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A retrospective study of spontaneous intracranial hemorrhage

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ABSTRACT

Spontaneous intracerebral hemorrhage (SICH) is a serious disease despite progressing medical knowledge. SICH appears suddenly without warning, unlike ischemic strokes that are often preceded by a transient ischemic attack. Outcome is determined by the initial severity of the bleeding; mortality and morbidity of SICH are high. The aim of this study was to describe the characteristics of type, location, and outcome of SICH. A retrospective review was conducted on the records of 2042 cases admitted to a private hospital in Karawaci, Tangerang, between 1 January 1996 to 31 December 2008. Analysis was done on type, location, and the final outcome measures by the Glasgow Outcome Scale (GOS). The results of the study showed that the most prevalent type of SICH was hypertensive stroke, amounting to 1698 cases (83.1%), and the least commonly encountered type was dural fistula totaling 5 cases (0.3%). SICH due to hypertensive stroke frequently occurred in the basal ganglia (50.8%) comprising the putamen, caudate nucleus and globus pallidus. On average, the outcome at the time of dismissal was good, where 105 cases (88.2%) were GOS 4 and 5. SICH requires prompt and appropriate management. Therefore the signs and symptoms of intracranial hemorrhage should be promptly recognized and followed by appropriate ancillary examinations in order to promptly determine the management required, including possible surgical interventions.

Keywords : Spontaneous intracranial hemorrhage, hypertensive stroke, arteriovenous malformations, prognosis

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INTRODUCTION

Intracranial bleeding is a serious clinical event because of the high rates of fatality and disability that it causes. Spontaneous intracranial hemorrhage (SICH) is an acute hemorrhage occurring in the cerebral parenchyma, that may spread into the cerebral ventricles or even into the subarachnoid space on rare occasions. This type of hemorrhage accounts for 10-15% of all attacks of stroke and has a higher mortality than ischemic stroke. It occurs mainly during

exertion, due to increased blood flow to the brains. Spontaneous intracerebral hemorrhage (SICH) must be considered separately from post-traumatic cerebral hemorrhage (TCH), in particular extra- or epidural hematoma, subdural hematoma (SDH), subarachnoid hemorrhage (SAH) and cerebral contusion. As the clinical presentation of ischemic atherosclerotic events is similar, the differential diagnosis relies on imaging techniques such as computerized tomography (CT) and nuclear magnetic resonance (NMR). The rate of SICH is about 0.1-0.2 cases/1,000 population/year in the United States, with a trend for progressive increase correlated to the aging of the population.[1] SICH represents about 15% of stroke cases. Cerebral hemorrhages (CH) can be divided into four major categories: (i) capsular or typical, (ii) intracerebral or atypical, localized in the frontal lobe or at the level of the parieto-temporal carrefour, (iii) cerebro-meningeal hemorrhage with blood leakage in the ventricular or subarachnoid space, and (iv) small cerebellar, thalamic, pontine or bulbar bleeding.[2] SICH can be divided into primary and secondary events. Primary SICH accounts for about 80% of cases and is mainly due to spontaneous rupture of a small vessel wall already damaged by arterial hypertension or amyloid angiopathy.[2] Secondary SICH is due to disruption of congenital arteriovenous fistulas or aneurysms, neoplasia, or inherited or acquired (iatrogenic) coagulation disorders. Risk factors for primary SICH are arterial hypertension, alcohol abuse, heavy meals, emotional stress, physical exertion, prolonged exposure to sun, and pregnancy. Genetic risk factors such as the mutation for the α subunit of factor XIII or lipoprotein E polymorphisms are under study.

One of the main and most frequent causes of SICH is hypertension, both acute and chronic, with degenerative changes in the cerebral vessel wall.[1,5] Cerebral Amyloid Angiopathy (CAA) is also one of the main causes of SICH and the most frequent cause of lobar hemorrhage in the elderly.[4] The second most frequent cause of SICH is blood vessel pathology,[4-5] such as cerebral aneurysms, AVMs, cavernomas, and angiographically occult vascular malformations (AOVMs), eg. dural arteriovenous fistulas and venous malformations.[2,3] Coagulation disorders, including patients on previous anticoagulation therapy, thrombolytic therapy, leukemia, thrombocytopenia, also play a role in the development of SICH. Patients with abnormal liver functions are also at high risk of suffering from SICH, because the liver plays a role in the production of coagulation factors and fibrinogen.[6]

The incidence of intracranial hemorrhage increases significantly at ages over 55 years, and there will be a twofold rise in the risk for each additional decade up to the age of 80 years. Above 80 years, the risk will increase 25-fold and more males than females are affected.[5] In the United States, Afro-Americans have a higher risk compared with Caucasians. The prevalence of hemorrhagic stroke ranges from 17.2% in Malaysia to 39% in Surabaya, Indonesia.[7] The aim of this study was to describe the characteristics of type, location, and outcome of the SICH.

METHODS

Subjects and design

This study was designed as a retrospective review of case records. Medical records of all patients with SICH admitted to the neurology department of a private hospital in Karawaci, Tangerang between 1 January 1996 to 31 December 2008 were screened.

Data collection and grading system

For each record, data were extracted concerning the patient's age, chronic medical conditions and concurrent medications. Relevant demographic, clinical, laboratory, and functional outcome data were collected during the study. Physical and neurological findings upon admission were noted. Computed tomography (CT) of the brain was performed upon admission for all patients. Cephalic CT scan is the initial examination of choice that may be performed rapidly and is capable of producing a hyperdense image of blood in the brain parenchyma immediately after the occurrence of hemorrhage. The CT scan can accurately identify small hemorrhages, even those only a few millimeters in diameter. CT angiography (CTA) and magnetic resonance angiography are performed in patients with SICH due to cerebral aneurysm. Surgical criteria were established according to the algorithm of decision in force at the author's institution, based on the recommendations of the Stroke Council of the American Heart Association.[8] The most commonly used classification of the severity of SICH is that according to Hunt and Hess, where the differentiation is based on the clinical symptoms, and the classification of the International Cooperative Study, which is based on the Glasgow Outcome Scale (GOS). There is also a classification based on the presence of neurological deficits.

The classification of Hunt and Hess is as follows: (i) grade I, patient is asymptomatic, with mild headache, and mild nuchal rigidity, (ii) grade II, patient has paresis of the cranial nerves, moderate to severe headache, and nuchal rigidity, (iii) grade III, patient has mild focal deficits, is lethargic or confused, (iv) grade IV, patient is stuporous, with moderate to severe hemiparesis, and early decerebration, and (v) grade V, patient is in coma, has decerebrate posture, and is moribund. The grade must incremented by one if there is serious systemic disease, such as hypertension and diabetes mellitus.[9] All cases presenting with intracerebral hemorrhage required prompt surgical intervention, whilst the remaining patients underwent elective surgery, among them 6 cases who were first given embolization, followed by excision. At the time of dismissal, the patients were assessed on functional outcome, using the Glasgow Outcome Scale (GOS). Based on previous literature, GOS = 1–3 was considered as unfavorable outcome and GOS = 4–5 as favorable outcome, thus distinguishing whether or not patients were able to live independently.[10,11] All clinical ratings were performed by trained staff and neurologists, who were unaware of the SICH results.

Statistical analysis

A univariate analysis was used to describe the type, location and outcome of the SICH.

RESULTS

A total of 2042 cases were collected at a private hospital in Karawaci, Tangerang, from 1996 to 2008, where the most prevalent type of hemorrhage was hypertensive stroke (1698 cases or 83.1%), and the least common was hemorrhage due to dural fistula (5 cases or 0.3%). (Table 1)

Table 1. Total number of cases of SICH at a private hospital from 1996 to 2008

Type of hemorrhage	n (%)
Hypertensive stroke	1698 (83.1)
Cerebral aneurysm	220 (10.8)
AVMs*	119 (5.8)
Dural Fistula	5 (0.3)
Total	2042

*AVMs: arteriovenous malformations

Table 2. Location of SICH due to hypertensive stroke in 1698 cases at a private hospital in Karawaci, Tangerang (1996-2008)

Location of SICH	n (%)
Basal ganglia	897 (52.8)
Internal capsule	330 (19.4)
Thalamus	315 (18.6)
Brain stem (pons)	77 (4.5)
Cerebellum	79 (4.7)

SICH due to hypertensive stroke frequently occurs in the basal ganglia (50%) comprising the putamen, caudate nucleus and globus pallidus. Next in order of frequency are hemorrhages in the internal capsule (19.4%), thalamus (8.6%), cerebellum (4.7%) and brain stem (4.5%) [particularly the pons] (Table 2).

Among the patients with cerebral aneurysm (76.8%) were in their productive years (below 50 years of age). The majority of the aneurysms were of moderate size (41.5%), followed by large (37.8%) and small (11%) aneurysms. The most common site of the aneurysms in this series was in the posterior communicating artery with a total of 82 cases (37.3%), followed by the anterior communicating artery with 77 cases (35%). The number of deaths in this series of observations was as high as 5% (11 cases), among which 4.1% (9/220) had a Hunt and Hess grade IV and V on admission. Average length of stay was 2-3 weeks.

Among 119 cases of SICH due to AVMs, 62 (52.1%) were males and 57 (47,9%) were females, with a mean age of 28.9 years (range: 12-59 years). Two of the patients were pregnant women, with gestational age of 6 and 9 weeks, respectively. Most cases (50%) presented with hemorrhage requiring immediate surgery, 36 cases (30%) complained of seizures, and the remaining 24 cases (20%) had progressive headache.

On average in the present study, the outcome at the time of dismissal was good, where 195 cases (88.2%) were Glasgow Outcome Scale (GOS) 4 and 5. All had previously been grade 1, 2 and 3, including the two pregnant women. Seven patients (5.8%) with grade 4 suffered from hemiparesis and required supportive care. At follow-up in the outpatient clinic, these patients showed improvement and were still under physiotherapy. Three patients (2.5%) with grade 5 and a large hematoma in the basal ganglia remained in the vegetative state and on follow-up CT scan showed extensive infarction. Three patients with GOS grade 4 died of operative complications in the form of air embolism (2.5%).

A CT scan of a patient with SICH is shown in Figure 1. In patients with cerebral aneurysm CTA and MRA was performed (Figure 2).

Figure 3 shows the results of CT scan and CTA in a patient with cerebral aneurysm. In patients with AVMs, CTA was also performed (Figure 4).

Figure 1. CT scan showing intracerebral hemorrhage extending intraventricularly

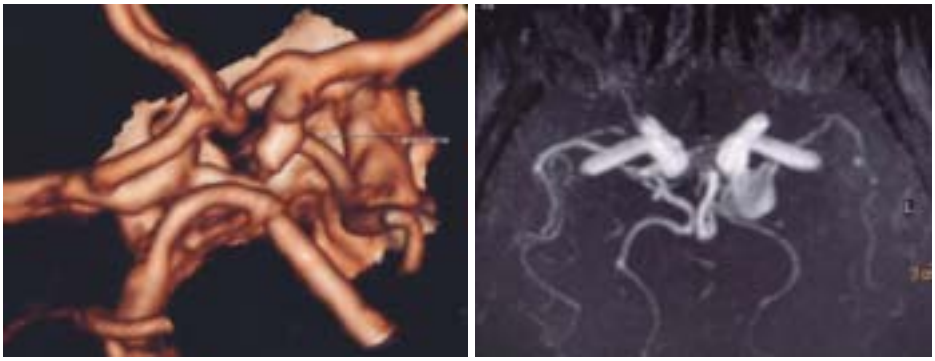

Figure 2. CTA and MRA of a cerebral aneurysm

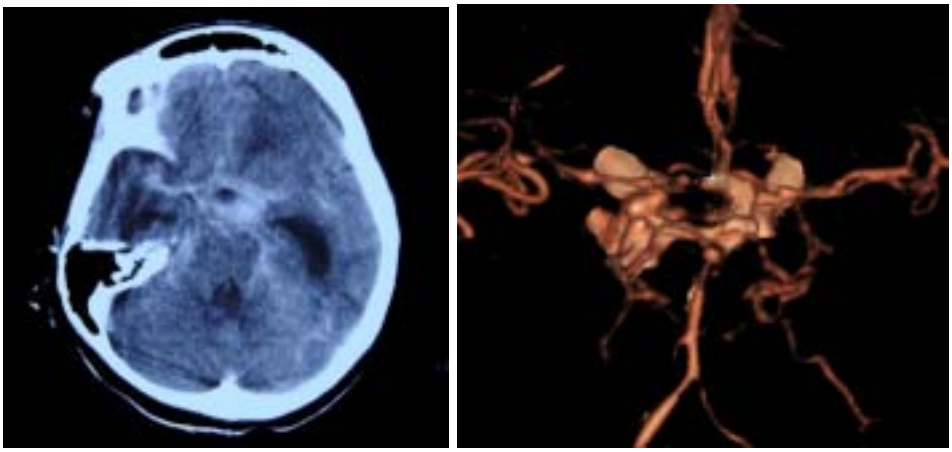

Figure 3. CT scan and CTA of a patient with cerebral aneurysm

Figure 4. CTA in a patient with AVMs

DISCUSSION

SICH is a common and serious clinical emergency. The retrospective design of this study must be taken carefully into account to give the right weight to the figures and rates of our study. In particular, since we may have missed asymptomatic events, or even worse, fatal events, in outpatients, our figures could be an underestimate and should be considered as the lower limit of an undefined range. This study group is representative of patients with SICH in general as reflected by the anatomical distribution of the ICH, which is in accordance

with a previous study in South Israel.[12] The majority of SICH locations are in the basal ganglia. Consistent results were found in a number of other studies.[3-5] SICH frequently occurs in the basal ganglia (50%) comprising the putamen, caudate nucleus and globus pallidus. Next in order of frequency are hemorrhages in the internal capsule (19.4%), thalamus (8.6%), cerebellum (4.7%) and brain stem (4.5%) [particularly the pons].

SICH is responsible for 10-15% of acute stroke.[13,14] The common causes of SICH are hypertension, aneurysms, arteriovenous malformations (AVMs), coagulopathies and vasculopathies.[15] In patients with SICH due to AVMs, the majority of cases (50%) presented with hemorrhage, requiring immediate surgical intervention. Around 30% presented with seizures and the remaining cases (20%) with progressive headache. The results of the present study did not differ appreciably from those of the study by Van Beijnum et al.[16] who found that approximately 50% of AVMs presented with hemorrhage, 25% with seizures and another 25% with other complaints, particularly headaches and neurological deficits. Aneurysms, AVMs, cavernomas, dural arteriovenous fistulas, and venous malformations all can result in secondary SICH. The hemorrhage due to a ruptured aneurysm almost always has a subarachnoid component and often extends into the ventricles. There should be a high index of suspicion in young patients with frontal or temporal lobe clots. Arteriovenous malformations are associated with an estimated mean annual hemorrhage risk of 4%.[17] Intracranial AVMs are lesions of the cerebral blood vessels comprising 3 components, namely a cluster of blood vessels with dysplasia (the nidus), a feeding artery, and a draining vein. Approximately 30-55% of patients with AVMs present with intracerebral hemorrhage. A number of studies found that the risk of hemorrhage in intracranial AVMs is up to 2-4% annually. This information is important for the neurosurgeon to enable him or her to give advice on the risk of hemorrhage that may possibly be experienced by the patient. In contrast to aneurysms, the risk of recurrent hemorrhage in AVMs is much lower, so that elective surgery may be performed, days or weeks after the initial hemorrhage. The advantage of this procedure is that the hematoma has time to undergo lysis, after which the condition of the patient may occasionally improve, so as to facilitate the operation and reduce the risk of the operation. Another advantage is that there is more time for evaluating the results of the radiological examination, such that an accurate diagnosis may be established. The type of SICH most frequently found in this study was hypertensive stroke. In several studies, SICH has been strongly linked to age, race, and hypertensive status.[18-20] Associations have been less consistent with many other risk factors, including greater alcohol consumption, male sex, smoking, low physical activity, body mass index (both high and low), total cholesterol (both low and high), and diabetes. Age, male sex, high alcohol intake, and hypertension had a statistically significant association with ICH in one recent meta-analysis.[19] Another meta-analysis of studies from the Asian-Pacific region found high blood pressure, smoking, low cholesterol, and possibly diabetes associated with greater ICH risk.[21] Conventional angiography is still the gold standard for diagnosis of vascular lesions.([22] Although the risk of angiographic procedures is small, there are a number of points to be taken into consideration before performing these procedures. The location of the hemorrhage, age of the patient, history of hypertension, and clinical condition are the points to be noted before selecting this procedure. However, with the development of the minimally invasive CT Angiography (CTA) and MRA, conventional

angiography examinations are now rarely used for diagnostic purposes, but more frequently for interventions.[22] On average in the present study, the outcome at the time of dismissal was good, where 88.2% of cases had a good outcome (GOS 4 and 5). This is in contrast to a study from Argentina, where 38.6% had a good outcome (GOS 4 to 5), but 22.8% survived with significant impairment (GOS 2 to 3).[23] Since some patients make a late recovery following rehabilitation, it remains to be determined whether the SICH score can predict the long-term outcome.

CONCLUSIONS

Based on the results of our retrospective study, hypertensive stroke was identified as the most prevalent type of SICH, while the most frequent location of SICH was in the basal ganglia. The majority of patients with SICH had a good GOS score. A prospective confirmation of these results is needed and is possibly worth being performed.

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