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A leading vascular surgeon from the Hospital of the University of Pennsylvania discusses an important study on malperfusion and rupture in complicated type B thoracic dissection.

What is different about the clinical presentations of malperfusion and rupture in type B dissections of the thoracic aorta?

Although both entities are considered complicated type B dissections, their presentations vary greatly. In malperfusion, the clinical presentation is a manifestation of the lack of perfusion to the end organ involved. Patients with visceral (superior mesenteric/celiac) malperfusion most often present with abdominal pain, although other symptoms such as nausea, vomiting, and distension can be present as well. Renal malperfusion is most often associated with increased creatinine levels, oliguria, anuria. In cases of lower extremity malperfusion, patients usually have absent pulses with symptoms of leg ischemia. Because lower extremity ischemia is easily recognized, these patients are generally quickly diagnosed with malperfusion secondary to their dissection.

In patients with rupture of the aorta, chest and back pain are most prevalent. Accompanying findings include a contained aortic leak, hemothorax, mediastinal hematoma, and hypotension. Because these findings are quite dramatic, patients are typically diagnosed and treated much sooner than patients with malperfusion. In fact, the average time to surgery in our study for a rupture patient was 0.67 days, whereas in malperfusion, it was 2 days.

Why do you believe malperfusion and rupture have previously been treated as the same entity?

Historically, we have characterized type B dissections as uncomplicated or complicated. This grouping arose from the different treatment plans. In uncomplicated type B dissections, medical management by means of blood pressure control was clearly the optimal therapy. Even in the present day of thoracic endovascular aneurysm repair (TEVAR), medical management still produces better outcomes with uncomplicated type B dissections. Complicated type B dissections, however, were associated with very high morbidity and mortality, if left untreated. Although open surgical procedures such as aortic replacement, fenestration, or extra-anatomic bypass had poor outcomes, they were still better than medical management. As a result, malperfusion and rupture were grouped together as complicated type B dissections due to their urgent need for intervention.

To what degree have previous and current treatment strategies for type B dissections been effective or problematic?

In cases of uncomplicated type B dissections, the historical treatment has borne out to be the optimal strategy, even in the current era of endovascular approaches. Regulating mean arterial pressure with various short-acting antihypertensives has, and continues to be, the treatment of choice. In complicated dissections, historical treatment plans have failed to deliver enviable results. Rupture was treated with aortic replacement/repair. This was fraught with morbidity and mortality because the acutely dissected aorta offered a very poor substrate for manipulation and reconstruction. In addition, these patients were usually in extremis and could not tolerate a large invasive operation. Treatment strategies for malperfusion were more abundant. However, aortic repair/replacement and surgical fenestration required operating on the acutely dissected aorta, as well as potentially very invasive surgery. Interventional fenestrations were long procedures that often did not achieve reperfusion of the compromised true lumen. Extra-anatomic bypasses were often limited by lack of appropriate inflow and targets. As a result, all options were suboptimal.

With the advent of TEVAR, a minimally invasive technique became available for treating patients with type B dissections. Complications associated with operating directly on the aorta became moot. Furthermore, these procedures could be done with minimal invasiveness and in an expedient manner. Ruptures could be sealed quickly, and malperfusion could be rectified by repressurizing the aortic true lumen and re-establishing anatomic flow.

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What were the goals of your study regarding these two complications of complicated type B thoracic dissections?

We wanted to raise awareness of the difference in presentation and treatment strategies for rupture and malperfusion. Although both entities have been grouped as complicated dissections, we felt that they were unique. Clinical presentations clearly differed, and physicians need to be aware of these differences. For instance, vague abdominal pain associated with a type B dissection could be a sign of visceral malperfusion. If left untreated, severe bowel ischemia/infarction could result with subsequent death. Clearly, there is still delay in recognizing malperfusion, especially of the visceral and renal types, as demonstrated by the increased time to surgery shown in our study.

The point is that chest/back pain may not be the only critical manifestation of type B dissections. Other vague, or sometimes not so vague (oliguria), findings may warrant urgent/emergent intervention.

How did your therapeutic strategies differ in patients who were being treated for malperfusion versus rupture?

We found that TEVAR was the critical initial step in treating these patients in both rupture and malperfusion. Covering the entry tear in the proximal aorta was the first crucial maneuver. Failure to do so could lead to disastrous consequences, such as continued pressurization of the false lumen and bleeding or retrograde type A dissections. In cases of rupture, complete exclusion of the ruptured aorta was subsequently required. This involved not only sealing the entry tear, but also sealing any other channels that might perfuse the false lumen and the ruptured thoracic aorta.

In terms of malperfusion, initial endograft placement sometimes, although rarely, was enough to re-establish perfusion in the true lumen and respective end organs. However, more often than not, additional endografts were needed to re-expand the true lumen. In addition, adjunctive stenting was often needed in the distal branches (superior mesenteric, renal, iliac, etc.) supplying the end organ.

In both situations, we found intravascular ultrasound (IVUS) to be absolutely critical. Only with IVUS were we able to ensure that our wires and devices were in the true lumen. Furthermore, IVUS provides a dynamic assessment of true lumen re-expansion and subsequent end-organ perfusion that is not possible with angiography. Finally, IVUS can limit the amount of contrast used, which may be important, especially in cases of renal malperfusion.

Were there significant differences in the respective success rates of these procedures?

Fortunately, success rates were excellent in both situations. Dissection-related survival was approximately 95% at 1 year for both rupture and malperfusion. In patients with malperfusion, no patients required bowel resections, and no patients lost any limbs. One patient developed permanent renal failure, but this was a patient with one kidney and a baseline creatinine greater than 2. Overall, there was a 6% incidence of paraplegia (4% rupture, 7% malperfusion). Compared to historical results for both rupture and malperfusion, TEVAR is clearly becoming the standard of care.

How have your experiences in this study affected your approach to treating type B dissection, as well as its associated complications?

We now approach all patients with type B dissections with a standard approach. Uncomplicated dissections continue to be treated expectantly with medical management. Complicated dissections are treated emergently in our operative angiography suite with endovascular techniques. It is critical to not only have immediate accessibility to various thoracic endografts but also to IVUS, a multitude of balloon-mounted, self-expanding, covered and uncovered stents and to the typical armamentarium of endovascular inventory. Successful management of these patients can be quite challenging, and we have found that a combination of experience, technique, and technological devices is key to achieving excellent results. ■