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SURGICAL MANAGEMENT OF THORACO-ABDOMINAL AORTIC ANEURYSM USING MODIFIED GOTT SHUNT AND PRUITT-INAHARA SHUNT - A CASE REPORT

SURYA SATYAGOPAL PALANKI[a1], VINEETH V.S.[b], SANDEEP MAHAPATRA[c] AND AMARESH RAO M.[d]

[abd]Department of Cardiovascular and Thoracic Surgery, Nizams Institute of Medical Sciences, Hyderabad, Telangana, India

[c]Department of Vascular Surgery, Nizams Institute of Medical Sciences, Hyderabad, Telangana, India

ABSTRACT

Thoraco-abdominal aortic aneurysms (TAAAs) are complex vascular conditions that present significant surgical challenges, particularly concerning blood flow control to the upper and lower body during repair. Various techniques have been developed, including aortic cross-clamping, passive shunting, and partial cardiopulmonary bypass, to minimize ischemic complications. This report focuses on the use of a modified Gott shunt and a Pruitt-Inahara shunt for distal perfusion and visceral perfusion, respectively, during the surgical management of a Crawford Type I thoraco-abdominal aortic aneurysm. A 55-year-old male presented with lower abdominal pain for one month and was diagnosed with a Crawford Type I thoraco-abdominal aortic aneurysm. A computed tomography (CT) angiogram revealed a fusiform dilatation of the descending aorta with thrombotic occlusion and dissection of the distal common iliac artery. The patient underwent a successful aorto-aortic bypass using a tubular Dacron graft, with reimplantation of the celiac artery and superior mesenteric artery (SMA) through jump grafts. The modified Gott shunt was utilized for lower body blood flow control, while the Pruitt-Inahara shunt was employed for visceral perfusion. The surgical procedure was completed without postoperative complications, including paraplegia or renal dysfunction. The patient remained stable with preserved renal function over a 6-month follow-up period. The combined use of the Gott shunt for distal aortic perfusion and the Pruitt-Inahara shunt for visceral perfusion during thoraco-abdominal aneurysm surgery offers a reliable method to minimize the risk of ischemic complications. These techniques help prevent spinal cord ischemia and postoperative paraplegia, providing a safer approach to managing complex aortic aneurysms.

KEYWORDS: Thoraco-abdominal Aortic Aneurysm, Gott Shunt, Pruitt-Inahara Shunt, Distal Aortic Perfusion, Visceral Perfusion, Aneurysm Repair, Spinal Cord Ischemia

Surgical repair of aneurysms of the distal arch and thoraco-abdominal aorta pose a great challenge for the surgeon. During such repairs, various methods are used for upper and lower body blood flow control, namely: simple aortic cross-clamping, passive shunts, atriofemoral bypass, partial cardiopulmonary bypass (CPB) and DHCA (O'Connor and Rothenberg, 1995). Passive shunts divert blood from proximal to distal aortic sites or femoral artery. The most commonly used passive shunt is the 9 mm heparin-coated conduit (Gott shunt) that does not require systemic anticoagulation (Verdant A., 1992). The Inihara Pruitt shunt (and it's modified version Pruitt F3 Carotid shunt) which is commonly used during Carotid surgeries can also be utilized for passive visceral perfusion during aortic clamping (Walker and Peterson, 1985).

CASE REPORT

A 55 year old male patient came with a complaint of lower abdominal pain since one month. He was evaluated and diagnosed with Thoraco-abdominal aortic aneurysm- Crawford Type 1. His CT angiogram showed fusiform dilatation with peripheral thrombosis of descending aorta for a length of 20 cms starting at level of D5 vertebra. Proximal celiac axis and SMA were dilated and showed thrombotic occlusion. Dissection of distal common iliac artery was noted extending into internal iliac artery. We performed an aorto-aortic bypass with tubular dacron graft and reimplantation of celiac artery & SMA with jump grafts (dacron) from the main graft. Gott shunt was successfully used in the process for lower body flow control during the surgery. Pruit Inahara shunt (it's modified version Pruitt F3 Carotid shunt) which is connected to the Gott shunt, is used to maintain visceral perfusion during the surgery when both sides of diseased segment are clamped. The diagrammatic representation of the procedure is provided in Figure 3.

The proximal and distal sites of cannulation of Gott shunt vary depending on the site of aneurysm. In this case, we placed the shunt from descending thoracic aorta to infrarenal aorta above the bifurcation. The total cross-clamp time was xxx minutes. Postoperatively, the patient

[1]**Corresponding author**

had no paraplegia or any other spinal cord ischemic deficit. Renal function remained unaffected in the immediate postoperative period and also at 6 months follow up.

Surgical Procedure Summary

Preparation: Patient cleaned and draped; positioned in modified lateral decubitus (right).

Incision: Postero-lateral thoracotomy in the 5th intercostal space, extended into the abdomen.

Layer Dissection: Incision deepened, intercostal muscles divided, thorax entered, diaphragm divided laterally.

Aorta Identification: Abdominal aorta identified; aneurysm located. Normal aorta above aneurysm and infrarenal aorta looped.

Aneurysm Dissection: Dissection performed on lateral and medial surfaces. Key vessels (IMA, renal arteries, SMA, celiac artery) identified and looped.

Gott Shunt Placement: Gott shunt placed from descending thoracic aorta (DTA) to infrarenal aorta.

Aortic Clamping and Graft Placement

Clamped aorta above aneurysm. Aorta incised; 16mm x 30cm Dacron graft anastomosed to DTA with 4-0 Prolene.(Figure 1)

Hemostasis secured; clamp applied to graft. Suprarenal aorta dissected and looped.

SMA and celiac artery disconnected from aneurysm; and perfusion maintained via Pruitt F3 Carotid shunt until the anastomosis is complete. Suprarenal aorta clamped.

Aorta transected above renal artery levels; graft anastomosed to suprarenal aorta.

6mm jump grafts placed from main graft to SMA and celiac artery. (Figure 2)

Closure: Hemostasis secured; diaphragm closed, left Intercostal drain placed, and wound closed in layers.

Postoperative Care: Patient transferred to ICU on moderate inotropic support, mechanically ventilated, and hemodynamically stable.

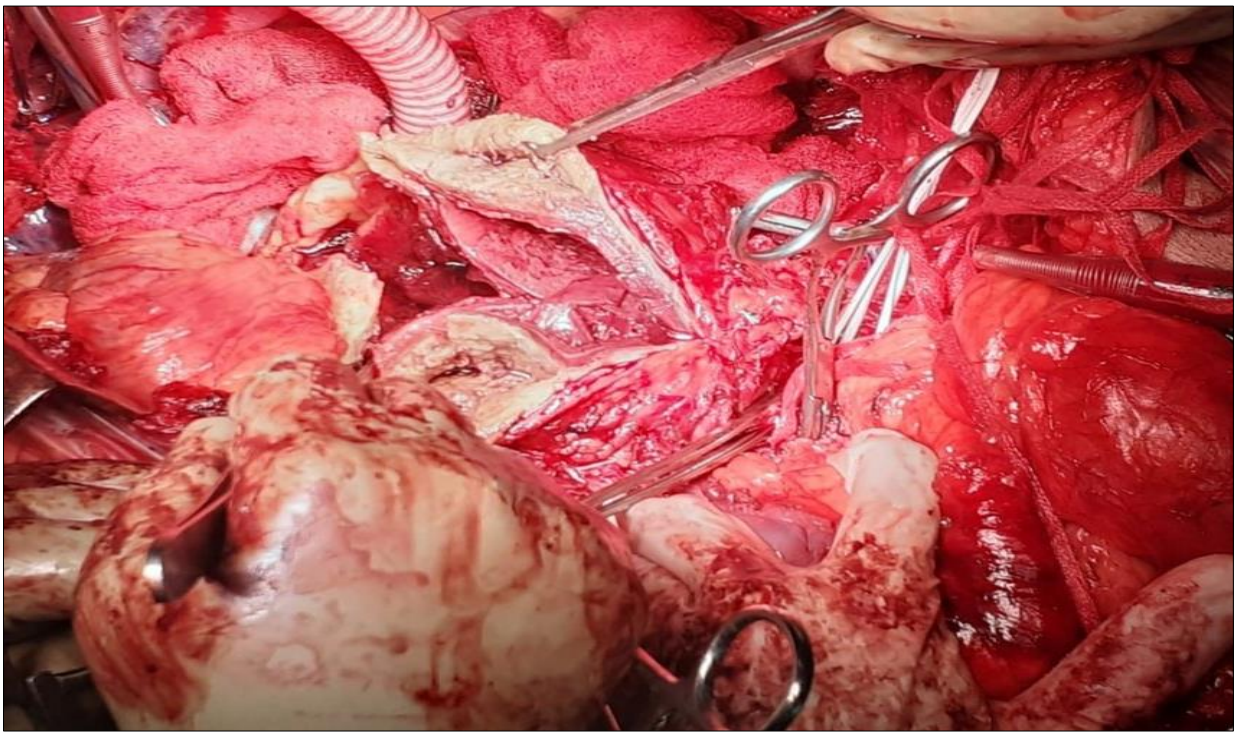

Figure 1: Image showing the aneurysmal descending Thoraco abdominal aorta looped, clamped and bypassed with a Gott shunt (from Proximal descending thoracic aorta to Left Common iliac artery) and completion of Proximal anastomosis of graft

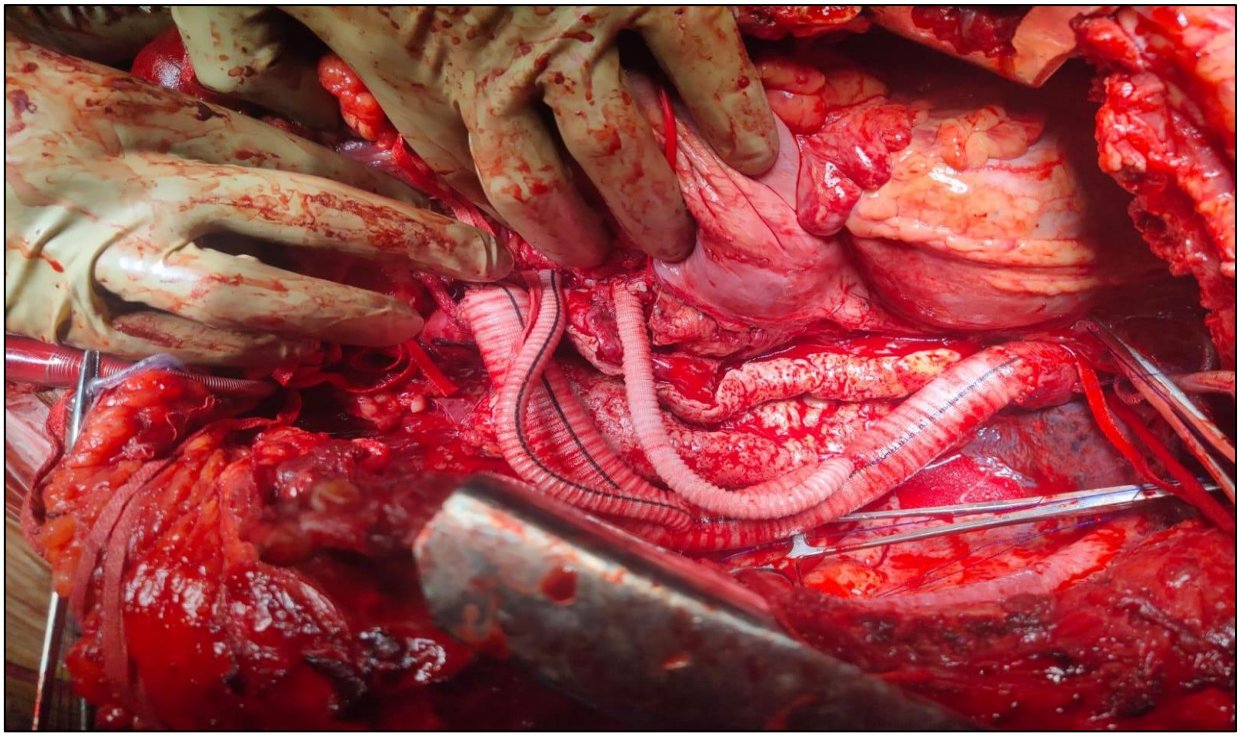

Figure 2: Completion of the visceral debranching (SMA and Coeliac) and Proximal and distal anastomosis of graft to native aorta

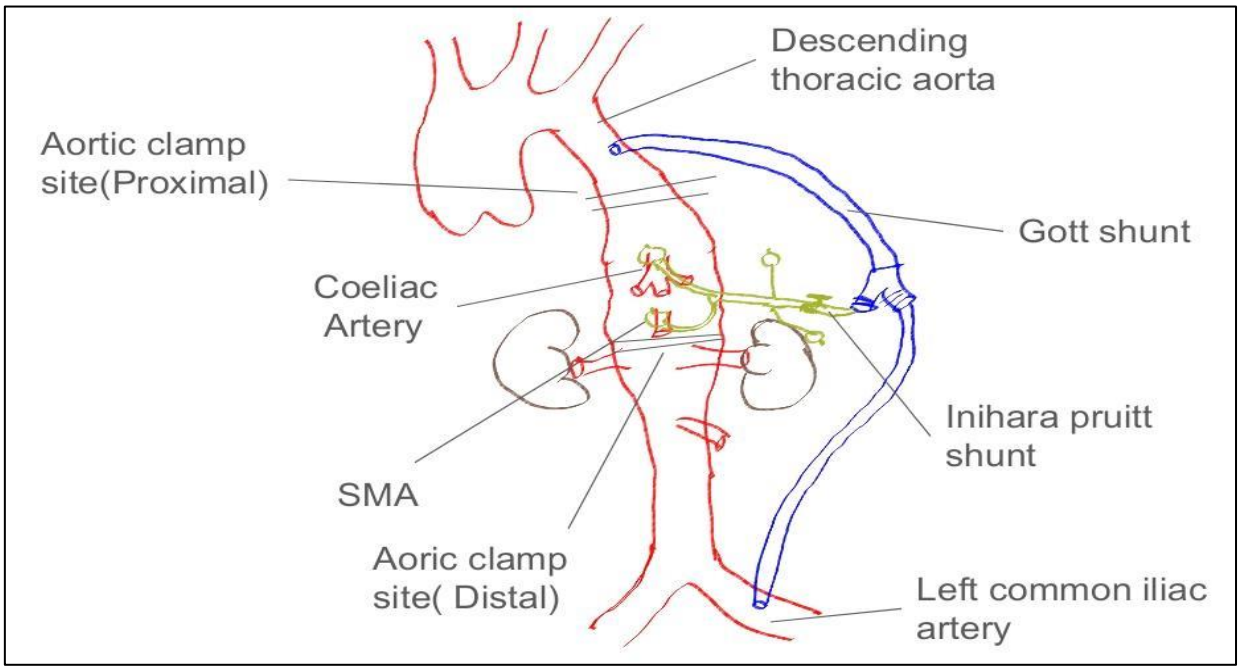

Figure 3: Line diagram depicting the procedure of passive shunt of thoracoabdominal aorta using Gott shunt and visceral perfusion using Pruitt Inahara shunt

DISCUSSION

A descending thoracic aorta aneurysm is defined as involving any portion of the thoracic aorta distal to the origin of the left subclavian artery. The surgical management involves cross-clamps insertion above and below the lesion, opening of the aneurysm and replacing the aneurysm with a graft. Distal aortic perfusion management is of paramount importance to prevent spinal cord ischemia (Innes *et al.*, 2001). Use of a 9-mm Gott shunt for distal perfusion during surgery for a descending thoracic aortic aneurysm has been successfully demonstrated by many surgeons over the past few decades and still remains an easy and effective alternative for distal aortic perfusion (Safi *et al.*, 2003).

Inihara Pruitt shunt plays an important role in providing blood flow to visceral organs during Aortic surgeries and reduces ischemic time and useful for early recovery (Walker and Peterson, 1985).

CONCLUSION

Passive aortic shunting with a 9-mm Gott shunt is a highly reliable and safe method of distal perfusion that avoids the need for systemic heparinization. The Pruitt Inahara shunt can be effectively utilized for visceral perfusion during Thoraco abdominal aneurysm surgeries thereby decreasing ischemic time. The effective usage of Gott shunt and Inihara Pruitt shunt, can prevent hazardous complications of spinal cord ischemia and postoperative paraplegia in the surgical management of aneurysms involving the descending aorta.

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