What is a Modern Fontan?

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The Fontan procedure has undergone multiple modifications since its original description in 1971 [1]. However, all modifications before 1988 focused on somehow connecting the right atrial appendage to the pulmonary arteries. This forced the caval blood to take a curved path to the pulmonary arteries, with the inferior caval return following an S-shaped route and the superior caval return taking a 180° turn. Consequently, the caval return lost significant kinetic energy [2]. To improve this, another modification of Fontan was described in 1988 whereby the caval return was “streamlined” (the caval veins took a straight path to the pulmonary arteries), with significantly better kinetic energy and outcome. This was the lateral tunnel total cavopulmonary connection (lateral tunnel TCPC) [2]. Then, 2 years later, an alternative form of streamlined Fontan was described, the extracardiac conduit [3].

Streamlining the Fontan circuit was very significant and marked the transition from the classic to the modern Fontan. The description of modern Fontan seemed simple: if the caval return follows a straight path to the pulmonary arteries, it is modern; otherwise it is classic. Both lateral tunnel TCPC and extracardiac Fontans are therefore modern. The rare cases of intra-atrial tube Fontans, as may be used in the setting of isomerism, also would be considered modern because the inferior caval blood takes a straight path toward the pulmonary arteries. However, this description is incomplete.

Another important difference between classic and modern Fontans is worth noting because it may have contributed to the improvement in outcome. In modern Fontans, the coronary sinus is not included in the Fontan circuit. Rather,

it drains into the atrium, where the pressure is 7 or 8 mmHg lower than in the Fontan circuit. If the coronary sinus drains into the Fontan circuit (classic Fontan), it may subject the myocardium to the same deleterious effects of chronic venous hypertension seen in other organs (e.g., protein-losing enteropathy, hepatic and renal dysfunction, ascites).

It is interesting that, at least in my experience, cardiac dysfunction usually is a prominent component in the clinical picture of a failing classic Fontan, whereas the clinical picture of a failing modern Fontan tends to be dominated by peripheral complications (e.g., protein-losing enteropathy, renal and hepatic dysfunction) with relatively well-preserved cardiac function. Perhaps the definition of modern Fontan should consist of both criteria: streamlining and maintaining the drainage of the coronary sinus within the atrium.

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