

Original Article

Management of Hollow Viscus Injury following Gunshot at Casualty Department of Dhaka Medical College & Hospital

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Abstract

Background: Gunshot injuries result from the effect of a bullet or projectiles emanating from the use of firearms. Firearm injuries are associated with substantial emotional, physical and financial burden causing an enormous human toll and imposing huge costs on the society. Abdominal injuries are associated with a high incidence of internal injury. These injuries are increasingly seen in many developing countries, which have been attributed to communal and ethnic clashes, political violence and armed robberies. **Objective:** The objective of this study was to determine the overall outcome of hollow viscus injury following gunshot on the basis of time duration of presentation and amount of blood loss at the time of presentation. **Materials and Methods:** This observational study was conducted at casualty department of Dhaka Medical College & Hospital over a period of one year from October 2014 to October 2015. All admitted patients with hollow viscus injury due to gun shot at casualty department of DMCH were included in this study by selective sampling technique. The main outcome variables were postoperative wound infection, anastomotic leakage, number of deaths and prolonged hospital stays. Data processing and analysis were done using SPSS 17.0. **Results:** There were total 76 patients with hollow viscus injury following gunshot during the period under review. All were male patients with mean age 31.13 years. Peak incidence occurred within age group 41–60 (52.6%). The most commonly injured organs were the small bowel in 34 patients (44.7%). Thirty (90.9%) patients presented within three hours of the event ($p=0.001$). Among six patients who died, 5 (83.8%) presented 10 hours after the event ($p=0.001$). Among 20 patients, 18 (90%) remained hospitalized more than 15 days, who presented within 4–6 hours of the event ($p=0.001$). In 29 out of 33 patients (87.9%) who did not suffer from any complications encountered only less than 15% of blood loss at the time of presentation ($p=0.001$). Among 15 patients who suffered from postoperative wound infection nine patients (60%) lost 30–40% of blood at the time of presentation ($p=0.011$). **Conclusion:** Outcome of the patients with hollow viscus injury following gunshot were found to be related to the time taken to reach the casualty department from the place of event and the amount of blood loss at the time of presentation.

Key words: Hollow viscus injury; Gunshot; Anastomotic leakage; Postoperative wound infection; Prolonged hospital stay

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Introduction

Gunshot injuries result from the effect of a bullet or projectiles emanating from the firearms. The degree of tissue disruption caused by a projectile is related to the size of the temporary versus permanent cavity it creates as it passes through tissue. The extent of cavitations, in turn, is related to the kinetic energy, deformation and tissue fragmentation. This helps to explain why wounds produced by missiles of higher mass and/or

higher velocity produce greater tissue disruption than missiles of lower mass and velocity and the wound process is also affected by the tissue fragments.¹

Firearm injuries are associated with substantial emotional, physical and financial burden causing an enormous human toll and imposing huge costs on the society.² These may lead to an instant death through

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exsanguinations from hemorrhagic shock or through hypoxia from cardiac tamponade, pneumothorax or damage to vital systems like the central nervous system. These injuries are increasingly seen in many developing countries, which has been attributed to spates of communal and ethnic clashes, political violence and armed robberies.^{3,4} The pathological effects of gun wounds do not merely depend on the caliber of weapons but also on the quantity of energy transferred, the rate of such transfer and the energy flux which is influenced by the range at shot, impact velocity and body tissue resistance.⁵

Abdominal injuries are associated with a high incidence of internal injury. All but the most superficial penetrating wounds of the abdomen require full exploratory laparotomy. This applies as much to knife as to bullet wounds. Observation is inadequate as there may be occult bleeding or perforation of bowel and body tissue resistance.⁶

Low velocity bullets fired from handguns such as revolvers and automatics may be quite heavy, but their muzzle velocity is only between 150–250 meters per second (mps). When these bullets penetrate, the tissues are crushed and stretched apart. Such damage is usually not serious unless vital organs or major blood vessels are directly injured. Little energy is being transmitted to the tissues surrounding the wound track.

High velocity bullets fired from rifles and some other high powered handguns possess velocity usually >300 mps. In addition to simple penetration and laceration, the high velocity bullets cause injury to the tissues by imparting shockwave and with cavity formation. Wounds in these cases are always at subatmospheric pressure which sucks in air debris, dirt, bacteria into the depth of it.

Materials and Methods

This observational study was conducted at Casualty Department of Dhaka Medical College Hospital (DMCH), Dhaka over a period of one year from October 2014 to October 2015. The target population of this study were all patients attending the Casualty Department of DMCH with gunshot injury. The study population was the patients with hollow viscus injury due to that. The sampling technique was purposive sampling. Every patient of the above mentioned group

after meeting the inclusion criteria was considered as sample unit. Cases of gunshot injuries but brought dead, patients having other comorbid illness, patients with gunshot injuries involving the areas other than hollow viscus were excluded from the study. Data collection method was structured interview with the sample unit by filling in the structured form which was prepared by the investigator. The results were presented in tables after being edited and analyzed by SPSS software version 17.0. Statistical significance was determined by Chi-square test (χ^2) for categorical data and by Student’s ‘t’ test for quantitative data. Wound infection, anastomotic leakage, length of hospital stay, death were considered to be dependent variables which were statistically analyzed with duration of presentation from the place of the event, site of hollow viscus involved, amount of blood loss, procedure done to manage the injury.

Results

There were total 76 patients with hollow viscus injury following gunshot. All were male with peak incidence at age range 41–60 years (Table I). The most commonly injured organ was small bowel in 34 patients (44.7%). The other organs affected are shown in Table II.

Table I: Distribution of the study subjects according to age (N=76)

Age range in years	Frequency	Percentage
<20	9	11.8
21–40	27	35.5
41–60	40	52.6
Total	76	100

Table II: Distribution of patients according to types of hollow viscus injury (N=76)

Organs	Frequency	Percentage
Small bowel	34	44.7
Colon	20	26.3
Stomach	15	19.7
Gallbladder	1	1.3
Rectum	2	2.6
Urinary bladder	4	5.3
Total	76	100

Relationship of outcome of hollow viscus injury with time duration of presentation was calculated and analyzed. In 33 patients who did not suffer from any

complications, 30 (90.9%) patients presented within three hours of the event (p=0.001). Nine patients who suffered from postoperative wound infection presented within 4–6 hours of the event. Two patients who ended up with the anastomotic disruption presented within three hours. Six patients died. Among them, 5 (83.8%) patients presented within 10 hours of the event (p=0.001). Among 20 patients 18 (90%), who presented within 4–6 hours of the event remained hospitalized for more than ten days (p=0.001). So time duration of presentation was found to be statistically significant with the two outcomes (death and length of hospital stay) following gunshot injury (Table III).

Outcomes were also analyzed with the amount of blood loss at the time of presentation. Out of 33 patients (87.9%) who did not suffer from any complications, 29 encountered only less than 15% of blood loss at the time of presentation (p=0.001). Among 15 patients who suffered from postoperative wound infections, nine patients (60%) lost 30–40% of blood at the time of presentation (p=0.011). There were two patients who ended up with anastomotic leakage, lost up to 40% of blood. Among the patients who died, four (66.6%) had 15–30% of blood loss at the time of presentation (p=0.010). Among 20 patients who were hospitalized for more than 15 days, eight patients (40%) lost 15–30% and seven patients (35.5%) lost 30–40% of blood at the time of presentation (p=0.001) (Table IV).

All patients underwent exploratory laparotomy. Primary repair of the viscus was done in 30 (39.5%) cases for jejunal, proximal ileum, colonic (transverse colon) and urinary bladder injury. Primary repair with proximal diversion was done in 18 (23.7%) patients for injuries in the distal ileum, descending colon, sigmoid colon, recto-sigmoid junction and rectum. Rest of the specific procedure done is depicted in Table V.

Table V: Distribution of patients according to specific management of hollow viscus injury (N=76)

Procedure	Frequency	Percentage
Primary repair	30	39.5
Primary repair with proximal diversion	18	23.7
Exteriorization	5	6.6
Resection and anastomosis	7	9.2
Repair with omental patch	15	19.7
Cholecystectomy	1	1.3
Total	76	100

Discussion

Gunshot injuries are a major socio-economic problem of our society. Due to increased sectarian and ethnic intolerance, poverty and easy availability of unlicensed guns, the crime rate has increased tremendously in our country. In our study most of the victims belonged to the middle age group.

The small bowel, colon and stomach at single or multiple sites are the most commonly injured viscus

Table III: Relationship of outcome of hollow viscus injury with average time of presentation (N=76)

Outcomes	Frequency	Percentage	<1 hour	1–3 hours	4–6 hours	7–10 hours	>10 hours	p values
No complication	33	43.4	2	30	1	0	0	0.001
Wound infection	15	19.7	1	1	9	2	2	0.236
Anastomotic leakage	2	2.6	1	1	0	0		0.946
Death	6	7.9	0	0	1	5		0.001
Hospital stay (>15 days)	20	26.3	0	0	18	2	2	0.001

Table IV: Relationship of outcome of hollow viscus injury with amount of blood loss (N=76)

Outcomes	Frequency	Percentage	<15%	15–30%	30–40%	>40%	p values
No complication	33	43.4	29	3	1	0	0.001
Wound Infection	15	19.7	4	0	9	2	0.011
Anastomotic leakage	2	2.6	1	1	0		0.396
Death	6	7.9	0	4	2		0.010
Hospital stay (>15 days)	20	26.3	2	8	7	3	0.001

found in this study, which is similar with the result of other series.^{7,8} Among small bowel injuries jejunum and among large bowel injuries transverse colon and sigmoid colon were the common sites. These sites were most common probably due to the free mobility within the abdominal cavity aided by their respective mesentery.

In this study the overall prevalence of hollow viscus injury following gunshot was 60.3% (76/126). Out of total gunshot victims attending the accident and emergency department of DMCH within this one year period of time and in all cases bullets were retained within the body and were not palpable under the skin. All were male patients and most of them were middle aged 41–60 years (52.6%). In this study the majority of the firearm injuries were due to low velocity weapons (65.8%) used in personal enmities while high velocity weapons were utilized in police encounters and robberies (34.2%). High velocity wounds were associated with more complications. But in other study⁹ done in Karachi, Pakistan a low velocity weapon was used in 61 (67.8%) cases and high velocity weapon was used in 29 (32.2%) cases and the result is consistent with that of our study. High velocity weapons were mainly used in police encounters and military injuries.

Postoperative wound infection developed in 15 patients (19.7%) and it was found statistically significant with the time taken to reach DMCH from the place of event and the amount of blood loss at the time of presentation. Death of the patients was also found to be significantly associated with the amount of blood loss and duration of presentation. The more was the delay the more the patients suffered from excessive bleeding. All patients were first resuscitated according to Advanced Trauma Life Support (ATLS) protocol and many of them needed blood transfusion. Most of the patients presented with hypovolemic shock and hypothermia due to shock. Infusion of intravenous saline and blood transfusion augmented the process of hypothermia and resulted into dilution of clotting factor. Metabolic acidosis was another contributory factor due hypoxia. Thus the three key factors that lead to the mortality of the patients were hypothermia, coagulopathy and acidosis.

Anastomotic leakage was found only in two patients out of seven patients who underwent resection and

anastomosis, but no relation was found with blood loss and duration of presentation. In our series the average hospital stay was 12 days. Prolonged hospital stay was due to multiple surgical procedures and certain postoperative complications like wound infection. Average hospital stay in other series of studies done in Karachi, Pakistan and Kanpur, India was 15 days.^{9,10} The attributable factors were demonstrated in those study were similar to those of our study.

Personal enmity is the leading cause of gunshot injuries in this study. There is every possibility that some of the victims of this study did not reveal the actual cause due lack of personal safety. Self-inflicted recreational gunshot injury is also one of the leading causes and hence has high potential for prevention. Armed robberies, stray bullets and police encounter were significant causes of injury found in other studies done in Nigeria, England, Pakistan and India.⁹⁻¹² Gun safety and firearm education programs should be directed towards recreational gun users, including hunters and target shooters. Emphasizing firearm safety messages during the late summer and early fall may remind hunters and target shooters to be cautious when engaging in gun related activities.

One issue always arises and becomes a matter of anxiety in most of the patients regarding the extraction of the bullet. The presence of a bullet in the soft tissues, in and of itself, is not an absolute indication for surgery.¹³

Operations are required to repair underlying injured structures, not specifically to remove the bullet, unless it is near an important structure and may cause trouble if it migrates. In certain cases, however, the bullet must be removed. These exceptions are related to the nature of the ammunition. For this reason it is important to have information about the type of gun and bullet that caused the injury.

The impact of firearm violence, however, extends well beyond deaths. Nearly 70,000 people suffer nonfatal gunshot wounds each year. This includes people hospitalized with serious injuries — most often from gunshot wounds to the trunk. Previous studies have shown that nonfatal firearm injury is a leading cause of spinal cord injuries in the United States.

Firearm injuries are now an endemic public health threat in the US. Firearm violence is among the leading causes of death for young adults.¹⁴ Recent research has

shown that gun violence spreads through a community in a similar manner to contagious disease.¹⁵

Most low-velocity gunshot injuries may be safely treated nonoperatively in an outpatient basis, as these wounds usually involve only the skin, subcutaneous and/or muscle tissue, and minor cortical bone fragments. Local wound care consists of superficial irrigation and careful cleansing followed by a dressing.

High-velocity and shotgun wounds require immediate and aggressive irrigation and debridement. The margins of the entrance and exit wounds should be excised and the missile tract thoroughly irrigated. A wide debridement of devitalized tissue must be performed and foreign bodies removed. The patient should then be returned to the operating room every 48 to 72 hours for serial debridement. Primary closure of bullet wounds must be avoided because of the possibility of contamination. Secondary wound closure can usually be performed within 5 to 7 days after injury. When wounds cannot be closed without tension, skin grafting or a muscle coverage procedure may be necessary.

There are few limitations of this study. It was an observational study without any randomization of patient selection. Sample size was less than expected as per calculation and hence it could be reached to desired number within this specified time period of study. This study was also single center-based study. But findings of this study may be utilized in the future to further explore the nature of these injuries by involving different centers with proper randomization of the sample.

In both civilian and military settings, applications of principles of good wound management and continuity of care by the transporting personnel and the trauma surgeon as well as early transfer of the victims to the hospital are vital to save the life. Due to increased economic imbalances, sectarian conflicts, poor law and order and easy availability of unlicensed weapons, we will continue to see an increase of the number of these gunshot victims. Strict enforcement of laws regarding unlicensed weapons and punishment of criminals as per the law can decrease the incidence of gunshot injuries.

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