your case, the conduit might be too long or over-curved than we simulated. Or there might be some kinking in some part, so if you can get a cardiac catheterization it might give you more information why that’s possible.

Dr R. Pretre (Lausanne, Switzerland): Many of those patients also have a bilateral superior vena cava and you know that after bilateral cavo pulmonary anastomosis, the segment of the pulmonary artery in between remains hypoplastic. Does that influence your decision to complete the Fontan circulation in this anatomy? Are you not better off with a straight connection—landing in the middle of the PA—than with this long, curved tube going far away on the left side, often on the lower lobar pulmonary artery?

Dr Yoshida: Usually we put a conduit between them. I didn’t show simulation in this series about the influence of offset simulation. But, actually, if you can place the conduit on the same side of SVC, the energy loss is more there. But also that involves another issue. So if you can put a complete offset situation, this might cause some AV malformation, but that’s another story. But I wanted to show energy loss inside a Fontan conduit.

Dr B. Maruszewski (Warsaw, Poland): A little comment. I think we should differentiate between right-sided juxtaposition of the apex and the IVC and left-sided. In our experience it’s crucial. When you get the apex on the right side and an IVC on the right side, it’s usually no problem. We had three or four cases and in all of them we used the reinforced Gore-Tex tube, but actually the proximal anastomosis of the IVC with a conduit is higher than the apex.

I think the problem occurs when you have left-sided juxtaposition of the left-sided apex and the inferior vena cava. In these cases we always avoided this huge loop on the left side because of what René said, because of the risk of the compression on the pulmonary vein, and we managed to mobilize the IVC towards the right and do the right position conduit.

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Re: Total cavopulmonary connection in patients with apicocaval juxtaposition: optimal conduit route using preoperative angiogram and flow simulation

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Early and late results in cardiovascular surgery are intimately influenced by the flow dynamics of the reconstructed domains. The quality of those repairs has been greatly enhanced by major advances in cardiovascular imaging technology, such as echocardiography, computed tomography (CT) scans and magnetic resonance imaging (MRIs). More recently, mathematical modelling technologies such as computational fluid dynamics (CFD) have been used to optimize the flow dynamics of reconstructive surgery. In this issue of the journal, Yoshida et al. [1] apply those technologies to optimize the position of the conduit connecting the inferior vena cava (IVC) to the pulmonary artery while completing the total cavopulmonary connection (TCPC) in the unusual setup of apicocaval juxtaposition. The authors elegantly illustrate that the IVC index, which refers to the distance of the IVC from the spine, could be used as a guide to position the conduit ipsilateral or contralateral to the cardiac apex. If the IVC does not overlap the spine >40%, the conduit can be placed on the side of the cardiac apex. The authors have measured the IVC index on preoperative angiogram and they indicate that CT scan and/or MRI can provide additional information in this preoperative assessment.

The CFD simulations confirm that it is the loss of laminar flow produced by compression or the kinking of the conduit rather than its length that produces the greatest energy losses. The authors wisely indicate, however, that other factors such as the flow competition between the superior vena cava and the IVC returns are even more important in terms of energy losses.

Patients with apicocaval juxtaposition often have complex cardiac anomalies, such as situs inversus or isomerism. Right isomerism, which was present in 5 of their patients, is often accompanied by anomalies of the pulmonary venous return and of the hepatic veins, which may drain separately into the atrial chamber. It is for these patients that some years ago, we had suggested using an intra/extracardiac conduit that is spatulated inferiorly in order to incorporate the IVC and all the hepatic venous return in a single anastomosis. In our experience, those intra/extracardiac conduits are ipsilateral.

A similar problem can arise in patients with left isomerism with azygos continuation of the inferior vena cava and separate drainage of the hepatic veins in the atrial chamber. This article is a neat example of bespoke surgery in which preoperative simulations could be used to optimize the flow dynamics of the individual patient.

REFERENCE