Cerebral haemorrhage in a French prospective population study

Maurice Giroud, Pierre Gras, Nadar Chadan, Pierre Beuriat, Chantal Milan, Patrick Arveux, Raymond Dumas

Abstract
The incidence of cerebral haemorrhage was studied from a population-based stroke registry. The incidence was 12.3 per 100 000 per year in women and 13.9 per 100 000 per year in men, with a peak in the eighth decade and a male preponderance. Haemorrhages were deep seated and mostly due to hypertension. Recognised clinical characteristics of haemorrhage are acute onset, convulsion, vomiting, and disturbed consciousness. This study showed that cerebral haemorrhage may present with pure motor deficit or transient deficit preceding the stroke. The mortality was 51% in the first month, and 61% by two years.

Stroke incidence varies in different studies partly because of different methods including retrospective studies, cohort studies, and prospective stroke registries based on hospital, or defined populations. All studies have shown a steep rise in incidence with increasing age.

The Rochester study has shown a steady decline in incidence in that population over several decades. The proportion of strokes due to haemorrhage has been estimated as about 25% of all strokes, with great variation from the Framingham study (5%) to the Shibata (30%) and Akita studies (30%). Racial characteristics may contribute to these differences, but we think that the method of diagnosis of haematomas (with or without CT scans) is one of the major causes. The oldest studies did not use CT scan without which diagnosis of stroke mechanism is often erroneous.

Since 1985, we have established a population-based stroke registry in Dijon using systematic CT Scans. We present the natural history of cerebral haemorrhage in this population from 1985–89.

Methods
The procedures at the Dijon Stroke Registry have previously been reported. Dijon is a medium size French town, with 150 000 inhabitants. There are no big industries, and activities are based mainly on business and administration, so that there is no migration flow, and social and demographical composition is stable. All persons from one year old in Dijon experiencing a first ever stroke can be admitted to hospital either in the University Hospital or in one of the five private hospitals, or kept at home. In each case, a neurologist examines the patient and his observation is communicated to the neurology service. For patients not admitted to hospital, family practitioners require an outpatient consultation in the neurology service. In all cases CT was performed when possible in the first seven days, and the three neuro-radiology services of the town provided results for the registry on every stroke patient in Dijon. For fatal cases, a necropsy was requested. If this was not possible, the probability of a stroke was estimated from clinical signs and symptoms.

We defined a stroke as rapidly developing clinical symptoms and/or signs of focal or global loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin (after Hatano and corresponding to the new special report from the National Institute of Neurological Disorders and Stroke). CT scan may distinguish several types of stroke. Primary intracerebral haemorrhage shows a spontaneous high density lesion without enhancement. After resolution of a haematoma, the area is hypodense (in 10–20 days), that distinguishes many lesions as subdural haematomas recognised by their extracerebral location, the density of their blood products, and their displacement of the brain parenchyma. Neo-plasms, meningeomas are shown by their mass effect, their heterogenous density, and their enhancement. Calcified lesions do not disappear on serial CT scans. Non-haemorrhagic infarcts, or cerebral infarction, within the first 24 hours following ictus, are often not seen on CT scan, but they may be seen as an area of slight hypodensity, becoming more apparent.

Table 1 Distribution of haemorrhage and other strokes in men and women

<table>
<thead>
<tr>
<th>Types</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIA</td>
<td>16%</td>
<td>15%</td>
</tr>
<tr>
<td>Cerebral infarction</td>
<td>44%</td>
<td>47%</td>
</tr>
<tr>
<td>Cerebral haemorrhage</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Subarach haemorrhage</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Uncertain mechanisms</td>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>Lacunes</td>
<td>19%</td>
<td>14%</td>
</tr>
</tbody>
</table>
Table 2  Incidence rates in each sex-band and age-band of primary intracerebral haemorrhage within 1985 to 1989

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Population</th>
<th>Male Number of cases</th>
<th>Incidence rates (n/100 000/year)</th>
<th>95% CI</th>
<th>Female Number of cases</th>
<th>Incidence rates (n/100 000/year)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–14</td>
<td>108 000</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>102 000</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>15–24</td>
<td>107 000</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>119 000</td>
<td>3 37 [0.95–5.84]</td>
<td></td>
</tr>
<tr>
<td>25–34</td>
<td>119 000</td>
<td>2</td>
<td>75 900</td>
<td>0.00</td>
<td>124 000</td>
<td>3</td>
<td>4.79 [1.25–8.32]</td>
</tr>
<tr>
<td>35–44</td>
<td>80 100</td>
<td>6</td>
<td>56 000</td>
<td>1.26</td>
<td>62 000</td>
<td>4</td>
<td>12.77</td>
</tr>
<tr>
<td>45–54</td>
<td>66 000</td>
<td>8</td>
<td>55–64</td>
<td>23.91 [14.86–22.18]</td>
<td>64 000</td>
<td>4</td>
<td>9.26</td>
</tr>
<tr>
<td>55–64</td>
<td>67 100</td>
<td>14</td>
<td>55–74</td>
<td>70 36 [54.76–86.92]</td>
<td>54 000</td>
<td>11</td>
<td>39.62</td>
</tr>
<tr>
<td>65–74</td>
<td>39 000</td>
<td>15</td>
<td>75–84</td>
<td>82.67 [61.12–103.49]</td>
<td>48 700</td>
<td>15</td>
<td>60 67 [49.57–71.85]</td>
</tr>
<tr>
<td>75–84</td>
<td>26 000</td>
<td>25</td>
<td>85–89</td>
<td>109 32 [78.49–142.26]</td>
<td>16 500</td>
<td>15</td>
<td>49 83 [27.86–60.25]</td>
</tr>
<tr>
<td></td>
<td>11 500</td>
<td>2</td>
<td>Total 267 700</td>
<td>13.94 [7.45–19.72]</td>
<td>74 800</td>
<td>44</td>
<td>12.35 [6.90–18.72]</td>
</tr>
</tbody>
</table>

over the first 24–72 hours. Lacunar infarcts are either not seen, or seen as a little circular hypodensity in white matter.

For patients dying at home, death certificates were reviewed in the District Health Office. This type of death does not exceed 4% of deaths from haemorrhage. Each patient dying in a care unit has a necropsy examination.

Every observation was reported on a check list of 89 items, indicating age, antecedents, clinical type of neurological abnormality, biological data, CT scan and clinical evolution. These 89 items were kept on an information data bank. To preserve confidentiality, the names were substituted by a number. Incidence was calculated from the number of first ever haemorrhages in a lifetime stroke during the five years of the study, and the number of inhabitants of Dijon, adjusted on 100 000 inhabitants, according to age and sex. Because of the starting point of the study, it is not possible to consider prevalence. Confidence intervals were calculated according to the Miettinein method. For our long-term survival study (117 weeks), we used the 16 deaths among the 26 primary intracerebral haemorrhages observed during 1987 and 1988, because of the quality of both their clinical investigation and their postal address.

Results

Nine hundred and eighty four patients were registered from 1985–89 for their first stroke with 503 men and 481 women. A CT was performed in 873 cases (88%) and 654 CTs (75%) were performed in the first seven days.

Necropsy was performed in 12 cases, eight after and four without CT. Diagnosis was defined in 877 cases (89%) and uncertain in 11%.

Of those with a certain diagnosis, cerebral infarction was present in 449 patients (45.6%), lacunar infarction in 165 (16.7%), transient ischaemic attack in 156 (15.8%), primary intracerebral haemorrhage was observed in 87 cases (8.8%), and subarachnoid haemorrhage in 15 cases (1.5%) (table 1). Eighty four haematomas were diagnosed by CT, three by necropsy (4%) and eight by both methods (9%).

Twenty two haematomas were observed in 1985, 17 in 1986, 18 in 1987, 15 in 1988 and 17 in 1989. Mean age was greater in men, 63-54 (14.1), than in women, 59-8 (12.8).

Table 2 shows age distribution by sex for patients with primary intracerebral haemorrhage according to the number of people in the population (denominator) in each sex- and age-bands. This age distribution differs by sex.

We observed no significant difference of age-standardised incidence in men and women, between each of the five years of the study (table 2).

The haemorrhage was located in the putamen in 36 cases (42%), thalamus in 22 (26%), cortical area in 16 (19%), cerebellum in 9% and brainstem in five cases (4%). There is a good correlation between hypertensive arteriopathy and putamo-thalamic haemorrhage (p < 0.01). Lobar haemorrhage had different causes (hypertension, rupture of an aneurysm, anticoagulant therapy, no apparent cause).

A transient ischaemic attack had occurred in the week before the stroke in seven cases (8%), and convulsions at setting of haemorrhage in five cases (6%). An acute deficit, vomiting, hyperglycaemia, were present in 37 primary intracerebral haemorrhage (43%) and headache in 30 cases (35%). Decreased consciousness was found in 37 primary intracerebral haemorrhages (43%), of which 27 were deep and extensive haemorrhages and 10 lobar and mild (p < 0.01). Decreased consciousness was observed in the initial stage of haemorrhage in 40 patients.

Pure motor hemiparesis was observed with primary intracerebral haemorrhage in seven cases (8%). Wernicke’s aphasia was associated with haemorrhage in only nine patients (11%). Forty seven patients (case fatality rate =
52%) died in the first month [95% CL; 40–64] compared with 20% [95% CL; 9–32] for infarction. Early death occurs due to cerebral herniation in 67 cases (78%), and also myocardial infarction or sepsis (table 3). The case fatality rate had risen to 61% at 117 weeks [95% CL; 27–94], without differences between the sexes. In comparison with the other types of strokes, primary intracerebral haemorrhage had the worst survival rate, at both four weeks, and 177 weeks.

Discussion
Our results, taken from a CT scan prospective population-based study, give the natural history of primary intracerebral haemorrhage. Before the development of CT, epidemiological studies were based only on clinical features to distinguish the two main pathological types of stroke, cerebral infarction versus primary intracerebral haemorrhage. The development of CT shows that these clinical features derived from necropsy,15 were valuable for fatal strokes, but not for non-fatal stroke.10 16 17 Both population-based and hospital-based studies which have not used CT extensively, have underestimated the incidence of small primary intracerebral haemorrhage,18 19 and have reported a falsely low proportion. Population-based stroke registries with CT scan have imposed the accuracy of the pathological diagnosis in community studies9 and outcome data. CT scan readily differentiates primary intracerebral haemorrhage from lacunes or transient ischaemic attacks without the need for MRI.20

Patients admitted to hospital are not always similar to those remaining at home.21 22 In our registry, 93% of primary intracerebral haemorrhage were admitted to public hospitals, 5% to private hospitals, and 2% remained at home. For cortical infarction, 90% are admitted to public hospitals, 8% to private hospitals, and 2% remain at home. For lacunes, differences were greater with 71% admitted to public hospitals, 20% to the private hospitals and 9% at home. In public hospitals, 9-5% of strokes are primary intracerebral haemorrhage, compared with 3% in private hospitals and at home. There may have been under-reporting of cases of cerebral infarction not referred to public hospitals, and of cases of subarachnoid haemorrhage who died suddenly without being admitted to hospital.23

We preferred to classify all the patients without CT scan or necropsy diagnosis in the group of “uncertain mechanisms”, which represents only 11% of our patients. The Oxford study (22%) were classified as uncertain, or only 5% with a clinical scoring system, which we know to be inaccurate.10 Clinical diagnosis is especially inaccurate in the elderly. Other community-based studies have had similar difficulties with elderly patients.11 12 17 24 25 27 29 Therefore proportions, incidence and case fatality rate of haemorrhage in the elderly need to be interpreted with caution. The fatality rate of the group of “uncertain mechanisms” was similar to the group of primary intracerebral haemorrhage in our study, and in Oxford.24 This artefact may explain the apparent decline in the incidence of primary intracerebral haemorrhage20 in the oldest groups, while the incidence of cerebral infarction continued to rise slightly with age. The incidence of primary intracerebral haemorrhage does not decrease when CT was used to discover small haematomas.31

The distribution of the pathological types of first stroke is similar between Dijon, North-American and European community-based studies.1 14 25 28 31 It seems that the proportion of haemorrhagic strokes in Japan22 and China31 is higher, because either the number of cases involved is small, or the rate of confirmation of stroke type is not high.

In Dijon, we observed that the male preponderance from primary intracerebral haemorrhage (male/female = 1.5:1) is lower than in cerebral infarction (male/female = 2.7:1), and that relation between primary intracerebral haemorrhage and age (mean age 63 years in men and 59 years in women) is not as evident as between cerebral infarction and age (mean age 78 years in men and 76 in women).

Nevertheless, whilst the proportion of primary intracerebral haemorrhage is similar in Western community-based studies, there is a great variation in the reported case fatality rate. The 30 days case fatality rate for primary intracerebral haemorrhage was 47% in Dijon, 50% in Oxford,24 and 84% in Rochester, Minnesota.25

This may be because methodological differences exist between these studies. The best case fatality rates in the new registers, reflect the more accurate diagnosis by CT of small haematomas with a good prognosis, and the prospective, and not retrospective, collection of data. Furthermore, we know that there is a decline in the population mortality due to stroke in general, and by haemorrhage in particular.25 34 35 The decline of mortality is not due to treatment32 since only a small part of stroke (40%) is not managed in hospital. Case fatality rate was low in hospital-based registers at Lausanne4 and Hamburg26 (20% at one month). The decrease of stroke from cardio-embolic origin may also explain the decrease of fatal strokes.37

We emphasise that as in the Oxford study, we studied only first-ever in a lifetime stroke, because aetiological factors and outcome of recurrent strokes are quite different with greater residual deficits and higher case fatality rate as shown by Aho.38

This work was supported by INSERM and la Direction Générale de la Santé.

We are grateful for the assistance of all the practitioners of the town of Dijon, who collaborated on the Stroke Register. Secretarial assistance was given by Madame Beuriat.