Con: "Debate: does every ascending aorta repair require at least an open distal anastomosis at the innominate? Or not?"

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Ascending aortic replacement is usually performed with a cross-clamp at the distal ascending aorta. This cross-clamping is one of the routine procedures in cardiac surgery, and the risk of the cross-clamping has been lowered to minimum in regular practice. Theoretically, the cross-clamp itself is a risk to apply and might lead to aortic dissection (1) or create a source of embolization in the aortic wall. However, when there is no atheroma, calcification, or other abnormal situations including aortic dissection in the aorta, the cross-clamp is applied very safely in modern cardiac surgery.

The distal anastomosis of the ascending aortic replacement is made on the aorta just proximal to the cross-clamp. In fact, the length of the replacement is actually shortened to allow for the width of the cross-clamp and seam. Although not wide, this area of the native aorta is not replaced. The region of the cross-clamp could be damaged and in the long run might lead to some new lesion at that site. Anastomosis with a graft adjacent to the cross-clamp is sometimes difficult, especially when the room allowed for the seam is minimal. On the contrary, the ascending aorta is known to be embryologically different from the aortic arch (2,3). The remnant of the diseased ascending aorta could dilate afterwards when ascending aortic replacement is undergone with a cross-clamp. Consequently, it is natural to consider that the diseased ascending aorta should be completely replaced.

The aortic return of a cardiopulmonary bypass is preferentially placed at the ascending aorta for antegrade perfusion. In itself, placement of the aortic return carries the same risk as that of the cross-clamp. Arch cannulation or peripheral cannulation, such as of the femoral and axillary arteries, requires more radical resection of the ascending aorta. The cannulation site at the ascending aorta could raise some problems including pseudoaneurysm and bleeding in the follow-up periods.

When ascending aortic replacement is performed with open proximal anastomosis, the place of the cross-clamp and the cannulation at the ascending aorta could be resected. Anastomosis is technically easy; no tension exists during anastomosis with the open proximal technique. From this point of view, open distal anastomosis can only be good for ascending aortic replacement. Two decades ago, King *et al.* reported that open distal anastomosis with hypothermic circulatory arrest does not increase the risk of ascending aortic replacement (4). However, whenever the open proximal anastomosis is utilized, body temperature needs to be lowered. Additional cerebral protection could alleviate the burden of hypothermia, but a longer pump time is mandatory to control the body temperature. In the end, open distal anastomosis cannot be considered a low-risk procedure for any patient.

Marfan syndrome (MFS) is known to come with numerous aortic complications in the patients' lifetime. Once patients with MFS have acute aortic dissection, the aorta becomes continuously dilated. Therefore, prophylactic root replacement is recommended to protect from the onset of dissection. Personally, I employ open distal anastomosis in younger patients with MFS. The site of the cross-clamp in patients with MFS could be a reason for dissection, which should be avoided at all costs. In practice, among these cases, open proximal anastomosis is not always utilized at the time of root replacement (5,6).

Two decades ago several studies shed light on the aortopathy of the ascending aorta related to the bicuspid aortic valve (BAV). The tissue pathology of BAV is not limited to the valves' leaflets, but extends from the left-

ventricular outflow tract to the ascending aorta. De Sa *et al.* reported that compared to patients with tricuspid aortic valve disease, those with BAV disease have more severe degenerative changes in the media of the ascending aorta (7). Russo *et al.* recommended the prophylactic replacement of even a seemingly normal and definitely of a mildly enlarged ascending aorta in cases of BAV when aortic valve replacement is done (8). Borger *et al.* also performed aggressive replacement of the ascending aorta in patients with BAV (9). These studies suggested prophylactic aggressive replacement of the ascending aorta due to the inherited nature of the aortopathy related to BAV. Similarly, Fazel *et al.* concluded that aortopathy with BAV usually involves the transverse arch (10). These reports mentioned cystic medial necrosis as an abnormal histopathology of BAV, which renders it close to the histopathology of MFS. When performing complete resection of the ascending aorta, open distal anastomosis is theoretically better, as previously mentioned. However, recent studies presented rebutting evidence (11-15). The inherited nature of the aorta in patients with BAV appears to be less serious than the nature of the aorta with MFS. Park *et al.* reported that progressive dilatation of the aortic arch, leading to reoperation after repair of an ascending aortic aneurysm, is uncommon in patients with a BAV (16). Additionally, aortic valve surgery could change the risk of the aortopathy in patients with BAV (17).

I think that in patients with acute aortic dissection, open proximal anastomosis is essential. Although the cross-clamp could be applied during surgery, the cross-clamp might cause new tears and increase the risk of new malperfusion (18). Lawton *et al.* reported that a strategy without cross-clamp for the treatment of acute type A aortic dissection was associated with a highly significant improvement in survival (19).

In conclusion, open distal anastomosis is not always required for every ascending aortic repair except cases of acute aortic dissection. Open distal anastomosis is an excellent strategy; however, in each case, application of this technique should depend on the balance between risk and benefit.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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