The Medical Journal of Tikrit University (2022) 28 (2): 73-84
DOI: http://dx.doi.org/10.25130/mjotu.28.2.7

IRAQI Academic Scientific Journals

ISSN: 1813-1638

The Medical Journal of Tikrit University

Available online at:www.mjotu.com

MJTU

The Medical Journal of Tikrit University

Causes and Outcome of Relaparotomies for Warfare Penetrating Abdominal Injuries

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***Keywords*:**

Penetrating abdominal injuries, relaparotomy, postlaparotomy complications.

ARTICLE INFO

Article history:

Received 12 Feb 2022
Accepted 17 Apr 2022
Available online 31 Sep 2022

Citation: Nazar S. Ibrahim; Bashar A. Abed; Duraid J. Kareem . Causes and Outcome of Relaparotomies for Warfare Penetrating Abdominal Injuries. The Medical Journal of Tikrit University (2022) 28 (2): 73-84

DOI: http://dx.doi.org/10.25130/mjotu.28.2.7

ABSTRACT

Background: Worldwide the incidence of penetrating abdominal injuries, including warfare injuries, is increasing and in most cases exploratory laparotomy is warranted. A single laparotomy may not be sufficient and a relaparotomy sometimes may be needed to deal with these patients.

Aim of the study: This study was done to evaluate the causes of relaparotomy following warfare penetrating abdominal injuries and to determine the relationship between the cause of the relaparotomy and the outcome.

Patients and methods: A retrospective study conducted on 252 patients undergoing laparotomy for penetrating abdominal injuries at Baghdad teaching hospital or was admitted to the hospital for continued care, in the period from August 2014 to August 2015. Out of these 252, relaparotomy was needed in 42 patients within 60 days of the primary surgery.

Results: Among 252 patients, in whom emergency exploratory laparotomy for warfare penetrating trauma were done, 42 patients required relaparotomy (16.17%), 40 patients (95.23%) were military male and 2 patients (4.77%) were civilians as one male and one female. The causes for a second laparotomy found to be broadly divided into three main groups:

A – Completion of damage control surgery (DCS) in 19 / 42 patients (45.24%)

B – Missed injuries in 8 / 42 patients (19.05%)

C – Postoperative complications in 15 / 42patients (35.71%)

The mortality rate was 4.36% after the first laparotomy and 21.42% after the second laparotomy.

Conclusions: Completion of damage control surgery and dealing with postoperative complications are the most common causes of relaparotomy. Relaparotomy is associated with a higher mortality rate, particularly among those with a leak from anastomosis or missed bowel injuries.

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Introduction:

Worldwide the incidence of penetrating abdominal injuries is increasing and mostly attributed to crime, suicide or accident (1, 2). The presentation of a penetrating abdominal trauma varies depending on the type of the insult sustained as a knife stab, gunshot or shrapnel injury from a blast, whether the injury is single or multiple, the type of the tissue affected and the speed of the offending agents whether slow or fast (3). Firearm injuries are more common than stab wounds and cause more damage to different sites of the abdomen with higher mortality (4).

In most cases of gunshot wounds or cases of rapid and multiple blast shrapnel injury an exploratory laparotomy is warranted both as a diagnostic and therapeutic modality (5, 6, 7, 8). However, the decision when to operate on such patients might not be straight forward and it is up to the surgeon to decide "whether" and "when" to operate on such patients. A single laparotomy may not be sufficient and a second or sometimes even a third laparotomy may be needed to deal with these patients (9). When it is not planned, relaparotomy is a big dilemma to the surgeon and a crucial surgery for the patient to undergo (10).

Relaparotomy is done within 60 days of primary surgery for the original disease (11, 12) and is called on demand if the laparotomy has to be redone because of patient's condition and is called planned if the second laparotomy is decided upon during the course of the first surgery itself like in case of severe intraabdominal sepsis or post damage limitation surgery (12).

Aim of the study

This study was done to evaluate the causes of relaparotomy following warfare penetrating abdominal injuries and to determine the relationship between the causes of relaparotomy and the outcome.

PATIENTS AND METHODS

A retrospective study conducted on 252 patients undergoing laparotomy

for warfare penetrating abdominal injuries at Baghdad Teaching Hospital – Medical City Complex or was admitted to the hospital for continued care and further management after exploratory laparotomy for warfare penetrating trauma in other hospitals, in the period from August 2014 to August 2015.

Data, regarding patient's demography, the type and nature of the injury, indication for operation, operative findings, any complications in the follow up period and the indications for relaparotomy, were collected.

Out of these 252 selected patients, relaparotomy was needed in 42 patients within 60 days of primary surgery.

Statistical analysis

Analysis was done using SPSS v. 17 (Statistical Package for Social Sciences).

Data were described using frequency and percentage for qualitative variables and mean ± SD for quantitative variables. Chi – square was used to test relation of different qualitative variables, and student's t-test or ANOVA test to test differences of quantitative variables between different groups. P-value of less than 0.05 was considered significant.

RESULTS

Among 252 patients, in whom emergency exploratory laparotomy for warfare penetrating abdominal injuries were done (248 males (98.4%) and 4 females (1.6%)), 42 patients required relaparotomy (16.17%) during the period of the study.

Out of the 42 patients with relaparotomy, 40 patients (95.23%) were military male and 2 patients (4.77%) were civilians as one male and one female. Thus, 41 patients (97.6%) were male and only one (2.4%) female patient. As shown in table1.

Table 1: the distribution of patients' according to their gender

Gender	*First laparotomy*	*Relaparotomy*
Male	248 (98.4%)	41 (97.6%)
Female	4 (1.6%)	1 (2.4%)
Total	252 (100%)	42 (100%)

The age range of the patients with relaparotomy was 17 – 45 years with a mean of 27.5 years. The most vulnerable age group involved was between 21-30 years (59.52%). As shown in table 2.

Table 2: the distribution of patients' according to their age

Age	*N0.of patients*	*%*
10-20	6	14.28%
21-30	25	59.52%
31-40	7	16.66%
>40	4	9.52%
Total	42	100%

Forty one patients had a second laparotomy in the same admission and one patient presented after discharge with intestinal obstruction after 50 days from his first laparotomy.

The causes for a second laparotomy found to be broadly divided into three main groups:

A – Completion of damage control surgery (DCS) in 19/ 42 patients (45.24%)

B – Missed injuries in 8 / 42 patients (19.05%)

C – Postoperative complications in 15 / 42 patients (35.71%)

Damage control surgery was mainly done for bowel injury with shock. Missed injuries were mainly found in the stomach (11.90%), while the main complications requiring relaparotomy were due to small bowel leak (9.52%) burst abdomen (7.14%). As shown in Table 3.

Table3: causes and outcome of second laparotomy

Causes of second laparotomy		***Outcome***		***Total no.***
		Cured	***Died***	
DCS	Inferior mesenteric artery injury	1 (2.38%)	-	1(2.38%)
	Liver injury	4 (9.52%)	1(2.38%)	5 (11.9%)
	Pelvic bleeding	1 (2.38%)	-	1(2.38%)
	Bowel injury	8 (19.04%)	2 (4.76%)	10 (23.8%)
	Stomach injury	1(2.38%)	1(2.38%)	2 (4.76%)
	Total no. of DCS	***15 (35.71%)***	***4 (9.52%)***	***19 (45.23%)***
Missed injuries	Missed rectal injury	1(2.38%)	-	1(2.38%)
	Small bowel injury	1(2.38%)	-	1(2.38%)
	Splenic flexure injury	-	1(2.38%)	1(2.38%)
	Stomach injury	5 (11.9%)	-	5 (11.9%)
	Total no. of missed injuries	***7(16.67%)***	***1(2.38%)***	***8 (19.04%)***
postoperative complications	Burst abdomen	3 (7.14%)	-	3 (7.14%)
	Colostomy ischemia	2 (4.76%)	-	2 (4.76%)
	Missed pack	1(2.38%)	-	1(2.38%)
	Pelvic collection	1(2.38%)	1(2.38%)	2 (4.76%)
	Pelvic hematoma	-	1(2.38%)	1(2.38%)
	Small bowel leak	2 (4.76%)	2 (4.76%)	4 (9.52%)
	Stomach leak	1(2.38%)	-	1(2.38%)
	Subphrenic abscess	1(2.38%)	-	1(2.38%)
	Total no. of postoperative complications	***11 (26.19%)***	***4 (9.52%)***	***15 (35.71%)***
Total		33 (78.57%)	9 (21.43%)	42 (100%)

There is no significant relation between outcome and second laparotomy causes ($P > 0.05$)

In our study the highest percentage of missed injury and post-operative complication are caused by shrapnel injury as shown in table 4.

Table 4: Mechanism of injury according to second laparotomy cause in this study

Mechanism of injury	***2nd laparotomy causes***			***Total***
	DCS	***Missed injury***	***Postoperative complications***	
Bullet	9	2	5	16
Shrapnel	10	6	10	26
Total	19	8	15	42

There was no significant relation between the cause of laparotomy and mechanism of injury (P>0.05).

The highest percentage of damage control associated with two organs injury 68.42% followed by one organ injury 21.05% , also in missed injury the highest percentage of patients associated with two organs injury 62.5% as is shown in table 5.

Table 5: Relation between the second laparotomy causes and no. of abdominal organ injured.

No. of organs injuried	***Second laparotomy cause***			***Total***
	DCS	***Missed injury***	***Postoperative complications***	
One organ	4	2	7	13
Two organs	13	5	6	24
Three or more organs	2	1	2	5
Total no.	19	8	15	42

There was no significant relation between the cause of relaparotomy and no. of abdominal organ injured (P>0.05).

The most common associated injury was haemothorax occurred in (14.28%) of the patients one of them died (2.38%) followed by pelvic fracture (9.52%) of the patients two of them died as shown in Table no 6.

Table6: Distribution of Associated injury and Outcome.

Associated injury	***Outcome***		***Total***
	Cured	***Died***	
Right lower limb injury	1 (2.38%)	1 (2.38%)	2 (4.76%)
Haemothorax	5(11.90%)	1(2.38%)	6 (14.28%)
No associated injury	24(57.14%)	4(9.52%)	28 (66.6%)
pelvic fracture	2 (4.76%)	2 (4.76%)	4 (9.52%)
Right humerus fracture	-	1 (2.38%)	1 (2.38%)
spinal cord injury	1 (2.38%)	-	1 (2.38%)
Total	33(78.57%)	9(21.43%)	42 (100%)

There is no significant relation between associated injury and outcome (P > 0.05)

Regarding the postoperative mortality, death occurred in 11/252 patients after the first laparotomy with a mortality rate of 4.36%, while 9/42 patients died after the second laparotomy with a mortality rate of 21.42%. As shown in table 7.

Table 7: Mortality after the first and the second laparotomy

No. of laparotomy	Total no.	No. of death	%
1st laparotomy	252	11	4.36%
2nd laparotomy	42	9	21.42%

The patients' hospital stay in general surgical wards ranged from 5- 23 days and mean hospitalization time of 10.5 days.

DISCUSSION

In this study 252 laparotomies were included, 248 males (98.4%) and 4 females (1.6%) with mean age (27.5 year).

Bodalal et al (13) had a study on gunshot injuries in Benghazi - Libya in 2011. They had 95.7% males and 4.3% females as many of the patients were military personnel and the battle field was almost exclusively male dominated like the situation with our study. Their patients mean age was 28 year.

In this study relaparotomy was required in 42 patients (16.17%). In 19/42 patients (45.24%), the first laparotomy was a damage control surgery (DCS) and this procedure was performed primarily to combat intraabdominal contamination and sepsis. In the group of DCS, packing for liver injury was done in 5/19 patients (26.3%), and in 14/19 patients (73.7%) for non liver injuries (bowel injury, pelvic bleeding). Relaparotomy for pack removal was performed (2.1 +/- 0.3) days (range, 1 to 3 days) after initial operation. The overall mortality rate was 21.1% (4/19 patients).

Sharp KW et al (14) studied 39 patients, packing for liver injuries was done for (79.4%) and for non liver injuries in (20.6%). Relaparotomy for pack removal was performed 2.0 +/- 1.1 days (range, 1 to 7) after initial operation. The overall mortality rate was 44% (17/39).

In the study of Stone et al (15), where they aborted the laparotomy for 17 patients with uncontrolled coagulopathy during surgery and then relaparotomized the patients after correction of their physiology, they had mortality at a rate of 29.5%.

In the study of Rotondo et al (16), thirteen patients had (DCS) for major vascular injury and two or more visceral injuries (maximum injury subset) mortality rate (23%).

Asensio et al (17) had a more dismal outcome when they studied 548 patients with penetrating abdominal injuries. When (DCS) was done for them, they had mortality rate of (63%).

The second group of patients in this study who required relaparotomy was to deal with post-operative complications in 15/42 patients (35.7 %). The mortality rate was 21.7%. Burst abdomen developed in 3/42 patients (7.1%). Intra-abdominal collection/abscess developed in 4/42 patients (9.5%).

Koirala et al (12) in Nepal performed 40 redo-laparotomies (1.99%) out of 2010 laparotomies excluding DCS. They had burst abdomens in 22.5%

of the relaparotomized patients. Intra-abdominal collection and abscesses developed in 17.5% and they had mortality at a rate of 30%.

In our study, stoma complication developed in 2/42 patients (4.76%). 5/42 patients had anastomosis leak.

In the study of Haluk RU etal (18), early urgent relaparotomy was performed in 81 patients; leakage from intestinal repair site or from anastomosis was the cause in 41.97% and stoma complications in 6.17%.

In a study by Gedlik et al (19), relaparotomy was done in 114 patients. In 29.8% of patients leak from intestinal primary repair or anastomosis was the reason of re-exploration.

The third group of patients who required relaparotomy was patients with missed injuries from the initial laparotomy in 8/42 patients (19% of relaparotomies and 3.17% from all the patients who required laparotomy).

Saghafinia M et al (20), there were 496 patients underwent laparotomy for gastrointestinal injuries. Missed injuries that need relaparotomy developed in 1.2% of the patients. Overall mortality from GI surgery was (3.6%).

In our study the postoperative death occurred in 11/252 patients after the first laparotomy (4.36%) and in 9/42 patients (21.42%) after relaparotomy.

Mortality is high whatever the indication of the relaparotomy and indifferent studies it ranged between (15.5 – 53%) (12, 18). In Koirala et al (12), they had a mortality rate of 12.5% with a second relaparotomy. Ching et al (21) studied 55 patients with one or more relaparotomies. They had a mortality rate of 38%. They found that relaparotomies for a burst abdomen and intestinal obstruction carried the least risk.

In study done by Martínez-Casas et al (22), total of 314 relaparotomies were performed. Mortality of the patients with a single relaparotomy was 20% vs. 44% if they were relaparotomied.

In the study of Haluk RU et al (18) the interval between the first

laparotomy and relaparotomy averaged as 6.95 (1–20) days, and average hospitalization period was 27.1 (3–78) days. And overall mortality was (34.97%) which is comparable to our study.

Conclusions

- Completion of damage control surgery and dealing with postoperative complications are the most common causes of relaparotomy.
- Relaparotomy for whatever reason in war trauma victims is associated with a higher mortality rate.
- The highest risk of mortality in relaparotomy patients was in the patients developing a leak from anastomosis or missed bowel injuries.
- The most common missed injuries were found in the stomach.

Source of Funding

There was no funding source

Ethical Clearance

The authers have no ethical conflicts to disclose

Conflict of interest

The authers have no conflicts of interest to declare

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