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Discussion

Presenter: Dr Hiroto Kitahara

Unidentified Speaker 1. Thank you, Dr Kitahara for the excellent presentation and those outstanding results. We have an invited speaker, Dr Zenati:

Dr Marco Zenati *(Boston, Mass)*. I have a comment and 3 questions for you. Back in 1998, that is 24 years ago, I was sitting where you are at the podium at the Western Thoracic Surgical Association presenting one of the first series on HCR. The first invited discussant basically said, "Well, what you're really presenting here is basically a combination of 2 inferior procedures, meaning beating heart surgery and PCI." I'm not going to ask you the same question today. The first point I have is that your study spans about 8 years, and from my calculations, you have basically 17% of your isolated eligible CABG population undergoing robotic hybrid based on an annual volume of isolated CABG of about 200 per year, which are data that Dr Balky shared with me. It is clear from this that there is a great deal of patient selection going on. Pretending that we are in the heart team at your institution, can you take us through typical discussion for selection criteria for the robotic hybrid operation? Specifically, diabetes, which as you know, is where the strength of CABG lies based on the FREEDOM trial and other data.

Dr Hiroto Kitahara *(Chicago, Ill)*. So, about the risk factor as we showed, we accept the whole patient who wants to have a minimally invasive option, so that every time we have a discussion with the robotic surgeon and the interventional cardiologist, we discuss about what's the best treatment plan for them. And then we think that even with the high-risk patient with morbid obesity, octogenarian and low heart function, we're comfortable to offer sternal-sparing bypass surgery, because we know that TECAB is feasible for those patients, for example, there is no risk of sternal infection

even in patients with diabetes. But of course, sometimes anatomically, if we think there are some concerns to offer TECAB, we always discuss about the possibility to provide PCI or conventional CABG. In a hybrid setting, if the patient has a difficult lesion that is not amenable for the PCI, or the interventional cardiologist has some concerns. We attempt the PCI first and see if they can open the lesion. For example, right coronary lesion if they can open it, so that we can do TECAB after. But if they not, we just change the plan to do the conventional CABG.

Dr Zenati. In your draft manuscript, you report complete follow-up and no conversion to sternotomy, which is really amazing. And you have freedom from MACCE over 3 years median follow-up of 94%, which is excellent. However, it is a little harder to compare your results with other series because you only include cardiac deaths in the MACCE composite. So, I recalculated your MACCE using the traditional definition with all-cause mortality, and it basically is about 13.7% at slightly over 2 years, which is comparable to traditional CABG series in the modern era. I would like to encourage you to continue to follow up these patients. It will be really important to determine freedom from this MACCE over a longer term follow-up. One question is that your average procedure duration is about 5 hours from the manuscript. Is there any concern about reexpansion injury of the lung because this is requiring single lung ventilation?

Dr Kitahara. Yes, 1-vessel TECAB usually takes 2 to 3 hours, and the 2-vessel or 3-vessel TECAB takes 5 hours. When the patient has some poor lung function, we can initiate the double lung ventilation during the procedure if necessary. So, the anesthesiologist checks the blood gas and then discuss with us about how much carbon dioxide, how much oxygen saturation. So, we always check those parameters and start inflating the lung. We can control the inflation of the lung with the intrapleural carbon dioxide pressure. I think that one of the benefits of TECAB even if the procedure takes a little bit longer.

Dr Zenati. And the last question is about Dr Puskas' HYBRID trial funded by the National Institutes of Health. As you know, unfortunately, the trial was stopped early because it failed to reach the randomization goals and had difficulty recruiting additional sites to complete the study. Given your results and those of others, some are trainees of Dr Balky, do you believe there is enough momentum for renewed interest in this type of HCR approach?

Dr Kitahara. Sorry, what's the question meaning?

Dr Zenati. Is there enough momentum now for a renewed interest in hybrid revascularization given that few years ago, a major trial failed to accrue enough patients?

Dr Kitahara. Yes. We think that this procedure is beneficial for selected patients, but the problem is to make this kind of randomized trial is difficult to perform because it is very unique practice and there are some difficulties to broaden this technique to the world. But we always think that this is the best practice for the patient, and then eventually, we would have some solutions to make a good study to verify that this is a better surgical procedure compared with conventional CABG or PCI.