Short Communication

J Babol Univ Med Sci
23; 2021. P: 222-228

Comparison of Diagnostic Laparoscopy and Exploratory Laparotomy in the Management of Patients with Penetrating Abdominal Trauma

M. Shams (MD)[1], A. Elyasi (MD)*[2]

1.Student Research Committee, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, I.R.Iran

2.Department of Surgery, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, I.R.Iran

J Babol Univ Med Sci; 23; 2021; PP: 222-228

Received: Jul 3rd 2020, Revised: Sep 29th 2020, Accepted: Nov 15th 2020.

ABSTRACT

BACKGROUND AND OBJECTIVE: Patients with penetrating abdominal trauma can be treated with invasive procedures such as laparotomy and less invasive procedures such as laparoscopy. Since the management of patients with penetrating abdominal trauma based on non-invasive methods is more important, the present study was performed to compare laparoscopic and laparotomy methods to evaluate the surgical outcomes, complications and costs of patients with penetrating abdominal trauma.

METHODS: In this retrospective study, the records of all patients with penetrating abdominal trauma and stable hemodynamics referred to Kowsar Hospital in Sanandaj during one year were reviewed. Patients' information including demographic characteristics, rate of laparotomy or laparoscopy surgery, time of operation, surgical wound infection, incidence of ileus, patients' pain intensity, length of hospital stay and hospital costs were collected and reviewed based on patients' records.

FINDINGS: In this study, the medical records of 40 patients were reviewed. The average pain intensity in the laparoscopy group was 2.03±0.69 and in the laparotomy group was 6.77±1.95. Postoperative ileus was seen in 3 patients (16.66%) who underwent laparoscopy and 17 patients (77.2%) who underwent laparotomy. The average number of hospitalization days in the laparoscopy group was 1.38±0.61 days and in the laparotomy group was 5.73±1.78 days. The average cost of surgery in laparoscopic surgery was equal to 532240 Rials and in laparotomy was 1365600 Rials (p=0.0001).

CONCLUSION: According to the results of this study, it seems that the use of diagnostic laparoscopic method for the management and treatment of patients with penetrating abdominal trauma and stable hemodynamics, significantly reduces complications and minimizes costs and length of hospital stay.

KEY WORDS: *Laparoscopy, Laparotomy, Penetrating Abdominal Trauma, Stable Hemodynamics*.

Please cite this article as follows:

Shams M, Elyasi A. Comparison of Diagnostic Laparoscopy and Exploratory Laparotomy in the Management of Patients with Penetrating Abdominal Trauma. J Babol Univ Med Sci. 2021; 23: 222-8.

***Corresonding Author: A. Elyasi (MD)**
Address: Department of Surgery, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, I.R.Iran
Tel: +98 87 33611232
E-mail: a_eliasi@yahoo.com

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]

Introduction

Trauma is the most common cause of death till the fourth decade of life and regardless of the economic and social level, it is one of the major problems of the health care system (1). Studies have shown that trauma accounts for about 10% of global mortality and 16% of the global burden of disease (2). In terms of the mechanism of injury, the abdomen is the third most vulnerable area that often requires surgery (3). Abdominal trauma is divided into penetrating and non-penetrating. The most common cause of penetrating trauma is stabbing and shooting, and the most common cause of non-penetrating trauma is vehicle injuries and falls from heights (1).

Some organs inside the abdominal cavity are more damaged due to trauma, which varies depending on the size and location of the organ inside the abdomen and the mechanism of the trauma (4). The most commonly damaged organs in penetrating abdominal trauma are the small intestine and colon and most postoperative complications occur in these organs (5). One of the main causes of increased mortality in penetrating abdominal trauma is the lack of detection of injury, uncontrolled bleeding from the liver, spleen and large arteries, and infections (6).

Diagnostic procedures for emergency abdominal trauma include FAST, CT scan, and Diagnostic Peritoneal Lavage (DPL). However, physical examination is still the most reliable diagnostic method in conscious patients (7). Diagnostic laparotomy is commonly used to evaluate patients with penetrating abdominal trauma, although over the past decade, the management of patients with abdominal trauma using non-invasive methods has received more attention. Previous studies have shown that patients with hemodynamic instability and abdominal tenderness indicating peritonitis still require emergency laparotomy (8).

However, using laparoscopy in some patients can be used to determine the type and severity of damage to the intra-abdominal organs. However, in critically ill and emergency patients, doing so is questionable in terms of usefulness (9). In laparoscopy, due to small incisions and non-opening of the abdominal wall, we observe less pain, shorter length of hospital stay, faster recovery time and lower possibility of wound infection and bleeding compared to the surgical incision, while the beauty of the skin is preserved. Researchers have shown that laparoscopy causes less pain in patients after surgery (10, 11). Laparoscopy seems to be an ideal diagnostic tool for stable patients with potential anterior abdominal injury due to the excellent view from the liver to the anterior diaphragm; A potential concern is carbon dioxide embolism through hepatic vein injury, but this complication can be minimized by performing smaller laparoscopies that can be used under regional anesthesia (9).

Considering the prevalence of penetrating abdominal trauma, the need for its management with less invasive methods, minimizing the cases of negative laparotomy and attention to laparoscopy features in the diagnosis and treatment of patients with penetrating abdominal trauma, this study was conducted to compare laparoscopy and laparotomy methods in evaluating the outcomes of surgery, complications and costs of patients with penetrating abdominal trauma.

Methods

After obtaining the approval of the ethics committee of Kurdistan University of Medical Sciences with the code IR.MUK.REC.1398.157 and obtaining a license, this retrospective study was conducted by reviewing the medical records of patients in Kowsar Hospital in Sanandaj during the period of September 2018 to September 2019.

To determine the sample size based on previous studies, assuming p1= 21.7% and p2= 62.2%, the type 1 error of 0.05 and the type 2 error of 0.20, the sample size was 19 people in each group, and 20 people were finally evaluated in each group. The medical records of patients with penetrating abdominal trauma with stable hemodynamics who had surgical indications and underwent laparotomy or laparoscopy surgery was reviewed. Patients with nonpenetrating traumatic injury, injury to other areas including pelvis and chest or head, back and flank trauma, patients with unstable hemodynamics and in shock during admission and in need of emergency laparotomy, as well as patients with penetrating abdominal trauma without indication for laparotomy were excluded.

The selected files were reviewed by a researcher and a colleague based on inclusion and exclusion criteria. Demographic characteristics of patients and the type of diagnostic and therapeutic procedure (laparoscopy and laparotomy) were collected in a researcher-made checklist in accordance with ethical principles and observing confidentiality. Collected data included age, gender, organ damage, location of trauma, postoperative ileus, site infection, postoperative pain,

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]

duration of surgery, length of stay, and treatment costs. The collected data were analyzed by SPSS software version 23 and Chi-squared test and Mann-Whitney test and $p< 0.05$ was considered significant.

Results

In this study, a total of 40 cases of penetrating abdominal trauma were reviewed, of which 18 patients (45%) underwent laparoscopic surgery and 22 patients (55%) underwent laparotomy. The mean age of patients in the laparoscopy group was 33.39±15.06 and in the laparotomy group was 27.77±7.86, and in this regard, there was no significant difference between the two groups. In addition, 14 patients (35%) were female and 26 patients (65%) were male.

The most common site of penetrating trauma was the subxiphoid region (16 cases), of which 68.8% underwent laparoscopy and 31.3% underwent laparotomy. The least common site of the observed trauma was the hypogastric region (3 cases), of which 66.7% underwent laparotomy and 33.3% underwent laparoscopy. Furthermore, 4 cases of right umbilical cord problem, 4 cases of left umbilical cord problem and 13 cases of trauma were observed at hypogastric region. There was a significant difference between the site of penetrating trauma and the choice of surgery method ($p< 0.05$). Six patients (27.3%) had laparoscopy surgery and 16 patients (72.7%) had laparotomy. Among the damaged organs, 5 cases (22.7%) were related to intestine and omentum, 2 cases (9.1%) were stomach and falciform ligament, 3 cases (13.6%) were liver, 4 cases (18.2%) were the spleen and one case (4.5%) was related to mesentery.

The highest rate of surgical wound infection as well as the incidence of postoperative ileus in patients in laparotomy group was significantly higher than patients in laparoscopy group ($p< 0.05$) (Table 1). Table 2 shows the average pain intensity after surgery based on the VAS scale, average surgery time, and average hospital stay. The average cost of surgery in laparoscopic surgery was 532,240 Rials and in laparotomy was 1,365,600 Rials. The results of Mann-Whitney test showed that surgical costs were significantly lower in the laparoscopy group ($p= 0.0001$).

Table 1. Frequency of surgical wound infection based on surgical technique

	Laparoscopy Number(%)	Laparotomy Number(%)	p-value
Surgical wound infection	0(0)	5(22.7)	0.040
Postoperative ileus	3(16.66)	17(77.2)	0.0001

Chi-square test (significance level 0.05)

Table 2. Average pain intensity and length of hospital stay based on the type of surgical technique

	Laparoscopy group Mean±SD	Laparotomy group Mean±SD	p-value
Pain intensity in the first 6 hours after surgery	2.03±0.69	6.77±1.95	<0.001
Duration of surgery based on minutes	36.83±9.07	92.61±48.20	<0.001
Length of stay based on days	1.38±0.58	5.73±1.78	<0.001

Mann-Whitney test (significance level 0.05)

Discussion

Based on the findings of our study, after reviewing the records of patients with penetrating abdominal trauma and stable hemodynamics, it was shown that 45% of patients underwent exploratory laparoscopy and 55% underwent exploratory laparotomy, which was consistent with other articles. It can be a sign of increasing popularity of diagnostic laparoscopy in this group of patients. Trauma surgeons can use various tools such as CT Scan, FAST and DPL to evaluate and manage patients with penetrating abdominal trauma (12). Routine laparotomy is not necessary in almost half of patients with stable hemodynamics and even increases the complications of surgery by 40% in some cases (13). That is why less invasive methods such as diagnostic laparoscopy has become popular. The use of diagnostic laparoscopy, especially when the patient's hemodynamics are stable, has been mentioned in many articles (14). In a systematic review, Hajibandeh et al. showed that on average, 47% of patients underwent laparoscopy and about 53% underwent laparotomy (15). The results of our study regarding surgical wound infection were in line with previous studies; no wound

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]

infection was observed in patients undergoing laparoscopy, while wound infection was reported in 22% of patients undergoing laparotomy. In laparoscopic method, due to creation of small incisions on the skin and less incisions on the skin surface, repair and reconstruction are done earlier and the probability of infection is reduced to almost zero, which indicates the success of laparoscopy surgery compared to laparotomy (16).

Laparoscopy method has been introduced as a safe, fast, high-sensitivity method with less complications for diagnosis and management in patients with penetrating abdominal trauma in several studies (15). In a study conducted by Karateke et al., surgical wound infection was not observed in any of the patients in the laparoscopic group, while wound infection was reported in 16% of patients undergoing laparotomy (13). Moreover, in the study of Chestovich et al., the infection rate in patients undergoing laparotomy was about 10%, while in patients undergoing laparoscopy, no infectious diagnosis was reported (14).

In our study, another complication that was examined was the incidence of postoperative ileus, which was not found in patients with penetrating abdominal trauma undergoing laparoscopy or laparotomy. Furthermore, in the review article by Hajibandeh et al., it was noted that the incidence of ileus was not reported in the reviewed articles (15). However, the incidence of ileus in the medical records of evaluated patients in this study was more than 77% in patients undergoing laparotomy, which was much higher than patients under laparoscopy (16.6%). This difference in the incidence of postoperative ileus in the two surgical methods can indicate less complications and higher safety in the laparoscopy method.

According to the results of this study, the average pain intensity in the first 6 hours after surgery according to VAS criteria in patients undergoing exploratory laparotomy was significantly higher than patients undergoing diagnostic laparoscopy. In a review article conducted by Li et al., it was mentioned that the duration of pain in patients with penetrating abdominal trauma under laparoscopy was much shorter than in patients under laparotomy (17). Although in the studies of Li et al., Khubutia et al. and Liang et al., postoperative pain was evaluated in the two surgical methods to manage patients with penetrating and non-penetrating abdominal trauma, but in these studies, the intensity of pain was not assessed and only the duration of pain was evaluated (17-19). Nevertheless, the duration of pain in the mentioned studies was much shorter in the laparoscopic group. In the study of Lee et al., in which pain was assessed at 6, 24, and 48 hours after surgery, the severity of pain in patients undergoing laparoscopic surgery was lower than in the laparotomy group at all hours of the study (20). Although the nature of surgery and incision in penetrating abdominal trauma and ovarian cancer surgery are not the same, but from this comparison it can be concluded that the pain in laparoscopic method is less than laparotomy in general and in different types of surgeries.

Increase in the duration of surgery and anesthesia increases the risk of complications during the operation. Therefore, in our study, the duration of surgery was also evaluated. The duration of laparoscopic surgery was 36.83 minutes on average and it was 92.61 minutes in the laparotomy group. In the study of Karateke et al., the mean surgery duration of patients with penetrating abdominal trauma was 17.9 minutes in diagnostic laparoscopic method and was 68.4 minutes in the group under laparotomy (13), which is generally consistent with our study.

In our study, the number of hospitalization days for patients undergoing laparoscopy was about one and a half, while the average number of hospitalization days was more than 5 days for patients who underwent laparoscopy. There is a huge difference between hospitalization days for laparotomy and for teaching hospitals that often face a shortage of beds, the type of operation will have a significant impact on the performance of the hospital. Uranues et al. and Rajaei et al. reported similar results (4, 11). Also, in the study of Karateke et al., the average days of hospital stay in patients under laparoscopy and laparotomy were 1.82 and 5.4 days, respectively (13), which shows the consistency between the results of other studies and our study.

The average cost of surgery in laparoscopic surgery is 532,240 Rials and in laparotomy is 1,365,600 Rials. According to the obtained average, it can be concluded that the cost of surgery in laparotomy is higher than laparoscopic surgery and this difference can be due to more days of hospitalization. Unquestionably, reducing hospitalization costs and consequently reducing hospital costs is one of the most important goals of the medical system, and the use of less invasive methods can be helpful in this regard. In the study of Lee et al., the cost of laparoscopic surgery was much lower than laparotomy (20). Studies by Yi et al. have also reported that laparoscopic surgery is more

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]

cost-effective than laparotomy (21). If the infection is examined after laparotomy, then the costs of laparotomy will be much higher than the cost of laparoscopy. According to the results of the present study and its comparison with previous studies, it can be inferred that the laparoscopic method compared to the laparotomy method has the advantages of reducing scarring, reducing the cost of surgery, reducing postoperative ileus, reducing hospitalization days, reduction of postoperative wound infection rate, bleeding and hematoma and less pain in laparoscopy compared to laparotomy, lower mortality rate, more visceral visibility and less need for re-surgery. Disadvantages of laparoscopy include the lack of vision of all dimensions of the organ, as well as the low efficiency of this method for patients with a wide range of trauma. As mentioned, the type of surgery in trauma patients is ultimately determined according to the facilities, equipment and conditions of the patient, hospital and surgeon.

Acknowledgment

We would like to thank the President of Kurdistan University of Medical Sciences, the Vice Chancellor for Research and Technology of Kurdistan University of Medical Sciences, as well as the Department of Surgery who helped us in this research.

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]

References

1.Gad MA, Saber A, Farrag S, Shams ME, Ellabban GM. Incidence, patterns, and factors predicting mortality of abdominal injuries in trauma patients. N Am J Med Sci. 2012;4(3):129-34.

2.World Health Organization. The global burden of disease: 2004 update. Available from: https://www.who.int/healthinfo/global_burden_disease/2004_report_update/en/

3.Hemmila MR, Wahl WL. Management of the Injured Patient. In: Doherty GM, editor. Current surgical diagnosis and treatment. New York: McGraw-Hill Medical; 2008. p. 227-8.

4.Rajaei S, Taziki MH, Keshtkar AA, Shoa-Kazemi A. Prevalence of intra abdominal injuries due to penetrating trauma in Gorgan, Iran (2002-07). J Gorgan Univ Med Sci. 2012;14(2):96-9. [In Persian]

5.Uludağ M, Yetkin G, Çitgez B, Yener F, Akgün I, Çoban A. Effects of additional intra-abdominal organ injuries in patients with penetrating small bowel trauma on morbidity and mortality. Ulus Travma Acil Cerrahi Derg. 2009;15(1):45-51.

6.Ma OJ, Mateer JR, Ogata M, Kefer MP, Wittmann D, Aprahamian C. Prospective analysis of a rapid trauma ultrasound examination performed by emergency physicians. J Trauma. 1995;38(6):879-85.

7.Taner AS, Topgul K, Kucukel F, Demir A, Sari S. Diagnostic laparoscopy decreases the rate of unnecessary laparotomies and reduces hospital costs in trauma patients. J Laparoendosc Adv Surg Tech A. 2001;11(4):207-11.

8.Abri B, Vahdati SS, Paknezhad S, Majd PS, Bahrami M. Abdominal penetrating trauma and organ damage and its prognosis. J J Anal Res Clin Med. 2016;4(4):203-6.

9.Brunicardi F, Andersen D, Billiar T, Dunn D, Hunter J, Matthews J, et al. Schwartz's principles of surgery, 10th ed. New York: McGraw-hill; 2014. p.415.

10.Ghadami N, Barzanji A, Nasseri K, Sarshivi F, Nouri B. Effect of gabapentin in comparison with hydrocortisone on postlaparoscopic cholecystectomy pain control. J Family Med Prim Care. 2019;8(2):652-6.

11.Uranues S, Popa DE, Diaconescu B, Schrittwieser R. Laparoscopy in penetrating abdominal trauma. World J Surg. 2015;39(6):1381-8.

12.Como JJ, Bokhari F, Chiu WC, Duane TM, Holevar MR, Tandoh MA, et al. Practice management guidelines for selective nonoperative management of penetrating abdominal trauma. J Trauma. 2010;68(3):721-33.

13.Karateke F, Ozdogan M, Ozyazici S, Das K, Menekse E, Gulnerman YC, et al. The management of penetrating abdominal trauma by diagnostic laparoscopy: a prospective non-randomized study. Ulus Travma Acil Cerrahi Derg. 2013;19(1):53-7.

14.Chestovich PJ, Browder TD, Morrissey SL, Fraser DR, Ingalls NK, Fildes JJ. Minimally invasive is maximally effective: diagnostic and therapeutic laparoscopy for penetrating abdominal injuries. J Trauma Acute Care Surg. 2015;78(6):1076-85.

15.Hajibandeh S, Hajibandeh S, Gumber AO, Wong CS. Laparoscopy versus laparotomy for the management of penetrating abdominal trauma: a systematic review and meta-analysis. Int J Surg. 2016;34:127-36.

16.Zhou Z, Zuo Z, Chen G. Diagnostic and therapeutic value of laparoscopy in abdominal trauma. Guangdong Med J. 2013;22:3492. Available from: http://caod.oriprobe.com/articles/40700662/fu_qiang_jing_zai_fu_bu_wai_shang_zhong_de_zhen_du.htm

17.Li Y, Xiang Y, Wu N, Wu L, Yu Z, Zhang M, et al. A comparison of laparoscopy and laparotomy for the management of abdominal trauma: a systematic review and meta-analysis. World J Surg. 2015;39(12):2862-71.

18.Khubutiya MS, Yartsev PA, Guliaev AA, Levitsky VD, Tlibekova MA. Laparoscopy in blunt and penetrating abdominal trauma. Surg Laparosc Endosc Percutan Tech. 2013;23(6):507-12.

19.Liang T-C, Fu G-W. Study on the application significance of laparoscope in the treatment and diagnosis of blunt abdominal trauma. Sichuan Med J. 2013;4:529-30. Available from: http://caod.oriprobe.com/articles/39383222/Study_on_the_application_significanceof_laparoscope_in_the_treatment_a.htm

20.Lee M, Kim SW, Paek J, Lee SH, Yim GW, Kim JH, et al. Comparisons of surgical outcomes, complications, and costs between laparotomy and laparoscopy in early-stage ovarian cancer. Int J Gynecol Cancer. 2011;21(2):251-6.

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]

21.Yi X, Chen S, Wang W, Zou L, Diao D, Zheng Y, et al. A systematic review and meta-analysis of laparoscopic and open distal pancreatectomy of nonductal adenocarcinomatous pancreatic tumor (NDACPT) in the pancreatic body and tail. Surg Laparosc Endosc Percutan Tech. 2017;27(4):206-19.

[DOR: 20.1001.1.15614107.1400.23.1.32.1]
[DOI: 10.22088/jbums.23.1.222]