Epileptic seizures in intracerebral haemorrhage

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SUMMARY Among 1402 patients with intracerebral haemorrhage (ICH), seizures occurred in 64 (4.6%) and epilepsy in 35 (2.5%). Seizure was the first manifestation of ICH in 19 patients (30%). Status epilepticus occurred in 11 patients (17%) and it was the initial presentation of ICH in six (9%). The majority had simple partial seizures that were predominantly focal and motor. There were 38 patients with early seizure and 26 patients with late seizure. Ninety per cent of seizures occurred within one year after ICH. Eleven patients (29%) with early seizure developed epilepsy, whereas 24 patients (93%) with late seizure developed recurrent seizures. The incidence of seizure was 32% for lobar haematoma, 2% respectively for putaminal, thalamic and pontine haemorrhages and 1% for cerebellar haemorrhage. Twenty-six (62%) out of 42 patients with lobar haematomas developed epilepsy. Thirteen patients (34%) with early seizure died within three months after the onset of seizures whereas three patients (12%) with late seizure died within the same period. The majority of patients who died had deep-seated haematomas.

Cerebrovascular disease is the most common aetiology of epileptic seizures in the older patients.¹⁻³ However, studies on seizures related to strokes have been relatively few. This is particularly true for the intracerebral haemorrhage (ICH). With the exception of one study,⁴ none of the previous reports have specifically dealt with seizures that occurred in the acute and/or late stages of ICH.

Because stroke is the most common disease in the older age group, the need for such a study cannot be over emphasized. We report our study on seizures following ICH with strict selection criteria of patients and detailed analysis of seizure manifestations.

Patients and methods

Chang Gung Memorial Hospital is the main teaching hospital of the Medical College that functions as the community and medical referral centre. The hospital has 2500 beds and the neurology service 180 beds. It is our policy to admit all patients with ICH.

We reviewed the medical records of patients with ICH between 1982 to 86. We selected patients who had their first seizures either as the first manifestation of ICH or following

ICH. We excluded patients who had the following neurological and/or medical conditions:

1 ICH from primary or metastatic brain tumours, dural sinus thrombosis, arteriovenous malformation, rupture of aneurysm, primary intraventricular haemorrhage, malignant hypertension or haemorrhagic infarct.

2 A previous history of severe head trauma, stroke or brain surgery.

3 Co-existing systemic or CNS infection or toxic-metabolic disturbances when seizures occurred.

4 Surgery to remove the intracerebral haematoma or shunting to relieve the intracranial pressure.

Of 1402 cases of ICH, there were 126 patients who had their first seizures at the onset of or after ICH, but only 64 patients had fulfilled our selection criteria.

All 64 patients had routine laboratory studies that included a complete blood count, urinalysis, serum electrolytes, blood chemistry, chest radiographs and ECG. All patients had CT scans. Forty-two patients had EEGs and 15 patients had cerebral angiography. The diagnosis of ICH was based on the CT findings. Intravenous contrast infusion was used in all cases. All the CT scans were reviewed by the authors. The size of the haematoma was considered small when the volume was estimated to be less than 20 ml and large when it was greater than 40 ml.

Seizures were classified according to the 1981 Proposal by the International League Against Epilepsy.⁵ The seizure was considered as early when it occurred within two weeks after ICH and as a late seizure when it occurred two weeks after ICH. This definition was in accordance with the criteria adopted for the post-traumatic seizure.^{6,7} Epilepsy was considered in patients with seizures that occurred more than once and beyond the acute phase of ICH, that is, two weeks

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Table 1 Duration of follow up in patients with early and late seizures

Duration of follow-up	Patients with early seizure	Patients with late seizure
Expired within 3 m	13	3
<3 m	3	0
4-6 m	3	3
7-12 m	4	6
13-18 mm	3	5
19-24 m	2	3
> 24 m	10	6
	38	26

m = month

after ICH. Status epilepticus is defined as a seizure that is repeated frequently enough to produce a fixed and enduring neurological condition lasting at least 30 minutes, or as a series of more than two convulsions without recovering consciousness between them.^{8,9}

We obtained the follow up data through the outpatient clinic or through telephone inquiry. Table 1 shows the duration of follow up. If the 16 patients who died within three months after the onset of seizure were excluded, the average follow up period would be 20 months for patients with early seizure and 22 months for patients with late seizure. The longest follow up was six years.

Results

Sixty-four out of 1402 patients with ICH had fulfilled our selection criteria giving an overall incidence of 4.6%. Forty-three were males and 21 females. The age distribution is shown in table 2. The majority of patients were aged over 50. The ICH of 62 patients was considered as primary spontaneous haemorrhage. The ICH of the remaining two patients was due to the rupture of a mycotic aneurysm in one and the complication of anti-coagulant therapy in another. Thirty-six patients (56%) had a history of hypertension.

Interval between ICH and the onset of seizure In 19 patients (30%), the seizure was the first manifestation of ICH. Eleven of those 19 patients had non-specific symptoms such as confusion, headache, dizziness, blurred vision, personality change and inappropriate speech. Their haematomas were usually small and

Table 2 Age distribution of 64 patients with ICH and seizures

Age (yr)	Number of patients
11-20	1
21-30	1
31-40	2
41-50	7
51-60	21
61-70	15
71-80	11
81-90	6

Table 3 Interval between ICH and onset of seizure in 64 patients with ICH

Interval	Number of patients
Onset	19
1d-2w	19
2w-1m	7
1m-6m	5
6m-12m	8
12m-18m	3
18m-24m	0
> 24m	3

Abbreviations: d = day, w = week, m = month.

located in the frontal, occipital or temporal lobe. The remaining 8 patients had focal neurological deficits found after the seizures. Their haematomas were usually located in the frontal and/or parietal lobes.

In another 19 patients their seizures occurred within two weeks after ICH (table 3). Thus, 38 patients (59%) with ICH had early seizures. By six months 78% of patients had seizures and by one year 90%. Eleven (29%) of 38 patients with early seizure developed epilepsy, whereas 24 (93%) of 26 patients with late seizure developed chronic recurrent seizures.

Seizures related to the site of the haematoma The haematomas were divided into lobar and deep-seated haematomas. The latter included putaminal, thalamic, pontine and cerebellar haemorrhages.

Forty-two patients (66%) had lobar haematomas (table 4). Parietal lobe was solely or partially involved in 27 patients comprising 67% of this group. The next common sites were frontal and temporal lobes. The remaining 22 patients (34%) had deep-seated haematomas with nearly half of them in the putamen.

The incidence of seizure was 32% for lobar haematoma, 2% for putaminal haemorrhage, 2% for thalamic haemorrhage, 2% for pontine haemorrhage and 1% for cerebellar haemorrhage, respectively. Seizure as the first manifestation of ICH and status epilepticus occurred far more frequently in patients with lobar haematoma. Twenty-six (62%) of 42 patients with a lobar haematoma developed epilepsy while 9 (41%) of 22 patients with a deep-seated haematoma had epilepsy. The overall incidence of epilepsy in cerebral haemorrhage was 2.5%.

Four (57%) of seven patients with large haematomas, 15 (63%) of 24 patients with medium-sized haematomas and 16 (48%) of 33 patients with small haematomas developed epilepsy.

Seizure type A simple partial seizure was the most frequent type occurring in 67% of the total patients with seizures (table 5). The simple partial seizure was predominantly focal, motor and one third of them had secondary generalisation. Complex partial seizures and primary generalised seizures were relatively rare. Absence seizures were not seen.

Table 4 Location of haematoma and clinical manifestations of seizure

Location	Number of patients	Seizure at onset	Status epilepticus	Epilepsy	Death within 3 months
I Lobar haematoma					
Frontal	6	4	2	4	0
Fronto-parietal	7	0	0	4	0
Parietal	13	6	3	9	3
Parieto-temporal	5	1	2	4	0
Temporal	5	2	0	1	0
Occipital	2	2	1	2	0
Parieto-temporo-occipital	2	0	0	1	0
Multiple	2	0	0	1	0
	42	15	8	26	3
II Deep-seated haematoma					
Putamen	12	2	1	5	5
Thalamus	7	1	1	3	5
Pons	2	1	0	1	2
Cerebellum	1	0	1	0	1
	22	4	3	9	13

Others include one patient with a pontine haemorrhage who had a myoclonic seizure, one patient with a thalamic haemorrhage who had a generalised tonic seizure and one patient who had a single partial seizure that developed into a complex partial seizure.

Status epilepticus Status epilepticus occurred in 11 patients (17%). It was the first manifestation of their seizures in nine and the first presentation of ICH in six. The status was the elementary partial variety in five patients and the generalised tonic-clonic status in the remaining six. Lobar haematomas accounted for 73% (eight out of 11) of the status patients.

Mortality Among 38 patients with early seizure, 13 patients (34%) died within 3 months after onset of the seizure. There were four with putaminal haemorrhage, four with thalamic haemorrhage, three with a lobar haematoma and one patient each with pontine and cerebellar haemorrhages.

Among 26 patients with late seizures, three (13%) died within the same period (one case each for putaminal, thalamic and pontine haemorrhages).

The mortality rate for patients with status epilepticus was 36%, which was slightly higher than that for those without status (24%).

Death in 13 patients may have been caused by the underlying cerebral lesions and/or their complications. Two patients died during status epilepticus and another died of an undetermined cause.

Table 5 Seizure types in patients with ICH

Seizure type	Number of patients
Simple partial seizure	27
Simple partial seizure with secondary generalisation	16
Complex partial seizure	2
Complex partial seizure with secondary generalisation	1
Primary generalised tonic clonic seizure	5
Others	3
Undetermined	10
Total	64

Discussion

The occurrence of epileptic seizures following ICH varies considerably from series to series (table 6). The incidence of seizure ranged between 2% and 17% (10–17). However, the majority of previous studies have relatively small numbers of patients, less strict selection and included seizures that occurred only in the acute stage of ICH. This study includes the late and recurrent seizures with a longer period of follow-up and a larger number of patients. However, the present period of follow up was still relatively short. The true incidences of early, late and recurrent seizures due to ICH are expected to be higher with a longer follow-up. On the other hand, our stricter criteria of patient selection might also contribute to the relatively lower incidences of seizures and epilepsy.

The present data show that the location of the haematoma is important for the development of seizures. Lobar haematomas had the highest incidence for early, late and recurrent seizures. The 32% incidence of seizures for lobar haematomas in this study is similar to that reported by Weisberg¹⁸ who found an incidence of 34% among 50 patients. Furthermore, status epilepticus and seizure as the first manifestation of ICH occurred far more frequently in patients with a lobar haematoma. The incidence of seizure for putaminal and thalamic haemorrhages was low, only 2%. This figure is much lower than the 14% reported by Lipton *et al*¹⁷ and the 22% reported by Weisberg.¹⁹

In this study, seizure as the first manifestation of ICH occurred in 19 (30%) of 64 patients. Similar incidences are also found in other series.^{16,18} In addition, status epilepticus was the initial presentation of ICH in six of 11 patients with status. Thus, ICH has a high incidence of seizure or status epilepticus as its initial neurological presentation. Status epilepticus in the present study did not show a frontal predilection as previously asserted.^{20,21}

Our results indicate that 29% of patients with early

Table 6 Previous reports on seizures in patients with ICH

Author	Year	Diagnostic method	Number of patients	Study period	Patients with seizure	Incidence of seizure (%)
1 Aring and Merritt	1935	autopsy	116	admission	16	13.8
2 Richardson and Dodge	1954	autopsy	23	admission	1	4.3
3 Schaafsma	1968	autopsy	42	admission	1	2.0
4 Fentz	1971	chart review	23	acute stage	2	6.0
5 Fentz	1971	chart review	12	late stage	2	17.0
6 Mohr, <i>et al</i>	1978	prospective, clinical diagnosis	115	acute stage	7	6.0
7 Harrison	1980	CT	62	acute stage	4	6.0
8 Kase <i>et al</i>	1985	CT and autopsy	24	acute stage	3	12.5
9 Lipton <i>et al</i>	1987	CT	112	acute stage	19	17.0
10 Berger <i>et al</i>	1988	CT	112	acute stage	19	17.0
11 Present study		CT	1402	acute and late stage	64	4.6

seizure developed epilepsy. This figure is similar to those (25% to 50%) reported for the post-traumatic epilepsy.^{22,23} Contrary to this, only 6% of patients with early seizure due to non-embolic cerebral infarction developed chronic recurrent seizures.²⁴ Our results also show that 93% of patients with late seizure developed epilepsy. In non-embolic cerebral infarction, an 81% incidence of epilepsy was reported in patients with late seizure.²⁴ Thus, this data seem to suggest that intracerebral haemorrhage differs from non-embolic cerebral infarction by having a higher incidence of epilepsy in patients with early seizure.

Berger *et al*,⁴ reported that in 19 patients who developed seizures during the acute phase of a supratentorial intracerebral haemorrhage, the seizures were generalised in 13 cases (68%) and focal in six (32%). This data differs from ours. In our study, simple partial seizure was the most common type comprising 67% of all seizure types. Complex partial seizure and primary generalised seizure were relatively rare. Our findings are similar to those found for head injuries and cerebral infarctions.

Our data also show that the outcome for patients with early seizure was more serious than that for patients with late seizure (34% versus 13%). The outcome for patients with status epilepticus was only slightly worse than for patients without status (36% versus 24%). The majority of patients who died within three months of the onset of their seizures had deep-seated haematomas. It is, therefore, the location of the haematomas rather than the type of seizure that determines the outcome in patients with ICH who develop seizures.

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