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Impact of Medical and Neurological Complications on Intra-Hospital Mortality of Stroke in a Reference Hospital in Ouagadougou (Burkina Faso)

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Authors' contributions

This work was carried out in collaboration between all authors. Author LDL designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors CK and KNJ managed the analyses of the study. Author NC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Medical and neurological complications occurring at the acute stroke stage are frequent and increase post-stroke mortality. Their prevention, early recognition, or effective management in stroke units, should contribute to a significant reduction in early post-stroke deaths. The purpose of our study was to assess the impact of the medical and neurological complications observed at the acute stroke phase, on intra-hospital mortality of strokes.

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Patients and Methods: It was a prospective, transversal, descriptive and analytical, hospital study, from 01/11/2015 to 31/10/2016, at Tingandogo University Hospital Centre, in Ouagadougou, Burkina Faso. The study concerned patients aged > 16 years, consecutively hospitalized for ischemic or hemorrhagic stroke, occurred less than 72 hours of hospitalization, confirmed with the brain scan, after informed consent of patients or members of their families.
Socio-demographic characteristics, vascular risk factors, comorbidities, clinical, neuroradiological and biological data at admission and intra-hospital evolutionary data were analyzed. A univariate, then multivariate, logistic regression analysis was performed between the various medical and neurological complications observed during hospitalization, at acute stroke phase (independent variables), and intrahospital deaths (dependent variable), to investigate the impact of these medical and neurological complications on intra-hospital mortality.
Results: We have consecutively collected 197 patients. The average age of the patients was 61.1 years old. The majority of patients (63.3%) were male. At the admission, 19 patients (9.6%) were in coma, the average NIHSS was 16.7.There were 129 cases of cerebral infarction (65.5%) and 68 cases of hemorrhagic stroke (34.5%). Fever (56.9%), pulmonary infection (42.6%), cardiac complications (25.9%), malnutrition (22.8%), malaria access to Plasmodium falciparum (17.3%), urinary tract infection (16.2%), were the most common medical complications. Neurological complications were represented by neurological deterioration (36%) and epileptic seizures (15.2%), respectively. The intra-hospital mortality rate was 25.9%. At the end of the multivariate analysis with logistic regression, pulmonary infection (OR 4.41; 95% CI [1,171-16,619]; p = 0,028) and neurological deterioration (OR 29.11; 95% CI [8,009-105,844]; p = 0,000) were the only predictive independant medical and neurological complications of intra-hospital post-stroke death.
Conclusion: Medical and neurological complications remain frequent at the acute stroke phase, causing a high intra-hospital mortality of about 26%. Post stroke pulmonary infection and neurological deterioration are the independent predictive complications of intra-hospital deaths. The use of therapeutics to reduce the size and severity of stroke, including fibrinolysis, control of physiological parameters and homeostasis within SU, would allow a significant reduction in early post stroke mortality.

Keywords: Medical complications-neurological complications-stroke.

1. INTRODUCTION

Stroke is one of the most important public health problems in the world today. This is the third cause of death in the world after ischemic heart disease and cancer [1]. Approximately 87 per cent of the world's registered stroke deaths in 2005 had taken place in developing countries. Overall 1-month stroke mortality is about 15% in both developed and emerging countries, compared with 24.1% to 41% in sub-Saharan Africa, with however greater early mortality of hemorrhagic strokes [2]. According to the causative type of cerebral infarction, the short-term prognosis of patients with lacunar stroke is better in comparison with other ischemic stroke subtypes [3]. About hemorrhagic strokes, patients aged 85 and older show higher in-hospital mortality and more severe neurological deficit at hospital discharge than younger patients [4].

The medical and neurological complications of acute stroke are common in 25 – 96% of cases. Previous studies had suggested that these complications had an adverse impact on the post-stroke clinical future [5-7]: They are obstacles to optimal functional recovery, aggravate functional prognosis, prolong the length of hospitalization and increase mortality. A variety of medical and neurological complications may occur. In previous studies [8], 51% and 49% of deaths at 3 months were attributable respectively to medical and neurological complications. Some of these complications may be the subject of prevention, early recognition or effective management, which are considered essential aspects of care in stroke units (SU) [9]. In our opinion, a significant reduction in early mortality post-stroke, should go through the prevention and effective management of the medical and neurological complications of the acute phase of stroke, through quality care ideally in the SU. With a view to effective intervention to prevent these complications, we conducted a study evaluating the impact of the various medical and neurological complications observed at the acute stroke phase, on intra-hospital mortality of strokes.

The aim of this study were to prospectively determine the prevalence of predefined medical and neurological complications in patients who were subsequently hospitalized for stroke at the Tingandogo University Hospital, Ouagadougou (Burkina Faso), and to assess the impact of different medical and neurological complications on intra-hospital post-stroke mortality.

2. PATIENTS AND METHODS

This was a hospital, prospective, transversal, descriptive and analytical study, which took place from 1 November 2015 to 31 October 2016. Included in the study were all patients over 16 years of age, consecutively hospitalized at Tingandogo University Hospital, for ischemic or hemorrhagic stroke, dating back less than 72 hours, confirmed by the brain scan. These patients or a family member had to give their informed consent to participate in the study. Were not included in the study, patients under the age of 16, those hospitalized beyond 72 hours after the onset of stroke, those who did not have a brain scan and/or for which the data could not be obtained, those hospitalized for other neurological diseases, or those for which consent to participation in the study could not be obtained.

Study variables: age, sex, educational level, residence environment and admission mode, time of admission, vascular risk factors, comorbidities, modified Rankin score (mRS) before stroke, constants at admission, Glasgow Coma Score (GCS) at admission, National Institute of Health Stroke Score (NIHSS) at admission, brain scan, chest x-ray, ECG, echocardiography, electroencephalogram, biological examinations at admission; length of stay, acute medical complications non-neurological and acute neurological (appearing during hospitalization).

Study protocol: sociodemographic data, vascular risk factors, comorbidities, time for admission, were informed at the admission. Vital constants (temperature, BP), neurological and general clinical data, neuroradiological and biological data were recorded, at admission and then during hospitalization, until the hospitalization exit. All patients were initially seen, followed by a senior neurologist during hospitalization. The interpretation of the brain CT scan or brain MRI was performed by radiologists. The ECG was systematic for any patient at admission and as appropriate, repeated during hospitalization.

The standard biological assessment performed systematically for each patient at admission included: creatinine, natremia, serum potassium, proteinemia, blood count-platelet levels, C reactive protein (CRP), lipid profile (cerebral infarction). Further examinations were prescribed on a case-by-case basis according to the patient's clinical condition: standard pulmonary X-ray, Urine Cytobacteriologic Examination (UCBE), blood heavy gout for the diagnosis of malaria, HIV serology.

NIHSS and GCS were respectivily used for the assessment of clinical severity and vigilance at the acute stroke phase and mRS for the evaluation of functional autonomy. A NIHSS score of ≤ 16 characterized a moderate neurological deficit while a NIHSS score of ≥ 17 defined a severe neurological deficit. A GCS ≤ 8 defined coma, a GCS between 9 and 14 defined an alteration of vigilance and a GCS = 15, defined normal vigilance. The location of hemorrhagic stroke was classified supra tentorial (lobar, deep), infra tentorial (brainstem, cerebellum), intra ventricular pure or mixed.

Acute medical complications were recorded as they appeared since admission and during hospitalization.

The management of stroke was made according to the recommendations of the European Stroke Organization (ESO) 2008: test of swallowing at the time of admission, nasogastric catheter if swallowing disorder; scope with cardio-tensional monitoring of cerebral infarction; bed rest until cervical ultrasound in case of cerebral infarction; oxygen to glasses if SPO2 < 95% under ambient air; paracetamol 1 g/6h or cold wrap in case of temperature > 37.5°c; prevention of deep limb venous thrombosis or stress gastric ulcer, respectively by Enoxaparin (40 mg) and omeprazole (20 mg); rapid insulin protocol to pushes electric syringe (PES) if capillary blood glucose > 11 mmol/L; protocol Nicardipine IV to PES when blood pressure (BP) > 220/120 mm Hg (ischemic stroke) or PA > 160/95 mm Hg (hemorrhagic stroke) during the first 72 hours after stroke; aspirin (160-300 mg/day) if cerebral infarction, low molecular weight (LMWH) or calciparine at curative doses in the following cases: emboligenic heart disease at high-risk, carotid stenosis > 70% pre-surgical, dissecting carotid, thrombus floating in a large-calibre artery destined for brain; antibiotics or arthemeter respectively in case of bacterial infection or malaria access. The intra venous thrombolysis by rT-PA is not yet available in Burkina Faso.

Stroke patients benefit from neurovascular expertise as soon as they are admitted to emergencies, in collaboration between emergency doctors, via an operational penalty.

Data entry and analysis was performed using the EPI INFO software in its English version 7.1.5.2. The Chi-square test and the student test were used as statistical tests with a 5% threshold of significance. An univariate analysis was first conducted to seek an association between the medical and neurological complications during hospitalization and the occurrence of intra-hospital deaths. Secondly, a multivariate analysis with step-by-step logistic regression was carried out to determine the effect of different medical and neurological complications on intra-hospital deaths of patients hospitalized for stroke, using independent variables that had a $p \leq 0.20$. Proportions of deaths attributable to the various incident complications were calculated using gold from significant variables in univariate analysis. The following proportions were obtained: the proportion of deaths attributable in the exposures (PDAE) to each complication, which gives the proportion by which the mortality rate among the exposures would be reduced if the complication was absent (PDAE = [OR − 1]/ OR); the attributable proportion of deaths in the population (APDP) to each incident complication, which indicates the proportion by which the death rate would be reduced in the overall population of patients hospitalized for stroke if the complication was absent (APDP = intra-hospital deaths in patients with strokes exposed to complications/all cases of intra-hospital deaths in patients hospitalisez for stroke).

Ethical considerations: The present study was conducted after authorization respectively from the administration of the Tingandogo University Hospital and the bioethics committee of Burkina Faso. The participation of patients in the study was conditioned by their informed consent or that of their families.

2.1 Operational Definitions

- **Pulmonary infection or pneumonia:** Crackling rails auscultatoires with fever and sputum purulent or radiographic evidence of pneumonia, requiring antibiotic therapy.
- **Sepsis:** Evidence of a bacteremia to the blood during a febrile peak.
- **Urinary infection:** clinical symptoms of urinary tract infection (dysuria, foul urine and fever), with pyuria, or confirmation at urine or cyto-bacteriological examination of urine, requiring antibiotic therapy.
- **Member deep venous thrombosis:** Clinical diagnosis of member deep venous thrombosis confirmed to the limb venous echo-Doppler;
- **Pulmonary embolism:** Clinical diagnosis of pulmonary embolism confirmed by thoracic angio-CT scan.
- **Cardiac complications:** Sustained heart rhythm disorders, symptomatic AtrioVentricular Block, acute IDM, heart failure,... diagnosed on the clinic, ECG, cardiac enzymes or cardiac ultrasound.
- **Musculoskeletal pain:** Shoulder-to-hand painful syndrome, algo-neuro-dystrophic syndrome, central post stroke pain
- **Pressure ulcer:** Any solution of skin continuity or necrosis resulting from an insignificant stress or trauma (a skin trauma resulting directly from a fall has not been included).
- **Extra-cranial hemorrhage :** Any extra-cranial bleeding requiring close observation, transfusion or surgery.
- **Neurological deterioration:** Aggravation of more than 4 points of total NIHSS score persistent over 24 h.
- **Epileptic seizure:** Onset of single or recurrent epileptic seizures, after the formation of stroke, without proof of prior epilepsy history.
- hyperglycemia was defined by a blood glucose random > 8.0 mmol/L (> 1.44 G/L); hypoglycemia was defined by a blood glucose random <4.0 mmol/l (0,72 g/l). Renal impairment was defined as serum creatinine> 100µmol / L measured by enzymatic method. Hypo- and hypernatremia were respectively defined by natremia <136 mmol / L and> 145 mmol / L; hypo- and hyperkalemia with serum potassium <3.3 mmol / L and> 5.0 mmol / L, during the hospital phase after stroke.

3. RESULTS

3.1 Descriptive Study

The mean age of the patients was 61.1 ± 14.4 years (range 26 to 90 years). The median age was 63 years old. The age groups 50 to 80 years and over were the most representative with 76.7%. The majority of patients were male with 124 cases (63.27%), residing in Ouagadougou with 120 cases (60.91%), not attending school with 115 cases (58.4%). Vascular risk factors

(VRF) were present in 161 patients (81.7%). Comorbidities were found in 41 patients (20.8%). The admission delay was relatively early (≤ 3 hours) for 45 patients (22.8%).

At admission, mean BP was 162 / 95.2 mmHg (range 80-240 / 60-180 mmHg), with 118 cases (59.9%); 34 patients (17.3%) had fever, 19 patients (9.6%) were in coma; the mean NIHSS was 16.7 (range 6 to 36) and 69 patients (35%) had a severe to very severe neurological deficit (NIHSS ≥ 17). Of the 197 patents collected, there were 129 cases of cerebral infarction, 65.5% and 68 cases of hemorrhagic stroke or 34.5%.

The socio-demographic, clinical and paraclinical characteristics of patients at admission are summarized in the following Table 1.

Table 1. Sociodemographic, clinical and paraclinical characteristics of patients present at admission

Sociodemographic characteristics	Effectives	Frequencies
Sex :		
Male	124	63.3%
Female	73	36.7%
Level of education :		
No level	115	58.4%
Instructed	82	41.6%
Residence :		
Urban	120	60.9%
Rural	77	39.1%
FRV	161	81.7%
Comorbidities	41	20.8%
Admission dealine		
≤ 3 hours	45	22.8%
3-6 hours	35	17.8%
6-72 hours	117	59.4%
Clinical features		
HBP	75	38.1%
State of alertness at admission		
GCS = 15 (normal vigilance)	124	62.9%
14 ≤ GCS ≤ 9 (impairment of alertness)	54	27.4%
≤ 8 (coma)	19	9.7%
Neurologic deficit on admission (NIHSS)		
Light (0-5)	6	3%
Moderate (6-16)	122	61.9%
Severe (17-25)	60	30.5%
Very severe (> 26)	9	4.6%
Admission swallowing disorders	102	51.3%
Nature of stroke		
Cerebral infarction	129	65.5%
Hemorrhagic stroke	68	34.5%
Etiologies of cerebral infarctions (n=129)		
Atheroma	34	26.3%
Emboligenic heart diseases	28	21.7%
Chronic diseases of small cerebral arteries	20	15.5%
Unknown causes	45	34.9%
Other causes	2	1.5%
Etiologies of haemorrhagic strokes (n=68)		
Cerebral micro angiopathy secondary to HBP	53	77.9%
other causes	8	11.8%
Undetermined causes	7	10,3%

3.2 Intra-Hospital Medical Complications

A fever was found in 112 patients or 56.9%. The most frequently encountered infectious complications were pulmonary infection in 84 cases (42.6%), Plasmodium falciparum malaria in 34 cases (17.3%), urinary tract infection in 32 cases (16,2%). Venous thromboembolic complications were found in 8 cases (4.1%). Malnutrition was found in 45 patients (22.8%). Hemorrhagic complications were found in 5 patients or 2.5%. Skin ulcers were noted in 21 patients, ie 10.7%. Painful and orthopedic complications were noted in 13 patients, ie 6.6%. Cardiac complications, sometimes associated, occurred in 51 patients (25.9%). A respiratory complication with respiratory distress type was recorded in 4 patients (2%). Clinical neurological complications were found in 77 patients (39.1%); isolated or associated in the same patients, they were distributed in neurological deterioration with 71 cases (36%) and epileptic seizures, 30 cases (15.2%). The intra-hospital medical complications observed are summarized in the following Table 2.

The average length of hospital stay was 12.7 ± 8.4 days (range 2 to 57 days). During the hospitalization, we recorded 51 cases of death, ie an intra-hospital mortality rate of 25.9%. Immediate causes were divided into neurologic complications directly attributable to stroke (cerebral edema, brain swelling, recuurence or extension of stroke, hemorragic transformation, acute hydrocephaus,…) with 25 cases (49%) and non –neurological medical complications with 26 cas (51%): infections (sepsis, pulmonary infection,..), 11 cases (21.6%); cardiac complications, 6 cases (11.8%); respiratory distress, 4 cases (7.8%); multisystem failure, 3 cases (5.9%); unexplained sudden death, 2 cases (3.9%). Of the 146 surviving patients, 38 (26%) were autonomous or independent (mRS 0-2) and 108 patients (74%) were dependent for activities of daily living (mRS 3-5).

3.3 Analytical Study

At the end of the univariate analysis, the following medical and neurological complications were associated with an increase in the risk of intra-hospital death: fever, lung infection, urinary tract infection, sepsis, respiratory complications, seizures and neurological deterioration.

Table 2. Intra-hospital medical complications observed

Type of complications	Number of people	Frequencies
Infectious complications		
Fever	112	56.9%
Pulmonary infection	84	42.6%
Malaria	34	17.7%
Urinary tract infection	32	16.2%
Sepsis	13	6.6%
Malnutrition	45	22.8%
Cardiac complications	51	25.9%
Heart failure	31	24%
Sustained heart rythm disorers	15	11.7%
Symptomatic atrioventricular block	5	3.9%
Acute myocardial infarction	5	3.9%
Respiratory distress	4	2%
Venous thromboemblic complications	8	4.1%
Pulmonary embolism+/- DVT of limb	7	3.6%
Isolated DVT of limb	1	0.5%
Extracranial haemorrhages	(digestive haemorrhage 3, hematuria 2)	2.5%
Skin bedsores	21	10.7%
Painful and orthopedic complications	13	6.6%
Algoneurodystrophy	6	3%
Neuropathic pain	5	2.6%
Tendon retraction	2	1%
Neurologic complications	77	39.1%
Neurologic deterioration	71	36%
Epileptic seizures	30	15.2%

Table 3. Results of univariate analysis evaluating the impact of medical and neurological complications on intra-hospital mortality of stroke

Complications	Death		OR [IC 95%]	P
Fever	Yes	No		
Yes	47	65	14.64 [5.01-42.76]	0.000
No	4	81		
Malaria				
Yes	5	29	0.43 [0,16-1,20]	0.102
No	46	117		
Lung infection				
Yes	30	12	11.55 [5.17-25.82]	0.000
No	9	146		
Urinary tract infection				
Yes	13	19	1.63 [0.72-3.68]	0.047
No	38	127		
Sepsis				
Yes	7	6	19.80 [4.21-92.99]	0.025
No	44	140		
Bedsores				
Yes	8	13	1.88 [0.73-4.86]	0.181
No	43	132		
Orthopedic				
Yes	3	10	0.84 [0.22-3.19]	0.802
No	48	136		
Cardiac				
Yes	13	38	0.98 [0.47-2.06]	0.972
No	35	101		
Respiratory				
Yes	3	1	12.26 [1.33-112.60]	0.0053
No	45	148		
Venous thrombo embolic				
Yes	3		1.39 [0.33-5.82]	0.645
No	9			
Seizures				
Yes	18	12	6.09 [2.53-14.61]	0.000
No	33	134		
Neurological deterioration				
Yes	47	24	59.72 [12.80-278.6]	0.000
No	4	122		

Table 4. Results of the impact of medical and neurological complications on intra-hospital stroke mortality, multivariate analysis with logistic regression and calculation of the proportions of deaths attributable to these complications

Medical and neurological complications	Independent predictive complications of intra-hospital death		Proportion of deaths attributable to		
	OR (95% IC)	P	Complication among patients who reported the complication (%)	complications among hospitalized patients for stroke (%)	P
Lung infection	4.41 (1.171-16.619)	0.028	46.01 (27.11-60.01)	18.07	0.0002
Neurological Deterioration	29.11 (8.009-05.844)	0.000	82.16 (74.06-87.73)	54.36	0.0000

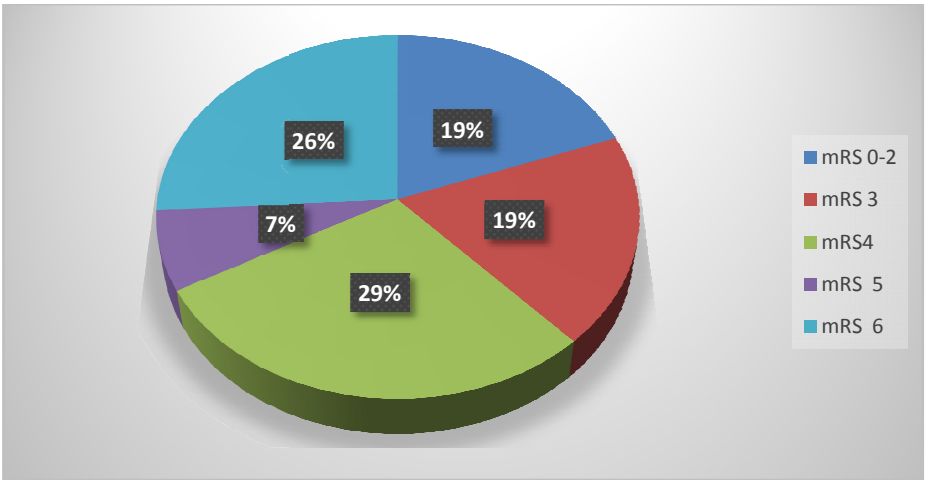

Fig. 1. Discharge status of hospitalized patients for stroke

At the end of the multivariate analysis with step-by-step logistic regression, neurological deterioration and pulmonary infection, were the only predictive neurological and medical complications independent of intra-hospital death. Intra-hospital mortality rate attributable to lung infection were 46.01% among patients who reported this complication and 18.08% among all patients in hospital for stroke. Intra-hospital mortality rates attributable to neurological deterioration were 82.16% for patients who reported this neurological complication and 54.36% for all patients in hospital for stroke.

4. DISCUSSION AND COMMENTAIRE

Acute stroke patients are at risk of developing a wide range of secondary medical complications to stroke. These complications can lead directly to death in more than 50% of cases [6] or hinder optimal functional recovery [10].

The pulmonary infection with 42.6% of our patients, was the most frequent medical complication, confirming the literature data, which estimate its incidence between 2.4 to 47%. The lowest rates, estimated to be between 9 and 17.2%, are observed in developed countries due to the positive effect of SU [6,11-14], while the highest incidence rates, estimated between 32 and 37%, are reported in developing countries [15,16], with the exception of a Cameroonian series [17] that only found a pulmonary infection in 15.1% of cases. These high incidence rates of infectious pneumonia reported in developing countries could be explained on the one hand by the absence of SU, and other parts, by prolonged bed rest due to the severity of stroke, by the elevated frequency of swallowing disorders, in contrast to the inadequacy of preventive measures of swallowing pneumonia in reception services.

In our series, malaria was found in 17.3% of cases, higher than the 1.5% reported in Cameroon [17]. However, few studies have mentioned this intercurrent complication in the acute phase of stroke, yet endemic and epidemic in tropical zones. This high prevalence of malaria in our series would be due to the high prevalence of this parasitosis in our context, to the inadequacy of malaria vector control in public hospitals in our country; in addition, the majority of our patients were recruited during the wet season, a period of malaria epidemic peak.

Urinary tract infections concerned 16.2% of our patients, in similarity to the results of other studies in sub-Saharan Africa, which reported this infection in 15.6% to 25% of patients hospitalized for stroke in the acute phase [15,17, 18]. However, in most developed countries, an average urinary infection rate of about 12% of patients, due to the beneficial effect of SU [6,11-15]. This high prevalence of urinary tract infections in our study and in sub-Saharan Africa would be due to poor hygiene, insufficient asepsis when laying bladder probes, and long delays in the replacement of urinary catheters for economic reasons.

Sepsis was diagnosed in 6.6% of our patients, a result much lower than those observed in Congo-Brazzaville (42.1%) [15] and Senegal (33.3%)

[19], which included coma patients hospitalized in resuscitation services.

In our study, thromboembolic complications were identified in 4.1% of cases, a result consistent with the literature data, which found a thrombotic and embolic venous complications in 3.7 to 5.8% of cases [14, 17, 20]. On the other hand, Danish [11] and Korean series [13], respectively found only 0.6% and no cases of pulmonary embolism or member DVT.

As for the pressure ulcers, they concerned up to 10.7% of our patients, a result comparable to that of Mapoure et al [17] which had recovered this complication in 4% of cases. This type of complication has almost disappeared in the series of developed and emerging countries since the advent of SU [14]. The pressure ulcers remain a worrying complication for acute stroke patients in sub-Saharan Africa, due to the quasi absence of SU, the lack of anti-ulcer mattresses, inadequate hygiene and nursing measures. In our health care system, there are no caregivers, the nursing of patients is left to the care of the families.

Malnutrition was noted in 22.8% of patients, in accordance with the literature data. Indeed, the incidence of malnutrition varies from 7 to 15% at admission, from 22 to 35% after 2 weeks [21]; Its prevalence reached 50% among patients requiring long-term rehabilitation [22]. It seems to be favored by dietary restrictions due to swallowing, vomiting and vigilance disorders related to intracranial hypertension complicating certain strokes, hypercatabolisme and diets in the acute phase of stroke.

The relatively high incidence of post stroke cardiac complications explain in part the poor short-term prognosis of patients with cardioembolic stroke in comparison with other ischemic stroke subtypes. A significant minority of patients have elevated levels of blood troponin indicative of heart damage, not found in our study [23].

A number of studies have examined the association between medical complications and post-stroke mortality. Differences in follow-up times and levels of control of confusing factors (several studies have only reported unadjusted risk estimates) between studies make direct comparisons sometimes difficult [11]. In previous studies, more than 50% of intra-hospital deaths or one month post-stroke were related to medical complications occurring during the acute stroke phase [24, 25, 26, 27, 28, 29]. During the first month following ischemic stroke, 51% of deaths were attributed to the initial infarction (neurological complications of acute cerebral ischemia), 22% to respiratory infections and 12% to cardiovascular events [30].

In our study, we found that pneumonia was the only independent predictive medical complication of intra-hospital mortality, which is consistent with most previous studies [11,13,24,25,26,28,29]. Thus, Katzan et al [25], Heuschmann et al [24], reported that about 1/3 of short-term deaths in patients with stroke were related to pneumonia. In the study of Katzan et al [25], pneumonia increased 3 times the risk of death at 30 days; 10% of deaths at 30 days among hospitalized patients for stroke were due to pneumonia. The risk of 30-day pneumonia-related death was not only a reflection of pneumonia, but also reflected the initial severity of stroke and other predisposition factors for the development of pneumonia such as general fragility markers (malnutrition, comorbidities, pre-stay in retirement home nursing,...). It should be noted that in the study of Ossou-Nguiet et al. [15], sepsis was the infectious complication independently associated with intra-hospital mortality, while pneumonia had no impact on intra-hospital mortality of haemorrhgic stroke.

The data on urinary tract infections are more rare and quite contradictory. Some studies found no correlation between urinary tract infection and hospital mortality [15,31,32], while others found an increase in the risk of hospital mortality associated with the presence of urinary tract infection [13,28,33]. The study by Hong et al. [13] showed that extra-cranial hemorrhage was independently associated with a 3-month adverse prognosis.

Some studies have identified thrombo-embolic venous complications as a major contributor to intra-hospital mortality in stroke patients [24,34]. In our study, neither urinary tract infection, thrombo-embolic complications, nor extra-cranial hemorrhage were independently associated with the risk of intra-hospital death.

Overall, our findings and existing literature strongly underline the need for effective preventative measures, careful monitoring and adequate treatment of medical complications, especially pneumonia, among patients with

stroke. Early mobilization and careful monitoring of clinical parameters, monitoring of physiological parameters and homeostasis, early detection of swallowing disorders, within the framework of SU, appear to be the key elements for the reduction of medical complications, and hence the reduction of at least 50% of intra-hospital deaths post-stroke [35,36].

Neurological deterioration after stroke was defined as a decrease of 2 or more points from the Glasgow Coma Scale (GCS) or an increase of 4 or more points in the NIHSS score. It is common, occurring on average in 25% of hemorrhagic strokes during the first 48 hours following the installation of stroke, about 9% between the 48th hour and the 7th day, or in 8 to 33% in post stroke [37-41]. For cerebral infarctions, the incidence of early neurological deterioration is estimated to be between 10-40% [42,43]. In our series, which combined all strokes, post-stroke neurological deterioration in the acute phase was observed in 36% of cases, falling within the usual range reported.

The pathological processes leading to neurological deterioration post hemorrhagic stroke are represented by the volume expansion of the hematoma, the obstruction of cerebral fluid spaces by hematoma and the importance of comorbidities [37].

For cerebral infarction, the mechanisms usually involved are malignant cerebral edema, hemorrhagic transformation and progressive cerebral infarction; as for their independent predictive factors of occurrence, this is initial hyperglycemia, lack of a history of aspirin use, history of transiant ischemic stroke, proximal arterial occlusion, early signs of cerebral ischemia. [42].

We were unable to determine the mechanisms of post-stroke neurological deterioration, because most of our patients were unable to perform control neuroimaging tests during hospitalization for reasons of financial inaccessibility.

Almost all studies have identified post-stroke neurological deterioration as an important independent prognostic factor of mortality and become unfavourable, short-and medium-term post-stroke [13,37,43]. In the study of [13], neurological deterioration after stroke was the most frequent complication and represented the most important adverse prognostic factor (7.48 [CI 95%, 4.73 – 11.84]) among the complications.

These results suggest that the use of therapeutics to reduce the size and severity of stroke, including the fibrinolysis of acute cerebral infarction and the monitoring and control of physiological and homeostasis parameters within SU, could be the best way to prevent medical and neurological complications, and thus significantly reduce early and short-term mortality.

4.1 Limits of Our Study

Some medical complications in the acute stroke phase were not taken into account in our study. These are traumas by falls with or without fractures, severe sphincterians disorders such as stubborn constipation, urinary or ano-rectal incontinence or urinary retention, severe electrolytic disorders, and others.

We have used rigorous criteria for the diagnosis of pulmonary embolism; these criteria included asymptomatic presentation associated with radiological evidence. For example, we have been able to sub-diagnose certain cases of pulmonary embolism or DVT, especially in patients who were asymptomatic or whose symptomatology was masked by a pulmonary infection, or those who could not bear the carrying out an imaging examination for example of an alteration of consciousness, or those who did not have the financial means to carry out this examination. Most of the patients in our study were treated with antithrombotic agents.

Neurological complications have been limited to neurological deterioration and epileptic seizures, based on predominantly clinical criteria, in the absence of intra-hospital neuroradiological monitoring (CT or MRI) or EEG, in our patients, because of financial inaccessibility. Thus, the various mechanisms that tend to neurologically deteriorate (hemorrhagic transformation of infarction, cerebral edema, recurrence or extension of stroke,...) could not be identified.

5. CONCLUSION

Medical and neurological complications remain frequent in the acute phase of stroke, in our context, due to the absence of SU and the high frequency of serious strokes,... They are dominated by pulmonary infection, neurological deterioration, cardiac complications, malaria

access, urinary tract infection, malnutrition. The intra-hospital mortality rate valued at 25.9%, still remains high in our context. Post-stroke pneumonia and neurological deterioration were the only medical and neurological independent predictive complications of intra-hospital stroke mortality. The use of therapeutics to reduce the size and severity of the stroke, including the fibrinolysis of acute cerebral infarction, monitoring and control of physiological parameters and homeostasis within SU, could be the best way to prevent medical and neurological complications, and thus significantly reduce early and short-term mortality.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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