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# Abdominal Wounds Caused by Firearms: Clinical Aspects and Treatment Methods

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**Abstract** | **Original Research Article**

Abdominal wounds caused by firearms are a real public health problem, the incidence of which is rising sharply in the world population. Their heterogeneity is linked to the variety of types of weapon used. In this study, we have endeavoured to show how abdomen wounds caused by firearms were managed during the period of our study, as our country has been through difficult times and has undergone profound changes punctuated by socio-political unrest for the establishment of its democracy. The overall objective was to contribute to improving the quality of management of abdominal gunshot wounds. We report the results of a retrospective descriptive study of 135 cases of abdominal gunshot wounds observed and managed in the visceral surgery department of the Donka CHU national hospital over a 16-year period from January 1, 2000 to December 31, 2015, with a view to highlighting anatomical, clinical and therapeutic aspects. In our series, 88.88% of patients underwent surgery for gunshot wounds, compared with 11.12% who did not. Of those who did not undergo surgery, 2.2% received shrapnel from grenades and 8.8% received shotgun pellets. The viscera most frequently affected were respectively the small intestine 41.8%, colon 40%, liver 20.74%, spleen 19.26% and stomach 13.33%. In our series, overall mortality was high and morbidity not negligible.

**Keywords:** Wounds, Firearm, Anatomo-clinical, Donka.



## INTRODUCTION

Firearm wounds are medical-surgical emergencies whose management requires coordination of all players in the care chain, from the first responder to the surgeon, and specific referral to a severe trauma unit [1].

Abdominal wounds caused by firearms are a real public health problem, with the incidence rising sharply in the world population. Their heterogeneity is linked to the variety of types of weapon used [2-4].

In this study, we have endeavored to show how firearm wounds to the abdomen were managed during the period of our study, as these wounds differ qualitatively from other traumas encountered in civilian practice.

**Overall objective:** was to contribute to improving the quality of management of firearm abdominal wounds.

## METHODS

### Study Design and Framework

This was a retrospective hospital-based descriptive study over a 16-year period from January 1, 2000 to December 31, 2015, carried out at the Donka CHU national hospital in Conakry, consisting of a case series of 135 patients with abdomen wounds caused by firearms.

All injured patients with one or more firearm wounds to the abdomen were included in the study Patients with incomplete records (lack of information on our study variables), patients injured by stabbing or by a public road accident (PRA) were not included in the study.

# RESULTS

From January 1, 2000 to December 31, 2015, we collected 450 cases of abdominal wounds in the visceral surgery department of the Donka CHU Conakry National Hospital; fig1 including 239 wounds caused by knives, 76 traumatic wounds caused by road accidents and 135 abdominal wounds caused by firearms, i.e. 30%.

**AGE**: The average age of our patients was 25 years, with extremes ranging from 13 to 75 years. The most vulnerable age group were young subjects (20-29), i.e. 44.44%.

**SEX**: Ee found a clear predominance of males (n1=123), i.e. 91% versus 9% (n2=12), for a sex ratio of 10.25.

**Vulnerating agent:** The most frequently encountered vulnating agent was the bullet (70.37%, see Table 1), followed by shotgun pellets (23.70%).

**Time since impact:** 71.11% of patients were seen before the 6th hour, 11.11% between the 12th and 24th hours, and only 4.44% after the 72nd hour.

According to the circumstances in which they occurred during the study period, we found that riots were the main source of firearm wounds to the abdomen (43.70%), followed by armed robbery (27.41%) and shooting accidents (20.74%).

According to impact site, the buttocks occupied 1st place (17.04%), followed by the umbilicus and epigastrium (15.56% for each quadrant).

The abdominal-gluteal projectile path was the most frequently encountered during the period of our study (64.44%), with pure abdominal wounds accounting for 54.07% and thoracoabdominal wounds for 28.14%.

**Hemodynamic status:** our results showed that the majority of our patients had stable hemodynamics on admission (90.37%), compared with 9.62% whose hemodynamics were unstable.

**Entry and exit orifices:** The projectile (bullet) path was transfixing in 68.15% of our patients, and we often observed entry orifices at a distance from the visceral lesions. 43 of our patients (31.85%) presented blind wounds with retention of the vulnating agent.

**Surgical trimming:** In our series, 73.33% of patients benefited from surgical trimming, compared with 26.67% who did not. Of these, 22.96% were admitted between 2000 and 2005.

**Anatomical and clinical aspects**: in our series, the viscera most frequently involved were the small intestine (41.8%), the colon (40%), the liver (20.74%), the spleen (19.26%) and the stomach (13.33%).

Retroperitoneal muscles and the diaphragm accounted for 18.52% and 11.85% respectively.

**Distribution of cases according to therapeutic course:** according to the therapeutic course in our series of 135 patients, we operated on 120 patients, i.e. 88.88% of whom had a formal indication for surgery (fig3), compared with 15 patients, i.e. 11.12% of non-operated patients. Among the non-operated patients, 2.2% had received grenade fragments and 8.8% had received shotgun pellets.

**Complications:** postoperative peritonitis was the most frequently encountered complication (13.33%), followed by parietal abscesses (10.37%) and complications such as parietal cellulitis, septicemia and acute renal failure (5.93%). We also noted 2 cases of pancreatic fistula and 2 cases of evisceration (1.48%).

**Onset of death:** Three patients (0.22%) died on admission, including one with an extremely haemorrhagic thoracoabdominal gunshot wound, even though clinical examination had revealed only one abdominal entrance wound (right flank) and one thoracic exit wound (4th space medial to the left mid-clavicular line). The other two died of evisceration with unstable haemodynamics.

Intraoperatively, there were 2 cases of death by gunshot (1.48%), the 1st by damage to the inferior mesenteric artery, the second by damage to the splenic artery.

Postoperatively, 18 cases of death were recorded, including 8 cases of postoperative peritonitis after reoperation (5.92%), 4 patients (2.96%) died of sepsis on d5 and d8; 2 patients (1.48%) died of complications of pancreatic fistula on d5 and d9 postoperatively; 3 patients (2.22%) died of complicated acute renal failure on postoperative days 2, 3 and 7; and one patient (0.74%) died of parietal cellulitis, the entry orifice of which was at the level of the superior-external quadrant of the right buttock, with abdominal ballistic retention after trimming on admission and conversion to median laparotomy on day 5.

During the period of our study, overall mortality was 17.03%, and operative mortality was 14.81%, including 13.33% postoperatively and 1.48% intraoperatively.

**Length of stay:** the average length of hospital stay was 11 days, with extremes ranging from 0 to 28 days.

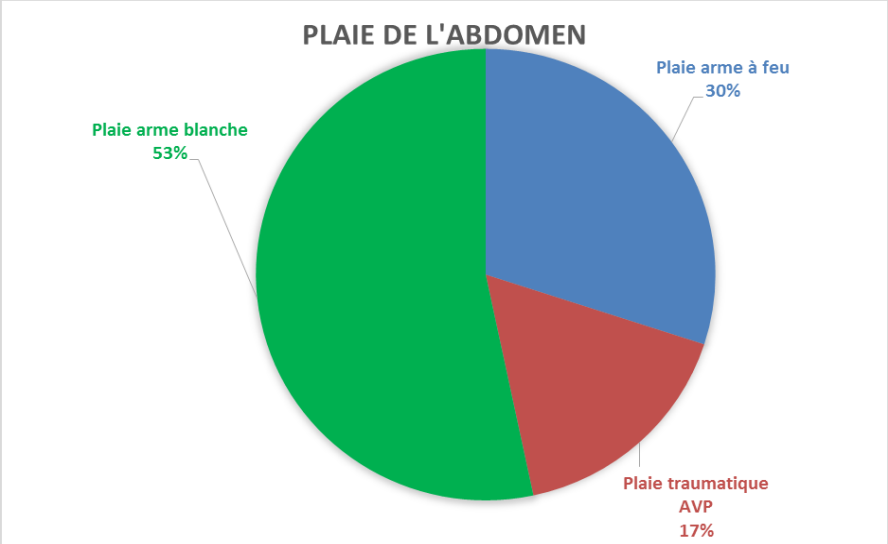


**Figure 1: Incidence of abdominal firearm injuries as a proportion of all observed abdominal injuries From January 1, 2000 to December 31, 2015.**

**Table 1: Frequency of the number of cases observed according to the years of study from 2000 to 2015, the table shows a peak between 2006 and 2007.**

| Year of study | Number of cases | % |
|---|---|---|
| 2000 | 7 | 5.19 |
| 2001 | 3 | 2.22 |
| 2002 | 3 | 2.22 |
| 2003 | 8 | 5.92 |
| 2004 | 6 | 4.44 |
| 2005 | 4 | 2.97 |
| 2006 | 7 | 5.19 |
| 2007 | 21 | 15.56 |
| 2008 | 15 | 11.11 |
| 2009 | 11 | 8.14 |
| 2010 | 5 | 3.70 |
| 2011 | 9 | 6.67 |
| 2012 | 7 | 5.19 |
| 2013 | 14 | 10.37 |
| 2014 | 4 | 2.97 |
| 2015 | 11 | 8.14 |
| Total | 135 | 100 |

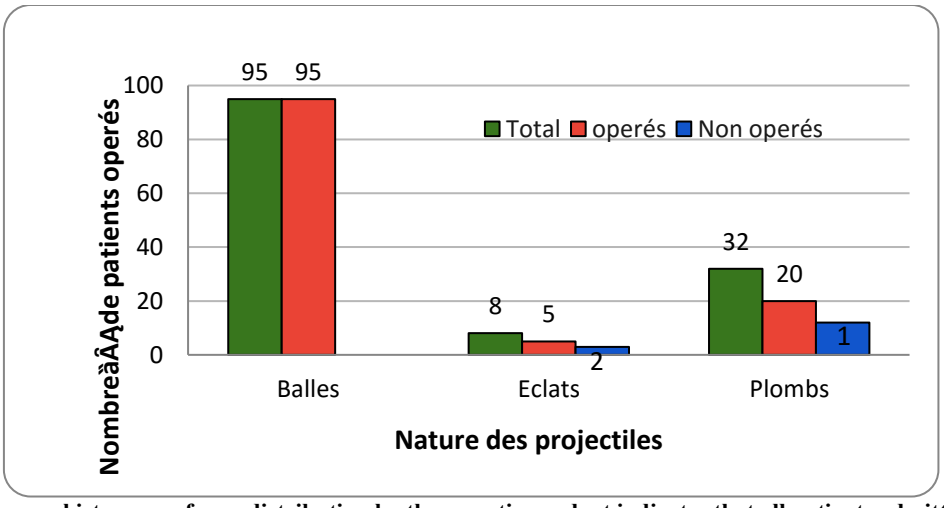


**Figure 3: Frequency histogram of case distribution by therapeutic conduct indicates that all patients admitted for gunshot wounds underwent surgery.**

**Table 2: Distribution of cases according to the vulnating agent, the most frequently encountered being the bullet.**

| Vulnerable agent | Number of cases | % |
|---|---|---|
| Balls | 95 | 70.37 |
| Leads | 32 | 23.70 |
| Metal splinters / fragments | 8 | 5.93 |
| Total | 135 | 100 |

**Table 3: Distribution of cases according to the circumstances of occurrence. We note that riots were the main source of gunshot wounds to the abdomen**

| Circumstance of occurrence | Number of cases | % |
|---|---|---|
| Riots | 59 | 43.70 |
| Aggression banditry | 37 | 27.41 |
| Shooting accident | 28 | 20.74 |
| Armed conflict | 5 | 3.70 |
| Inter-community conflict | 3 | 2.22 |
| Attempted autolysis | 3 | 2.22 |
| Total | 135 | 100 |

# DISCUSSION

**Epidemiological data:** From January 1, 2000 to December 31, 2015, we recorded 135 gunshot wounds to the abdomen, i.e. 30%. Our results are comparable to those of J Bahebeck *et al.,* [5] in their study of abdominal gunshot wounds in 86 observations in Cameroon in 2005, who found a frequency of 31.5% over a 5-year period.

After dividing the years of study into three brackets, we observe in our series that the incidence of abdominal gunshot wounds varied from year to year,

The number of abdominal gunshot wounds was 6 per year, from 2006 to 2010 the average number of abdominal gunshot wounds was 12 per year, fig2, and from 2011 to 2015 the number of wounded was 9 per year. We can thus see that the 2nd and 3rd tranches saw a clear increase in the number of injuries per year.

Our results are comparable to those reported by Boubakeur Seddiki. [6]

Who recorded 65 cases of abdominal gunshot wounds over an 11-year period from 1991 to 2001, with increasing incidence in his series in the years 1994, 1996 and 1998.

Regarding the age of our patients, the most vulnerable group were young subjects (20-29), i.e. 44.44%. Mapouka *et al.,*[7] in their study of penetrating abdominal wounds caused by firearms at Bangui University Hospital, reported that the average age of their patients was 29.8+3.9 years.

According to sex, we found a clear male predominance (n1=123), i.e. 91% versus 9% (n2=12), for a sex ratio of 10.25.

During the period of our study, merchants, pupils and students were the most affected, at 26.67% and 24.44% respectively.

**Vulnerable agent:** our results are comparable to those of Hommel *et al.,*[8] in their 1994 study of abdominal wounds caused by war projectiles on 36 wounds operated on in Mogadishu, who reported 83.3% for bullets and 8.4% for explosive projectiles.

Sar Boubou et al [9], in a study of 20 cases of penetrating abdominal wounds in Bissau during the 1998-1999 war, reported 70% shrapnel wounds, versus 5% bullet wounds.

The number of impacts varied, with 82 or 60.74% of patients having received a single impact, compared with 53 or 39.25% of patients having received several impacts.

Our results are superior to those reported by O.J.-Y. Monneuse *et al.,* In a retrospective study of 79 patients with penetrating abdominal wounds at the Edouard Herriot Hospital, Lyon, France, 2004, they reported 3.12% of isolated skin entry holes.

**Time since impact:** We note that most of our patients were admitted to hospital before the 6th hour. The 6 patients admitted between the 48th and 72nd hours were referred by peripheral health facilities.

Pons *et al.,* [10] in 1997, in their study of abdomino pelvi gluteal war wounds, reported 33% before the 6th hour, 42% between the 6th and 48th hours and 23% after the 48th hour, up to several weeks.

According to the circumstances in which they occurred during the study period, we found that riots were the main cause of abdominal gunshot wounds (43.70%), followed by armed assaults (27.41%) and shooting accidents (20.74%).

J. Bahebeck *et al.,* reported 56.5% assaults, 21% police shootings, 20% hunting accidents and 2% weapon handling accidents among 86 patients in Yaoundé in 2004.

This may be explained by the fact that our study covers a period marked by security and socio-political unrest.

**Hemodynamic status:** 90.37% of our patients were hemodynamically stable on admission. This hemodynamic stability could be explained by the small amount of blood loss prior to patient admission, and by the shortened management time.

**Entry and exit orifices:** F. Pons *et al.,* in 1997 reported an 80% frequency of entry and exit orifices in 16 cases in the buttock.

In our study, we often observed entry orifices at a distance from visceral lesions, with 43 of our patients (31.85%) presenting blind wounds with retention of the vulnating agent.

**Surgical trimming:** In our series, 73.33% of patients benefited from surgical trimming, compared with 26.67% who did not of the 26.67%, 22.96% of patients were admitted between 2000 and 2005, during which time the surgeons working in our facility were not familiar with firearm wounds of the abdomen. They were rarely confronted with these types of wounds.

The ICRC's experience has made a major contribution to improving the quality of management of abdominal gunshot wounds.

Our results show that most of our patients benefited from hydroelectrolytic support; however, the volume of fluid, the infusion and the nature of the solutes used were often imprecise and unquantified. Nevertheless, we found that 76.29% of our patients benefited from crystalloid infusion, and 32 (23.70%) were transfused, in the following groups: B+=19 cases; O+ =7 cases and AB+= 6 cases.

**Medication received:** In our series, the administration of antibiotics posed a number of difficulties, particularly the lack of precision as to when the antibiotic was administered, and the fact that our patients were treated for longer than 24 hours, with 97.78% receiving systematic antibiotic therapy, 99.26% analgesics and 6 polytraumatized patients anticoagulants.

**Anatomical-clinical aspect:** lesion assessment in our series, it is important to note that most of our patients had multi-visceral lesions. This could be explained by the energy transfer and cavitation effect of the projectiles.

In 1991, Hommel et al in Mogadishu reported 61% of injuries to the small intestine, 41% to the colon, and 11% to the liver and stomach respectively, in a series of 36 wounds.

F. raherinantenaina *et al.,* [11] in Madagascar in 2012 reported that the organs most frequently injured in penetrating trauma were, in descending order, the small intestine 48%, the colon 28%, the liver 16% and the spleen 12%.

Most patients received anti-tetanus serum (82.22%), but no patient in the series received anti-tetanus vaccine.

**Distribution of cases according to therapeutic course of action:** For a patient with multiple abdominal lead splinter wounds, the therapeutic sanction is often difficult to determine, especially when the indication is surgical. In hemodynamically stable patients, clinical and paraclinical monitoring is more effective than unilateral laparotomy. [12]

During this period, 61 patients (45.19%) underwent surgical trimming, while 23 patients (17.04%) received hemostatic sutures. Surgical trimming and hemostatic suturing involved the liver, kidney and pancreas (body and head), while 4 patients (2.96%) underwent total spleen removal.

**Procedure (hollow organs):** In this series, according to the procedure performed, we found that surgical trimming plus simple suturing concerned 32 cases, including 9 for the small intestine, 5 for the stomach and 18 for the colon, i.e. 23.70%. Anastomotic resection involved the small intestine in 25 cases (18.52%).

Simple suturing without surgical trimming concerned 56 cases, including 20 for the small intestine, 13 for the stomach and 23 for the colon (41.48%), compared with 1 case of perineal amputation (0.74%). For the retroperitoneal muscles and the diaphragm, sutures and approximations were performed on a case-by-case basis.

**Complications:** postoperative morbidity showed that the rules of septic surgery had not been sufficiently applied in this series, with 54.07% of patients suffering postoperative complications.

**Occurrence of death:** During the period of our study, we found that overall mortality was very high compared with the results of Boubakeur Seddiki T et al, in their retrospective series at the Oran military hospital involving 65 casualties, found an overall mortality of 21.4% (15 casualties) and an operative mortality of 6.2% (4 casualties).

We note that early mortality on admission and intra-operatively could be due to haemorrhage and the failure of the technical platform, while post-operative mortality may be attributable to infections, since firearm

projectiles are responsible for wounds that are always soiled and contaminated.

**Length of stay:** the hospital stay of the injured was 11 days longer than that of Chouan O *et al.,*[13] in 2016, who reported in their series an average hospital stay of 8.9 days.

## CONCLUSION

Our country, Guinea, has gone through difficult times marked by social and political unrest culminating in riots, which have been the main source of abdominal gunshot wounds, posing problems of abdominal penetration, indication and treatment of intra- and extra-abdominal injuries.

Laparotomy was systematically performed on all patients admitted in a state of hemorrhagic shock for abdominal gunshot wounds, despite the fact that surgeons were unfamiliar with gunshot wounds, which are always soiled and contaminated. Surveillance was recommended for abdominal wounds caused by projectiles of very small size and dimensions, whose projectile path and location were free of symptoms of haemorrhage and/or peritonitis. In our series, mortality was high and morbidity non-negligible.

**Conflicts of interest**

The authors declare no conflicts of interest.

**What is known about this subject ?**

- Firearm wounds are always immediately heavily soiled and contaminated, and tissue damage depends on the amount of energy transferred.
- Any surgeon called upon to treat a firearm wound to the abdomen is confronted with a variety of injuries.
- The context of firearm injuries varies

**What's new in your study ?**

- Heavy morbidity and mortality
- According to the circumstances in which they occurred during the period of our study, security incidents, particularly riots and armed attacks, were the main causes of abdominal wounds caused by firearms.
- Surveillance was recommended for abdominal wounds caused by very small projectiles whose projectile path and location were free of symptoms of haemorrhage and/or peritonitis.

**Author contributions**

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Monsieur le Professeur ABDOULAYE BOBO DIALLO: Professeur agrégé d'urologie andrologie à la faculté de médecine à L U.G.A.N-CONAKRY
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## REFERENCES

1. V. des Robert. Prise en charge d'une blessure abdominale par arme à feu sur le territoire national : apport de l'expérience du service de santé des armées Journal Européen des Urgences et de Réanimation, Volume 33, Issue 3, Octobre 2021, Pages 141-145
2. O. J. –Y, Monneuse, Barth X, Gruner L, Pilleul F, et col. Les plaies pénétrantes de l'abdomen. Conduite diagnostique et thérapeutique à propos de 79 patients. *Avril 2004,129(3), 156-163* Annales chirurgicales (Elsevier Masson)
3. Giannou C, Baldan M, Molde Å. La chirurgie de guerre Travailler avec des ressources limitées dans les conflits armées et autres situations de violence. *19, March 2013(1), International Committee of the Red Cross 19-59-63-74,*
4. David Tran Van. Traumatologie thoracique plaie par balle *2016 Page 1-9*

5. J Bahebeck et col. La plaie abdominale par balle à propos de 86 observations au Cameroun. 2005 Med top ; 65 :554-558.
6. BS. Taouagho, W.Kadjam, R. Koudjiti. Traumatisme de l'abdomen par arme à feu. Expérience du service de chirurgie générale d'ORAN à propos de 65 plaies de l'abdomen observée pendant 11 ans –Congres d'Alger 2008 ; Vol 82 P 68-2009
7. Mapouka, P. A. I., Ngatchoukpo, V. N., Mirotiga, P. A. N., Nabia, D. R., Fioboy, V. A. R., & Tékpa, B. J. de D. Les Plaies Pénétrantes De L'abdomen Par Armes À Feu : Aspects Épidémiologiques, Cliniques, Lésionnels Et Thérapeutiques Au CHU Communautaire De Bangui, Centrafrique (2019) *European Scientific Journal, ESJ*, *15*(36), 475. Retrieved from https://eujournal.org/index.php/esj/article/view/12669
8. Hommel et Col. Plaies de l'abdomen par projectiles de guerre à propos de 36 plaies opérées. 1994 MSF; N4. Mogadishu
9. Sarre Boubou et col. Les plaies pénétrantes de l'abdomen en pratique de guerre. Expérience de Bissau à propos de 20 cas 1998-1999.
10. Pons et Col. Les plaies abdomino-pelvi-fessières de guerre principes de traitement. Annales d'urologie 1997 V31 ; N 5
11. F. Raherinantenaina, T. Rajaonarivony, SD Rakotomena, H.N. Rakoto Rat Simba – Madagascar. Prise en charge des plaies abdominales par arme à feu en situation précaire. Médecine d'Afrique noire 2012; 59, N° 12.
12. *A. MEJDANE, A. AMEUR, H. OKHEIRA*. Les plaies abdominales par éclats de plomb. Décembre 2001 Maroc Médical. Vol 23 n 4 ;
13. O.Choua K. Rimtebaye, et col -Les plaies pénétrantes par armes Blanches et à Feu a DJAMENA TCHAD une Epidémie Silencieuse Publié le 30 mars 2016 Revue scientifique européenne, ESJ.