

## Case Report

# Stepwise External Wrapping Surgery for Stanford Type A Acute Aortic Dissection and Aortic Rupture

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## Abstract

A 74-year-old female with sudden back pain was transported to our hospital. At arrival, she showed hypotension with disturbance of consciousness. Computed tomography revealed Stanford type A acute aortic dissection and cardiac tamponade. Median sternotomy and pericardium incision were performed, and bloody pericardial fluid blew out, allowing us to identify the aortic rupture. Due to the great amount of bleeding from the ruptured aorta, it was difficult to maintain the blood pressure. We successfully performed stepwise external wrapping with good hemostasis. Type A acute aortic dissection, particularly that with aortic rupture, still has a high mortality rate, despite advances in medical technology. We herein report stepwise external wrapping surgery for type A acute aortic dissection and aortic rupture.

**Keywords:** Acute aortic dissection; Aortic rupture; Stepwise external wrapping surgery

## Introduction

Acute aortic dissection is a life-threatening disease, and the acute mortality rate increases by 1% with each passing hour after the onset [1]. Stanford type A Acute Aortic Dissection (TAAAD), which affects the ascending aorta, is a particularly serious condition, as it can be complicated by cardiac tamponade, mal-perfusion and aortic valve regurgitation. In many cases, emergency surgery is recommended. However, the mortality rate is high at 26%, even after surgery, and the outcomes of aortic rupture are particularly poor [1]. We developed a surgical approach involving Stepwise External Wrapping (SEW) using a zero-porosity artificial graft. We herein report a case of SEW surgery for TAAAD and aortic rupture.

## Case Presentation

The patient was a 74-year-old female without any medical history. She developed sudden chest pain and was emergently transported to our hospital. She complained of strong chest pain with hypotension (blood pressure 75/54 mmHg) and gradually fell unconscious (Glasgow Coma Scale: E3V4M5). Computed Tomography (CT) showed TAAAD with a 15 mm intimal tear in the ascending aorta along with cardiac tamponade. We decided to perform emergency surgery, so she was immediately taken to the operating room and intubated. Median sternotomy and pericardium incision were performed, and bloody pericardial fluid blew out. We detected

pulsatile bleeding from the dorsal side of the ascending aorta, which suggested aortic rupture. Due to the large amount of bleeding from the ruptured aorta, it was difficult to maintain the blood pressure, so we decided to perform SEW (Figure 1). Cardio-Pulmonary Bypass (CPB) was established through femoral atrial cannulation and single two-stage venous cannulation via the right atrial appendage. The ascending aorta was separated from the pulmonary arterial trunk and right pulmonary artery. Pieces of a Triplex artificial graft\* (Vascutek Terumo, Tokyo, Japan) were tailored, placed around the ascending aorta from the coronary ostia to the innominate artery, and approximated with a running suture of 4-0 Prolene\* (Ethicon, Somerville, NJ, USA) to tightly wrap the ascending aorta (Figure 2). Good hemostasis was subsequently obtained, and the blood pressure in the extremities as well as the findings of near-infrared spectroscopy cerebral oximetry with Invivo™ (Medtronic, Minneapolis, MN, USA) normalized. The operation time was 77 min, and the CPB time was 30 min. She was taken to the intensive-care unit in a stable condition and, extubated the next day without any neurological damage. The postoperative course was good, and she was discharged 16 days after surgery without any complications. CT, performed three months after the surgery, showed a thrombosing tendency in the false lumen (Figure 3). She was doing well six months after the surgery.

## Discussion

The gold-standard treatment for TAAAD is replacement of the dissected aorta, but SEW is also an option at our hospital [2]. Compared to aortic replacement, the advantage of SEW is that the surgical stress can be reduced because of the short CPB durations and lack of deep hypothermic circulatory arrest [2]. We perform SEW in elderly and high-risk patients who are at risk of complications of aortic replacement and we have experienced many cases in which the patients' lives were saved [2,3]. A total of 49 patients with type A intramural hematoma underwent SEW between January 2016 and January 2020, showing no in-hospital deaths and no persistent postoperative complications [3]. Taking the surgical stress of aortic surgery into consideration, it is difficult to judge the benefits of aortic replacement in elderly and high-risk patients with advanced complications, such as aortic rupture. The main purpose of performing SEW is to prevent aortic rupture [4]. However, there are no reports

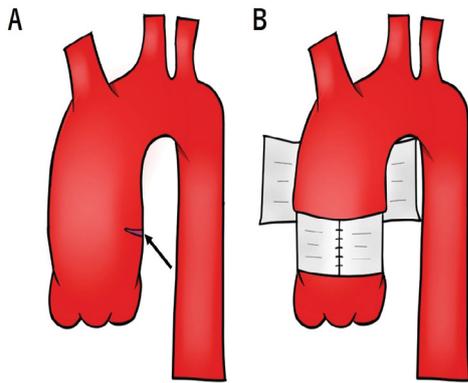
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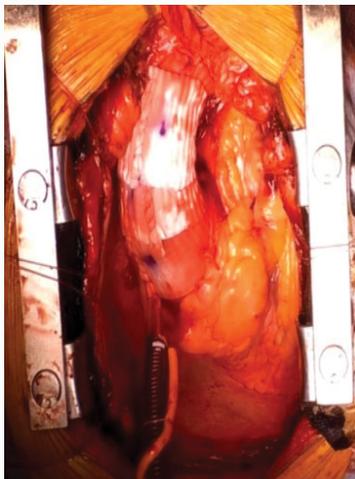
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**Figure 1:** Illustrations: (A) The ruptured aorta. Black arrow indicates the fissure of the aorta. (B) Stepwise external wrapping surgery.



**Figure 2:** Intraoperative view of stepwise external wrapping surgery in type A acute aortic dissection.

of SEW being successfully performed in patients whose aorta had already ruptured. In the present case, we successfully performed SEW even though the aorta had already ruptured, and good hemostasis was obtained. Aortic rupture is a serious complication of TAAAD that immediately leads to a lethal condition, and there are few reports of a successful survival. In a previous report on cases of traumatic thoracic aortic rupture, endovascular treatment was shown to be effective even when patients were in a shock state [5]. The most common location of traumatic aortic rupture is at the aortic isthmus, which is a suitable location for endovascular treatment, although aortic rupture due to TAAAD occurs in the ascending aorta. Therefore, it is difficult to treat aortic rupture due to TAAAD using only stent grafts. It is also noteworthy that no postoperative neurological damage was observed in this case. This may be because the hemodynamic status was stabilized quickly due to rapid hemostasis. In fact, intraoperative Invos™ (Medtronic) showed that a good cerebral blood flow was maintained after SEW was performed.

### Conclusions

SEW is expected to be a useful alternative to aortic replacement for TAAAD and aortic rupture. However, further careful follow-up will be needed.

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**Figure 3:** A: Preoperative CT scan. B: Postoperative CT scan (one week after surgery). C: postoperative CT scan (six months after surgery). Aortic remodeling was observed. The white arrow indicates the line of the artificial graft.