process and surgeon's preference. This publication outlines a new hemostatic technique using suction-assisted bioglue application for aortic suture line reinforcement during surgery on acute aortic dissection. Twenty consecutive patients were treated in our center for acute aortic dissection using this technique. There were no bleeding complications during surgery and there were no re-explorations or early deaths as a result of bleeding. Average daily chest tube drainage was  $582 \pm 150$  ml/day, with the duration of drainage of  $2 \pm 0.9$  days. In conclusion, this new hemostatic technique is simple to use and demonstrates excellent, immediate and early postoperative results.

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**Keywords:** Aortic dissection; Glue; Bioglue; Hemostasis

### 1. Background

In 1977, Guilmet and colleagues first applied gelatin-resorcinol-formaldehyde glue in aortic root reconstruction to reinforce the vessel wall made fragile by acute aortic dissection (AAD), and to reinforce the aortic anastomosis [1]. Since then, bioglue has been widely and variously applied in treating acute aortic dissection according to the pathological process and surgeon's preference.

This publication outlines a new hemostatic technique using suction-assisted bioglue application for aortic suture line reinforcement during surgery on acute aortic dissection.

### 2. Technique

Following induction of general anesthesia, the right subclavian artery and the right atrium are cannulated in a standard fashion, followed by retrograde cardioplegia catheter placement and left ventricular vent. The ascending aorta is carefully prepared and the innominate vein is mobilized but not divided. The brachiocephalic trunk and left common carotid are exposed and rubber snares are placed around each. Extracorporeal circulation (ECC) is started in a standard fashion. After achieving moderate body hypothermia,  $30^\circ\text{C}$ , whole body perfusion is stopped; the brachiocephalic trunk and left common carotid are snared, and antegrade brain perfusion started. After aortotomy and inspection of the aortic valve, the ascending aorta is completely removed. Then the aortic arch is

inspected for intimal tears. Reconstruction of the dissected layers and open distal aortic anastomosis is performed, reinforcing the suture line with previously cut strips from the Albograft prosthesis (Biomateriali Srl; Brindisi, Italy). After completing the anastomosis, we apply bioglue Surgical Adhesive (Cryo-Life, Inc, Kennesaw, GA) on the outside of the anastomosis while applying suction from the inside of the prosthesis using catheters from the house suction, thus forcing the bioglue to impregnate the suture line, reinforcing it and closing the needle holes (Figs. 1 and 2, Video 1). Care should be taken to ensure that the tissue surface is dry and bloodless.

In the case of a normal size aortic root and no pathological change on the valve or commissural detachment, proximal anastomosis is performed at the sinotubular junction using previously cut prostheses strips after reconstruction of the dissected layers. The proximal suture line is reinforced with the application of bioglue on the outside of the suture line while applying suction from the inside using a needle placed proximally to the aortic cross clamp and connected to the house suction (Figs. 3 and 4, Video 1). Following the de-airing process, the operation is finished in a conventional way.

Between January 2004 and October 2005, 20 consecutive patients were treated in our center for AAD using suction-assisted bioglue application for aortic suture line reinforcement. Moderate hypothermia ( $30^\circ\text{C}$ ) with antegrade selective cerebral perfusion via the right subclavian artery was used during ascending aorta and hemiarch reconstruction in 17 patients and complete arch reconstruction in three others. Re-suspension of the aortic valve was completed in nine patients and Bentall procedures in two

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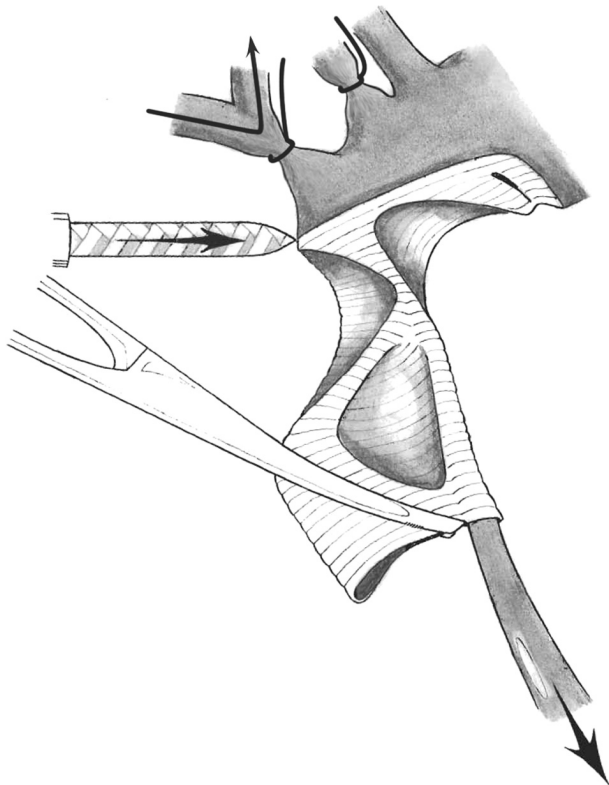


Fig. 1. Suction-assisted application of bioglue on the distal aortic suture line via catheters from the house suction and cell saver placed in the prostheses.

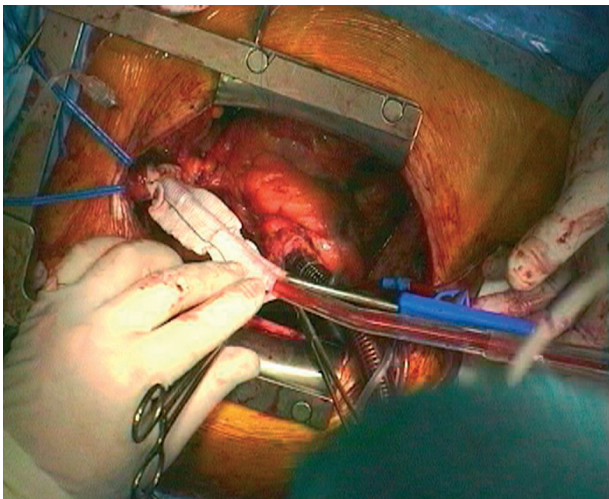


Fig. 2. Suction-assisted application of bioglue on the distal aortic suture line via catheters from the house suction and cell saver placed in the prostheses (intraoperative view).

patients [2]. There were no bleeding complications during surgery and there were no re-explorations or early deaths as a result of bleeding. Average daily chest tube drainage was  $582 \pm 150$  ml/day, with the duration of drainage of  $2 \pm 0.9$  days. There were two early deaths unrelated to bleeding; these resulted from multiple organ failure. Average in-hospital stay was  $8.3 \pm 3.1$  days.

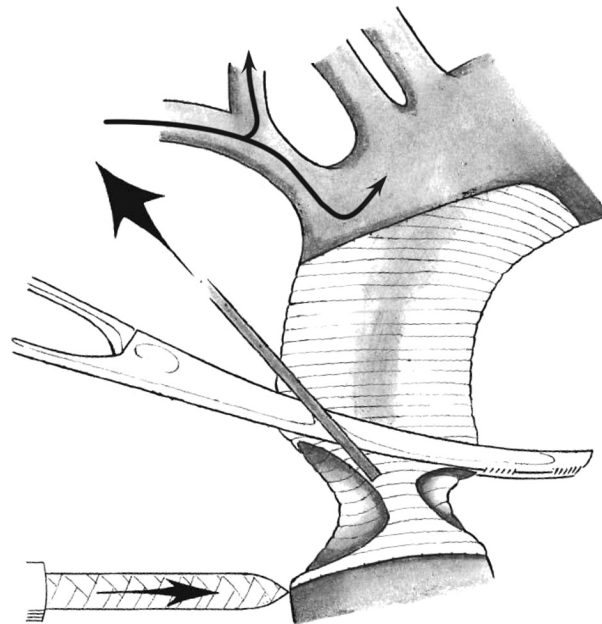


Fig. 3. Suction-assisted application of bioglue on the proximal aortic suture line via a needle connected to the house suction and placed proximal to the aortic cross clamp.

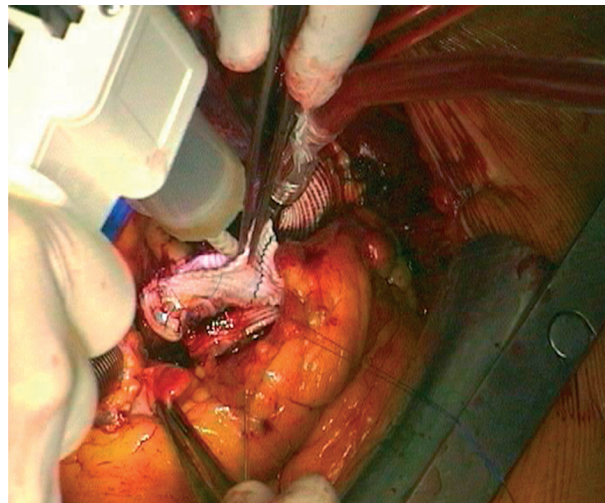


Fig. 4. Suction-assisted application of bioglue on the proximal aortic suture line via a needle connected to the house suction and placed proximal to the aortic cross clamp (intraoperative view).



Video 1. Acute aortic dissection, glue reconstruction of the dissected layers, suction-assisted application of bioglue on the proximal and distal aortic suture line (intraoperative video).

### 3. Comment

One of the biggest challenges during surgery for AAD, besides adequate neurological protection, is preventing suture line bleeding. Fragile aortic walls weakened by the pathological process and further antagonized by impaired coagulation resulting from induced hypothermia and long ECC times, leads to such bleeding. Several techniques are employed in efforts to resolve uncontrollable bleeding, notably the Cabrol-shunt [3]. With the development of novel perfusion and brain protection techniques, bleeding became the biggest problem, despite the development of tissue glues and zero-porosity grafts. This novel method for suction-assisted bioglue application on the aortic suture lines impregnates the prostheses and the aortic wall, reinforcing it and closing the needle holes. Technically elegant, this procedure requires only the house suction and cell saver suction, adding approximately 30 s to the surgery's duration. There were no bleeding complications during surgery, and re-exploration was not necessary in any instance. Additionally, no bleeding-related deaths occurred. Although literature reports exist describing bioglue

embolization through needle holes [4], no such complication was observed, and we try to use the minimal amount of the necessary bioglue to achieve optimal hemostasis.

In conclusion, this new hemostatic technique during surgery on acute aortic dissection using suction-assisted bioglue application for aortic suture line reinforcement is simple and safe and demonstrates excellent operative results.

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