

Research Article

Clinical Characteristics, Treatment and Outcome of Gunshot Injuries in South West Region of Cameroon

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Abstract

Background: Gunshot injuries have been on the rise in the south west region of Cameroon for the past 6 years due to the current socio-political crisis.

With the increasing violence in the South West Region of Cameroon due to the socio-political crisis, proper management of Gunshot injuries at the local referral health facilities is very crucial. The outcome of management varies depending on factors such as firearm used, injury site, clinical presentation, and the time between injury and medical intervention. There is limited data on the management and outcome gunshot injuries in Cameroon; especially in the South West region. The aim was to provide data on the characteristics, management and outcome of gunshot injuries. We had as objective to describe the characteristics, treatment and outcome of gunshot injuries in South West, Cameroon.

Methods: It was a 5-year retrospective and descriptive cross-sectional study of all patient records with Gunshot Injury (GSI) presenting at the Limbe and Buea Regional hospitals, Kumba district hospital and Baptist Hospital Mutengene. A chart review was done from files such as age, gender, location of injury, number of injuries, mode of treatment, outcome, from January 2016 to December 2020. Data was analysed using SPSS version 23.

Results: A total of 353 patient records were included the study. The mean age was 33.2 ± 8.9 years. Most of the participants 310 (87.8%) were males. The main circumstance of injury was an unknown shooter. Most of the injuries involved the lower limbs 147(41.6%), followed by the upper limbs 85(24.1%). 27.5% presented with signs of shock while 18.1% presented with a reduced GCS between 10-14. The majority 221(62.6%) of gunshot patient were managed surgically, 93(26.9%) were managed conservatively. 25(7.1%) were referred to a higher level of care for further management. While 14(4.0%) left the hospital against medical advice, and 25(7.2%) of the participants died in the course of management.

Conclusion: Most of the patients in this study were young males, the lower limbs were mostly affected, and most patients were surgically managed. Most of the patients with gunshot injuries recovered. The mortality was higher in cases involving the chest and abdomen.

Keywords: Clinical characteristics; Gunshots; Injuries; Outcome; Treatment; South-West; Cameroon

Introduction

Firearms are the most destructive of the readily available weapons in modern society [1]. Within the last two decades, the incidence of civilian gunshot injuries and their ensuing fatalities has been on the increase worldwide [2,3]. Gunshot injuries are considered to be a global public health concern [4]. When compared with Other Inter Personal Injuries (OIPI), Gun Shot Wounds (GSW) patients arrived more severely injured and required more surgical intervention, more ICU admissions, and longer hospital stays. Patients with GSW incurred significantly higher hospital charges and had a significantly higher mortality rate [5]. Gun Shot Wounds (GSW) pose a unique surgical and public health challenge [5]. In the U.S 50,000 deaths occur annually from gunshot wounds.

In the US, an estimated 180,533 fatal gunshot wounds and approximately 411,000 nonfatal gunshot wounds were registered from 1993 through 1998. The stated cause for injury was assault in 57%, self-inflicted in 20%, unintentional in 13%, and unknown in 10%. It was also found that the rate of firearm-related injuries was seven times higher in males than in females. Initial hospitalizations involving firearm injuries cost \$734.6 million a year nationally [5,6].

In Africa, firearm injuries represent a major health problem. In Sudan, the incidence of injuries for different causes was 82.0/1000 persons per year, with a low socioeconomic status population placed at an increased risk. There is a lack of reliable resources documenting injury-related deaths [4].

In South Africa, the trauma caused by crime is overwhelming. There are an estimated 8 million legal and illegal weapons in circulation in South Africa. Hand-gun violence has become a public health priority and needs to be addressed as such [7]. The availability of firearms is directly related to the assault, homicide and suicide rates.

In Cameroon, the average incidence of GSI is 1.14 per 100,000 per year. Civilian assaults, armed forces assaults, hunting accidents and accidental manipulation are the main causes of GSI [8].

Each gunshot is classified as Grade 1, 2, or 3, based on the examination of the wound and the radiographic findings. Grade 1 is a low energy injury with small (<2 cm) entrance and exit wounds, Grade

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2 is when the entrance and exit wounds are small (5 cm); however, radiographs show ominous signs of deep tissue destruction, and Grade 3 gunshots can be defined by the size and appearance of the entry or exit wound or by radiographs alone.

In the management of gunshot patients, the first concept to be emphasized is the rapid transport of patients to an appropriate trauma center that is equipped to treat gunshot injuries. It has been estimated that for every 10 minutes of delay in definitive treatment, survival for certain types of injuries decreases by 10%, suggesting that a prolonged injury-to-treatment interval is deleterious [9]. Mandatory laparotomy, irrespective of abdominal signs, was the treatment of choice before the proposal of selective conservatism. The policy of selective conservatism in gunshot wound injuries has now been accepted and adopted in the management of such patients [7]. This approach, based on clinical examination, has undergone repeated reappraisal and has been shown to be a safe and reliable form of patient management. About 70%-80% of patients with abdominal gunshot wounds present with signs [7].

In Cameroon, there is limited data on trauma in general and penetrating injuries in particular. Hospital records are used as the primary source of injury data in the trauma reports registry [10].

There is an armed conflict in the south-west region of Cameroon due to the socio-political unrest [11]. The incidence of Gun Shot Wounds (GSW) across the region will therefore relate significantly to the presence of military conflicts. We therefore went to the field with the following objectives: to determine the clinical characteristics of gunshot injuries in the SW Region, to assess the treatment modalities of gunshot injuries in the SW Region, and to evaluate the outcome of gunshot injuries in the SW Region.

Materials and Methods

Study design

It was a 5 years (January 2016 to December 2020) retrospective and descriptive cross sectional study.

Study area

This study was carried out in the South West region of Cameroon. The South West (SW) region of Cameroon has a population of about 1.2 million inhabitants, and a surface area of 24.571 km sq. The hospitals that were purposefully chosen for this study were hospitals that carry out General/visceral and orthopedic surgery. These hospitals were; Limbe Regional Hospital (LRH), Buea Regional Hospital (BRH), Kumba District Hospital (DHK), Mutengene Baptist Hospital (MBH).

Limbe regional hospital

Limbe Regional Hospital (LRH) is located in Limbe, an urban coastal city on the shores of the Atlantic Ocean in the SW region of Cameroon. The LRH has a capacity of 200 beds. It is one of the principal referral hospitals in the region. It has the following facilities; an imaging center, an obstetrics and gynaecological unit, dentistry department, an ophthalmology unit, HIV treatment center, paediatric and neonatology units, physiotherapy department, internal medicine department OPD/emergency, ICU and a surgical unit. There are 2 main operating theatre rooms, with 6 main surgeons, 1 anaesthetist and reanimation specialist and four anaesthetist nurses.

Buea regional hospital

Buea Regional Hospital (BRH), located in Buea at the foot of

mount Fako. It is a secondary healthcare facility with a capacity of about 200 beds. It has the following facilities; a radiological unit, internal medicine unit, obstetrics and gynaecology, paediatrics and neonatology units, HIV treatment center, physiotherapy, surgery and haemodialysis center, imaging diagnostic centre and the ICU. It has 3 main operating theatre rooms with 3 surgeons and 2 anaesthetist doctors.

Kumba district hospital

The Kumba health district is the largest of the 18 health districts in the South west Region of Cameroon and comprises 12 health areas: Kummba town, Fiango, Kumba Pulletin, Kumba Mbeng, Mokonje, Ntam, Mbanga Bakundu, Big Bekondo, Big Ngwandi, Dikome Balue, Ekombe-Mbonji, Massaka.

The hospital has five main departments: Emergency, Surgery, internal medicine, Pediatrics and obstetrics and gynecology plus one major theatre. With one general Surgeon, two Gynecologist and six general practitioners.

Baptist hospital mutengene

This is a missionary secondary healthcare facility located in Mutengene. It has four main departments which include Surgery, Internal medicine, paediatrics and obstetrics and Gynaecology. Which each department has a specialist, General practitioners and nurses.

It also has specialised orthopaedic surgery center handled by three orthopaedic surgeons. These hospitals were purposefully chosen because; they are the hospitals that are equipped to manage gunshot injuries in terms of personnel and resources in the South West (Figure 1).

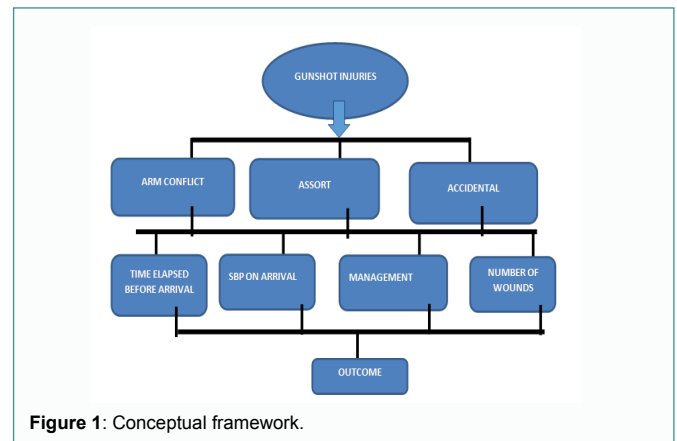


Figure 1: Conceptual framework.

Study population and sampling

The study included all files of gunshot patients from January 1st 2016 to December 2020 in the four hospitals purposefully chosen (Limbe and Buea Regional hospitals, Kumba District hospital and Mutengene Baptist hospital).

Sampling method

The consecutive sampling method was employed.

Inclusion criteria

All available files of patients with gunshot injuries in the four hospitals included in the study.

Exclusion criteria

Incomplete Files.

Sample size

All available files in the four hospitals within January 2016-December 2020.

Study Procedures

Administrative procedures

Ethical approval to carry out this study was obtained from the Institutional Review Board of the Faculty of Health Sciences, University of Buea (IRB FHS UB). Authorization was obtained from the Delegation of Public Health SWR, the directors of Limbe and Buea Regional hospitals, Kumba and Baptist Institutional Review Board. Copies of the protocol were submitted to the above authorities. Patient files that met the inclusion criteria were considered eligible for the study and were recruited. The recruitment of participants was done by the investigator.

Data collection

All files available were studied to see if they contained the minimum requirement to be included in the study. The data that was collected from the Emergency Ward, admission registry and call duty reports of nurses and doctors using a data abstraction form with at least 14 variables ideally included in a basic trauma registry [10]. Variables abstracted include:

- Socio-demographic variables; name, age, gender, residence, occupation.
- Trauma variables include; circumstances, time of presentation to the hospital, number of injured organs, the entrance site of the bullet, the presence of accompanying chest or other trauma, Glasgow coma scale, systolic blood pressure and respiratory rate on arrival, and the Injury Severity Score (ISS) and Revised Trauma Score (RTS). The amount of blood administered.
- Management: surgical or conservative.
- Final outcome: discharge or death, referral, discharge against medical advice

Data management and analysis

The data was analysed using SPSS VERSION 23. The Chi-square test was used to evaluate the relationship between: the heart rate and outcome, GCS and the outcome, anatomic location and outcome, which were all significant with a P-value less than 0.05. Categorical variables were presented as frequencies and their proportions. Continuous variables were presented as means (and standard deviation) or median (and inter-quartile range) where appropriate for continuous variables, or as frequencies and percentages after categorizing using predefined cut-offs or the median. Results were represented on tables and figures (pie chart, bar chart).

Ethical Considerations

The study commence only after administrative and ethical clearance were obtained. The authorization for administrative consideration was obtained from the Faculty of Health Sciences Institutional Review Board, while administrative authorisation was gotten from the directors of the aforementioned hospitals. Other ethical aspects of research were also sorted;

Confidentiality

To ensure confidentiality, data collection sheets were coded for identification. These sheets were kept secured in a place known only

by the research team.

Beneficence

The information obtained at the end of our study will improve on the scientific knowledge and help in the management of these patients.

Non-maleficence

The medical records were kept clean and in order after being reviewed by the research team.

Justice

Each medical record was studied carefully and the relevant information was collected. Reports on the findings of the study will be made fully available to all patients involved at the end of the study, and the institutions concerned, so that all those interested can draw maximum benefit from the study.

Results

A total of 435 cases were coded. 353 were eligible for the study. That is 56cases (15.9%) from Buea regional Hospital, 35 cases (9.9%) from Limbe regional hospital, 159 cases (45%) from Baptist hospital Mutengem, 103 cases (29.2%) from Kumba District hospital. Incomplete files were files that lack vital information about the patient such as: blood pressure, heart rate, location of injury, method of treatment and outcome of the patient (Figure 2 and 3).

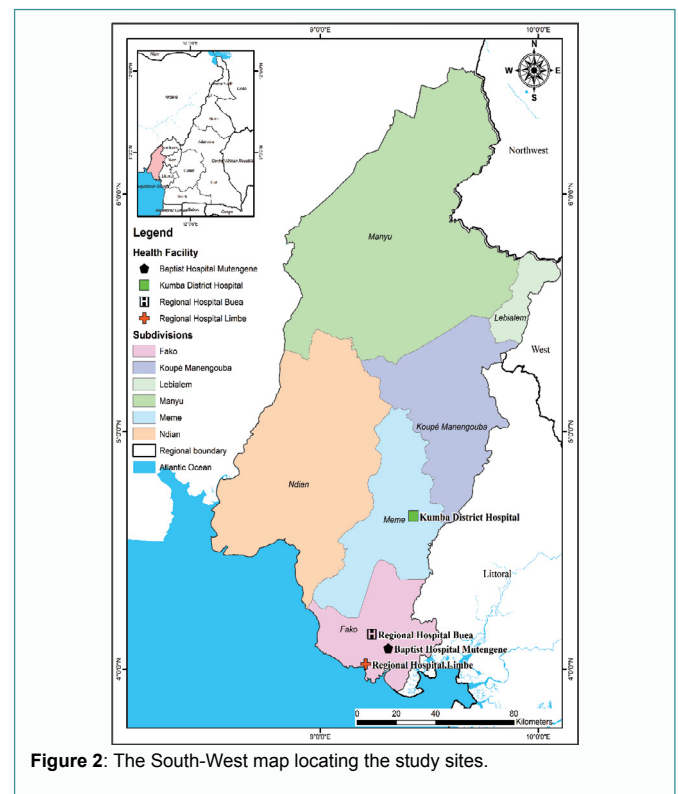


Figure 2: The South-West map locating the study sites.

General Characteristics of the Study Population

Socio-demographic characteristics

Patients' age ranged from 2years to 87 years with mean age of 33.2 ± 8.9 . A large majority of participants 310 (87.8%) were males while 42 (11.9) were females. The most affected age group 128(36.3%) were those between 20 to 29 years old. The most affected set of people

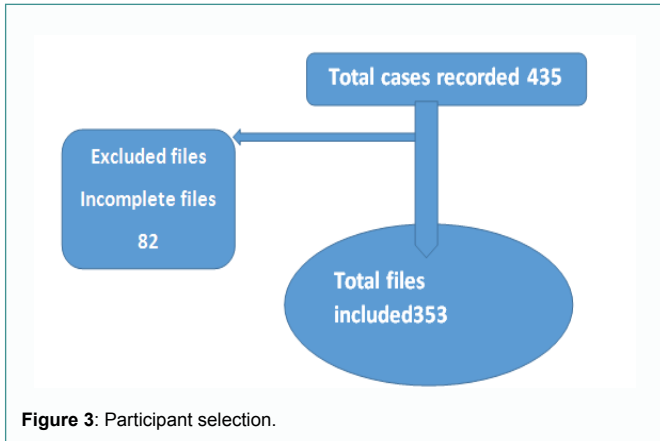


Figure 3: Participant selection.

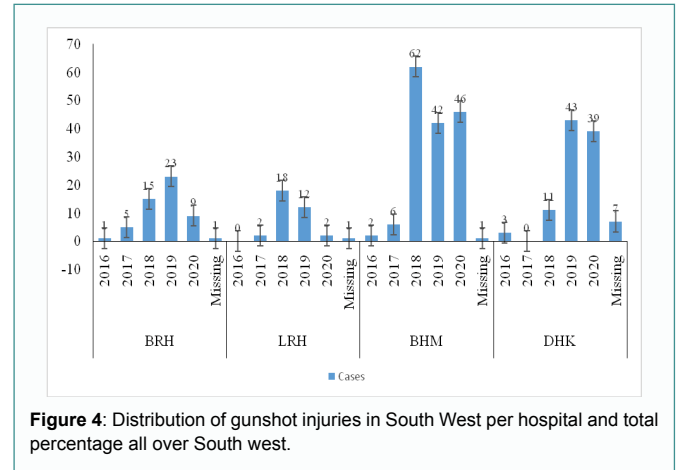


Figure 4: Distribution of gunshot injuries in South West per hospital and total percentage all over South West.

are those working in the private sector/self-employed (farmers) 120 (34.0%), followed by students 86(24.4%) (Table 1).

Our study revealed a sudden change in the number of gunshot cases received in the selected health institution with a peak in 2019 with 120 (34.0%) cases, followed by 2018 with 106 (30.0%) cases, the least occurred in 2016 with 6 (1.7%) cases. 11 cases were not documented (Figure 4).

Circumstances of injury in the South-West, 2016-2020 In Buea regional hospital and Kumba district hospital the injury were all due to armed conflict, Baptist hospital has 1. case of self-inflicted and 2 cases of accidental injuries, while Limbe regional hospital has 2 cases of armed robbery.

Distribution of injury according to anatomical location in South-West 2018-2020

Most of the injuries involved the **lower limbs** (LL) 147(41.6%), followed by the Upper Limbs (UPL) 85 (24.1%), 3 cases (0.8%) location were not specified (Table 2).

Table 1: Sociodemographic characteristics of study participants.

Variable	Frequency	Percentage (%)
Age (Years)	Mean ± SD (33.2 ± 8.9)	
<20	35	9.9
20-29	128	36.3
30-39	92	26.1
40-49	49	13.9
50+	47	13.3
Not recorded	2	0.6
Gender		
Male	310	87.8
Female	42	11.9
Not recorded	1	0.3.
Occupation		
Student	86	24.4
Driver	40	11.3
Farmers	120	34
Military	43	12.2
Business	56	15.9
Not recorded	8	2.3
Year of accident		
2016	6	1.7
2017	13	3.7
2018	107	30.3
2019	120	34
2020	96	27.2
Not recorded	11	3.1
Co-morbidity		

Table 2: Circumstances of injury in 4 hospitals in South West.

Hospital	circumstance			
	Armed conflict	Armed robbery	Self- inflicted	Accidental
BRH	56	0	0	0
LRH	33	2	0	0
BHM	156	0	1	2
KDH	103	0	0	0
Total	348	2	1	2

Mode of transportation of the injured

Most patients, 263(74.5%) were transported in a non-medicalized manner to the hospital, and 90 (25.5%) were transported in a medicalised manner, (Table 3).

Clinical characteristics of patients

Blood pressure: A total of, 22 patients (6.2%) presented with a blood pressure of less than 90/50 (shock), 94(26.6%) presented with a blood pressure between 90-110/60-70, 86 (24.4%) presented with a blood pressure between 111-130/71-90, and 66 (18.7%) presented with a blood pressure greater than or equal to 131/91 (Table 4).

Heart rate distribution

In the study, 97 (27.5%) presented with an elevated heart rate of greater than or equal to 100 beats per minute (Table 5).

Glasgow coma score: A total of 37 (10.5%) of the participants had gunshot injury to the head. Of the total population, 3(0.8%) presented with GCS of less than 9, and 64 (18.7%) presented with a GCS of 10-14 while 267 (75.6%) presented with a normal GCS of 15/15. And in 19 (5.4%) of cases the GCS was not documented (Table 6).

The treatment modalities of gunshot injuries, South-West, 2016-2020

The majority 221 (62.6%) of gunshot patient underwent a surgical intervention which was either: laparotomy, chest tube, bone fixation or wound debridement (Figure 5 and 6).

For the patients who were managed surgically, 202 (91.6%) were managed by specialist, and 19 (8.6%) were managed by general practitioners. 216 (97.7%) were operated once while 5 (2.3%) were operated more than once (Table 7).

The outcome of gunshot injuries

A total of 237 (67.1%) recovered without complication, 25 (7.1%) of patient with GSI died in the course of management, and 50 (14.2%) the outcome was not documented (Figure 7).

Table 3: Distribution of GSW according to anatomical location per hospitals

Hospital	Upper limb	Lower limb	Abdomen	Chest	Spine	Head
BRH	10	27	8	7	0	4
LRH	5	11	6	4	2	7
BHM	42	71	13	14	3	16
KDH	28	39	17	6	3	10
Total freq	85	148	44	31	8	37
Percentage (%)	24.1	41.6	12.5	8.8	1.7	10.5

BRH: Buea Regional Hospital; LRH: Limbe regional Hospital; BHM: Baptist Hospital Mutengene; DHK: District Hospital Kumba

Table 4: Blood Pressure.

Blood pressure.	Frequency	Percentage (%)
< 90/50	22	6.2
90-110/50-70	94	26.6
111-130/71-90	86	24.4
131+/91+	66	18.7

Table 5: Heart Rate.

Heart rate	Frequency	Percentage
< 60	15	4.2
60-99	157	44.5
100+	97	27.5
Missing	84	23.8

Table 6: Management of gunshot injuries in South West per Hospital.

Hospital	Conservative	Surgical	DAMA	referred
BRH	2	49	2	0
LRH	12	22	1	0
BHM	25	124	5	1
KDH	45	26	6	24
Total	84	221	14	25

Table 7: Outcome of Gunshot injuries in 4 hospitals in the South West.

Hospital	RWC	ND	complication	referred	Died
BRH	39	7	8	0	2
LRH	25	4	5	0	1
BHM	117	0	18	1	15
KDH	56	32	8	24	7

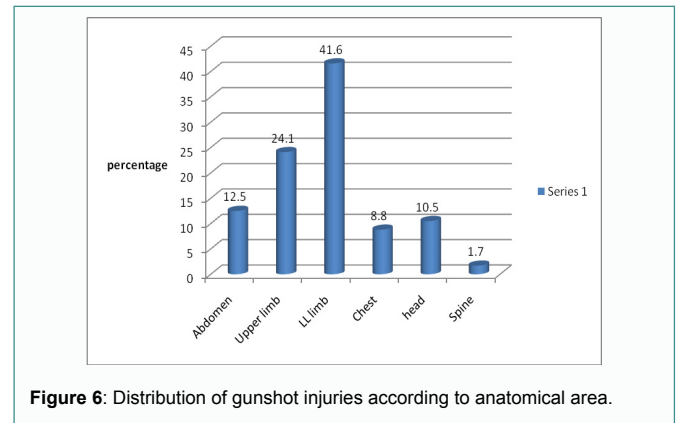


Figure 6: Distribution of gunshot injuries according to anatomical area.

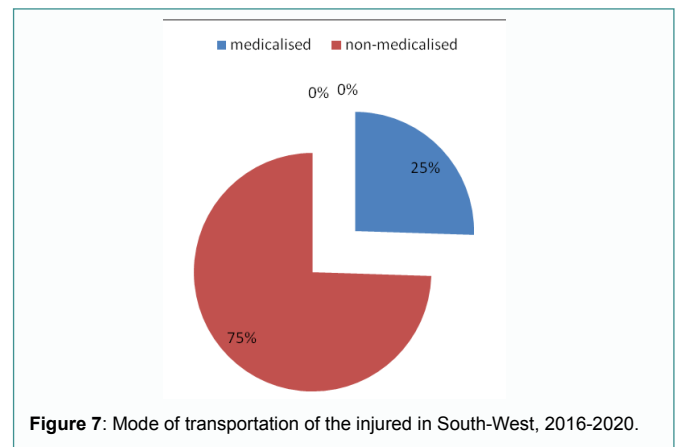


Figure 7: Mode of transportation of the injured in South-West, 2016-2020.

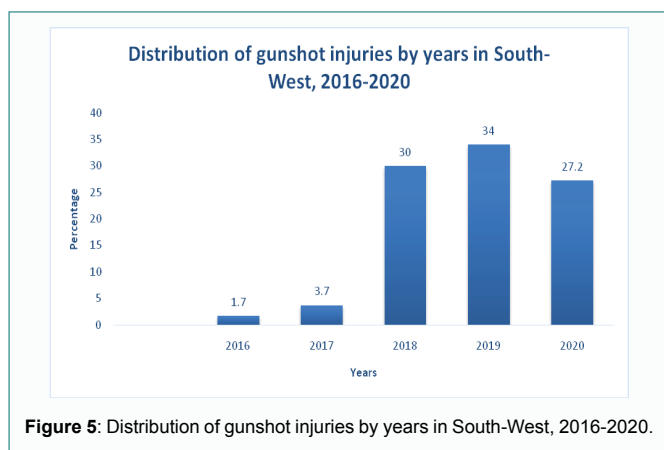


Figure 5: Distribution of gunshot injuries by years in South-West, 2016-2020.

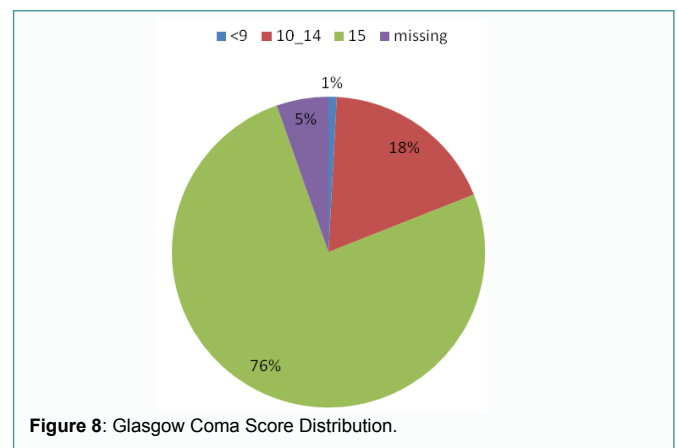


Figure 8: Glasgow Coma Score Distribution.

Complications of gunshot wounds in the South-West, 2018-2020

A total of 24 patient developed complications. The main complication was infection 17 (70.8%) and nerve injury 5 (20.8%) mn (Figure 8).

There was a statistically significant relationship between the heart rate and outcome using the Chi-Square, (P-value of 0.006), between the injury location and outcome using Chi-Square (P-value of 0.001), between the GCS and the outcome using the Chi-square test (P-value

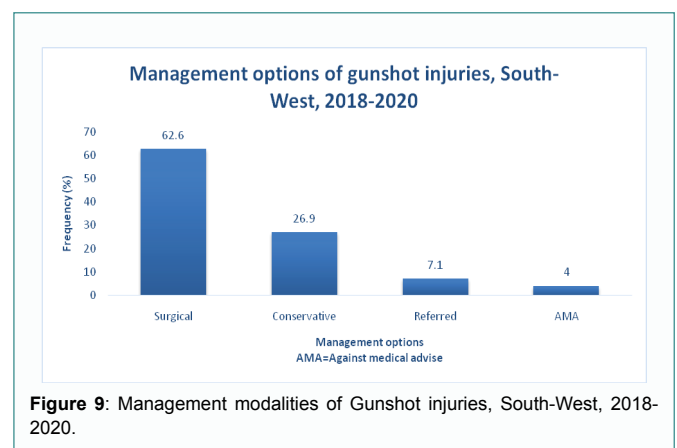


Figure 9: Management modalities of Gunshot injuries, South-West, 2018-2020.

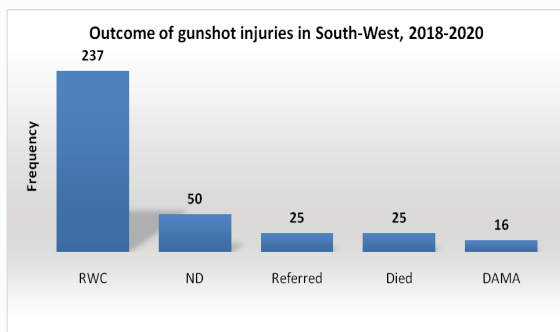


Figure 10: Outcome of Gunshot injuries, South-West, 2018-2020. Complications of gunshot wounds in the South-West, 2018-2020. RWC: Recover Without Complication; ND: Not Documented; DAMA: Discharge Against Medical Advice

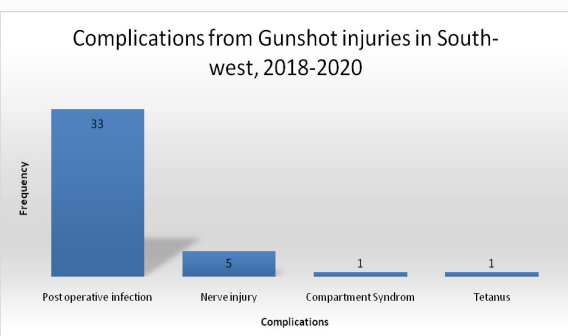


Figure 11: Complication of GSI in the South-West, 2018-2020.

of 0.001) and between the delay before arrival at the hospital and the outcome. Using the Chi-Square, (P-value of 0.04).

Discussion, Recommendation and Conclusion

Gunshot injuries represent a major health problem worldwide with direct burdens to health service and economy. The SWR is one of the region affected by internal conflict, consequently, gunshot-related injuries and mortalities are common.

To the best of our knowledge, there were no studies that determine the extent of firearm injuries in SWR. In this study, we reviewed the data (clinical presentation, treatments, and management outcome) of 353 patients presented to the hospital with gunshot wounds due to various causes in the period of January 2016 to December 2020 to assess the pattern, causes, management, and the outcome.

Gunshot injuries affect all age groups at different stages of life, but are more prevalent in younger age groups [12]. The most common age group affected by gunshot injury in this study is the younger age (20-29) which was similar in Sudan and Yaounde (Cameroon), [13,8]. Our data revealed that male were disproportionately affected. This could be explained by their outdoor presence and are mostly the one involved in armed conflict.

The most common anatomical site of the body affected by nonfatal firearm injuries is the extremities of upper or lower limbs including soft tissue as well as bone tissue [6]. In this study, the lower limb followed by the upper limb is the most common site injured (65.7%). Conversely, the spine was found to be the least affected site. This was the same with a study in Sudan, but their least affected side was the perineum [13].

The extent of injury and tissue damage following gunshots depends on several factors such as wound ballistics, tissue structure, and the respective anatomical relationships [14]. Our data showed limb fracture with local soft tissue injuries as the most common presenting diagnosis, followed by abdominal and chest injuries, and head injuries. These findings are consistent with that of Yaounde (Cameroon) and Sudan [15,14]. More than a half of our participants underwent one or more surgical intervention(s) ranging from minor wound debridement to exploratory laparotomy. Other surgical procedures included bone internal, external fixation or both, and chest tube insertion. However, this was lower compared to a study in Sudan where almost their entire participant underwent a surgical intervention [14].

The overall outcome of the patient in our data was good, where close to three quarters of patients were cured and discharged in good condition, but this was lower compared to Sudan [8]. This could be explained by the fact that, in our study, there were many GSI to the chest and abdomen which are associated with high mortality. About 7% of patients were referred to specialized centers for further management. This is lower than what was reported by other studies due to the availability of specialized human resources and availability of required equipment in our chosen hospitals.

Suicidal attempts are the commonest cause in developed countries [16]. However, in Nigeria and some other African countries, armed robbery attacks were found to be the commonest cause of gunshot injuries [17,16]. In this study, our findings are not in agreement with the previous studies showing armed conflict (unknown shooter) was found to be the common causes of gunshot injuries. This could be explained by the presence of the socio-political crisis in this region.

In our data the mortality rate was 7.0%, which is comparably higher to that reported in Sudan [13]. This could be explained by the fact our study was carried out in the situation of armed conflict. But the mortality was lower than that reported in Kano, Nigeria [18]. This could be explained by the fact that their study had a higher percentage involving the abdomen and chest which is associated with high mortality (Figure 9-11).

Conclusion

In our study, 27.5% of our participants presented with signs of shock while 18.1% presented with a reduced GCS between 10-14. Surgical interventions were the main treatment modalities which included: Wound debridement, bone fixation, chest tube and laparotomy, with significant success rates.

Majority of patients with GSW recovered and were discharged home, 7.1% were referred to a higher level of care, and 4.5% left the hospital against medical advice and 7.1% of the patients died during the course of management.

Most of the patients in this study were young males, with unknown shooter being the common cause of injury. Upper and lower limb injuries are the most common presentations.

Authors' Contributions

This work was carried out in collaboration between all authors. Authors Mokake Divine and Nkemnguatem Nelson...conceived the study, authors...Nkemnguatem Nelson and...Nana Theophile...designed the study. Authors Mokake Divine and Chichom Mefire supervised the study and provided major contributions in writing the manuscript. Author Nkemnguatem Nelson...managed literature

search and wrote the first manuscript while author Nkemnguatem Nelson.... And Mokake Divine.....analyzed the data and all authors proofread the manuscript and approved the final manuscript.

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