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Mortality Factors in Severe Head Injury (SHI) at the Neurosurgical Intensive Care of the University Hospital Center of FANN (Dakar-Senegal)

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Abstract | **Original Research Article**

Severe head injury is a major public health problem. About half of the deaths from traumatic causes are due to head trauma. The essential goal of early treatment is to prevent and / or limit the occurrence of secondary cerebral aggression factors of systemic origin. In developing countries, difficulties in accessing emergency diagnostic means and the availability of suitable drugs pose a problem of care. The aim of this study was to determine the factors of death of severe head injuries. This is a retrospective, descriptive and analytical study over a period of 5 years carried out in the neurosurgical intensive care unit of the UHC of FANN. It concerned all patients aged 15 and over received for SHI. The 15-44 age group was the most represented with a predominance of the male gender. Road accidents were the predominant causes followed by falls. In pre-hospitalization, more than half of the patients had received no treatment. Hemorrhagic contusion in the brain was the most common lesion seen on computed tomography. In the majority of cases was isolated SHI. In rare cases, lesions of the thorax and pelvis were associated. Factors correlated with death were: age, arterial hypotension, hypoxia and hypernatremia.

Keywords: SHI, arterial hypotension, hypoxia, hypernatremia, road traffic accident.

INTRODUCTION

A traumatic head injury is the consequence of accident (trauma) on the cephalic extremity. It's serious if the Glasgow score ≤ 8 during the treatment. The severe traumatic brain injury (TBI) is a major cause of death and invalidity of young adult. If he is sometimes isolated, it's most often part of a polytraumatism. The causes are still dominated by road accidents, but the falls of old people also take a significant place. It's specificity in rapport to affected extra brain expresses itself by its great responsibility in the death causes in the polytraumatic person responsible of 68% of deaths [1-3]. The objective of this study was to identify the factors responsible of the mortality in severe traumatic brain injury in order to improve their taking care.

MATERIAL AND METHODS

It's a retrospective study, descriptive and analytic exhibited on a period of 50 months (January 1st 2018 to December 31st 2013) and realized at the unity of the reanimation of neuron chirurgical service of the UHC of FANN. It concerned all adult patients (age>15 years) admitted to intensive care for coma due to severe traumatic brain injury isolated or associated to other traumatic injuries regardless of sex and trauma mechanism during the period of our study. Were not included in our study all adult patients admitted to intensive care for other causes of coma and patients whose files were not usable. Our data were collected on the basis of hospitalization records, treatment and monitoring files. The variables measured were: socio-demographic data, clinical and para-clinical data, causes of trauma, means of transport, what to do and the factors that caused the death. The test of Chi2 and the test of FISHER were used to analyze the conditions of applicability.

RESULTS

Of the 265 traumatic brain injury admitted to intensive care during the study period 106 were severe including 95 men (89, 6%) and 11 women (10,4%). The majority of our patients were between 15 and 44 years old (78, 30%). More than the majority of patients were from Dakar region (51, 90%) followed by regions (47, 16%) and one patient was from the Gambia. The majority of patients were admitted following an public road accident (61, 30%) following by floor fall (18%)

and bawl (10, 30%). In pre-hospital, non-medical transport was the most used mode of transport (57,53%) (Table -1).

Table-1: Distribution of patients by mode of transport

Transport	Effective(n)	Percentage (%)
Medical ambulance	31	29,26
SAMU	14	13,21
firefighter	28	26,41
Non-medical ambulance	16	15,09
Particular vehicle	13	12,26
Taxi	04	03,77
Total	106	100,00

42,47

57,53

Neurological examination found initial loss consciousness in 52 patients (49, 10%), a seizure in 11 patients (10, 40%), and a papillary abnormality (37, 65%). The deadline for taking charge was not specified in 77, 40 (Table-2).

Table-2: Distribution of patients by the deadline of taking charge

Deadline	Effective (n)	Percentage (%)
0-2H	13	12,30
3-5H	09	08,50
6-12	02	01,80
Unspecified	82	77,40
Total	106	100,00

For pre-hospital care, oxygen therapy was performed in 42, 90% of patients, including 18, 90% with hight concentration mask and 23, 60% with orotracheal intubation. Diazepam was the most commonly used hypnotic for Orotracheal intubation (32%) followed by thiopental (24%). The most used combination for sedation was diazepam and fentanyl. Half of the patients were almost admitted within the first six hours (48, 11%). More than half of the patients had a Glasgow score between 7 – 8 (64 cases). Arterial hypotension was observed in 31,10% of patients. Hypoxia with an SPO2 less than 90% was observed in 61,32% of patients. Anemia with a hemoglobin level below 7g/dl was observed in 35,84%. In biochemistry, hyponatremia was the most observed ionic disorder (12,30%). Hyperglycemia was observed in 28,30% of patients. Only one patient had received a blood gas. Brain CT was performed in 90% of patients. Numerous lesions were observed: subdural hematoma (24 cases), extradural hematoma (13 cases), hemorrhagic contusion of the brain (31 cases), intra parenchymental hemorrhage (8 cases), commitments (15 cases), diffuse cerebral edema (8 cases), diffuse axonal lesion (4 cases) and cranial cerebral wounds. Other lesions were associated with severe head injury including the thorax (5 cases), pelvis (5 cases) and spine (2 cases). For hospital care, orotrachel intubation was performed in all admitted non-intubated patients. Thiopental was the most used drug for orotracheal intubation (22 cases) followed by diazepam and propofol in the same proportion (19 cases). Mannitol was administrated in 31,10% of patients and transfusion performed in 29,20% of patients. The surgical procedure was performed (33%) within an unspecified time frame (78,30%). A mechanical thromoprophylaxis was performed (15,10%). During the hospitalization, many secondary brain attacks of systemic origin had occurred of which the most observed were hypotension (49,05%) and hyperthermia (47,16%) (Table-3).

Table-3: Distribution according secondary brain attacks of systemic origin during hospitalization

Secondary brain attacks of systemic origin	Effective (n)	Percentage (%)
Hypotension	52	49,05
Hypertension	16	15,09
Hypoxia	25	23,58
Hyperglycemia	38	35,84
Hypernatremia	15	14,15
Hyponatremia	25	23,58
Hyperthermia	50	47,16
Anemia	38	35,84

Amines were used in 21,70% of patients. The most common combination used for sedation was diazepam and fentanyl. Pneumophathia acquired under mechanical ventilation was the most frequent infectious complication (15,09%) with two isolated germs : Klebsiella pneumonae and Pseudomonas aeruginosa.

The mean duration of sedation was 11,77 days with extremes ranging from one to 13 days. The average duration of orotracheal intubation was 6,62 days with extremes ranging from one to 18 days. The tracheotomy was performed in 9,43 of patients and this after 13 days of hospitalization. More than half of the patients died (69,80%) and the majority of deaths occurred after the 48th hour (71,60%).

Mortality according to hypernatremia

Death is correlated with hypernatremia with a statistically significant difference (p=0,0229) (Table-4).

Table-4: Mortality according to hypernatremia

Hypernatremia	Death	P-value
Yes	74	0,0229
No	32	

Mortality according to age

Death is correlated with age with a statistically significant difference (p=0,0009) (Table-5).

Table-5: Mortality according to age

Age	Death	P-value
YES		
15-44 years	54	
45-59 years	14	0,0009
> 60 years	6	
NO	32	

74

Mortality based on arterial hypotension and hypoxia

All the patients with board of arterial hypotension and hypoxia died.

DISCUSSION

In our series, the majority of our patients were young subjects with an age between 15-44 years (89,6%). Our result is close to certain series [4, 5] which had reported that traumatic brain injury mainly affected young subjects with ages varying between 15-25 years.

This high frequency of SHI in young subjects can be explained by the fact that they were more exposed to road accidents. In our study, the male gender was most affected (89,6%). This could be explained by the fact that men perform more activities that expose them to head trauma than women. Several authors [4, 6, 7], had reported this male predominance. More than half of our patients came from Dakar (51,90%). In our study, road accidents were the predominant cause of serious head injuries (61,30%) followed by falls with 18%. Our results were close to those of Tiret et al., [8] who observed that 60% of SHI were due to road accidents and 33% were due to falls. Same observation with Aguèmon AR [9] with 86%. Unlike Servadei et al., [10], falls and aggressions were more responsible for SHI with 72% to 47% respectively. The increase in accidents on public roads is due to poor condition of vehicles and certain roads, excessive speed and also overload. In our study the neurological examination focused on the Glasgow score, the state of the pupils and the occurrence of initial loss of consciousness. In literature [11] the initial examination showed not only the Glasgow score (GCS) but also the mean arterial pressure (MAP) and the arterial saturation in O_2. This observation was different from ours. Papillary abnormalities associated with initial loss of consciousness were observed in 37,65% and 49,10, respectively. Our results were different from those of MALEOMBHO JP [12] in Ivory Coast, which found 50% papillary anomaly. Convulsions and vomiting were observed in 10,40% and 18,90% respectively. In the literature [13,14] we found 85,9% and 90% respectively of cases of convulsion. These results exceeded by far our results. Our results were not comparable to those of Y. BANDE [15] in Burkina Faso which had found 50% of signs of intracranial hypertension in particular nausea, vomiting and headache. In the majority of cases, the time to pre-hospital taking charge was not specified (77,40%). Orotracheal intubation was performed in23,60% and 18,90 had received oxygen therapy with a mask. 84% of the intubated patients were sedated. The effects of orotracheal intubation with mechanical ventilation on the outcome of patients with SHI had been evaluated in a study of 600 patients [4]. The authors had observed over successive periods an increase in the proportion of patients intubated, ventilated and sedated for transfer, a reduction in the frequency of hypoxia on arrival and an improvement in the outcome of the patients [14, 5].

The first objective of pre-hospital intensive care is to fight against hypoxemia and hypercapnia. Thus, any traumatic brain injury with a Glasgow score less than or equal to 8 must benefit from endotracheal intubation and controlled ventilation with continuous monitoring of arterial saturation in O_2 and $PETCO_2$ [16]. In our study, the drugs used for orotracheal intubation were the combination of diazepam + suxamethonium and thiopental + suxamethonium with respectively 32% and 24%. According to some authors [16] for anesthetic induction in these patients at risk (full stomach, unknown history, sometimes precarious hemodynamic state), etomidate is the most suitable hypnotic and to date suxamethonium remains the reference curare. Maintenance of sedation is carried out with an morphine hypnotic association (fentanyl). More than half of our patients (57,53%) were admitted to hospital by unsafe transport. This finding was close to that of Cissé N [17] who found 69,7%. Medical transports have greatly contributed to the speed of diagnosis and therefore to the quality of treatment of SHI [6]. In our study the SAMU, which is a structure specializing in the transport of these cases, intervened

in 13,21 of the cases. This low intervention rate of this structure is due to its ignorance by the population. Nearly half of our patients were admitted to hospital within the first six hours, either 48,11%. In the literature [11] the average time to arrival at the hospital was 2h55 ± 1 h 40. On admission 77,36% of our patients had papillary abnormalities, the most observed of which was mydriasis (48,10%). Our result was close to that of Coulibaly M. [13] with 84,50%. Arterial hypotension was observed in 31,10% of our patients and 19,80% presented hypotension. Our result was far from that of ETORI [18] who found a high rate of hypotension (90). Some studies report that low blood pressure is usually associated with another lesion and this hypotension is deleterious [4]. On the other hand, in the studies of Coulibaly M. [13], SIEYAMDJI [19] and TRAORE M. [20], it is the rate hypertension which was higher with respectively 25%, 30% and 50%. More than half of our patients were hypoxic, i.e. 61.32%. Our result was close to some studies [14, 19]. Anemia was observed in 35,84% of our patients. Our result was close to that of Coulibaly M. [13] who found 42,2% anemia but far behind that of El Hadiri in Morocco [21] who had 66,70% hyponatremia was the most observed ionic disorder in our study at12,30%. The most observed glycemic disorder was hyperglycemia. Hyperglycemia is an aggravating factor in brain damage and glucose fluids are contraindicated during the first hours of resuscitation [22]. Blood gases were performed only once in our study. This observation was partly due to the unavailability and the difficulty of carrying out this examination. Almost all of our patients had received a brain scan, i.e. 90%. The scanner is essential for the lesion assessment. It's sometimes the only available element of assessment of an emergency intracranial hypertension. Our result was close to that of NABOULOUM [23] in whom the scan was systematically performed in all his patients. On the other hand, our result far exceeded that of Aguèmon AR [9] who had found 7% completion of the scanner. Hemorrhagic cerebral contusions were the most frequent lesions in our patients followed by subdural hematoma with 16,80% and 11,60% respectively. Our results were comparable to those of Coulibaly M. [13] who found 18% hemorrhagic contusions. In 7,40% of our patients, the CT scan performed was normal. This result was similar to that of Audibert G and al [24] who found 13% of patients with a normal CT scan. In our study 88,70 were isolated SHI. In the remaining 11,30% cases, the associated lesions were dominated by trauma to the thorax and pelvis in the same proportion(4,70%) followed by trauma to the spine with 1,90%. This finding was comparable to that of Cissé N. [17] who reported that thoracic trauma was associated in 53% of cases, followed by spinal trauma with 23,5%. On the other hand, our results were in contradiction with those of Bruder N [25], which reports that the risk of cervical spine injury in head trauma reached 8%. This fact would certainly be explained by the proximity of the cervical region to the cephalic region. Orotracheal intubation was systematically performed on admission in all our patients who were not intubated and then they were put on controlled ventilation. This finding was comparable to that in the literature [15, 26] with 65,5% and 60% of cases of Orotracheal intubation on admission, respectively, in patients with a Glasgow score < 8. Some studies have shown the benefit of early tracheal intubation in the prevention of morbidity associated with SHI [27]. Thiopental and succinylcholine were the most widely used drugs for Orotracheal intubation, at 27,20%. According to several studies [17,5] thiopental was the most used drug at induction in the majority of cases. Our result is super imposable on these results. Moreover, according to Audibert G and al [28], the choice can be made between thiopental or etomidate depending on the hemodynamic state of the patient. In severe TBI, the combination of etomidate succinylcholine is recommended [24]. Arterial hypotension markedly worsens cerebral filing with 0,9% saline and hydroxyl-ethyl-starch [16]. Sedation was assured in 38,68% of patients by diazepam and fentanyl, the mean duration of this sedation was 11,77 days with extremes of one to 13 days. The combination of a hypnotic and morphine was the most frequently used technique. The high use of the combination diazepam-fentanyl, would be due to its low cost and its accessibility. The transfusion was performed in 29,20% of our patients within the first 24 hours. According to the literature [29, 30], the clan transfusion threshold (7 to 8g /dl) probably needs to be raised in certain patients with severe cerebral aggression. A recent review of clinical and experimental studies [30] carried out in neuro-intensive care patients had shown that anemia up to 7g/dl was well tolerated without a history, that the transfusion worsened the prognosis in terms of mortality, disability and length of stay. Only 15,10% of our patients had received mechanical thromboprophylaxis. Mannitol was used in 31,10% of patients. Our result was different from some studies [31,32] in which mannitol was used in all patients. Several studies had shown that mannitol was the most classic means of obtaining cerebral relaxation [24, 25]. Until recent years, it was clan to recommend the infusion of low doses of mannitol (0,5g/kg). The surgical procedure was carried out in 33% of patients and this within an unspecified time frame in the majority of cases, i.e. 78,30%. The evacuation of hematoma was the most performed gesture. Our result was different from those of ETORI P [18] in 1999 at the university hospital center of Point-G and NABOULOUM [23] in Burkina Faso which found respectively 3,70% and 17,5% of performing a surgical procedure. Arterial hypotension was the most observed secondary brain attacks of systemic origin (49,50%) followed by hyperthermia (47,16%). Hypotension and hypoxia were the most common, respectively 28,6% of cases in the study by Cissé N. [24]. These results were different from ours. Both secondary brain attacks of systemic origin (hypotension and hypoxia) are particularly common. However, several studies had

emphasized their importance [25] and had reported high mortality in patients with both. Secondary brain attacks of systemic origin management must be a priority in pre-hospital care. Secondary brain attacks of systemic origin are decisive in the survival prognosis of patients. Among the complications encountered were glycemic disturbances, hemodynamic instability and septic shock which would probably be due to the registered pneumonia. Hyperglycemia should also be sought, blood glucose greater than 1,8g/l must be treated, with targets of 1,08 to 1,44g/l, hyperglycemia leads to cerebral ischemia [33]. Klebsiella pneumonae and pseudomonas aeruginosa were the germs found in the same proportion, 50%. However, no study had made case of germs responsible for infectious complications. Amines were used in 21,70% of patients and the most used was adrenaline. The average duration Orotracheal intubation was 6,62 days with extremes ranging from one to 18 days. Our result was close to that of Cissé N. [17] in whom the mean duration of the Orotracheal intubation was to allow very rapid weaning from ventilator. More than half of the patients died either 69,80% and more than half o the deaths occurred after 48 hours either 71,60%. In our study, all of the deceased patients presented with a picture of arterial hypotension and hypoxia. Death was correlated with age with a statistically significant difference (p=0,0009). The part of hypernatremia in mortality is explained by the severity of the lesions. Cooke and al [36] ha thus reported that the risk of mortality increased significantly if the time to treatment was longer than 2 hours (p=0,028). Boyd [37] had insisted on the relationship between mortality and associated lesions.

CONCLUSION

Severe head injury is major public health problem. About half of the deaths from traumatic causes are due to head trauma. The essential aim of treatment is to prevent and/or limit the occurrence of secondary cerebral aggression factors of system origin. In recent years, the better understanding of the effect of therapeutics and the appearance of new agents have greatly simplified management in the majority of situations. This apparent ease should not make us lose sight of the very high mortality of severe head injury.

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