Introduction

Techniques for aortic root replacement with valve salvage are complex surgical procedures (1). When facing a patient with a dilated aortic root with or without aortic insufficiency but normal valve leaflet morphology, valve sparing techniques are feasible options (2-4). Management of the enlarged aortic root becomes even more complex in the setting of an acute ascending aortic dissection (5-7). Acute type A aortic dissections are often emergency operations with a high complexity (8,9). In properly selected patients with an aortic dissection, an aortic root repair with valve salvage is a viable alternative to root replacement (10,11). Valve-sparing root replacement utilizing reimplantation technique has the added benefit of stabilizing the annulus (4).

The Florida Sleeve technique for root remodeling with preservation of the aortic valve and sinuses is a well-established technique for saving the aortic valve while narrowing the annulus and sinotubular junction (12-15). Allowing the patient to keep their native aortic valve decreases the risk of bleeding issues related to mechanical valves as well as circumvents the potential need for the future re-intervention with a bioprosthetic valve (16). Additionally, the Florida Sleeve root repair technique is a particularly good option in patients who have enlarged aortic root and aberrant coronary anatomy. The ability to salvage the valve but not needing to re-implant the coronary buttons decreases the clamp time, which the importance of operative time cannot be understated in the setting of an emergency surgery.

Patient selection

The Florida Sleeve technique has been employed at our...
institution in the setting of acute type A aortic dissections with good technical success. We present a video (Video 1) of our standard Florida Sleeve root repair in a patient with slightly offset coronary arteries with an ascending aortic aneurysm of 6.0 cm and an aortic root of 5.3 cm with moderate aortic insufficiency pre-operatively. The patient is a healthy 57-year-old male that had normal trileaflet anatomy but central aortic insufficiency appearing to be related to his root dilation on pre-operative echocardiogram (Figure 1). For preserving the aortic valve in the setting of an acute aortic dissection, it is imperative that the valve leaflets be of normal morphology and the aortic insufficiency be related to the enlargement of the aortic root. If the insufficiency is related to a valve leaflet abnormality, the patient is best served with a root replacement. Familiarity with root replacement and valve preserving techniques during non-emergency setting is crucial in order to complete the procedure in an efficient manor during an aortic dissection operation.

**Pre-operation preparation/equipment**

Standard open-heart equipment should be available. Transesophageal echocardiography, central line, swan-ganz catheter, arterial line, foley catheter should be utilized. Graft conduits should be available. We typically use a 32 mm or 34 mm Dacron Gelweave™ Valsalva graft (Terumo Aortic Vascutek Ltd., Scotland, UK) for creation of the sleeve root repair in large aortic roots.

**Procedure**

**Standard central cannulation**

Patient is cannulated for cardiopulmonary bypass centrally with an aortic cannula placed in the distal ascending aorta/proximal arch and a dual stage venous cannula placed into the inferior vena cava via the right atrium. Additionally, a retrograde coronary sinus catheter via the right atrium and a left ventricular vent via the right superior pulmonary vein is placed (Figure 2). If the operation is proceeding in the setting of a dissection, confirmation of placement of the aortic cannula into the true lumen is imperative. The aorta is cross-clamped proximal to the aortic cannula. In an elective operation without an aortic dissection, antegrade cardioplegia is attempted in the setting of up to moderate aortic regurgitation, and then switched to retrograde cardioplegia after one liter of antegrade. In the setting of a dissection, typically retrograde cardioplegia is utilized to arrest the heart, followed by coronary ostial antegrade cardioplegia. Retrograde cardioplegia is given every 15–20 minutes. The patient is cooled to the desired temperature, in this case the patient was cooled to 18 degrees Celsius for deep hypothermic circulatory arrest for a hemiarch replacement.

**Inspecting the valve**

After the heart arrested the aorta is opened and the valve is visualized. Confirmation of normal valvular morphology must be made. After the leaflets are confirmed normal, the valve is inspected for coaptation to determine if root remodeling would improve the aortic insufficiency. Attention is then turned to the location of the coronary ostia. If the coronary ostia are dissected then consideration
for full root replacement will need to be made. The size of
the annulus is determined by sizing with Hegar dilators or
valve sizers and a graft is selected. For a large aortic root,
a 32–34 mm Valsalva graft is used. Smaller grafts may be
needed for smaller roots.

**Mobilization of the proximal coronary arteries**

Circumferentially the root is mobilized down to the
aortic annular level. This mobilization includes the
proximal coronary arteries. The coronary arteries are
circumferentially dissected at their insertion into the aorta.
This will allow the Dacron graft to be secured underneath
the coronary arteries later.

**Creating coronary “keyholes” in the graft**

After the proximal coronary arteries are mobilized, the
coronary ostia are identified and determination is made as
to their location in relation to the commissures. Once a
determination is made on their relation then a “keyhole” cut
it made into the Dacron Valsalva graft in a likewise position.
If the coronary ostia are closer to one of the commissures
then the “keyhole” is offset to ensure proper placement
around the proximal coronary artery.

**Securing the graft**

Three to four subannular horizontal mattress pledgeted
sutures are placed that will secure the position of the graft.
These sutures are placed below the aortic annulus and then
directed outside the aorta. These subannular sutures are
the passed through the base of the Valsalva graft. Attention
is then turned to securing the graft below the proximal
coronary arteries. Horizontal mattress sutures are placed
on one side of the base of the “keyhole”, both free sutures
passed below the coronary artery, and then driven out the
other side of the graft at the base of the “keyhole”. The
distal end of the graft is then cut down by a few centimeters
to aide in positioning.

**Positioning the graft**

The graft is then placed over the root as a sleeve. The graft
must be adequately positioned with the graft down to the
annulus and below each coronary artery. A 26-mm Hegar
dilator is placed, taking care not to injure the aortic valve,
through the annulus to prevent narrowing while tying the
sutures. The subannular sutures and coronary keyhole
sutures are tied down. The coronary arteries are assessed
for patency and potential need for lengthening the coronary
keyhole incision.

**Completing the root repair**

Commissural resuspension horizontal pledgeted sutures
are placed through the aorta a few millimeters above
the commissures and out of the graft. A felt strip is then
sutured in place by use of a running horizontal mattress
at the sinotubular junction securing the aorta to the graft
circumferentially. The commissural resuspension sutures
are tied.

**Assessing the sleeve**

The valve is the inspected for coaptation (*Figure 3*). The
aorta is cut to the level of the sinotubular junction, and
likewise the graft is cut to the level of the sinotubular
junction. The repair is completed. The graft from the
ascending aortic replacement is then sutured to the sleeve
repair with a running polypropylene suture.

**Final evaluation of root repair**

After de-airing and removal of the cross clamp, the repair
is accessed with the heart beating. Location of the proximal
coronary arteries are again inspected and confirmation is
made that there is no impingement of outflow. The valve is
assessed by transesophageal echocardiogram to determine
the new level, if any, of aortic insufficiency (*Figure 4*).
The patient is separated from cardiopulmonary bypass, decannulated, and closed per standard protocols (Figure 5).

Conclusions

When facing a patient with a dilated aortic root with aortic insufficiency, but normal valve leaflet morphology, valve-sparing root replacements can be a suitable option. With proper patient selection, an aortic root repair with valve salvage can be accomplished in the setting of an acute aortic dissection. Knowledge of and experience with the Florida Sleeve technique for valve-preservation in the setting of enlarged aortic root is important, and particularly in the application of root repair strategies during surgery for acute ascending aortic dissection.

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References


Figure 4 Transesophageal echocardiogram image showing no aortic insufficiency after completion of Florida Sleeve root repair.

Figure 5 Intraoperative image of completed Florida Sleeve root repair.

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