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Original Research Article

Care of Patients who Presented Severe Burns from Flammable Liquid Following the Explosion of a Gasoline Tank Truck on the Outskirts of Niamey

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Abstract: ***Aim of the study***: To evaluate the care, at the National Hospital of Niamey, of patients who suffered severe burns following the explosion of a petrol tank truck. ***Patients and methods***: It was a descriptive and analytical prospective study that took place from May 6 to August 8, 2019. All the patients, victims of the explosion, who were taken care at the National Hospital of Niamey were included in the study. Our data were entered and analyzed by computer software such as Epi info 7.2.3.1, Word Office and Excel Office 2016. Fischer and Pearson tests were used, with a significant value $p<0.05$. ***Results***: The explosion concerned 104 people of which 55 (52.95%) were died, charred and unrecognizable. There were 41 (39.4%) patients with burn injury and 8 (7.7%) with smoke intoxication. 35 (71.43%) of the patients were taken care at the National Hospital of Niamey. The average age of the patients was 23.45 years with a sex-ratio (M/F) of 16.5. The average skin burnt area (SBA) was 57.12%; 3rd degree burn predominated with 71.87%. Hydro electrolytic resuscutation according to Parkland Hospital formula was the most used in the care of the patients with 87.5%. The most frequent localisation concerned the pelvic limb with 84.37%, the death rate represented 57.14%. The extend of skin burnt area, the depth of the burn, the Baux score value and the time at which death occurred were all significant factors that are associated with the mortality with respectively $p=0.008$; $p=0.002$ et $p=0.003$. ***Conclusion***: The explosion of the gasoline tank truck showed our limits in care at the HNN. The establishment of a white plan for the management of massive influxes, the creation of a burns center as well as prevention through information and education of the population is more than necessary.

Keywords: Tank explosion, massive influx of burn victims, prognosis, HNN.

INTRODUCTION

Burn accidents are a real global scourge. They are responsible for more than 265000 deaths per year, especially in the middle and low income countries which account for 95% of burn victims [1]. Thus, burn in Africa constitute a real public healthcare problem that, neverthless doesn't appear among the health priorities of those countries [1]. Although burn disaster is not a frequent event in our countries, the explosion of a petrol tank truck that occurred in the night of May 05 to 06, 2019 had caused many losses in human life and an influx of burn victims who were taken care of by 4 hospitals in the town, mainly the National Hospital of Niamey.

The aim of our study was to evaluate the management of burn victims of the explosion in the National hospital of Niamey.

PATIENTS AND METHODS

It was a descriptive and analytical prospective study that took place from May 6 to August 8, 2019 in the unit of Surgical Emergencies, Resuscitation department, the Burn unit and Oto-Rhino-Laryngology department which was selected for the circumstance to receive burn victims.

Were included in our study, all the burn victims of the explosion who were admitted and cured at the HNN and all the patients who were readmitted after a secondary transfer. The sociodemographic data (age, gender) and clinical data (human assessment, means of transport, time to admission, characteristics of the burn) were all studied. The prognostic score (Baux score), the received treatment after admission in the hospital and the evolution of the patients state were also taken in account. Our data were analyzed by Epi info 7.2.3.1; typing and graphics were made Word and Excel

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2016. For the quantitative variables, the standard deviation means were calculated and compared by Anova Test. Associations between qualitative variables were made with Khi² or Fischer tests. A value of $p<0.05$ was considered as significant.

RESULTS

The explosion affected 104 people of which 55 (52.9%) were burned to death on the scene and unidentifiable, 41 (39.4%) were burnt and 8 (7.7%) cases of smoke intoxication were reported (table I). the average age of the patients was 23.45 ± 7.68years with extremes of 14 and 49 years. The age group from 16 to 30 represented 77.14% of the workforce (Table I). The male gender predominated with 94.28% with a sex ratio of 16.5. From the site of the explosion, 32 patients (65.31%) were referred immediately to the HNN, 9 patients (18.75%) went home of which 3 were secondary admitted at HNN; thus, 35 patients (71.43%) were admitted at HNN following the explosion. The average time of admission was 3±2,75hours with extremes of 1hour and 12 hours; 18 patients (51.43%) were admitted less than 2hours after the accident (Table I). Transport to HNN by fire brigade involved 27 patients (77.14% of cases) (Table I). The average skin burn area (SBA) was 57.12±29.17% with extremes of 6% and 100%; 18 of the patients (51.3%) had at least 60% of SBA (table II). Third degree burn predominated with a rate of 71.87% (Table II). The most frequent localisation was the pelvic limbs in 84.37% (Table II). The severity of burn was related to its localisation on the flexion folds and the face in 87.5% and 40.62% of the cases respectively. The average Baux score was 80.71±29.06 with extremes of 30 and 122. In term of managing the influx, no patient benefited from a care according to the white plan of HNN. All our patients had received analgesics and a systematic antibiotic therapy. The central veinous line was placed in 62.50% of patients and hydro electrolytic resuscitation was performed according to Parkland Hospital rule in 28 patients (87.5%). Oxygen therapy with goggles or face mask concerned 22patients (68.75% cases), it was associated with orotracheal intubation in 2patients (6.25%). All patients received an antiseptic and occlusive dressing in operating room. Stripping and fasciotomy were performed in 56.25% and 15.62% of cases respectively. The evolution in the first 48hours was favorable in 15patients (46.87%). 10 patients has presented hemodynamic and respiratory complications and 7 patients (21.88%) have died. The secondary evolution of the patients was complicated with anemia and malnutrition in respectively 40.62% and 25% of the cases. The average length of stay was 19.01±26.69 days with extremes of 5hours and 98days and an overall mortality rate of 57.14% (Figure I). SBA greater than or equal to 60% was found in 80% of deceased patients and this association was significant (Table III). 18 of the deceased patients (90%) were diagnosed with 3rd degree burn and this association was also significant (Table III). Death was found to be significantly associated with its onset period during the first week in 18 patients (90%) (Table IV). More than a half of the deceased patients (55%) had a Baux score >100 and this association was also found to be significative (Table IV).

Table I: distribution of patients according to on-site human assessment, demographics, admission time and means of transport

Parameters	Number	%
Human losses		
Charred dead	55	52.9
Burned	41	39.4
Intoxicated	8	7.7
Total	104	100
Age (years)		
0-15	2	5.71
16-30	27	77.14
31-45	25	14.29
>45	1	2.86
Gender		
Female	2	5.72
Male	32	94.2
Admission deadline (hours)		
<2	18	51.43
[2-4]	13	37.14
[4-6]	1	2.86
[6-24]	3	8.57
Means of transport		
Taxi	1	2.86
Other	7	20
Fire brigad	27	77.14

Table II: Distribution of patients according BSA, depth and localization of the burn

Parameters	Number	Percentage (%)
BSA		
<15	1	2.86
[15-30]	6	17.14
[30-45]	7	20
[45-60]	3	8.7
[60-75]	10	28.7
≥75	8	22.6
Total	35	100
Depth of the burn		
1st degree	5	15.62
2nd degree superficial	10	31.25
2nd degree deep	14	43.75
3rd degree	23	71.87
Localization of the burn		
Neck	9	28.12
Entire body	10	31.25
Perineum	11	34.37
Face	13	40.62
Trunk	13	40.62
Thoracic limbs	20	62.50
Pelvic limbs	27	84.37

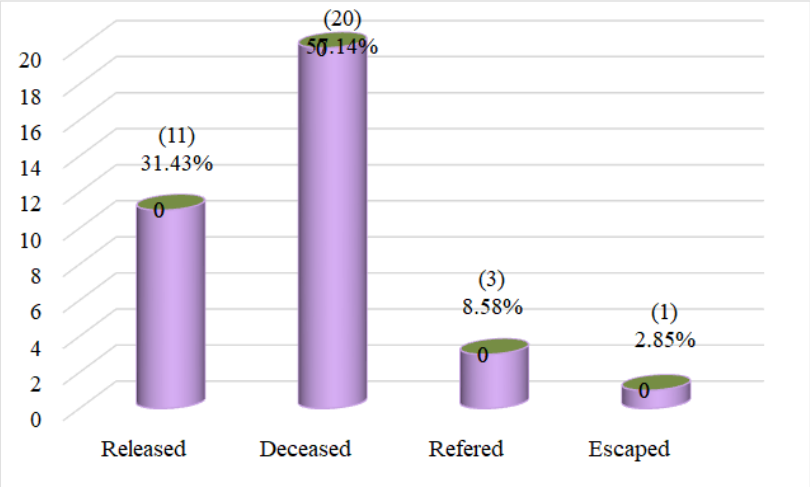

Figure I: Distribution of the patients according to mode of discharge

Table III: Distribution of deaths according to BSA and depth of the burn

Parameters	Deceased				Total	p
	Yes		Non			
	Number	%	Number	%		
BSA						
<15%	0	0,0	1	6.67	1	
[15-30]	1	5	5	33.33	6	**0.008**
[30-45]	1	5	6	40	7	
[45-60]	2	10	1	6.67	3	
[60-75]	8	40	2	13.33	10	
≥75	8	40	0	0.00	6	
Total	20	(100%)	15	(100%)	35	
Depth of the burn						
1st degree	5	25	15	75		
2nd degree	14	70	6	30		**0.002**
3rd degree	18	90	2	10		

Table IV: Distribution of deaths according to the period of its occurrence and deaths according to the Baux index

Parameters	Deceased				Total	p
	Yes		No			
	Number	%	Number	%		
Time of death's occurrence (Day)						
D0-D2	7	35	2	33.33	9	**0.0003**
D3-D7	11	55	0	0	11	
D8-D14	0	0	0	0	0	
>D14	2	10	10	66.67	12	
Total	20	100	12	100	32	
Baux indice						
<75	2	10	11	91.6	13	**0.001**
75-100	7	35	1	8.33	8	
>100	11	55	0	0	11	
Total	20	100	12	100	32	

DISCUSSION

The explosion concerned 104persons, more than a half of the victims (52.9%) were burn to death and unrecognizable on site. Our results are superior to those of Chobli M *et al*., in Benin in 2006 [2] and Agbenorku P *et al*., in Ghana [3] who respectively found a death rate on site of 25.86% and 17%. This difference could be explained on one hand by the ignorance of our population about the risk of hydrocarbons and the violence of the explosion, and the other hand by the fact that the majority of victims were close to or inside the tank while the explosion occured. In our series, the average age of our patients was 23.45 years with extrems of 14 and 49 years. Patients aged 16 to 30 years were the most represented with 77.14%. Mitiche B *et al*., in Algeria in 1994 [4], Agbenorku P *et al*., in Ghana in 2010 [3] also reported a predominance among young adults with 59% and 47.8% respectively. Some authors had found a predominance in children: Mashreky SR *et al*., in Bangladesh in 2010 [5] with children under 12years age in 23.80% and Chaibou MS *et al*., in Niger in 2015 [6] with children aged 0 to 5years in 35.89%. This difference, in our context, could be explained by the circumstances and the time at which the explosion occured (1:00 am) while many children were sleeping. Male gender represented 94.28% with a sex ratio of 16.5 as told in many series [3, 5] with a varying rate of 1.21 to 2.3. This is explained on the one hand by the great freedom of movement granted to the male gender in our societies, and on the other hand, by their tendancy to risky behavior. The admission time was less than 6hours in almost of the patients, ie 91.42%. Tchagu BA *et al*., [7] in Benin in 2019 had found an admission time of less than 6hours in 71.4% of cases, Sani R *et al*., [8] in Niger in 2008 had found 52.89% of admission during the first 8hours, and Boukind H *et al*., [9] in Morocco in 1995 reported 65.5% of admission beyond the first 6hours. This difference could be explained by the fact that in our study, the accident occured in a place not far from HNN and at night while road traffic is clear. In addition, the alert was given quickly to the fire brigad, which allowed a rapid intervention on the site. Patients with BSA comprises between 60 and 75% represented the majority of our population with 28.7% and in 51.3%, the BSA was superior or equal to 60%. In Ghana, Agbenorku P *et al*., [3] had reported in 57.20% cases a BSA greater than 60%. Our results are superior to those reported by some authors in the literature: Chobi M *et al*., [2] had reported 55.81% of patients with at least 50% BSA, Messadi A *et al*., [10] in Tunisia in 2004 had obtained in 84% of patients a BSA less than 10%, and in Ivory Cost, Kouassi YM *et al*., [11] in 2011 reported that 95,3% of patients had less than 15% BSA. This is probably related to the causative agent of the burn which was gasoline in our study, and the context which was the explosion of a gasoline tank nearby victims. The 3rd degree burn predominated with 71.87% followed by the deep 2nd degree in 43.75%. Our results are higher than those of Joseph A *et al*., [12] in Benin in 2019 who obtained 36.76% of 3rd degree and 63.23% of 2nd degree. On the other hand, Kouassi YM *et al*., [11] reported 56.20% 1st degree burn. This difference could be explained by the violent nature of the explosion in Niger whereas in Kouassi's serie, it was a work accident. The pelvic limbs were the most frequent localization with 84.37%, followed by thoracic limbs in 62.50% and the trunk and the face in 40.62% each. Our results are similar to those of Boukind H *et al*., [9] who reported a predominance of burns to the thoracic limbs in 71.6% then the trunk in 63.5%. The majority of authors explain this localization by the fact that everyone mainly uses their limbs for the various gestures performed during daily life. All our patients had benefited from a prescription of analgesics and antibiotics. Oral O *et al*., [13] in Turkey in 2014, reported antibiotic therapy in only 36.32% of cases and claim that antibiotic prophylaxis is dangerous because of selection of resistant strains. However, HNN is multipurpose health structure not adapted to the management of severe burn patients with a high risk of more serious nosocomial infection in burn patients, which justified our systematic antibiotic therapy. The central veinous line was laid in 64.52% of the patients and the hydro electrolyte intake accordign to Parkland Hospital rule was used in 87.5% of the cases. On the

other hand, Chaibou MS *et al*., [6] reported that 41.02% of patients were rehydrated according to the parkland hospital rule, 33.33% according to Evan's rule, and in 25.64% no rule was used. In our study, we registered a high mortality rate (57.14%) in our patients. Death was significantly associated with its onset period in the 48hours in patients with at least 60% BSA and 3rd degree burns. In our low-resources countries, mortality is very high. In Benin, Chobi M *et al*., [2] had reported 74.44% of death and Agbenorku P *et al*., [3] in Ghana had reported a rate of of 54%. In this context, like in Niger, the severity of burn injuries, the blast effect and the massive influx of victims in hospital can be explained by the explosion of the gasoline tank truck nearby the victims.

CONCLUSION

Severe burns represent a permanent challenge for the medical world both in hospitals and pre hospitals, especially in situations of massive influx of victims during disasters. The first forty eight hours following the burn, the BSA and depth of the burn were real severity factors associated with very high mortality. The care must be adapted, fast and structured on an organizational plan, equipment and personnel with the implementation of the white plan by the reception service. Prevention through the creation of a specialized center for burns and public education on the danger of hydrocarbons will certainly optimize the chances of survival for burn victims.

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