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#### DISCUSSION

DR. MICHAEL E. DEBAKEY (Houston, Texas): I am sure that you appreciate the fact that I take great pride in Stanley's presentation—greater pride than anyone else. His perseverance, his dedication, and his creative abilities have resulted in great improvement in the treatment of this highly fatal disease.

This disease is highly fatal if not treated, and even with good medical measures, which consist essentially in maintaining the blood pressure at the lowest level possible, it still has an extremely poor prognosis. Therefore, the ability to achieve a 30 or 40% survival rate of 10 or 15 years means that these patients not only live longer but most of them lead a reasonably normal life.

I would like to emphasize a few points that Stanley made about the long-term effects.

(Slide) This patient is still alive 24 years after treatment; in fact I talked with him yesterday. I heard from him about 1 year ago and had a report from his physician. He has had some cardiac problems, namely coronary disease, but he still is able to work in his garden and enjoy life reasonably well, nearly 25 years since his operation.

(Slide) This slide exemplifies one of the reasons for early failure that we did not recognize, that is, if there is any question about aortic valve incompetence and the inability to preserve that valve satisfactorily by repair, it is best to put in a valve. We did not place a valve in this patient, and you see 6 years later he required valve replacement. He is still living today, nearly 20 years after the original operation.

(Slide) This slide exemplifies one of the cases that Dr. Crawford showed, a patient who had been operated on elsewhere, but in whom all the dissected part of the aneurysm had not been removed. To some extent this is the result of concern about the coronary arteries, the ostia of the coronary arteries. Six years later an extensive aneurysm had developed involving the proximal portion that was not resected at the time it should have been even though valve replacement was done. Therefore, a second operation had to be performed, and 7 years after that operation, the patient is doing well.

(Slide) This slide exemplifies another point that Dr. Crawford made, that is, the condition will progress if one is not careful and may result in rupture of a distal aneurysm. It is therefore important that these patients be observed carefully and closely because one of the results of analysis of our experience is the fact that next to cardiac reasons, the highest incidence of late deaths was rupture of a distal aneurysm that had not been taken care of earlier. The original operation for a Type III dissection was limited to the descending thoracic aorta. Six years later, however, a large aneurysm of the entire abdominal aorta developed, and a second operation of resection and graft replacement with attachment to the previous graft was performed; the aortogram shows good function 11 years later and 17 years after the original operation.

This is also an example of Type III dissection with extension below the diaphragm in a 46-year-old woman. After resection of the dissected segment arising just below the origin of the left subclavian artery, a Dacron graft was attached proximally and then distally to the normal lumen after the false lumen was obliterated by suture closure with Teflon baffles of the inner and outer layers. The postoperative aortogram shows good function with no evidence of aneurysmal formation distally 23 years later.

(Slide) This last slide illustrates that if one can remove the entire aneurysm, as was done in this patient, the prognosis is good. This patient was operated on 28 years ago. He was 14 years old then and had a Type III dissection. You can see the technique that was used then to try to avoid ischemic changes. Fortunately, he did not have any, and he is leading a normal life now 28 years after his operation; therefore, in a certain proportion of patients, long-term survival is possible. Indeed, in an analysis of 527 cases reported several years ago, there was an overall survival rate of 57% for 5 years, 32% for 10 years, and 5% for 20 years. With the technical advances and indications that Dr. Crawford has provided, we can expect not only the mortality rate to be lower, but the number of long-term survivors to improve.

DR. FRANK C. SPENCER (New York, New York): I rise primarily to compliment Drs. Crawford and DeBakey on their spectacular accomplishments with aortic aneurysms over the last 20 years. It is a particular credit to Dr. DeBakey, for Dr. Crawford was one of his early faculty appointments, coming to Houston after finishing his residency at the Massachusetts General Hospital in Boston. Over the past several years, especially in the past 10 years, Dr. Crawford's publications have become the landmark references for complex aortic aneurysms. With thoracoabdominal aneurysms, his concepts have been particularly fundamental, lowering operative mortality rates from a range of 30-40% to 10-15%.

Just this past week in New York we admitted a patient on my service with a dissecting aneurysm with the Marfan syndrome. She had previously been operated on under emergency circumstances with a complex conduit reconstruction of the aortic root. After reviewing the aortogram (and Dr. Crawford is not acquainted with the patient yet), which shows a dissection extending down to the bifurcation of the abdominal aorta, and considering the possibilities, I said, "This is a very nice case for Dr. Crawford. I will be talking to him in San Francisco!"

In comparing our limited experiences with the extensive ones presented by Dr. Crawford, two questions arise. In the past 2 years over 40 patients have been operated on at New York University with ascending aneurysms involving the arch, 22 of whom had acute dissections. The mortality rate was about 15% in both groups, a total of six deaths. This

work was primarily done by Dr. Galloway and Dr. Colvin, with a small contribution by myself. The low mortality merits particular emphasis, primarily reflecting the safety and effectiveness of the hypothermic circulatory arrest technique. Before the introduction of this technique, which I attribute to Randy Griep with his publication in 1980, and subsequently developed by Dr. Crawford and others, an acute dissection in the ascending aorta had an operative mortality rate in the range of 50–75%.

Such patients are routinely operated on emergently, taking them to the operating room within a few hours after admission, with the expectation of a mortality rate near 10%. My first question for Dr. Crawford is whether he uses the circulatory arrest technique routinely with acute dissections or does he apply the distal clamping technique across the dissected aorta.

My second question concerns his approach with acute dissections of the descending thoracic aorta. Although we uniformly operate promptly on acute dissections of the ascending aorta, a policy Dr. Shumway at Stanford has followed for over a decade, a more selective approach is used with acute dissections of the descending thoracic aorta. If these patients are hemodynamically stable, operation is often delayed for 2 to 3 months and then performed. A few such patients have had complications during this time; therefore, at the moment we are uncertain about the best course. I wonder if Dr. Crawford's approach with acute descending dissections is a routine prompt operation or a selective approach as described?

DR. E. STANLEY CRAWFORD (Closing discussion): We wish to thank Drs. DeBakey and Spencer for discussing our paper and for the knowl-

edge that they have contributed to the understanding and treatment of aortic dissection.

Our objective in treatment of acute dissection involving the proximal aorta is complete removal of the site from which the dissection originates and the adjacent damaged aortic segments. In most cases, this involves replacement of the entire tubular segment of the ascending aorta. In a large portion of cases, proximal reconstruction of the sinus segment of the aorta including the aortic valve is also required. In other cases, particularly those in whom the site of origin is in the transverse aortic arch (10% of cases) and in those in whom brachiocephalic vessel abnormalities or adverse mural changes are present, the reconstruction is extended into the transverse aortic arch both to achieve a successful first operation and to prevent progressive dilatation later. In any case, this approach is best achieved using profound hypothermia and circulatory arrest with reconstruction being performed without use of aortic clamps. This approach has been successful in 24 (92%) of our most recent 26 patients, and long-term results up to 2 years have been excellent.

Medical treatment for acute dissection involving the descending thoracic aorta in patients without complications has been excellent in a small number of our cases. Unfortunately, most of our patients have complications including aortic dilatation, rupture, vessel obstruction, and continued pain, despite successful blood pressure control from the time of admission. Operation has therefore been necessary in the majority of the patients with this type of disease. Risk factors included need for extensive aortic replacement, rupture, advanced age, and mesenteric vessel obstruction. Regardless, 16 (84%) of the most recent 19 patients survived operation.