



Management of Abdominal Gunshot Wounds of Ballistic Trauma at Somine DOLO Hospital of Mopti

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Abstract

Background: Abdominal gunshot wounds are common in areas of armed conflict. Mali a west African country has been going through a security crisis since 2012, which has led to an avalanche of wounds. The management of these wounds calls for multidisciplinary expertise due to their complexity. The aim of this work was to describe the clinical, epidemiological, surgical and therapeutic characteristics of abdominal gunshot wounds.

Patients and Methods: This was a prospective study (January 1, 2019 to December 31, 2019) on 1601 trauma received in emergency and general surgery departments of the Sominé DOLO Hospital of Mopti. The study involved all patients who had a gunshot wound to the abdomen during the study period. Data were entered into Excel and analyzed using SPSS (Statistical Package for Social Sciences) version 20 software.

Results: A total of 27 cases (10.8%) of visceral gunshot wounds were recorded out of the 250 cases of ballistic wounds recorded during the study period. Intestinal perforation was the most common abdominal lesion, 11/27 cases (40.7%). The most surgical process performed was the ileo-ileal anastomosis resection with 9/27 cases (33.3%). The evolution was favorable in 22/27 (81.5%) of cases however was noted some cases of infectious complication and 2/27 cases of death (7.4%).

Conclusion: Abdominal gunshot wounds are common in areas of armed conflict with intestinal perforation as the most common abdominal wound.

Keywords: Abdominal Gunshot Wounds; Armed Conflict; Surgical Science

Introduction

Ballistic trauma is the consequence of the penetration into the body of a projectile: bullet, lead, metal fragment from the envelope or the contents of an explosive device (grenade, mine, shells, bomb) [1]. Firearm trauma is a real public health problem in several countries, especially developing countries [2]. In recent years, they have experienced an upsurge, linked to: the increase in gun crime, the illegal and uncontrolled possession of firearms; armed and intercommunal conflicts and the war against terrorists. Nowadays, gunshot wounds increasingly affect civilian populations [3]. Adolescents and young adults are the most disadvantaged social groups who pay the heaviest price [2]. The management of these wounds responds to specific rules that must be known because sometimes different from the usual traumatology [3]. In times of war the systematic exploration of penetrating wounds is the rule. Since January 2012, Mali has been facing an unprecedented armed conflict. This conflict started with the rebellion in the up-north and then spread to the center, where it turned into inter-community conflicts thus propagating terrorism in all the country. It opposes on the one hand the national army and the terrorists and on the other hand the self-defense groups (hunters) and the terrorists. This insecurity drains its share of war wounded. Among firearm wounds, abdominal wounds occupy an important place. Sominé DOLO Hospital of Mopti (SDHM) is the only second referral health facility in the region capable of caring for war wounded both civilian and military. Little scientific work has been done on ballistic trauma, particularly on abdominal gunshot wounds in Mali. Therefore, the aim of this work was to describe the sociodemographic, clinical and the surgical process of the management of abdominal gunshot wounds in the setting of armed conflict.

Patients and Methods

We conducted a prospective study from 1st January 2019 to 31 December 2019 in the emergency and surgical departments of SDHM. During cases of massive and saturating influx, the alert and the triggering of the white plan were carried out by the chief executive officer (CEO) of Sominé Dolo hospital. This white plan included a crisis unit made up of two zones: a first which was the center for calls and coordination with the other extra-hospital intervention teams and the second zone brings together the hospital staff around the referent CEO of the white plan. On admission, the war wounded were classified into four different categories of actions to be made according to the white plan of

the Sominé Dolo hospital. The 1st category was the expectants or black triage tag color, the 2nd category was the immediate or red triage tag color, the 3rd category was the delayed yellow triage tag color and the 4th category was the minor or green triage tag color. The study population consisted of patients of all ages presenting a ballistic injury to the limbs. Patients who refused hospital care at the profit of traditional treatment, patients with an unusable record and patients who refused to give their consent were excluded from this study. Patients of all ages with an abdominal gunshot wound were included in our study. Patients with wound other than abdominal gunshot wounds were not included in the study. The epidemiological, clinical, para-clinical, medical treatment and surgical process data from abdominal gunshot wounds patients were collected. Data were captured in Excel and analyzed by SPSS software (Statistical Product and Service Solutions) version 28.0.1 (IBM Corp. 2021, Armonk, NY). Quantitative data was presented as mean values \pm standard deviation or medians with interquartile ranges for none parametric variables. Qualitative variables were presented as percentages.

Results

Our study focused on 27 cases (10.8%) of abdominal gunshot wound out of the 250 cases of ballistic trauma recorded at the Sominé DOLO Hospital of Mopti. The standard X-ray was the most performed medical imaging examination with 18 cases (66.7%) and abdominal ultrasound 6(22.2%). Blood grouping in ABO and Rhesus system and total cells count were the most performed biological analysis with 12(44.4%) and 11(40.7%), respectively. All of our patients received medical treatment based on analgesic and antibiotic. Blood transfusion was performed in 5 of cases (18.5%). Intestinal perforation was the most common abdominal gunshot wound with 11 cases (40.7%) followed by hepatobiliary wounds and gastric perforation each representing 4(14.8%), respectively (Table I). Ileo-jejunal anastomosis, ileostomy and colostomy were the most performed surgical process in 9 cases (33.3%), 7 cases (25.9%) and 6(22.2%), respectively (Tableau II). We noted 5 cases (18.5%) of post-operative complication and 2 cases of death representing a lethality of 7.4% (Figure 1 A and B). The length of hospitalization was 10-30 days in more than half of our patients with 14(51.9%) of cases. The average length of hospitalization was 35.05 days with the extremes ranging from 1 to 99 days. The two deaths occurred in a context of polytrauma and concerned farmers, the majority of whom belonged to the age group of 46-60 years.

| Site of injury | Frequency | Proportion % |
|------------------------|-----------|--------------|
| Intestinal perforation | 11 | 40,7 |
| Hepatobiliary wound | 4 | 14,8 |
| Splenic fracture | 3 | 11,1 |
| Renal contusion | 3 | 11,1 |
| Splenic contusion | 2 | 7,4 |
| Gastric perforation | 4 | 14,8 |
| Total | 27 | 100 |

Table 1: Distribution of patients according to the location of abdominal lesions.

| Surgical procedure performed | Frequency | Proportion % |
|------------------------------|-----------|--------------|
| Anastomosis (ileo-jejunal) | 9 | 33,3 |
| Ileostomy | 7 | 25,9 |
| Colostomy | 6 | 22,2 |
| Splenectomy | 1 | 3,7 |
| Cholecystectomy | 1 | 3,7 |
| Hemicolectomy | 1 | 3,7 |
| Partial hepatectomy | 1 | 3,7 |
| Damage control | 1 | 3,7 |
| Total | 27 | 100 |

Table 2: Distribution of patients according to the surgical procedure performed.

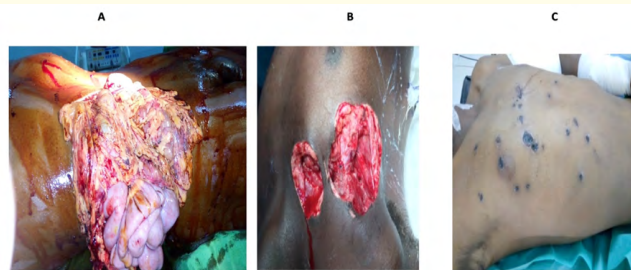


Figure 2: A. Open abdominal gunshot wound; B: Gunshot wound to the chest; C: Chest riddled with bullets.

Source: Somine DOLO hospital of Mopti.

Discussion

Abdominal gunshot wound is common in adults living in the area of armed conflict. The average age of our patients was 40.9 years with extremes of 2 and 98 years. This result was significantly higher compared to that of Alain., *et al.* [17], Keita I. [2], Chaibou MS., *et al.* [15] and Djibo A. [16] who found 28 years; 29.4 years; 29.5 years and 30.9 years, respectively; $p < 0.05$. The majority age group in our study was 46-60 years with 48.8%. This result is different from that reported by Djibo A. [16] in Niger which had found a majority age group of 16-30 years with 48.5%. Keita I in Mali found an age group of 21-40 years with 55.8%. The difference in our results compared to those of the literature could be explained by the particular context of the war in central Mali, which occurs against a backdrop of intercommunal conflict, but also by the fact that it is young adults who are the holders of rifles and especially the most suitable to enter the brotherhood of hunters (the first combatants to organize self-defense in the villages). Male sex was in the majority in our study up to 90.4% with a sex ratio of 9. Same trend was reported by Djibo A. [16] and Kéita I. [2] who found a male predominance of 89.53% and 88.4%, respectively. On the other hand, this result is a little lower than that of Alain., *et al.* [18] with 98%. This male predominance is explained by the fact that it is men who are at the forefront of defense during armed conflict to defend women and children. The majority of the wounded patients came from the circles of Bankass (27.6%), Bandiagara (22.8%) and Mopti (22.4%). The populations of the three health district have been the most affected by the intercommunal conflict in the Mopti region. Civilian population in our study has paid the heaviest burden unlike the military and the hunters, which represent the biggest belligerents. The military represented 18.4% of our patients, this result differs from that of Hoffman C [18] who found 95.5% but comparable to those of Djibo A. [16] and Kéita I [2], which reported 28.27% and 20.9%,

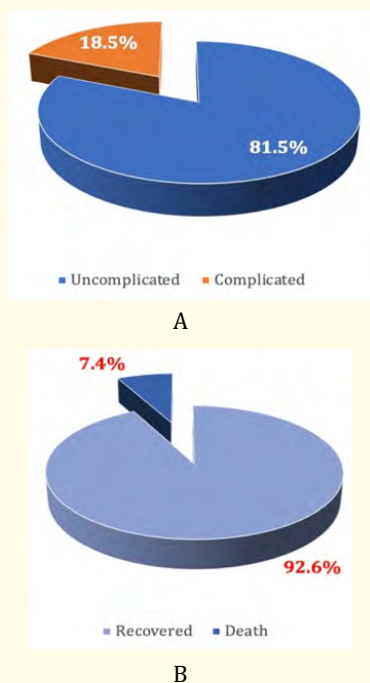


Figure 1: A. Patients immediate clinical outcome, B. Final outcome.

respectively. This could be explained by the fact that in our study, attacks were much more directed against the civilian population in the context of inter-communal conflicts and attacks by armed groups. The majority of patients were admitted in less than 6 hours or 71.2% of cases comparable to that of Kéita I. [2] which found 79% of cases. Due to the proximity of conflict zones to health facilities, the readiness of the population to contact civil protection or the police and the availability of transport equipment's, the wounded were evacuated for treatment within a reasonable time. The majority of patients were referred in 83.2% of cases because Sominé DOLO Hospital is the only 2nd reference medico-surgical facility in the Mopti region. The less seriously wounded were cared for locally without being referred. A strong humanitarian presence in the region facilitates the care of the wounded. In our study abdominal lesions were found in 10.8%. Our result does not differ statically from those of Owens, *et al.* [20] of Djibo A. [16] and the ICRC [19] in 2015 who found 11%, 6.5% and 7% of cases, respectively. In our study, only 22,2% of patients had received an ultrasound. Our result was significantly higher than that of Djibo A. [16] who reported 1.1%, $p < 0.05$. This could be explained by the fact that most of the clinical pictures encountered were quite suggestive of visceral involvement justifying a laparotomy from the outset. All patients received pain management treatment among them analgesics was used in 100% of the cases. this result was similar to that of Djibo A. [16] but significantly superior to that of Chaibou MS., *et al.* [15] in Niger who reported at the National Hospital of Niamey in 2016 93.3% as a rate of paracetamol use, $p < 0.05$. All of our patients had received probabilistic antibiotic therapy. This could be explained by the very high risk of infection in war surgery and the systematization of antibiotic therapy in case of abdominal gunshot wound in the war surgery. Indeed the wounds have a strong bacterial contamination, the bullets and other fragments are not sterile at the time of firing and the contaminated projectile introduces bacteria through the point of entry [13]. In our series 18.5% of our patients received a blood transfusion, our result does not differ from that of by Hoffman C. 2012 [19] in Afghanistan, who found a rate of 18% but higher than that of Djibo A. [16] who reported 8.4%; $p < 0.05$. The median laparotomy above and under umbilical has been the systematic way in our series. Ileo-jejunal anastomosis was performed in 9 cases (33.3%). All patients admitted for firearm wounds benefited from debridement and delayed primary closure. This is a cardinal principle in the care of war wounded. We never close a war wound immediately. We

have done the debridement, dress with compresses and then we have proceed to the delayed closure 5 days after the trimming only if the wound was clean and the dressing was dry [13,21]. Among the 5 complications, we recorded 3 infectious of the operative sites 3/27(11.1%). This result was significantly different to that of Murray, *et al.* [21] in Afghanistan and Iraq in 2009 who reported an infectious complication of abdominal gunshot wounds in 5.5% of cases. This confirms the hypothesis of the high risks of infections in the event of a war wound. The presence of necrosis, clots, foreign bodies and serositis are factors favoring infections in the same way as the contamination of wounds by skin germs [13]. In our series, the intra-hospital case lethality rate related to abdominal gunshot wound was 7.4%. Our result was significantly higher to those found by Hoffman C. [19] in Afghanistan in 2012 and Djibo A. [16] which had reported a lethality of 3.3% and 5.1%, respectively; $p < 0.05$. In contrast, our result was merely little different from that of Chaibou MS., *et al.* [15] in Niger in 2017 who reported 9.9%. This could be explained by the use of weapons of war and improvised explosive devices. In our study the two (7.4%) patients who died were all polytraumatized. Polytrauma is defined by abdominal gunshot wounds at least one of which can be life-threatening. The duration of hospitalization was in the majority of cases between 10-30 days 51.9%. The average duration was 35.1 days with extremes ranging from 1 to 99 days.

Conclusion

Abdominal gunshot is common during the army conflict. Its management is multi-disciplinary especially in the setting of saturating massive influx. Systematically surgical trimming and differentiated primary closure could reduced the risk of complications. The morbidity and mortality associated with Abdominal gunshot wounds depend on the nature of the lesions, the experience of the surgical team and the context in which the wound occurs.

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