

Presentation, management and evolution of patients with abdominal gunshot wound. A decade of violence in Mexico

Presentación, manejo y evolución de pacientes con herida por proyectil de arma de fuego en el abdomen. Una década de violencia en México

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Abstract

Background: Traumatic injuries represent 9.6% of the global surface of the disease and represent the third most common cause of death in adults and adolescents. Patients were admitted to the hospital presenting traumatic injuries, penetrating abdominal traumatism remains a major cause of morbidity and mortality. **Objective:** To analyze the presentation, handling and development of patient's gunshot wound. **Method:** Retrospective, descriptive, observational study. It was reviewed from 2010-2015 in the statistics department of the University Hospital Dr. José E. González all patients diagnosed with firearm projectile injury in abdomen. **Results:** Were admitted above an average of 1.22 ± 0.51 lesions, on a Glasgow coma scale of 13.59 ± 2.5 , oxygen saturation of 96.2 ± 2.09 , heart rate of 94.4 ± 20 , respiratory rate of 22 ± 6 and shock degree of 1.5 ± 0.80 . **Conclusion:** Vital signs and specific characteristics of the lesion are essential and useful for the prediction of mortality due to abdominal traumatism by firearm projectile, in addition to the quantification of wounds and associated organic lesions, these are being evaluated both as a whole and separately.

Keywords: Abdomen. Hospital stay. Firearm projectile injury. Mortality. Trauma.

Resumen

Antecedentes: Las lesiones traumáticas representan el 9.6% de la carga global de la enfermedad y son la tercera causa más común de muerte en adultos y adolescentes. Entre los pacientes ingresados en el hospital con lesiones traumáticas, el traumatismo penetrante abdominal sigue siendo una importante causa de morbilidad y mortalidad. **Objetivo:** Analizar la presentación, el manejo y la evolución de los pacientes con herida por proyectil de arma de fuego en el abdomen. **Método:** Estudio retrospectivo, descriptivo y observacional. Se revisaron todos los pacientes con diagnóstico de herida por proyectil de arma de fuego en el abdomen en el departamento de estadística del Hospital Universitario Dr. José E. González durante los años 2010-2015. **Resultados:** Del total, 21 (9.1%) pacientes eran del sexo femenino y 229 (90.9%) del sexo masculino. Se ingresaron con un promedio de 1.22 ± 0.51 lesiones, con una puntuación en la Escala de coma de Glasgow de 13.59 ± 2.5 , saturación de oxígeno de 96.2 ± 2.09 , frecuencia cardíaca de 94.4 ± 20 , frecuencia respiratoria de 22 ± 6 y grado de choque de 1.5 ± 0.80 . **Conclusión:** Los signos vitales y las características específicas de la lesión son esenciales y útiles para la

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predicción de la mortalidad por traumatismo abdominal por proyectil de arma de fuego, además de la cuantificación de heridas y lesiones orgánicas asociadas, siendo evaluadas estas tanto en un todo como por separado.

Palabras clave: Abdomen. Estancia hospitalaria. Herida por proyectil de arma de fuego. Mortalidad. Traumatismo.

Introduction

Traumatic injuries account for 9.6% of global burden of disease and are the third most common cause of death in adults and adolescents^{1,2}. Among hospital-admitted patients with traumatic injuries, penetrating abdominal trauma (AT) caused by gunshot wound (GSW) remains a major cause of morbidity and mortality³⁻⁵. Worldwide, homicidal firearm injuries occur at a rate of 0.2-4.8 per 100,000 population⁶, with a mortality rate close to 88%⁵.

Improvements in trauma care systems in high-income countries, such as the United States of America, have resulted in a significant improvement in the survival of patients with penetrating AT (including gunshot wounds)⁷⁻⁹. In low- and middle-income countries, where the burden of firearm injuries is huge¹⁰⁻¹², it is still necessary for their presentation and current evolution to be established and identified, which are data that are not known in Mexico.

In Mexico, traumatic injuries have been relevant within the last decade, with a marked annual increase. These injuries are especially relevant in young adults, given that they accounted for 50% of mortality at between 15 and 34 years of age. In 2016, 72,821 violent deaths were recorded. The organs most affected by GSW AT are the small intestine (50%), the large intestine (40%) and the liver (30%)¹³.

In the present study we propose two hypotheses:

- The presence of shock and the number of abdominal organ injuries represent variables of interest for AT and GSW stratification.
- There are GSW AT accompanying variables that modify mortality and hospital length of stay.

The primary endpoint was to provide a direct comparison of mortality with different patient scenarios, and thus determine the variables of poorer prognosis and high mortality.

The secondary endpoints were to postulate variables to optimize stratification methods in developing countries and to perform a risk analysis for prolonged hospital stay (≥ 14 days).

Method

Retrospective, descriptive, observational study. Medical charts of 230 patients admitted to the surgery

department of the José Eleuterio González University Hospital, from 2011 to 2015, who presented with AT by GSW were reviewed. The sample size was determined by the highest number of viable cases for the study that were found within the specified time period ($n = 230$).

The study was carried out with authorization of the research committee of the corresponding institution. The obtained information was collected in an electronic database for later use on statistical analysis. Patient private information was reviewed only by the authors and co-authors, and as a privacy protocol, digital files will be deleted in a 5-year period.

This research was subjected to review by the José Eleuterio González University Hospital surgery department staff.

- Inclusion criteria: the operations related to this study will be carried out within the José Eleuterio González University Hospital; patient who has suffered AT caused by GSW.
- Exclusion criteria: the medical record to be reviewed does not contain the information relevant to this study; the medical record has irregularities in its content.

The variables of interest were obtained after review of the medical records, which are under the care of the archive department at José Eleuterio González University Hospital. Said review was carried out for each one of the different formats that make up the medical record. The medical records were reviewed exclusively by the authors of this research.

- Clinical data: injured organ, type of injury, whether it was single or multiple, and quadrant of the injury or injuries.
- Physical examination: Glasgow coma scale, vital signs including heart rate, respiratory rate, blood pressure, temperature and oxygen saturation.
- Surgery: type of injury, surgical time, packed red blood cell units, whether intensive care was required.

Data were analyzed using the Numbers® v3.6.1 software (Apple Inc.) and statistical analysis was carried out with IBM SPSS Statistics v20.0 program (SPSS, Inc., Armonk, NY, USA), contingency tables and the chi-square test².

Results

In total, 237 cases were identified, but seven did not have complete medical records, which might have increased the confounding factor and, therefore, a total of 230 cases were reviewed from 2011 to 2015, out of whom 22 (9.6%) were females and 208 (90.4%) were males (Fig. 1), with AT by GSW, the distribution of which is shown in table 1.

Sociodemographic data are described in table 2. In addition, an analysis was carried out for organ lesions and whether or not they increase the risk of death when present, state of shock and number of organ injuries and penetrating wounds.

As for clinical variables, patients were admitted with an average of 1.22 ± 0.51 injuries, with a Glasgow Coma Scale score of 13.59 ± 2.5 , oxygen saturation of 96.2 ± 2.09 , heart rate of 94.4 ± 20 beats per minute, respiratory rate of 22 ± 6 breaths per minute, shock grade of 1.5 ± 0.80 , average Trauma and Injury Severity Score (TRISS) of 19 and Revised Trauma Score (RTS) of 6.4. Peritoneal irritation was identified in 64 patients.

Mean hospitalization time was 14.28 ± 19.82 days. A total of 41 patients were transferred to the intensive care unit, where they remained 1.29 ± 3.2 days. An average of 3.4 ± 4.1 transfusions were carried out. No injury was identified in 28 patients. Among all 230 patients, only 147 had injuries exclusively in the abdomen, 69 in the abdomen and chest, 11 in the abdomen and extremities, and 4 in the abdomen and neck. Reported mortality was 27 (11.7%). The mortality factors associated with prolonged hospital stay are shown in table 3, including vital signs, injuries and affected abdominal quadrant.

Confounding factors are present owing to a lack of differentiation of variables between preoperative, intraoperative and postoperative times. The confounding factor is reduced when all variables of interest are quantified.

Discussion

This research had limitations related to obtaining preoperative, intraoperative and postoperative variables, in addition to the interpretation of medical records given to the different surgical criteria used for decision making. Currently, there is a large number of injury severity measurement instruments available to quantify and stratify the risk of penetrating abdominal injuries¹⁴⁻¹⁸. The presence of shock and the number of compromised abdominal organs have been shown to be reliable markers of severity in patients with AT by GSW¹⁹.

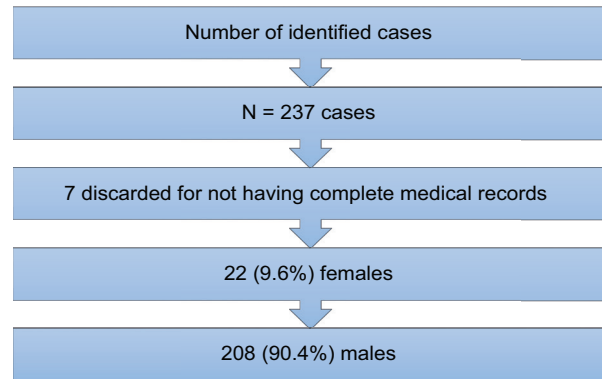


Figure 1. Number of cases identified after electronic database analysis.

Table 1. Patients assisted for abdominal gunshot wound per year (n = 230)

Year	Patients
2011	56
2012	63
2013	54
2014	29
2015	28
Total	230

Similarly, delays in surgical interventions and a high injury severity score (ISS) have also been linked to high complication rates²⁰. Many of these measurement instruments, especially the ISS, are based on injury evaluations on multiple regions of the body.

Various injury severity measurement instruments are available for assessing penetrating AT^{18,20,21}. Gunshot wounds are common characteristics of traumatic injuries in many metropolitan cities. For patients in developing countries, they can be especially damaging due to a general lack of pre-hospital care and difficult access to health services, as it occurs in the country where this research originates from²². GSWs disproportionately affect young adult patients during their most economically productive years, which makes it necessary for channels for improving both emergency and surgical management and subsequent follow-up to be established^{1,6}.

In most studies carried out in the developed world, the small intestine has been reported to be the most frequently injured organ in penetrating AT. Adesanya et al.¹⁹ and Feliciano et al.⁵ reported that 52.4% and

Table 2. Sociodemographic data and associated mortality in patients with abdominal gunshot wound (n = 230)

	General (n = 230)	Statistical analysis	Mortality (n = 28)	No mortality (n = 202)
Mortality	28 (12%)		28 (100%)	202 (100%)
Number of injuries				
1	131 (56%)		5 (17%)	127 (62%)
≥ 2	98 (42%)		23 (82%)	75 (37%)
Affected abdominal quadrant				
Upper right	80 (34%)	NS	9 (32%)	77 (38%)
Upper left	60 (26%)	NS	7 (25%)	50 (24%)
Lower right	30 (13%)	NS	5 (17%)	30 (14%)
Lower left	60 (26%)	NS	7 (25%)	55 (27%)
Shock grade				
1	159 (69%)		14 (50%)	155 (76%)
2	59 (25%)		10 (35%)	44 (21%)
≥ 3	10 (4%)		4 (14%)	4 (2%)
Gender				
Males	208 (90%)		28 (100%)	181 (89%)
Females	22 (10%)		0	21 (10%)
	29.5 ± 11.2	NS	30 ± 13.5	29.5 ± 10.9
Age				
Hospitalization days	47 (20%)	NS	10 (35%)	58 (28%)
>14 days	50 (21%)		22 (78%)	28 (13%)
Intensive care				
Injury site				
Abdomen	147 (63%)		14 (50%)	133 (65%)
Abdomen and other site	82 (35%)		14 (50%)	69 (34%)
Associated injuries	77 (33%)	NS	14 (50%)	63 (31%)
Glasgow	14.3 ± 1.3	0.033	13 ± 1	14 ± 1
Vital signs				
Temperature	36.3 ± 0.41	0.035	36 ± 0.5	36 ± 1
Saturation < 92	14 (6%)	NS	3 (10%)	11 (5%)
Heart rate > 100	80 (34.8%)	NS	18 (64%)	62 (30%)
Systolic pressure	120 ± 21	0	121 ± 19	119 ± 21
Systolic pressure < 90	28 (12.2)	NS	2 (7%)	26 (13%)
Respiratory rate > 20	139 (60%)	NS	21 (75%)	118 (58%)
Respiratory rate < 12	6 (2%)	NS	1 (3.5%)	5 (3%)
RTS				
3-10	230 (100%)		28 (100%)	202 (100%)
Peritoneal irritation	68 (29%)	NS	12 (42%)	56 (27%)
Chest	69 (30%)	NS	12 (42%)	57 (28%)
Trachea	31 (13%)	NS	3 (10%)	28 (13%)
Esophagus	37 (16%)	NS	8 (28%)	29 (14%)
Duodenum	12 (5%)	0.043	8 (28%)	4 (2%)
Small intestine	72 (31%)	0	12 (42%)	60 (39%)
Large intestine	99 (43%)	NS	13 (46%)	86 (42%)
Spleen	34 (14%)	NS	5 (17%)	29 (14%)
Liver	59 (25%)	NS	9 (32%)	50 (24%)
Pancreas	13 (5%)	NS	5 (17%)	8 (4%)
Vascular	26 (11%)	0.002	6 (21%)	20 (10%)
Renal	33 (14%)	NS	5 (17%)	28 (14%)
RBC packs	3 ± 4	0	8.6 ± 5.5	2.3 ± 3.1
> 6 RBC packs	33 (14%)	NS	17 (60%)	16 (8%)
ICU				
ICU (days)	2 ± 5	0	9.3 ± 10	1.16 ± 3
ICU > 7 days	26 (11%)	0	12 (42%)	14 (7%)

(continues)

Table 2. Sociodemographic data and associated mortality in patients with abdominal gunshot wound (n = 230) (Continued)

General (n = 230)		Statistical analysis	Mortality (n = 28)	No mortality (n = 202)
Small intestine				
Grade	Frequency	Treatment		
		EEEEA	Derivation	Primary repair
1	0	0	0	0
2	11 (15%)	3 (6%)	0	8 (44%)
3	41 (57%)	28 (60%)	3 (43%)	10 (56%)
4	17 (24%)	13 (28%)	4 (57%)	0
5	3 (4%)	3 (6%)	0	0
	Stomach	Kidney	Spleen	Liver
1	2 (5%)	4 (12%)	4 (13%)	8 (13%)
2	26 (70%)	11 (33%)	8 (25%)	28 (47%)
3	8 (22%)	2 (6%)	10 (31%)	21 (35%)
≥ 4	1 (3%)	16 (49%)	10 (31%)	3 (5%)
Large intestine				
Localization	Total	Grade 1	Grade 2	Grade ≥ 3
Right colon	34	6 (18%)	6 (18%)	22 (64%)
Transverse colon	25	1 (4%)	6 (24%)	18 (72%)
Left colon	22	1 (5%)	7 (32%)	14 (63%)
Sigmoid colon	12	1 (8%)	5 (42%)	6 (50%)
Rectum	7	1 (14%)	3 (43%)	3 (43%)

EEEEA: end-to-end entero-enteric anastomosis; ICU: intensive care unit; NS: non-significant ($p > 0.05$); RBC: red blood cells; RTS: Revised Trauma Score.**Table 3. Risk variables for prolonged hospital stay (≥ 14 days) (n = 230)**

	p	Hazard ratio
Respiratory rate ≤ 12	0.023	73.442
Heart rate > 100	0.007	23.627
Oxygen saturation < 92%	0.071	8.863
> 1 injuries	0.050	8.455
Abdominal quadrants		
Upper right	0.579	1.271
Upper left	0.053	2.289
Lower right	0.081	2.332
Lower left	0.244	1.701

60% of their patients, respectively, had injuries in the small intestine. In our study, the large intestine was more commonly injured than the small intestine,

although the latter was also a frequently injured organ. This may be a reflection of the diverging trends in gunshot wounds; in particular, it reflects the use of high-caliber weaponry capable of inducing damage through a larger segment of internal tissue²¹⁻²³.

The abdominal quadrant with the highest risk for prolonged hospital stay was the upper left, which is probably linked to spleen injury, which is the most frequently injured organ (30-40%) with regard to AT. Abdominal pain and bleeding-associated shock are the most common clinical presentation. Peritoneal irritation occurs as a complication of hollow organs damage (small intestine, stomach, colon, omentum). On the other hand, the number of injuries was shown to be a variable that increases the risk for prolonged hospital stay by 8.45 times²⁴, which in turn increases the risk of complications such as associated empyema, urinary infections and pneumonia, impaired quality of life and

decreased optimization of resources in this area, in addition to a (already documented) mortality increase²⁵.

It is necessary for variables at different surgical times to be correlated, in addition to including more specific data regarding the different therapeutic methods used in this study and data obtained in the emergency room, where the first contact with patients with AT by GSW takes place. The reproduction of this study for future research will benefit the generation of statistics and risk staging in developing countries and with preference for cases of violence presenting with this type of injuries, which might complicate early medical care.

AT caused by GSW is, currently, an issue that requires multidisciplinary care, since it is imperative for the quality of medical services to be improved by adapting them to the unfavorable situations that prevail in developing countries, in addition to improving therapeutic evolution and contributing to increase the state of national public safety.

Conclusions

The results demonstrate the usefulness of the presence of shock and the number of damaged abdominal organs as valid predictors of injury severity for a critical subgroup of AT caused by GSW in adults and adolescents, in addition to assessing vital signs and injury-specific characteristics for predicting GSW-related AT mortality. This is one of the first reports on GSWs with a high volume of patients in Mexico.

Conflicts of interest

There are no conflicts of interest among the authors of this study.

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained informed consent from the

patients and/or subjects referred to in the article. This document is in the possession of the corresponding author

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