CHAPTER I

INTRODUCTION

Cerebrovascular disease, after heart disease and cancer, is the third commonest cause of death in the United States. Every year there are 85,000 or more fatalities from this cause in US alone; in addition about 1 million persons survive strokes, but are left disabled. Interestingly, from the hospital based studies, the incidence has been falling for the past 30 to 35 years. In Rochester, Minnesota, a reduction of 54 percent in cerebral infarction and hemorrhage from the period 1975-1979 to the period 1945-1949 and it was reported a 20 percent decline in the United States between 1968 and 1976. Both sexes shared the reduced incidence. The reduction in the incidence of stroke is related to the improved control of hypertension (Adams and Victor, 1989). A community survey suggested that primary intracerebral hemorrhage (ICH) accounts for about 12 percent of the cerebrovascular diseases (Kurtzke and Kurland, 1984). Although more than a dozen causes of ICH are listed in table 1, primary or hypertensive (spontaneous) ICH, ruptured saccular aneurysm, vascular malformations and hemorrhage associated with bleeding disorders account for most of the hemorrhages that present as a stroke. Duret hemorrhages, hypertensive encephalopathy and brain purpura will not simulate a stroke and are included for the sake of completeness (Adams and Victor, 1989).

Primary(hypertensive) ICH: this is a common, well-known "spontaneous" brain hemorrhage. Although it occurs rarely with levels of blood pressure within the normal range and sometimes with levels of only 150/90 to 170/90, in most cases the levels are much higher. Hypertensive hemorrhage occurs within brain tissue. Rupture of arteries lying in the subarachnoid space is practically unknown, apart from aneurysms. The blood extravasation forms a roughly circular or oval mass that disrupts the tissue and grows in volume as the bleeding continues. Adjacent brain tissue is displaced and compressed. If the hemorrhage is large, midline structures are displaced to the opposite side and vital centers are compromised, leading to coma and death. Rupture or seepage of blood into the ventricular system usually occurs, and the cerebrospinal fluid (CSF) becomes bloody in more than 90 percent of cases.

A hemorrhage of this type almost never ruptures through the cerebral cortex, the blood reaching the subarachnoid space is via the ventricular system. When the hemorrhage is small and located at a distance from the ventricles, the CSF may remain clear even on repeated examinations. And one can see in unenhanced CT scans that the blood clot is remote from the ventricles and cisterns of the subarachnoid space.

Hemorrhage may be described as massive, small, slit or petechial. Massive refers to hemorrhages several centimeters in diameter; small applies to those 1 to 2 cm in diameters. Slit refers to a hypertensive hemorrhage that lies subcortically at the junction of white and gray matter.

CAUSES OF INTRACEREBRAL HEMORRHAGE (INCLUDING INTRACEREBRAL HEMORRHAGE, SUBARACHNOID, VENTRICULAR AND SUBDURAL TYPES)

a. Primary (hypertensive) ICH.

b. Ruptured saccular aneurysm.

c. Ruptured arteriovenous malformation (AVM).

d. Undetermined cause (normal blood pressure, no aneurysm or AVM).

e. Trauma including posttraumatic delayed apoplexy.

f. Hemorrhagic disorders: leukemia, aplastic anemia, thrombocytopenic purpura, liver disease, complication of anticoagulant therapy, hyperfibrinolysis, hypofibrinogenemia, hemophilia, Christmas disease, etc.

g. Hemorrhage into primary and secondary brain tumors.

h. Septic embolism, mycotic aneurysm.

i. Hemorrhage into infarction, arterial or venous.

j. With inflammatory diseases of arteries and veins.

k. Cerebral amyloid angiopathy.

l. Miscellaneous rare types: after vasopressor drugs, upon exertion, during arteriography, during painful urologic examination, as a late complication of early-life carotid occlusion, complication of carotid-cavernous AV fistula, with anoxemia, migraine, teratomatous malformation, herpes simplex encephalitis and acute necrotizing hemorrhagic encephalopathy (which may be associated with up to 2000 red blood cells or more per cubic millimeter in the CSF), tularemia, anthrax, and pseudomonas meningitis and snake venom poisoning.

TABLE 1.1

In order of frequency, the most common sites of hypertensive hemorrhage are (1) the putamen and adjacent internal capsule (50 % of cases), (2) various parts of the central white matter of the temporal, parietal, or frontal lobes (lobar hemorrhages) sometimes extending from the putamen, (3) thalamus, (4) cerebellar hemisphere, and (5) pons (Adams and Victor, 1989) (TABLE 1.2). The majority of cases of ICH occurs in the supratentorial compartment, mostly involving the deep structures of the cerebral hemispheres, the basal ganglia and the thalamus (Kase and Mohr, 1986).

DISTRIBUTION BY SITE OF 100 CASES OF ICH AT THE UNIVERSITY OF SOUTH ALABAMA MEDICAL CENTER

TYPE		NUMBER OF CASES
Putaminal		34
Lobar		24
Thalamic		20
Cerebellar		7
Pontine		6
Miscellaneous:	Caudate	5
	Putaminothalamic	4

TABLE 1.2

Deep hemisphere hemorrhage typically produces a contralateral hemiparesis. Aphasia can occur in cases of hemorrhage into the thalamus of the dominant hemisphere. The presence of oculomotor findings such as forced downward or upward gaze palsy, unreacctive miotic pupils, and convergence paralysis are characteristic of thalamic hemorrhage.

The clinical features of brain hemorrhage vary depending on the location and severity of the bleeding. The process is usually acute, frequently with severe headache and a decreased level of consciousness. Usually, the blood pressure is elevated at the time of the initial examination, even if there was no preexisting hypertension. Patients with lobar hemorrhage into the cortex or subcortical white matter less frequently have a history of hypertension than those with deep hemorrhage. In elderly persons, amyloid angiopathy is a common cause of lobar hemorrhage. Headache is a common feature, disturbance of the level of consciousness also occur less often and is seen later in the clinical course. The neurologic deficits are more variable in lobar hemorrhage than deep hemorrhage and depend upon the location and size of the hematoma.

Hypertension, especially uncontrolled hypertension, is the leading condition associated with brain hemorrhage. Other predisposing conditions include ruptured aneurysm, arteriovenous malformation (AVM), cavernous angioma, drug abuse with cocaine, amphetamines or alcohol, blood dyscrasia, anticoagulant therapy, amyloid angiopathy, and brain tumor.

The natural history of ICH is influenced by the site, size, and cause of the hemorrhage. The majority of hemorrhages occur in the cerebral hemispheres. Putaminal hemorrhage has a reported mortality of 37 percent, thalamic hemorrhage a mortality of 50 percent, and lobar hemorrhages into the frontal, temporal, and occipital regions have a mortality of about 46 percent (Berraquer-Bordas et al., 1981; Brennan and Bergland, 1977; Ojemann and Heros, 1983; Ojemann and Mohr, 1976; Wega and Yamamoto, 1983). The reported mortality rates of ICH has declined because, with the routine use of the CT scan, many small hemorrhages have been detected that tend to have a much more benign course and outcome.

The size of the hemorrhage has a marked influence on the mortality. For a putaminal or striatal area hemorrhage, with a hematoma with a diameter of 3 cm or more, the mortality rate may reaches 100 percent. For a small hemorrhage, survival is more likely. A thalamic hemorrhage that is over 2 to 3 cm in diameter has a mortality of about 100 percent. For those of smaller size, the mortality are considerably lower, about 20 percent.

The prcgnosis of ICH is also related to the level of consciousness. For a striate area hemorrhage, the mortality for patients who are alert is less than 10 percent, for those who are stuporous or drowsy, the mortality is 10 to 30 percent, and for those who are in coma the mortality is 75 to 100 percent (Kanako et al., 1983). For patients with thalamic hemorrhage who are stuporous or in coma, the mortality can reach 80 - 90 percent (Kwak et al., 1983). And for patients who are alert or drowsy the mortality is reported to be 10 - 30 percent (Kwak et al.,1983).

Primary ICH most commonly occurs in the 5^{th} and 6^{th} decades, and the mortality increases with increasing age. The older the patients at the time of ICH, the higher their mortality. It occurs with about equal frequency in males and females.

There is a distinct racial preponderance for primary ICH. In the United States, it is consistently more common in blacks than in white (Furland et al., 1979).

In Thailand, Public Health Statistics show that the incidence of stroke has been increasing. The mortality rate from cerebrovascular disease (CVD) was 3.7/100,000 in 1950, rising to 6.7/100,000 in 1970, and to 11.8/100,000 in 1983. In 1984, there were 9,414 cases of CVD admitted to hospitals in Thailand. The incidence of CVD increased from 12.7/100,000 in 1981 to 18.7/100,000 in 1984. Since 1957, the mortality rate has been steadily increasing from around 1/100,000 to 6/10,000. In a survey taken in 1983 of a medium-size community in Bangkok, it was found that the prevalence of CVD was 6.9/1,000. The same Public Health Statistics also showed that the rate of immediate death after stroke (which is defined as death within 4 weeks after the onset) from nonembolic cerebral infarction, embolic cerebral infarction, and cerebral hemorrhage was reported to be 19.5, 37, and 85 percent respectively (Viriyavejakul, 1990). The prognostic factors of death in ICH under different conditions including age, level of consciousness, site of bleeding, hematoma size, ventricular hemorrhage and hyperglycemia, are reviewed by Kier (Kier, 1992).

Information about the prognosis is useful for the following reasons:

1. Patients and relatives need information to plan their lives;

2. To permit triage of patients with different prognosis, thus allowing rationing of resources and balanced comparisons in treatment trials;

3. To identify those patients with a critical state but who may benefit from special efforts;

4. To find predictors of poor prognosis that may be amenable to change, and thus possibly improve prognosis and outcome (Ebrahim, 1990).

There are at least two or three studies that found no difference in the mortality rates among surgical and medical interventions in ICH (McKissock et al., 1961; Lussenhop et al., 1967; Pallas and Alliez, 1973). However, there is still controversy in the alternative of medical or surgical treatment of patients with supratentorial ICH not only among internists but also neurologists and neurosurgeons . Some clinicians use level of consciousness as a criteria, some others use the size of the hematoma or the site of the lesion as criteria for surgery. Combinations of variables that predict survival and death more accurately have been sought. Any combination of unconsciousness, gaze paresis, or dense hemiplegia was said to be a better than predictor of early death in a series of patients with clinically diagnosed cerebral thrombosis (Kier et al., 1992). So we aimed to create the prognostic model that would combine multiple predictors by using a multiple logistic regression to predict the death in hospital of those patients with spontaneous supratentorial ICH . This would provide the clinicians with a tool to assess the patient's prognosis and allow of proper management.