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Discussion

DR. J. MICHAEL HENDERSON (Cleveland, Ohio): Dr. Cameron, Dr. Copeland, Members, and Guests. I appreciate the opportunity to discuss this paper and to add some of my thoughts as to the importance of these hemodynamic changes in the shunt population.

I would like to applaud Dr. Rosemurgy for undertaking this prospective randomized control trial in which he has continued to add patients. This is an important study to answer clinical questions about the efficacy of transjugular intrahepatic portosystemic shunt (TIPS) versus surgical shunts.

I would like to break my discussion down into a couple of major points. First, let's talk about the portal flow. I think it is misleading to say we have increased portal flow with TIPS. Yes, there is increased flow in the main trunk of the portal vein, but I do not think there is increased portal flow through the sinusoids, and that is where it counts. So my first question to you, Alex, is do you have data regarding right and left branch of the portal vein? TIPS usually takes off just above the bifurcation, and in a functioning TIPS, which is decompressing portal hypertension, there is usually reversal of flow in the right and left branches of the portal vein coming back down to the TIPS and going out through the shunt. So I think we need to be careful when talking about increased flow in the portal vein.

The second issue I would like to raise is effective liver blood flow. I, again, applaud you for using low-dose galactose clearance. It has been one of my hobby horses for the last fifteen years, but the more I have used it, the more confused I have become about exactly what we are measuring.

Effective flow is a clearance method that is going to measure any blood flow going past functioning hepatic cells. It does not matter if it comes from the portal vein or the hepatic artery. These are such low doses of galactose, that, providing blood is seen by the hepatocytes, it is totally extracted at these very low concentrations.

In some of my previously published work, we have shown as the liver gets sicker, it tries to compensate by increasing effective blood flow. I think the missing component to the equation here is overall hemodynamic changes. These patients, when they get their total shunts, increase cardiac output. They become systemically hyperdynamic in an attempt to compensate for loss of portal flow to the liver.

I have asked you this question before, and I ask again if you have any cardiac output data in this population. As we look at patients with TIPS in particular and, over the years, your group of patients with partial shunts, do you have any data as to whether there are any systemic hemodynamic changes that might tie in with these effective blood flow changes that you are showing us? The only way I can put this data together is to say that your group of patients with TIPS did not show the compensation with systemic hyperdynamic changes.

Finally, I would like to raise the issue of the time scale of your observations. Hemodynamics are dynamic. You measured flow before and one week after the shunts were placed in these two groups of patients. Do you have any data at a later time frame in either of these groups of patients?

I think the changes do continue to happen. Stenosis in TIPS is a phenomenon, and I suspect that with stenosis, the effective as well as the portal flow are restored up beyond the TIPS into the hepatic parenchyma.

I think this is an important study. The clinical study is very important. The hemodynamics are very difficult to sort through. I applaud your effort to try and bring some sense to the hemodynamic changes in these two groups of patients.

Thank you very much.

DR. WILLIAM C. MEYERS (Worcester, Massachusetts): Dr. Rosemurgy and colleagues have provided some hard data that show the TIPS procedure is not all that it is said to be. I was recently on an National Institutes of Health study section for TIPS versus traditional methods to treat portal hypertension, and I was impressed by two things. Number one, there is an impressive volume of data that show the patency rate of TIPS to be about 50% at one year. And, two, TIPS has become one of the more common procedures to be performed by community arteriographers. Often, the latter are done by inexperienced radiologists for questionable indications, or they are done in patients who might benefit by a different procedure.

I congratulate the authors for these data and ask one question. Besides the short-term relief of variceal bleeding, or as a last-ditch effort, to stop bleeding, what do you now believe are the indications for TIPS?

Thank you.

DR. ALEXANDER S. ROSEMURGY, II (Closing Discussion): I would like to thank Dr. Henderson and Dr. Meyers for their

comments. I think Dr. Henderson strikes at the essence of the study: though portal vein flow does increase dramatically, the flow through the sinusoids is decreased dramatically.

Flow in the left branch of the portal vein in the patients that had TIPS is often noted to be reversed. In other words, they will have hepatopetal flow, if you will, in the right branch of the portal vein and hepatofugal flow in the left branch of the portal vein. What we see when we do a post-TIPS venogram is that the superior mesenteric vein will be injected and all the flow will race up through the TIPS. There is no opacification of the collaterals, nor any opacification of the contralateral portal vein branch. And with that, there obviously has to be a decrease in flow, portal flow, into the liver and its sinusoids.

The decrease in effective hepatic blood flow that occurs in these patients is almost equal to the amount of portal flow, suggesting all the portal flow is lost after TIPS. Portal flow after TIPS was up by almost 50%. But if you assume all portal flow is non-nutrient, then it equals the decrease in effective hepatic blood flow in these patients.

Cardiac output increases rather dramatically in patients that have had TIPS, as well as have had H-graft shunts. Though I have not hemodynamically monitored all these patients with pulmonary artery catheters, I have monitored enough of them that were sick to know that the cardiac outputs can increase

dramatically, and they can increase immediately following portal systemic connection.

We have a group of patients that we have studied long-term, but I do not have a handle on that well enough to report yet. But, hopefully, in the next year or so we will be able to begin breaking down longer-term follow-up as our patients approach being four years out from the beginning of our perspective randomized clinical trial.

I think at this time that TIPS, in our institution at least, is a bridge to transplantation. However, when placed in "healthier" cirrhotic patients, it may push patients towards transplantation. TIPS is a way to decompress a patient who has such ill health that they cannot undergo general anesthesia and an intra-abdominal operation.

An example of a patient like that might be someone who has very severe aortic stenosis with mitral regurgitation. They are just not going to be able to handle the resuscitation that goes along with a major intraabdominal operation, particularly if they have another group of patients would be those that have rather profound encephalopathy and ascites, even if they may not be a candidate for a liver transplant, just because their outcome is going to be very poor.

Again, I would like to thank the Association for the privilege of the floor. Thank you very much.