

*Full Length Research Paper*

## **Epidemiology of brainstem haemorrhage in a population of patients admitted at the Department of Neurology, Fann Teaching Hospital, Dakar-Senegal**

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Brainstem haemorrhage is a low but lethal health condition and few studies have been conducted about it in Africa. The objective of this study was to assess the epidemiology of brainstem haemorrhage among patients hospitalized in the Department of Neurology, Fann University, Dakar-Senegal. During a cohort study, patients hospitalized from February to July 2009 for brainstem haemorrhage were followed at days 1, 3, 7, 15 and 90. Sociodemographic characteristics of the patient, medical history, clinical, biological, radiological and prognostic data were collected. In a population of 711 patients, 288 cases of stroke were reported, of which 91 were haemorrhagic. The number of brainstem haemorrhage cases was 10 representing a frequency of 10.98% of the total cases of haemorrhagic stroke and 1.49% of the total population. The patients had a mean age of 54.6 years. They were mostly male (6 cases), admitted for coma (4 cases). Hypertension was the main past medical history (5 cases). The mean time of admission was 26.9 hours. The haemorrhage was mainly located at the pons and peduncle (4 cases) and all the brainstem (3 cases). Lethality rate was 70% with 10% on day 3, 33.3% at day 7, 16.7% at day 15 and 60% at day 90. It is necessary to sensitize the community about the primary prevention of stroke.

**Key words:** Cerebral haemorrhage, brainstem haemorrhage, epidemiology, stroke, Senegal.

### **INTRODUCTION**

Stroke is a real public health priority with high morbidity and mortality worldwide (WHO, 2000). Primary intracerebral haemorrhage (ICH) accounts for 10 to 15% of all cases of strokes. Also, it is more fatal than ischemic stroke or subarachnoid hemorrhage. Management of patients with ICH is generally limited to supportive care or evacuation of the hematoma, although the efficacy of

surgical removal is variable (Adeoyo et al., 2005; Broderick et al., 1999; Heiskanen, 1993; Qureshi et al., 2001). Brainstem haemorrhage represents almost 6 to 9 % of all ICH and is located mostly in the pedunculus, the pons, the bulb or the mesencephalon (Araga et al., 1987; Broderick et al., 1999; Mangiardi and Epstein, 1988). It can be primary or secondary (Mangiardi and Epstein, 1988). The main risk factors are hypertension, vascular malformations, coagulopathy, anticoagulant treatment or amyloid angiopathy (Mangiardi and Epstein, 1988; Sahni and Weinberger, 2007). Cerebral imaging is very important for diagnosis, etiology and predicting prognosis

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(Sahni and Weinberger, 2007). The clinical features which can be lethal are generally very precocious, few minutes or hours after the haemorrhage even if the haemorrhage is a small one (Mangiardi and Epstein, 1988). As an emergency, management should be well-oriented in a stroke-unit as quickly as possible to improve the vital prognosis, because lethality is often very high. Surgery can help to improve prognosis (Adeoyo et al., 2005; Zia et al., 2009). Few studies have been conducted on the epidemiology of brainstem haemorrhage in the African region. Thus, we conducted this study to describe the epidemiological aspects of brainstem haemorrhage in a population of patients admitted at the Department of Neurology, Fann Teaching Hospital, Dakar-Senegal.

## METHODOLOGY

### Study site

This study was conducted at the Department of Neurology, Fann Teaching Hospital, Dakar-Senegal. This department is a 65 bedroom service with units dedicated to inpatient care (of which 11 beds for intensive care sub-unit), outpatient care, electrophysiology, radiology and physiotherapy. It is the only neurological department in Senegal with activities related to care, training and research on neurological diseases.

### PATIENTS AND METHODS

Through a cross-sectional and cohort study, patients admitted from February to July 2009 for spontaneous brainstem haemorrhage, confirmed by CT scan of the brain, were screened and followed. Patients with post-traumatic haemorrhage or extra-brainstem localization of the haemorrhage were excluded. Every patient fulfilling the inclusion criteria was screened using a questionnaire elaborated for the purpose of the study. By the way, each patient underwent a complete clinical exam followed by blood tests, cerebral imaging (CT scan or MRI of the brain)? Electrocardiogram and echocardiography were also performed for every patient when they were available. Consequently, the patients (who were alive during the study) were followed clinically on days 3, 7, 15 and 90 to assess the prognosis. CT scan of the brain was performed for all the patients to confirm the existence of brainstem haemorrhage and localize it. Due to financial constraints, only one patient had an angio-Magnetic Resonance Imaging. Thus, data on sociodemographic characteristics of the patient, past medical history, clinical exam (motor or sensory deficit, loss of consciousness using the Glasgow Coma Scale) lab tests (hemogram, glycemia, lipidogram, syphilitic serology, HIV serology, uric acid, liver function, urinary function), cerebral

imaging (confirmation of hemorrhagic stroke, localization of the hematoma) and prognosis were collected during the period of study using the questionnaire

### Variables of study

Diagnosis of stroke was made according to WHO criteria with CT scan of the brain showing haemorrhage (WHO, 1989). The other variables were: age (in years), Sex, symptoms at admission (consciousness, existence of motor deficit), the admission time after the occurrence, the past medical history, the blood pressure, temperature. We collected also data related to physical exam, particularly the level of consciousness assessed with the Glasgow Coma Scale (Teasdale, 1974), the motor deficit, the pupillary reflex, the localization of the hemorrhage and the prognosis on days 3, 7, 15 and 90.

### Data analysis

Qualitative datas were expressed in percentage while numerical ones were computed in means  $\pm$  standard deviation by univariate analysis. Excel software was used for this purpose.

## RESULTS

During the study period, 711 patients were admitted for neurological diseases. Among them, 288 had stroke (40.5%) of whom 91 presented a cerebral haemorrhage (31.59%). Brainstem haemorrhage was diagnosed in 10 patients giving a specific prevalence of 10.98% (all cases of cerebral haemorrhage) and 1.40% (all the patients). The patients were mostly male (6 cases) with a mean age of 54.6 years ( $\pm 4.6$  years: 40-72 years). Coma and motor deficit were the main symptoms for admission. The mean admission time was 29.6 hours and only two patients were received within 2 and 3 hours after the occurrence of the stroke. Past medical history of hypertension was present in 50% of the patients (Table 1). During hospitalization, coma was present in 70% of the patients. The locations of the haemorrhage were: the pons (2 cases), the pedunculus (1 case), pedunculus and pons (4 cases) and all the brainstem (3 cases) (Table 2). No patient had surgical removal of the hematoma. Global lethality was 70 % with: 10% on day 3, 33.3% on day 7, 16.7% on day 15 and 40% on day 90 (Table 3).

## DISCUSSIONS

This cross-sectional and cohort study aimed to assess the epidemiology of brainstem haemorrhage in a population of patients admitted at the department of neurology, Fann teaching Hospital, Dakar-Senegal from

February to July 2009. The prevalence of brainstem haemorrhage was 10.98% of all the cases of brain hemorrhage and 1.4% of all the patients admitted for neurological diseases. These results give us a view of the frequency of brainstem hemorrhage in stroke. In fact, frequency of brainstem haemorrhage is considered low (2 comparing outcome of brainstem haemorrhage surgery in 1988 and 2005 in USA. The frequency was 10 cases in a series of 171 hemorrhagic stroke and 19 cases in 259 cases of hemorrhagic stroke respectively (Adeoye et al., 2005). In Malmö-Sweden, Zia et al. (2009) found 20 cases of brainstem haemorrhage in a series of 474 patients with brain hemorrhage. In the USA, the prevalence was 6% in a populational study conducted in Nueces County of Texas (Zahuranec et al., 2006). These results gave us an idea about the frequency of brainstem haemorrhage in inpatient population. However the frequency is considered low, the disease can occur in any age and sex (Broderick et al., 1999).

In developed countries, patients are admitted very precociously, thus improving the lethality. In our study, patients were admitted mostly after 24 hours and only 27.5% were within 3 hours. For Sene-Diouf et al. (2008), only 17.6% were admitted within 6 hours. Many factors could explain this delay: ignorance of the disease by the health personnel and the population, problem of financial and geographic accessibility to health care, sociocultural beliefs of the population. This delay of admission can compromise the prognosis of the neurological pattern.

There are various risk factors of brainstem hemorrhage. It appears that primary brainstem haemorrhages are mostly hypertensive (Auer and Sutherland, 2005; Ruiz-Sandoval et al., 2006; Zahuranec et al., 2006; Raison et al., 2008). Alternatively, secondary brainstem haemorrhages evolve mostly from vascular malformations or hemorrhagic conversion of ischemic stroke (Sutherland and Auer, 2006). It can also be associated with head trauma (Se et al., 2009), anticoagulant therapy (Flaherty et al., 2009; Hill et al., 2001), abnormal coagulation (Qureshi et al., 2001), amyloid angiopathy (Auer and Sutherland, 2005; Wattendorff et al., 1995) and sinus thrombosis (Canhoe and Ferro, 2005). Hypertension was the main risk factor in our patients. Unfortunately, it wasn't well controlled. Also, due to lack of explorations, other etiological and risk factors were not well documented, probably in relation mostly to financial constraints and the precocious death of the patients before the investigations (especially cerebral arteriography or biology). Nevertheless, radiological imaging is important for a better management of this disease. CT scan is crucial for the diagnosis. The pattern and topography of the hemorrhage can also help for etiology and predict prognosis. MRI can also be done but its validity is identical to CT scan (Becker et al., 1999; Murai et al., 1999).

The clinical manifestations are also variable depending on many factors like the site of the hemorrhage, the

to 16 %) with an incidence of 6-9% for all hemorrhagic strokes (Mangiardi and Epstein, 1988). Sene-Diouf et al. (2008) and Raison et al. (2008) found a prevalence of 1.9 % in Senegal and 2.9 % in France respectively. This low frequency was also found by Adeoye et al. (2005) when

volume of the hematoma, and mostly the existence of intraventricular hemorrhage (Broderick et al., 1999). However, coma is very common, justifying hospitalization in intensive care unit and surgery sometimes. Most of our patients had a Glasgow Coma Score of less than 9/15.

The management of brainstem haemorrhage is not easy at all, especially in a developing country. Several recommendations have been formulated in developed countries taking into account the emergency state of the disease (Broderick et al., 1999; Qureshi et al., 2001; Sahni and Weinberger, 2007). Thus, patient with cerebral haemorrhage should be maintained in Intensive Stroke Care Units or similar settings for at least 24 hours after the diagnosis is made. This is related to the fact that patients with brainstem hemorrhage have mostly depressed level of consciousness requiring ventilator support (Sahni and Weinberger, 2007). Sometimes, hospitalization in Neurosurgery Unit is indicated whenever consciousness is declining and/or signs of acute hydrocephalus appear due to high hematoma volume (Adeoye et al., 2005).

Death can occur precociously or be delayed. In and out-hospital lethality is still high even in developed countries from 25 to 50% worldwide (Adeoye et al., 2005; Barber et al., 2004; Ruiz-Sandoval et al., 2006; Kim, 2009; Fogelhom et al., 2005; Giroud et al., 1991; Anderson et al., 1994; Sene-Diouf et al., 2008). Neurosurgical evacuation of hematoma contributed a lot to improve the prognosis of the disease (Adeoye et al., 2005). This lethality is higher in brainstem haemorrhage. In our study population, lethality was 70%. In France, the three month lethality was 50% (Raison et al., 2008) while in Australia the 28 day lethality was 100% (Anderson et al., 1994). Predictive factors of death are variable, depending on the level of consciousness, size of the hematoma and the presence of intraventricular haemorrhage (Dziewas et al., 2003; Murata et al., 1999).

This study has some limits related to inaccessibility to exams (biology and MRI) and treatment. Some patients died before laboratory exams were performed. Neurosurgical evacuation of hematoma which can help improve prognosis was not done. However, this study has shown that brainstem haemorrhage was frequent in neurological patients with a high lethality. Development and equipment of Stroke-Unit and Intensive care Unit are prerequisites for a better management of patients with brainstem haemorrhage. Neurosurgery is also important. However, it is necessary to implement educational program to tackle the main risk factors in the Senegalese population for primary prevention.

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## Appendix

**Table 1.** Characteristics of patients (N=10).

Variables	Number of cases
Mean age: 54.6 years ( $\pm 4.6$ years: 40-72 years)	
Sex	
Male	6
Admission time	
Mean time: 26.9hours ( $\pm 5.8$ Hours)	
< 3hours	2
3-24hours	6
> 24hours	2
Past medical history	
Hypertension	5
Diabetes	2

**Table 2.** Neuro-imaging findings of the hematoma.

Localization	Number of cases
Pedunculus	1
Pons	2
Pedunculus and pons	4
All the brainstem	3

**Table 3.** Prognosis of the patients.

Day number	Number of cases	Number of death	Lethality	Cumulative probability	survival
1	10	0	0%	100%	
3	10	1	10%	90%	
7	9	3	33.3%	30%	
15	6	1	16.7%	5%	
90	5	2	40%	2%	

