

**ASSESSMENT OF PEACETIME GUNSHOT INJURIES OF ABDOMEN IN REPUBLIC OF YEMEN, IBB
DISTRICT**

Ghabisha Saif Ali Ahmed .

M.D., Ph.D. Department of Surgery, Al-Nasr Hospital, Ibb, Yemen.

Abstract:

We reviewed the records of 218 patients admitted to Al Nasr Hospital City IBB due to GSWA, during the period from January 2006 to December 2010. This retrospective study on those who sustained abdominal gunshot wounds was performed to evaluate the pattern of injuries, treatment outcome and the role of selective conservative management. 17(7.7%) patients with superficial wounds were managed by local wound care. 15 (6.9%) stable patients with minimal abdominal signs were selected for conservative management. Laparotomy was performed in 186 (85.3%) patients who were presented with an acute abdomen. The commonly injured organs were the small bowel (30.1%), colon (16.7%), liver (14.5%) and stomach (12.4%). Complications related directly to GSWA occurred in 36(19.4%) patients. Prolonged injury to arrival and surgical intervention time were contributing factors to the incidence of mortality (7.4%) from penetrating abdominal injury. Eight patients selected for conservative management required delayed laparotomy, which was negative. Selective conservative management is feasible without the use of expensive investigations.

BACKGROUND: Gunshot wounds of the abdomen (GSWA) are still a subject of considerable disagreement and controversy regarding the indications of laparotomy and the appropriate methods of management.

OBJECTIVE: To examine our experience in Civilian GSWA and to identify the important factors that affect the morbidity and mortality.

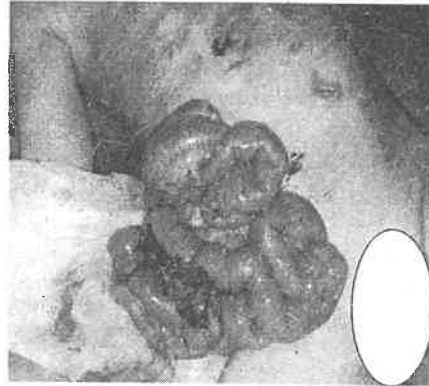
Introduction: The incidence of civilian abdominal gunshot wounds is on the rise in many cities⁽¹⁹⁻²²⁾. The suggested reasons for this ever-increasing problem include easy availability of firearms, premeditated arrangements, acts of spontaneous violence and civil strife^(4,10,11). The current laws governing the possession of firearms has led to the blurring of the precise line between war and peace^(2,6). More than ever before, it is important that surgeons should be conversant with the management of gunshot wounds, more so of the abdomen, which presents a large surface area to assault. Most civilian abdominal gunshot wounds are caused by low velocity missiles fired from handguns, firelock klashnecov and shrapnel. GSWA continues to occur with increasing frequency in our country especially places weapons in the homes are not safe from children and women and habits of the Yemeni people the possession of arms in the house, the street and markets, during the escalation of the peoples conflict. Khat lands and money peoples in Yemen have firearms and as problems of the arable lands are the mean of unceasing causes the conflicts⁽¹⁾. Also, the experience of our surgeons and all the medical and paramedical staffs, which developed on order that money peoples in Yemen have firearms and as problems of the arable lands. The aim of this study is to declare our experience and to identify the important factors that influence the mortality and morbidity in patients with abdominal gunshot wounds.

Patient and Methods: We reviewed the records of 218 patients admitted to Al Nasr Hospital in IBB due to GSWA, during the period from January 2006 to January 2010. Of the 218 patients reviewed, The first group patients with penetrating GSWA and positive abdominal signs underwent exploratory laparotomy 186(85,3%) ,the second group patients in whom the missile tract was tangential in the abdominal wall, appearing superficial to the peritoneum 17(7,8%) ,the third group included those stable patients 15(6.9%) with minimal signs and they were admitted to the department for more investigations and evaluation. 203 patients were explored while the remaining 15 patients were observed and discharged without operations and hence were excluded from the study. 203 patients were 157(77,3%) males and 46(22,7%) female with median age 20.4 years, ranged between 5 and 65 years. The surface anatomical definition of the abdomen was from the nipple line to the pubis anteriorly and from a line joining the inferior angles of the scapulae to the lower buttock crease, posterior⁽³⁾. Patients with GSWA were classified into three groups; those unstable and/ or with evisceration were sent immediately to the operation room. The stable patients were prepared in the waiting area or in the surgical department for surgery. The third group included those stable patients 15(6.9%) with minimal signs and they were admitted to the department for more investigations and evaluation. Routine blood investigations e.g. complete blood picture and cross matching performed for all patients. Plain x-rays for skull, chest, abdomen and extremities done according to the needs. Ultrasonography performed to the stable patients with minimal signs to see blood or fluid collection in the

peritoneal cavity. The first group patients with penetrating GSWA and positive abdominal signs underwent exploratory laparotomy 186 (85,3%), usually through a midline incision. The second group patients in whom the missile tract was tangential in the abdominal wall, appearing superficial to the peritoneum 17 (7,8%), were explored and observed in the surgical department for 24 to 72 hours to exclude visceral injuries. When the depth of injury was in doubt or when equivocal abdominal signs occurred, C-T scan of the abdomen was performed. Laparotomy was performed in patients with developed acute abdomen during observation; otherwise they were discharged home after few days. The approach to the gunshot wounds of the lower thorax was similar to that just outlined for abdominal gunshot wounds. The realization that nearly half of gunshot wounds in the region are associated with significant intra-abdominal injury has led to a more aggressive search for visceral injury⁽⁴⁾. Peri-operative antibiotics are given to all patients with penetrating abdominal wounds. Intravenous ceftriaxone, or cefazolin and metronidazole were commonly used. Splenorrhaphy rather than splenectomy was performed when the condition of the patient and the severity of the injury allowed. In this study 25% of splenic injuries resulting from gunshot wounds were repaired. Hepatic injuries were managed by different techniques according to the severity of injury. The superficial wounds or the inlet and exit tract without any bleeding were left alone. In deep hepatic wounds resectional debridement or hepatotomy with selective vascular ligation were performed in preference to deep horizontal mattress sutures. Perihepatic packing to stop the bleeding on the basis of damage control surgery was used in 5% of patients with hepatic injuries during this study. Pancreatic injuries not involving the major duct were treated by open Penrose drainage for 7-10 days. Intraabdominal vascular injuries were treated with lateral arteriorraphy or venorrhaphy, whenever possible. When more extensive injuries were present, an end to end anastomosis or insertion of a graft was performed. Wounds of gastrointestinal tract were usually closed in two layers using 3-0 vicryl sutures. Colonic injuries treated with primary repair in 72% of cases, whereas colostomy was performed in another 28%. Before closure, irrigation of the abdomen with saline was performed until the effluent was clear. In patients with diffuse bleeding from the retroperitoneal space or pelvis an intraabdominal packs were left in the abdomen to control the bleeding and the patients were sent to the intensive care unit for stabilization; usually for 24 to 72 hours then the packs removed in the operation room. Intra-abdominal drainage done either with Penrose drains or closed system tube drains. Closure of the abdominal wall done either with mass suturing or in layers. The Penetrating Abdominal Trauma Index (PATI) score for each patient was calculated as described by Moore et al⁽⁵⁾. The trauma score was calculated for each organ injured by multiplying assigned risk factor (1-5) by the severity of each injury estimate (1-5), the sum of the individual organ injury score comprise the final PATI. In the postoperative period the diagnosis of a wound infection was confirmed by the presence of pathogenic organisms in exudates obtained from the wound⁽⁶⁾. Intra-abdominal abscess was defined as the presence of localized pus within the abdomen diagnosed by ultrasound or C-T scan.

Results: The patients were males and female, their age ranged between 5 and 65 years with mean age 20.4 years. High velocity bullets were the most common

cause of injury while shrapnel from shell were less common. Abdominal explorations were done in 218 patients.



Two images of penetrating abdominal trauma. Small bowel going out in two patients (45 years and 5 years) with a previous gunshot wound to the abdomen.

Symptoms	n	Signs	n
Abdominal pain	186	Peritonitis	186
Abdominal distension	151	Shock	145
Vomiting	140	Paresis	137
Haematemesis	7	Evisceration	7
Exit wound bleeding	113	Haemothorax	51
Haematuria	5	Fractures	2
Rectal bleeding	2		

Table1: Clinical Features of Penetrating Abdominal Gunshot Wounds (n= 186)

In the third group 15 patients (6.9%) no intra-abdominal injuries were found; in the second group 17 (7.8%) patients in whom the missile tract was tangential to the abdominal wall, appearing superficial to the peritoneum, the wounds were explored and observed in the surgical department for 24 to 72 hours to exclude visceral injuries, while in the first group 186 (85.3%) patients the commonly injured organs were the small intestine 56 (30.1%), colon 31 (16.7%), stomach 23 (12.4%) Table 2. A total of 15 patients were discharged without operations and so were not included in the statistics.

Injured organ	Number and percent
Small intestine	56 (30.1%)
Colon	31 (16.7%)
Stomach	23 (12.4%)
Liver	27 (14.5%)
Big vessels	3 (1.6%)
Diaphragm	13 (6.98%)
Spleen	15 (8.06%)
Kidneys	11 (5.9%)
Urinary bladder	5 (2.7%)
Pancreas	2 (1.08%)

Retroperitoneal Haematoma (75, 32.6%)

Table 2; Distribution of the injured organs.

Complications related directly to GSWA occurred in 36(19.4%) of the patients. The most common complication encountered was wound infection which occurred in 19(10.2%) of all patients; table 3.

Complication	Number of patients	Percentage
Wound infection	19	10.2%
Intraabdominal abscess	2	1.08%
Septicemia	7	3.8%
Intestinal leaks	5	2.7%
Wound dehiscence	3	1.6%

Table 3; Postoperative complications.

The number of organs injured versus mortality rate is depicted in table 4

No of injured organ	No of patients (%)	No of deaths (%)
0	15(7.4%)	0
1	49 (24.1%)	1(2.04)
2	65(32.01%)	1 (1.5%)
3	44(21.7%)	2(4.5%)
4	22 (10.8%)	5(22.7%)
5	6 (2.95%)	6(2.95%)
Total	203 (100%)	15(7.4%)

Table 4; Number of injured organs versus mortality

fifteen patients (7.4%) died; two of them died in the operating room from uncontrolled bleeding, while the other thirteen patients died later.

Discussion: Civilian gunshot wounds of the abdomen were multi in Republic of Yemen. Availability of firearms, escalation of inter-personal-violence and civil strife has increased the incidence. The median injury to arrival time of 200 min is the result of inefficient ambulance services in this part of the world. This is in contrast to other continents where gunshot victims are transferred to our hospital trauma centers within 30 min^(18,21). The prolonged delay before medical care is reached may have affected the proportion of severe injuries presenting to trauma centers as critically injured patients possibly died during transit. It could also be detrimental in patients with non-fatal injuries as blood loss and faecal contamination of the peritoneal cavity becomes prolonged. This may partly explain why systemic sepsis was a common cause of death in our patients with colon injuries. Prolonged surgical intervention time was also observed by others⁽¹⁴⁾. We had perform labarotomy before procurement of adequate units of donor blood, was opposed by some surgeons away as to not knowing the circumstance of Yemen (Efficient ambulance and blood bank services). Elsewhere, it was a reflection of referral patterns and a large volume of trauma admissions⁽⁹⁾. Surgical intervention time of less than 2 h had been achieved⁽²²⁾. Efficient ambulance and blood bank services would improve treatment outcome in our patients with gunshot wounds of the abdomen. 186 (85,3%) of our patients presented with indications for emergency laparotomy. In this study, and many others, the small bowel, colon, liver and stomach were the organs most commonly injured^(1,4,5). The frequency of penetrating injury to intra-abdominal organs is directly related to size, location and the protection offered by the pelvis and spine to these organs⁽⁴⁾. The standard operative principles involved in the therapy of various organ injuries in patients with abdominal gunshot wounds has been well documented^(5,20,11). In spite of vigorous and meticulous treatment, important prognostic factors like injury to arrival time, number of organs injured and severity of injuries are outside the control of the surgeon⁽¹⁰⁾. The evaluation and operative management of civilian gunshot wounds of the abdomen is now 123 years old, the major impetus to this form of treatment being the discussions of several papers presented at the 1887 meeting of the American Surgical Association in Washington, DC. A literature review reported at that meeting noted a mortality rate of 77.2% in 22 patients who underwent laparotomy after a gunshot wound⁽²³⁾. The evaluation and management of abdominal war wounds have seen great advances over the past century. In 1882 Simms emphasized the need of laparotomy in abdominal wounds, but the mortality rate remained 72%. It was not until end of World War I that operative management replaced expectant therapy and reduced the mortality rate to 53.5%. Since then the mortality rate from abdominal wounds dropped to 25% in World War II and 12% in the Korean conflict, reaching 8% at present⁽⁷⁾. This reduction in mortality rate was herald by the introduction of blood transfusion, the liberal use of antimicrobials, The prompt evacuation of casualties as well as improved pre-, intra-, and postoperative patient care⁽⁸⁾. Whether or not all patients with penetrating abdominal wounds should undergo surgical exploration has been the subject of several studies⁽⁹⁾. Because some workers documented that mandatory exploration irrespective of clinical signs carries a high percentage rate of negative laparotomy^(10,11). Others mentioned that wound exploration under local anesthesia in the emergency department is now the preferred technique to establish

if the peritoneum is entered ⁽¹²⁾. Our approach was to explore those patients with definitive peritoneal penetration, and we observed those stable patients with minimal clinical signs in order to minimize the number of negative explorations. By this policy we performed only 8 negative explorations from 218 patients explored; in those negative exploration cases we found the bullet settled pre peritoneal and we could remove all of them. The small intestine, colon, liver and stomach have been the most commonly injured organs in recent large series of abdominal gunshot wounds ⁽¹³⁾, such as in the current study. The most devastating and difficult injuries were those produced by multiple large pieces of shrapnels and were often with injuries to another body area. A major problem for patients who survive a traumatic injury is morbidity due to infectious complications ⁽¹⁴⁾. In this study wound infection occurred in 19 (17.0%) patients, which is not different from the 18% to 24% rate reported previously for similar studies ⁽¹⁵⁾. This relatively low rate of wound infection is difficult to explain; also serious wound infection was extremely rare. This was hypothesized that, those young basically healthy, resilient population possesses some form of herald immunity ⁽¹⁶⁾. The incidence of intra-abdominal sepsis following penetrating abdominal trauma varies from 2.4% to 45.7% in published reports ⁽¹⁷⁾. In this work 2 (1.08%) patients had intra-abdominal abscesses which are similar to other works. The use of broad spectrum perioperative antibiotics in combination with metronidazole and saline irrigation of the peritoneal cavity, contributed to the low incidence of post operative intra-abdominal sepsis reported in this study. In those patients with infectious complications, like in other similar works. we found prolonged duration of hospitalization ^(18,19). In this work the average period of hospitalization for all patients was 12.5 days, ranged between 1 to 32 days. Previous studies have shown that in abdominal gunshot wounds, the mortality rate rise with the number of intra-abdominal injured organs ⁽²⁰⁾. Like the others we demonstrated a positive correlation between the number of intra-abdominal injured organs and mortality. However, the number of injured organs does not accurately quantify the overall severity of injury, for example, a patient with an isolated 3 cm. superficial liver injury is not severely injured as another with extensive liver parenchyma destruction, but both have one organ injured. The PATI score is a more accurate method of quantifying the extent of damage to different organs and more valid index of overall severity of injury. The overall mortality rate in this work was 7.4 % which is surprisingly low. In most series the mortality from penetrating abdominal injury is close to 10% ⁽¹⁾. The age of the injured persons, the efficient transportation system, the rapid surgical intervention after injury, the use of fresh blood for transfusion all are among the factors that contributed to minimize the low mortality rate in this work.

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الخلاصة:

راجعنا سجلات 218 مريضاً أدخلوا إلى مستشفى النصر بمدينة إب بسبب إصابة البطن بالأعيرة النارية، خلال الفترة من يناير 2006 إلى ديسمبر 2010. وقد أجريت هذه الدراسة المتوقعة للذين اثبتوا بإصابات أعيرة نارية في البطن لتقييم نمط عينة من الإصابات، وفتائج العلاج ودور طريقة العلاج الوقائية الانتقائية. 17 (7.7%) من المرضى يعانون من الجروح السطحية وكانت طريقة العلاج عن طريق العناية الموضعية بالجروح. 15 (6.9%) من المرضى الذين تم اختيارهم كان عندهم الحد الأدنى من علامات البطن ملتبسة وتم انتقاؤهم للعلاج الوقائي. 186 (85.3%) من المرضى عملت لهم عملية فتح بطن والذين قدموا مع علامات البطن العادية. وكانت إصابة أعضاء البطن عادة الأمعاء الدقيقة (30.1%) والقولون (16.7%)، الكبد (14.5%) والمعدة (12.4%). المضاعفات حسبت عند 36 (19.4) مريض. وكانت لفترة وصول المصاب إلى المستشفى ووقت إجراء التدخل الجراحي هي العوامل المساعدة على حدوث الوفاة (7.4%) بسبب اختراق الأعيرة النارية للبطن. ثمانية من الأمراض الذين اخضعوا للعلاج الوقائي أجريت لهم عملية فتح بطن وكانت النتيجة سلبية. العلاج الوقائي بدون استخدام أي فحص مكلف.