The Evolution of Medical and Surgical Management of Acute Aortic Dissection

SINCE 1761 when Morgagni described in detail the clinical course and the pathologic findings in three fatal cases of aortic dissection, the grave prognosis of this disease has been well recognized. Throughout the 19th century and the first half of the 20th century, the true incidence of aortic dissection was not realized. In his classic monograph written in 1934, Shennan was able to collect only 300 cases from the world literature over a period of 150 years. Although Shennan's report exhaustively documented the clinical and pathologic features of acute dissections and clarified the probable pathogenesis of this disease, recognition of dissection during life remained infrequent and treatment remained symptomatic.

The extremely high mortality rate of aortic dissection either untreated or with supportive medical treatment was documented in 1958 by Hirst in a review of 505 dissections reported in the English literature over a 21 year period. In this series the mortality rate was 50% at four days, 75% at two weeks and 90% after three months. Hirst's review also emphasized the protein manifestations of acute dissections, the infrequency of correct antemortem diagnosis (40%), and the increasing overall incidence of dissections to approximately one in 363 autopsies.

During the past 20 years with the routine availability of angiography, the premortem diagnosis has increased sharply and is now generally greater than 90% (unpublished data). This increased rate of correct diagnosis has led to the realization that acute aortic dissection is the most common catastrophic illness involving the aorta, occurring at a rate of at least 2,000 new cases per year in the United States. Until 1955, surgical treatment of aortic dissections had been confined to local fenestration procedures; results were poor. During the past 20 years, since DeBakey, Cooley and Creech reported their early successful experiences with surgical treatment, treatment of aortic dissection has evolved rapidly. For dissections confined to the ascending aorta, these workers employed excision and graft replacement of the proximal portion with obliteration of the false lumen distally. DeBakey initially treated dissections arising in the ascending aorta by creation of a wide re-entry passage from the false to the true lumen in the descending aorta, but abandoned this basically palliative approach after only six patients. Thereafter, obliteration of the dissecting channel proximally near its origin and distally with or without graft replacement was his procedure of choice. By 1965 this group had operated upon 179 aortic dissections with an overall mortality of 21%. One-third of these dissections were acute with a similar mortality rate, and 37 involved the ascending aorta and had a 30% mortality. On the basis of his extensive experience, DeBakey classified aortic dissections into types I, II, and III, and urged emergent surgical intervention as the treatment of choice for nearly all cases of aortic dissection. During the early 1970s, DeBakey's original classification of dissections was simplified, dividing all thoracic dissections into two groups, those involving the ascending aorta (formerly types I and II) and those originating in the descending aorta (formerly type III).

Unfortunately, most other series reported far less favorable surgical results with operative mortality rates ranging from 64 to 100% in acute dissections. Faced with these discouraging statistics, Wheat and his colleagues re-examined the natural course of progression of untreated acute aortic dissection and concluded that most acute dissections could be successfully treated with pharmacologically induced hypotension. Wheat's method involved reducing both mean systemic arterial pressure and dP/dt through the administration of trimethaphan, reserpine, and guanethidine. His goal was to convert all acute dissections into subacute or chronic dissections; then, a careful evaluation and possible elective surgical treatment of any complications that arose could be undertaken.

Other groups adopted Wheat's method, adding propranolol, methyldopa, and diuretics when needed, and their collective results in 50 patients showed a very impressive 84% one-year survival. During the latter half of the 1960s many medical centers used Wheat's method whenever possible, reserving early surgical treatment for cases with localized rupture, tamponade, or associated severe aortic insufficiency. One substantial advantage of induced hypotensive therapy was its use in community hospitals, thereby avoiding the need to transport unstable patients to cardiac surgical centers.

Even as the pendulum swung toward medical treatment of most acute dissections, the serious limitations of nonsurgical treatment were beginning to be seen and reported. The more the hypotensive therapy was employed, the lower the overall survival rate for unoperated patients fell. It became evident that blanket adoption of Wheat's method

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did not assure the remarkably high one-year survival rate he had attained.

The complications of this antihypertensive regimen included drug sensitivity and aggravation of associated renal failure. Sensitivity to the drugs in each patient may vary; trimethaphan may cause respiratory arrest and cerebral effects of reserpine are common.

Nitroprusside replaced these drugs in some series because of its effectiveness in lowering pressure and ease of control. However, some question has been raised as to its effectiveness in protecting against continued dissection despite the lowered blood pressure because of the nitroprusside's effect of increasing aortic DP/dt. We continue to feel that intravenous nitroprusside is the agent of choice for controlling the blood pressure acutely in aortic dissection in both medically and surgically treated patients. Propranolol and methyldopa are administered at the same time, and once the pressure is under control, the nitroprusside is slowly discontinued. Although lowering the blood pressure is essential, renal output must be carefully monitored and maintained at no less than 20–30 ml/hour.

With the exponential increase in the volume of cardiac surgery in the United States, there have been rapid advances in cardiovascular surgical techniques and technology. Improved cardiopulmonary bypass methods and equipment, closer monitoring of heparin therapy, better blood-banking, newer prosthetic and suture materials, and especially refinements in surgical technique combined to improve the operative results for acute dissections. Similar improvements in anesthetic management, intensive care unit techniques, and the expertise in controlled hypotensive therapy gained during application of Wheat's method led to smoother postoperative courses and greatly improved overall surgical survival rates.

Once the short-term survival following acute dissections had reached 65–70%, long-term survival began to be considered more carefully in selection of the appropriate treatment regimen. Patients treated successfully with drug therapy develop late complications including sacular aneurysms or progressive aortic valve insufficiency. These complications require cardiac surgery, and even elective cardiac surgery has a relatively high mortality in such a group of patients. There was a definite reluctance to subject these patients to the risks of elective cardiac surgery once they had survived the early post-dissection period with only drug treatment. However, without operation, the late mortality is significant in this group of patients. Therefore, recognition of specific contraindications to medical treatment of acute dissections, especially dissection involving the ascending aorta, and appreciation of improving capabilities for treating dissections surgically, led to a new philosophy of management. Presently, we believe controlled hypotensive therapy should be reserved for uncomplicated dissections of the descending aorta, while immediate surgery should be advocated for nearly all dissections involving the ascending aorta.

Recent reports indicate late mortality rates following successful surgical treatment of acute dissection of the ascending aorta are less than 15% at 4–5 years. During the same time period, the operative mortality for acute dissection of the descending aorta has continued to fall to less than 25%. More significant, however, is the survival at 36 months, which including the operative mortality, was 60% in the surgical group and 30% in the medical group. A general consensus concerning the principles of management of acute dissections has evolved from the collective experiences of the past 20 years. The initial 0–4 hours after presentation should be devoted to stabilization of the patient, utilizing the Wheat treatment with antihypertensive and negative inotropic agents during aortography. During this period, all necessary preparations for operation can be completed. Nearly all cases involving the ascending aorta should be taken directly to the operating room after stabilization. The only exceptions to this policy are those patients who have deteriorated to such an extent as to be inoperable on the basis of well-established multisystem failure, extremely advanced age (> 80), or unrelated terminal illness. Hospitals lacking the facilities to manage these problems medically and surgically should have arrangements with centers performing open-heart surgery so that the patient can be transferred promptly.

Dissections confined to the descending aorta can be monitored carefully in an intensive care unit. Indications for immediate operative intervention in these patients are failure to control hypertension, continued pain, expanding aneurysm or rupture, development of neurological deficit or evidence of compromise of a major subdiaphragmatic branch of the aorta. In the absence of one of these indications, operation can be postponed. With the passage of time, the edema around the aorta clears and the developing fibrosis transforms the initially friable aorta into less fragile tissue. Approximately one-third of this group of patients eventually require surgery, usually for an enlarging aneurysm. Delayed operation on dissections of the descending aorta, when necessary, have a very low mortality rate.

Management postoperatively and during prolonged drug treatment alone is similar. The cornerstone of treatment is stringent control of blood pressure to protect suture lines and the diseased native aorta. Careful attention to pulmonary toilet and gradually progressive ambulation as well as very careful monitoring of renal function are crucial. Later in the hospital and after discharge, close follow-up of each patient and his blood pressure is essential to satisfactory long-term results.

Unfortunately, recognition of aortic dissection and early diagnosis remains a significant problem. Prompt recognition should permit salvage of 65–75% of all acute dissections for a period of two to four years. In view of the many associated cardiovascular diseases these patients are often subject to, such a survival rate is a remarkable achievement.

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References


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