

# Insertion of the Intraaortic Balloon Pump via the Ascending Aorta or the Aortic Arch Using the HEARTSTRING Proximal Seal System

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## ABSTRACT

**Purpose:** The HEARTSTRING Proximal Seal System is used to avoid aortic clamping to insert the intraaortic balloon pump (IABP) in the ascending aorta or the aortic arch. This technique is used when calcification or atheroma prevents side clamping of the ascending aorta or the aortic arch.

**Description:** A vein graft or a small-caliber vascular prosthesis for the later insertion of the IABP is sewn to the ascending aorta or the aortic arch using the HEARTSTRING Proximal Seal System.

**Evaluation:** In our department, this technique is applied whenever insertion of the IABP is not feasible via the femoral arteries.

**Conclusion:** The technique allows the safe insertion of the IABP via the ascending aorta or the aortic arch.

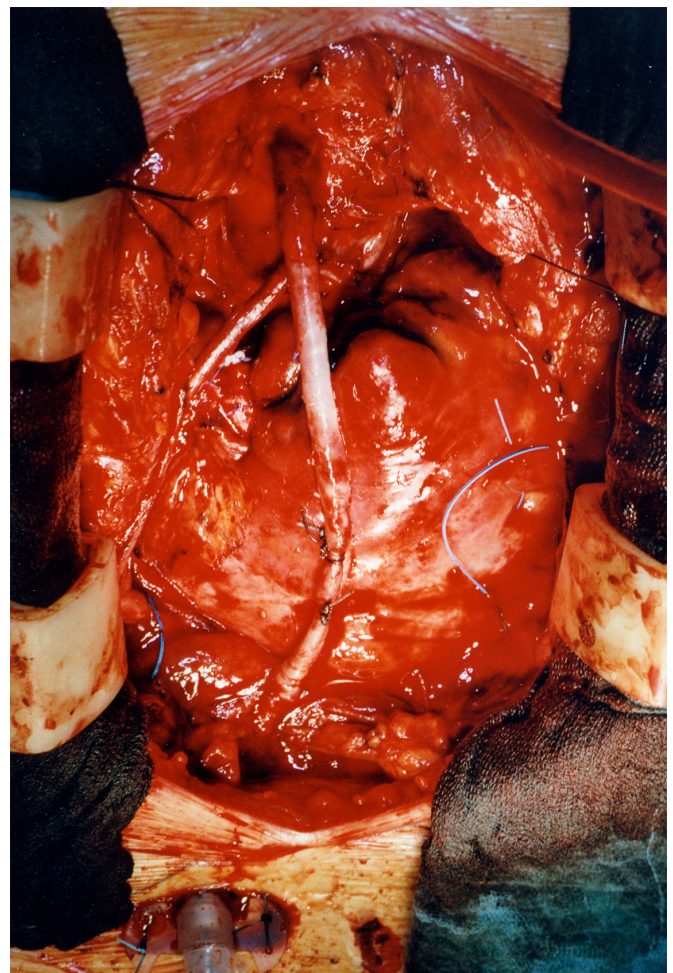
## INTRODUCTION

The HEARTSTRING Proximal Seal System (Guidant, Santa Clara, CA) was originally used as a tool to facilitate proximal anastomoses in coronary artery bypass grafting (CABG) operations by making partial aortic clamping redundant [Vicol 2005; Medalion 2004]. The system includes an aortic punch, a delivery device, and the proximal seal. The fact that there is no longer a need for aortic side clamping while performing proximal anastomoses makes the tool very interesting for surgeons, as it is known that any aortic clamping may cause embolic events [Roach 1996]. The described technique was adapted for the insertion of the intraaortic balloon pump (IABP) via the ascending aorta or the aortic arch when insertion of the device via the femoral arteries was not feasible (for example in severe peripheral artery disease).

## TECHNIQUE

In order to insert the intraaortic balloon catheter only the 4.5 mm device is used to perform a punch hole large enough for insertion of the IABP. As described previously, we used a

clear transparent plastic foil to protect the surgeon from squirting blood when using the 4.5 mm HEARTSTRING Proximal Seal System [Lamm 2009]. The following is exactly the technique described by Guidant in the product information: The left hand of the surgeon is put underneath the foil in proximity to the position of the punch hole. The punch is put through the incision and the punch hole performed in the usual technique.



Intraaortic balloon pump inserted with the HEARTSTRING Proximal Seal System at the end of a redo CABG operation. Aortic clamping was impossible due to heavy calcification. A devitalized stored allograft vein was used for the insertion of the IABP.

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After removal of the punch a finger is put on the punch hole and the punch removed through the insertion. In the next step the device gets inserted through the insertion, the finger removed, and the device inserted in the aorta. Only now does the foil get removed. In the next step either a vein remnant of at least 4 mm inner lumen diameter or a small-caliber vascular prosthesis (for example 6 mm Dacron prosthesis) is used, in which one end is shaped like a horseshoe. The shaped end is now sewn with a 5/0 Prolene running suture to the punch hole similar to a proximal vein graft anastomosis. Prior to the removal of the HEARTSTRING Proximal Seal System the free end of the prosthesis is occluded with a clamp. After removal of the HEARTSTRING Proximal Seal System, the prosthesis is deaired by opening the clamp and allowing a short flushing of blood. In the next step the IABP catheter is pushed via the prosthesis in the aorta and positioned with the distal end of the catheter just below the left subclavian artery. While inserting the catheter the prosthesis is held tight with the left hand to minimize blood loss via the free end of the prosthesis. It is recommended that the see-through plastic foil is used again when the catheter is inserted to protect the surgeon from squirting blood. When the catheter is in place the plastic foil is removed and the prosthesis is knotted tight on to the catheter with at least two independent sutures. If there is still some oozing of blood at the end of the operation a stripe of Tabotamp (Ethicon, Norderstedt, Germany) can be inserted in the prosthesis at its free end and tightly knotted between 2 additional sutures (see figure). When the patient is weaned from the IABP the balloon-catheter is removed after rethoracotomy or via closed chest-decannulation using a technique described earlier [Meldrum-Hanna 1985]. Immediately after pulling the free end of the catheter out of the aorta we place a clamp in close proximity to the anastomosis on the prosthesis and cut the prosthesis approximately 1 cm distal from the clamp. The free end of the prosthesis becomes over sewn using 4/0 Prolene sutures (Ethicon, Norderstedt, Germany).

## DISCUSSION

Insertion of the intraaortic balloon pump is often necessary for hemodynamic support. Usually the catheter is inserted via the femoral arteries and positioned in the descending aorta. By doing so, system related complications are rare. If insertion of the device via the femoral arteries is not possible the

device has to be inserted via the ascending aorta or the aortic arch. This may become difficult when there is not enough space to place a side clamp (ie after having performed the proximal anastomoses or when there is heavy calcification in the desired access area). There is, however, almost always enough space to perform a punch hole in the aorta and to apply the HEARTSTRING Proximal Seal System. The 4.6 mm System allows ample space for performing an anastomosis with either a vein remnant after an aortocoronary bypass operation or with a small-caliber vascular prosthesis. The needle of a Prolene 5/0 suture is strong enough to cut even through calcified areas and can be used easily when the proximal seal is in place. Ideally the anastomosis is placed at the beginning of the aortic arch to simplify the positioning of the catheter in the descending aorta. The position is easily controlled by transesophageal echocardiography.

In conclusion, this modification in the use of the HEARTSTRING Proximal Seal System facilitates the insertion of the IABP via the ascending aorta or the aortic arch. It is economical and very easy to perform. It should always be considered when aortic side clamping is not feasible and peripheral arteries are not accessible.

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