

# **STROKE**

**VOLUME 2**

**Pathophysiology, Diagnosis, and Management**

Edited by

**HENRY J. M. BARNETT, O.C. BENNETT M. STEIN, M.D.**

**J. P. MOHR, M.D.**

**FRANK M. YATSU, M.D.**

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## Pathophysiology, Diagnosis, and Management

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Accurate indications, adverse reactions, and dosage schedules for drugs are provided in this book, but it is possible that they may change. The reader is urged to review the package information data of the manufacturers of the medications mentioned.

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# Preface

Over the past decade there has been a rapid explosion of the advancing diagnostic and research technologies on stroke and a burgeoning interest in interventional therapies which have reduced the occurrence and severity of stroke. As we elbow our way past failed treatments and abandon therapeutic nihilism, we in the field are optimistic that the unfolding investigations on stroke pathophysiology and treatment will result in a better outlook for various stroke syndromes.

These exciting advances in treatment and the absence of an encyclopedic work on the subject convinced the editors to put together a comprehensive work on stroke. *Stroke: Pathophysiology, Diagnosis, and Management* is broad in scope and detailed in presentation and is intended to address the needs of the internist, surgeon, neurological practitioner, and students of these disciplines. The book provides current information on stroke pathophysiology, diagnosis, and therapy in a single reference. The reader is not spared technical details but is introduced to these details in understandable terms presented in a readable style. Each of the five major sections—pathophysiology, diagnosis, clinical manifestations, medical therapy, and surgical therapy—is self-contained, although a certain degree of arbitrary separation of topics has been necessary to minimize redundancy.

We have organized the book to provide practical and ready access to the conventional approaches to stroke syndromes, but have also examined viable future options in stroke therapy and prevention. More importantly, we hope we have conveyed a sense of the excitement of stroke research, the enthusiasm for which is fueled by the certain knowledge that stroke occurrences can be further curtailed to an irreducible minimum.

*Henry J.M. Barnett, M.D.*

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### EPIDEMIOLOGY

Rupture of an intracranial saccular aneurysm is the most common cause of subarachnoid hemorrhage, far exceeding that of intracranial arterial mycotic or myxomatous aneurysmal rupture or even subarachnoid hemorrhage from rupture of an arteriovenous malformation. Estimates based on the most recent Cooperative Study data indicate that 80 percent of nontraumatic subarachnoid hemorrhage is a result of aneurysmal rupture.<sup>158</sup> The rupture of an intracranial aneurysm may also cause bleeding into the brain substance, the ventricular system, or the subdural space.<sup>16,67,110,118,131,144,164,208</sup>

In the United States, the peak age for aneurysm rupture is between 55 and 60 years of age.<sup>159</sup> In children and adolescents intracranial aneurysms are rare, even at routine postmortem examination. They increase in frequency to reach their highest incidence in persons between the ages of 35 and 65. When subarachnoid hemorrhage occurs in children, bleeding from an arteriovenous malformation is usually the underlying cause. Beyond the age of 20, hemorrhage is more likely to be the result of aneurysmal rupture (Fig. 31-1).

Subarachnoid hemorrhage from both arteriovenous malformations and aneurysms occurs in association with pregnancy, but aneurysms predominate. Rupture of an intracranial aneurysm is reported to be an etiologic factor in 12 to 25 percent of maternal deaths, and in one series, aneurys-

mal subarachnoid hemorrhage contributed to 80 percent of maternal mortality.<sup>89</sup> If the condition of the patient permits, surgical management of the aneurysm during pregnancy is the most appropriate form of therapy. While abortion and prophylactic cesarean section have been recommended for the management of patients with known aneurysms, normal vaginal delivery appears to be equally safe and effective.<sup>154</sup>

While autopsy studies estimate that as much as 5 percent of the population may harbor aneurysms,<sup>32,35,88,182,194</sup> the frequency of ruptured aneurysms has been noted to be as low as 3.9 per 100,000/year,<sup>140</sup> a median value being 11 per 100,000/year,<sup>145</sup> to as high as 19.4 per 100,000/year.<sup>59</sup> In the most recent report by the Cooperative Study Group (1981), Sahs et al. estimated the incidence of aneurysmal subarachnoid hemorrhage in the United States at 26,000 cases per year.<sup>158</sup> This is higher than the 20,000 figure cited by Sypert in 1978, who indicated that there were an estimated 400,000 adults in the U.S. harboring unruptured cerebral aneurysms, and that every year 5 percent of these people undergo a major neurological catastrophe.<sup>189</sup> Of all strokes entered in the Harvard Cooperative Stroke Registry between 1972 and 1976, subarachnoid hemorrhage from ruptured saccular aneurysm accounted for 6 percent.<sup>119</sup>

The true incidence of intracranial aneurysms is difficult to ascertain. One aspect of this problem is the lack of agreement about the size at which an arterial defect should be designated as an aneu-