

# Hybrid Gore<sup>®</sup> Vascular Graft: A New Tool for the Hybrid Treatment of Thoraco-Abdominal Aneurysms

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**Copyright:** © 2015 Bonardelli S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. **Keywords:** Thoracoabdominal; Aneurysms; Laparotomy; Aortic

#### Introduction

The Hybrid procedure, first performed in 1999 by Quinones-Baldrich and colleagues [1], has been proposed for thoracoabdominal aneurysms (TAAA) repair as a less invasive technique than the traditional open surgery (avoiding both thoracophreno-laparotomy and aortic cross-clamping): in our Institute, the Hybrid technique has been performed since 2005 [2]. Since then, Literature showed several disadvantages: the overall duration of the procedure due to extensive dissections to prepare each visceral vessel and to make 5 to 7 anastomoses and the length of end-organ ischemia during the execution of each anastomosis (15 to 30 minutes) can cause critical rates of post-operative organ failure, morbidity and mortality [3]. Furthermore, nowadays total endovascular techniques make the Hybrid repair less attractive, but it can still be useful when you don't have enough time (at least 3-4 weeks) to develop customized endovascular prosthesis. The new Gore<sup>®</sup> Hybrid Vascular Graft (HVG) can be a useful tool because it allows performing a "sutureless anastomosis" in a few minutes, and minimizes both the ischemia time of the target organ and the overall length of the operation. Effectively, this device is an ePTFE heparin bonded vascular prosthesis which has a section reinforced with nitinol. This part is partially constrained into a tubular shape to allow for easy insertion and deployment into a vessel. Gore<sup>®</sup> HVGs Instruction for Use (IFU) presents the device as a vascular prosthesis for replacement or bypass of diseased vessels in patients suffering occlusive or aneurysmal disease, for dialysis access, and in each patient requiring vascular replacement.

### **Case Presentation**

In 2014, a 73 years old woman had undergone a substitution of the ascending aorta and aortic valve for aneurysmal disease, but she was afflicted also by type II Thoraco-Abdominal Aortic Aneurysm (TAAA), with a diameter of 55 mm. In the spring of 2015, she came to our Institution because of back pain. CT-scan showed the TAAA extended from post-isthmic region to Superior Mesenteric Artery (SMA), associated to a pre-occlusive stenosis of Celiac Trunk (CT) (Figure 1).

No cardiologic diseases were found, and the blood sample displayed only a slight anaemia, but neither renal nor hepatic insufficiency. Coagulation exams were physiological. Given the above, we decided to operate her: due to the recent sternotomy with a severe limitation of her pulmonary function, we chose the hybrid technique both to avoid thoracotomy, whilst we believed it was too dangerous to delay the operation required in order to receive a custom made endoprosthesis.



Figure 1: Preoperative Computed Tomography.



Figure 2: Stent graft inserted in renal artery.



Figure 3: Y Branch.

#### Page 2 of 3



Figure 4: End of visceral reconstruction.

Before the procedure a spinal drainage was placed. Through a midline laparotomy and transperitoneal approach, we isolated the infrarenal aorta till the origin of both Common Iliac Arteries (CIA), Celiac Trunk (CT), Superior Mesenteric Artery (SMA) and both Renal Arteries (RAs). During the selective clamping of CT (pre-occlusive stenosis site), Doppler CW Spectral Analysis directly detected on vessels showed the optimal collateral pathways coming from SMA towards Common Hepatic, Left Gastric and Splenic Arteries. Careful cholecystectomy was performed to avoid any subsequent ischemia of that "borden organ". With a 10 mm Dacron graft we built a conduit on the anterior face of the infrarenal aorta. Two Gore<sup>\*</sup> HVGs (6 mm of diameter with 5 cm of stent-graft length) were used to revascularize both RAs and SMA: after cutting the free part of the first HVG so that

the needed length of the graft could reach the right RA, using 6-0 Prolene the donor anastomosis was performed end-to-side on the right CIA. Then, the right RA was plumb sectioned at 1 cm from its origin from the aorta, and sewn medially. At once, in the lateral edge of RA the stented end of HVG was inserted for a length of 2.5 cm (the half of the stent length), the stent was released and the blood flow was restored after overall 6 minutes of ischemia. Two 6-0 prolene stitches were then sewn between the arterial and graft walls at 3 and 9 hrs position of the anastomosis to make it stable (Figure 2). With the second HVG, we packeda Y branch 'on bench', attaching the exceeding part of the graft without nitinol stent reinforcement - in respect to the distance from the left iliac artery and the left RA - to the middle part of the prosthesis with an end-to-side anastomosis (Figure 3). Just like the right ones, the donor anastomosis on the left CIA and, clamping the origin of the second branch of the Y prosthesis, the left renal sutureless anastomoses were performed with 5 minutes of kidney ischemia. Eventually, the second branch of the Y graft in a recurrent C-fashion position in the retroperitoneal space was end-to-side anastomosed to SMA. After this, Superior Mesenteric Artery and Celiac Trunk were sutured at their origin from the aorta (Figure4). Doppler CW Spectral Analysis check was optimal in all visceral vessels.

Thereafter, through the aortic conduit we arranged three overlapped Gore<sup>\*</sup> c-TAGs ( $31 \times 26 \times 150$ ,  $34 \times 34 \times 200$  and  $40 \times 40 \times 200$ ), deployed from the aorta just above the Inferior Mesenteric artery to the isthmus. Completion angiography was optimal for TEVAR and visceral reconstructions.



Figure 5: Postoperative computed tomography.

The operation ended with the removal of the aortic conduit and a transmesolic omentoplasty to cover the vascular reconstructions and separate them from duodenum and ileum, and with a multilayer wall reconstruction. The overall duration of the operation was 5 hrs. 15

min. The immediate postoperative course was uneventful, and the spinal drainage was removed after 72 hrs.

Seventy two hours after the procedure a Computed Tomography showed the exclusion of TAAA, regular patency of visceral by-passes

#### Page 3 of 3

and symmetric urine excretion (Figures 5 and 6). The patient was discharged on the 8th post-operative day without any complication. The same good results were confirmed by both clinical examinations and a new CT check at 6 months of Follow up.

## Discussion

A hybrid approach to complex aortic aneurysms that involve visceral feeding arteries seems to offer a lesser morbid technique than open surgery, avoiding thoracotomy, cross clamping of the aorta, single lung ventilation and prolonged end organ ischemia. A recent meta-analysis [3], however, shows that the hybrid technique is still associated with a considerable mortality and morbidity rate. In particular, this work revealed a 30-day mortality of 14.3%; permanent renal failure of 7%, and 21% of patients treated suffered an endoleak that required a reintervention in 5% of cases. Most of the intraoperative and subsequent life-treating complications depend on the length of the operation and the possible organ failure due to ischemic problems. Gore<sup>®</sup> HVG seems to be a significant tool to reduce both problems, because sutureless anastomoses can be rapidly deployed in vessels, especially those with an adverse anatomy, like the remote location of the right renal artery can be: in our case report we drew a real reduction of the operative time (overall 13-15 minutes for both renal anastomoses instead of 30-50 minutes on average for traditional ones).

## Conclusion

With this approach, Hybrid procedure for TAAA may continue to play a role for patients unfit for both Open surgery and total

endovascular reconstruction, especially when you don't have enough time for custom made endograft procurement. In Literature there are only small cohort studies which use Gore<sup>\*</sup> HVG but the results are encouraging [4,5]. Long term results are still lacking and need to be awaited.

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