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A comparative study of open versus laparoscopic repair of duodenal ulcer perforation in relation to recovery and postoperative complications

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ABSTRACT

INTRODUCTION- Perforation is a life-threatening complication of the duodenal ulcer which requires urgent surgical intervention. The aim of surgery is to close the rent with or without an omental patch and adequate peritoneal lavage which is conventionally being done by open technique i.e. laparotomy which is the gold standard.

In recent decades, after the advent of Minimally Invasive Surgery, laparoscopic repair has become an attractive alternative option for the repair of DU perforation. The laparoscopic method can overcome various complications encountered in open surgery during the post-operative and recovery period.

AIMS AND OBJECTIVES- This study is a comparative study of open versus laparoscopic repair of duodenal ulcer perforation in relation to recovery and post-operative complications.

MATERIALS AND METHOD-

STUDY PERIOD: 1 year (1st September 2020- 31st August, 2021)

STUDY POPULATION: All patients admitted to the department of General Surgery of Fakhruddin Ali Ahmed Medical College and Hospital with a final diagnosis of DU perforation during the study period of 1 year (1st September 2020- 31st August 2021) were included in the study.

STUDY TYPE: Hospital-based descriptive study (Group Comparison)

SAMPLE DESIGN: Purposive sampling

METHOD OF ALLOTMENT TO GROUP: Every alternate patient allotted to either open or laparoscopy group.

STUDY SAMPLE SIZE: 63 (31 laparoscopy group and 32 open group)

ETHICAL CLEARANCE: Ethical Clearance was taken from Institutional Ethics Committee, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta.

RESULTS- Early return to a normal diet, early removal of Ryles tube, better postoperative analgesia, less amount of abdominal drain collection and minimal post-operative complications like minimal wound dehiscence, less incidence of wound infection, less incidence of fever and earlier discharge from hospital are observed in laparoscopic repair than in the open repair.

CONCLUSION- From the present study it can be concluded that the laparoscopic approach for duodenal ulcer perforation repair is a safe and favorable option. Laparoscopy as the first policy can be adopted in selected cases of duodenal ulcer perforation for a better outcome.

I. INTRODUCTION

Perforation is a life-threatening complication of Duodenal Ulcer (DU) and it requires emergency surgical treatment. Despite the dramatic decrease in the incidence of Peptic Ulcer Disease (PUD) due to the advent of various anti-ulcer agents, the relative percentage of perforated DU remains stable[1].

The use of non-steroidal anti-inflammatory drugs and smoking are two important risk factors for perforation[2].

Various studies show the perforation rate of DU to be 2-10%[3]. The mortality rate of PUD perforation is alarmingly high, at 10-40%4. A variety of factors including patient's age, sex, site of the ulcer, delay in treatment, concurrent disease, preoperative shock, and type of anesthesia used can influence mortality of PUD[5].

DU perforation constitutes a majority of abdominal emergencies along with acute appendicitis and acute intestinal obstruction. The resulting generalized peritonitis is an immediate threat to life; as such surgery is urgently required in almost all cases. The aim of surgery is the closure of the rent with or without an omental patch and

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adequate peritoneal lavage. This is conventionally done by open technique i.e. laparotomy which is the gold standard.

In recent decades, after the advent of Minimally Invasive Surgery, laparoscopic repair has become an attractive option for DU perforation, an alternative to open repair. Laparotomy has the disadvantages of a large abdominal incision which leads to increased wound infection, wound dehiscence, paralytic ileus, lung complications, and also the late complication of incisional hernias. These complications can be minimized or avoided by a laparoscopic approach. It has been possible to identify the perforation and deal with it laparoscopically just like laparotomy and is being practiced worldwide with favorable results[6,7,8].

Many series have reported laparoscopic repair of perforated DU to be superior to open repair in terms of less pain, shorter hospital stay, better wound healing, and low incidence of incisional hernias. Some authors prefer laparoscopic procedures only in low-risk patients[9], while others like to take a "Laparoscopy First Policy"[10]. Laparoscopic repair of DU perforation is now being applied widely and this procedure may become Gold Standard in the future especially in patients with perforations less than 10 mm in size presenting within the first 24 hours of the onset of pain[11].

AIMS AND OBJECTIVES

Aim - This study is a comparative study on open versus laparoscopic repair of duodenal ulcer perforation in relation to recovery and post-operative complications.

General objectives - To determine whether open or laparoscopic repair of duodenal ulcer perforation is beneficial for the patients.

Specific objectives - To compare between open and laparoscopic repair of duodenal ulcer perforation in terms of recovery and post-operative complications using the following parameters

- Duration of surgery
- Nasogastric tube requirement
- Starting of oral feed.
- Requirement of analgesia
- Postoperative collection in the abdominal drain.
- Occurrence of wound-related complications like wound dehiscence, wound infection, and wound leak.
- Incidence of postoperative fever.
- Length of hospital stay

II. MATERIALS AND METHODS

This was a hospital-based descriptive study (Group Comparison) involving patients with a final diagnosis of duodenal ulcer perforation who has undergone either open or laparoscopic repair of the perforation during the study period of 1 year (1st September 2020- 31st August 2021) in the Department of General Surgery, Fakhruddin Ali Ahmed Medical College and Hospital (FAAMCH).

METHODS OF DATA COLLECTION

Informed and written consent was obtained from all patients before participating in the study

All patients admitted to the General Surgical departments of FAAMCH with a final diagnosis of DU perforation during the study period of 1 year (1st September 2020- 31st August 2021) were included in the study.

Detailed clinical examination and necessary radiological and laboratory investigations are done for all patients according to the pre-designed and pre-tested proforma.

Patients were stratified into two groups (as per informed consent and after finding out Boey score) by using systematic random sampling to undergo either open or laparoscopic repair of DU perforation.

The Boey score[12,13], used for the severity of the disease is based on three criteria- (A) Shock at admission (systolic blood pressure<90 mmHg), (B) Severe medical illness (ASA 3-5)[14], (C) Delayed presentation (duration of symptoms >24 hrs). In this scoring system, the patient is given one point for each positive criterion, with possible scores of 0-3.

Patients with a Boey score of 0-2 were included in the study

Patients with Boey score 3 were excluded as the laparoscopic procedure is usually not possible in this group.

A total of 63 patients were selected for the study and every alternate patient was selected for open or laparoscopic repair by using systematic random sampling. 31 patients have undergone laparoscopic repair and 32 patients were selected for open repair. Informed and written consent was taken from all the patients before the surgical intervention. Patient treated laparoscopically was compared with a similar number of patients undergoing open surgery using different parameters.

Patients will be followed up to discharge from the hospital. During the follow-up period, post-operative findings are recorded as per protocol and compared between the two groups.

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INCLUSION CRITERIA

(1) All patients undergoing surgery at FAAMCH with clinical and radiological diagnosis of hollow viscus perforation with peritonitis and found to be DU perforation.
(2) Patients with Boey score 0-2.
(3) Patients less than 60 yrs of age.

EXCLUSION CRITERIA

- Hollow viscus perforation other than duodenal perforation diagnosed either laparoscopically or in laparotomy
- Patients above 60 yrs of age
- Patients with Boey score 3.
- Those cases where laparoscopy to open conversion will be done due to the larger size of the ulcer etc. will be excluded.

The following parameters are observed during the intra and post-operative period

- Duration of Surgery
- Requirement of the nasogastric tube
- Starting of oral feed
- Postoperative analgesic use
- Postoperative abdominal drain collection
- Wound leak
- Wound dehiscence
- Wound infection
- Postoperative fever
- Length of hospital stay

STATISTICAL ANALYSIS OF DATA

All relevant data were documented in a tabular form. Analysis was done statistically and interpretation was elicited. For statistical analysis, data were entered into a Microsoft excel spreadsheet and then analyzed by using the software. Data have been expressed in terms of mean and standard deviation for numerical variables and the counts for categorical variables. The Chi-square test was used where relevant
For statistically significant p-value was considered to be ≤ 0.05.

ETHICAL CLEARANCE

Ethical Clearance was taken from Institutional Ethics Committee, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta.

III. DISCUSSION

This study is a comparative study that is done between two groups – open and laparoscopic repair of duodenal ulcer perforation. Comparison is done between the two groups in relation to recovery and post-operative complications till the patient is discharged from the hospital.

Different parameters are taken into consideration to compare the two groups and the findings are discussed as follows.

1) **AGE**

In this present study, the mean age in the laparoscopic group was 39±11 years and in the open group it was 41±10 years and the p-value was found to be 0.461 which is more than 0.05. So, it is statistically not significant.

LAPAROSCOPIC Average of AGE	OPEN Average of AGE	Total	p-value
39±11	41±10	40±11	0.4610

2) SEX

In this study 23 of 31 patients were male in the laparoscopy group and the open group 30 of 32 patients were male where the p-value was 0.0752 and it was statistically not significant.

	LAPAROSCOPIC		OPEN		Total		p-value
Count of SEX	**N**	**%**	**N**	**%**	**N**	**%**	
FEMALE	8	25.81%	2	6.25%	10	15.87%	0.0752
MALE	23	74.19%	30	93.75%	53	84.13%	
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**	

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3) **COMORBID CONDITIONS-**

In this study 2 out of 31 patients in the laparoscopy group and 5 out of 32 patients in the open group were presented with comorbidities where the p-value was 0.3830 and it was not significant statistically.

	LAPAROSCOPIC		OPEN		Total		p-value
ANY COMORBIDITIES PRESENT ON DAY ONE OF ADMISSION	**N**	**%**	**N**	**%**	**N**	**%**	
COPD		0.00%	1	3.13%	1	1.59%	0.3830
DIABETES MELLITUS	2	6.45%	2	6.25%	4	6.35%	
HYPERTENSION		0.00%	2	6.25%	2	3.17%	
NO	29	93.55%	27	84.38%	56	88.89%	
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**	

4) **DURATION OF SURGERY (FROM STARTING OF INCISION TO CLOSURE)**

The average duration of surgery is found to be 104±10 mins in the laparoscopy group in the current study and the same is found to be 75±11 minutes in the open surgery group and the p-value was 0.0001 (<0.05) which is statistically significant.

This study showed that the time required for open repair is comparatively less than for laparoscopic repair of duodenal ulcer perforation.

LAPAROSCOPIC	OPEN	Total	p-value
Average DURATION OF SURGERY (FROM INCISION TO CLOSURE) IN MIN.	**Average DURATION OF SURGERY (FROM INCISION TO CLOSURE) IN MIN.**		
104±10	75±11	89±18	0.0001

5) NASOGASTRIC TUBE REQUIREMENT (IN DAYS)

A nasogastric tube can be removed earlier in the laparoscopy group than in the open group. In the current study nasogastric tube requirement was 4±1 days in the laparoscopy group but in the open group, it was 8±1 days. The result was statistically significant as the p-value was calculated as 0.0001(<0.05).

LAPAROSCOPIC	OPEN	Total	p-value
Average NASOGASTRIC TUBE REQUIREMENT (IN DAYS)	**Average NASOGASTRIC TUBE REQUIREMENT (IN DAYS)**		
4±1	8±1	6±2	0.0001

6) **STARTING OF ORAL FEED**

The average day of starting of liquid was 4±1days in the laparoscopic group and it was 8±1days in the open group in the present study where it is observed significant p-value 0.0001(<0.05). In the same study, it was observed the average day of starting solid food was 5±0 days in the laparoscopy group and it was 9±1 days in the open group.

Oral feeding can be started earlier in patients who have undergone laparoscopic repair as compared to patients with open repair in accordance with the study results.

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LAPAROSCOPIC Average DAY OF STARTING LIQUID	OPEN Average DAY OF STARTING LIQUID	Total	p-value
4±1	8±1	6±2	0.0001

LAPAROSCOPIC	OPEN	Total	p-value
Average DAY OF STARTING SOLID FOOD (IN DAYS)	Average DAY OF STARTING SOLID FOOD (IN DAYS)		
5±0	9±1	7±2	0.0001

7) REQUIREMENT OF POSTOPERATIVE ANALGESIA-

In the present study, all the patients in both groups required non-narcotic analgesics postoperatively. But in the open group 10 patients out of 32 patients required narcotic analgesics whereas none of the patients in the laparoscopy group required narcotic analgesics. This comparison showed a statistically significant p-value of 0.0022 (<0.05).

From the results of the present study, it can be concluded that the requirement for post-operative analgesia is significantly less in the laparoscopy group as compared with its open counterpart.

POSTOPERATIVE REQUIREMENT OF NARCOTIC ANALGESIC	LAPAROSCOPIC		OPEN		Total		p-value
	N	%	N	%	N	%	
NO	31	100.00%	22	68.75%	53	84.13%	0.0022
YES		0.00%	10	31.25%	10	15.87%	
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**	

8) POSTOPERATIVE COLLECTION IN ABDOMINAL DRAIN-

Significantly less amount of abdominal drain collection was observed in the laparoscopy group as compared to the open surgery group (p-value 0.0001).

LAPAROSCOPIC Average AMOUNT (IN ML) AND NATURE OF COLLECTION IN ABDOMINAL DRAIN IN 1ST 24 HRS	OPEN Average AMOUNT (IN ML) AND NATURE OF COLLECTION IN ABDOMINAL DRAIN IN 1ST 24 HRS	Total	p-value
124±14	172±18	148±29	0.0001

LAPAROSCOPIC Average of AMOUNT (IN ML) AND NATURE OF ABDOMINAL DRAIN COLLECTION IN 2ND 24 HRS	OPEN Average of AMOUNT (IN ML) AND NATURE OF ABDOMINAL DRAIN COLLECTION IN 2ND 24 HRS	Total	p-value
96±10	132±19	114±23	0.0001

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LAPAROSCOPIC Average AMOUNT (IN ML) AND NATURE OF COLLECTION IN ABDOMINAL DRAIN IN 3RD 24 HRS	OPEN Average AMOUNT (IN ML) AND NATURE OF COLLECTION IN ABDOMINAL DRAIN IN 3RD 24 HRS	Total	p-value
66±13	98±13	82±21	0.0001

9) WOUND LEAK-

No wound leak was observed in the present study in both open and the laparoscopy group.

	LAPAROSCOPIC		OPEN		Total	
WOUND LEAK	**N**	**%**	**N**	**%**	**N**	**%**
NO	31	100.00%	32	100.00%	63	100.00%
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**

10) **WOUND DEHISCENCE-**

Partial wound dehiscence is seen in 9 patients out of the 32 patients in the open group, but in the laparoscopy group, no wound dehiscence is observed in the present study. While comparing, the p-value is found to be 0.004(<0.05) and it is significant.

The result of the current study showed that wound dehiscence is rare in the laparoscopic group and the incidence of wound dehiscence is more in the open surgery group.

	LAPAROSCOPIC		OPEN		Total	
TOTAL WOUND DEHISCENCE	**N**	**%**	**N**	**%**	**N**	**%**
NO	31	100.00%	32	100.00%	63	100.00%3
Grand Total	**31**	100.00%	**32**	100.00%	**63**	100.00%

	LAPAROSCOPIC		OPEN		Total		p-value
PARTIAL WOUND DEHISCENCE	**N**	**%**	**N**	**%**	**N**	**%**	
NO	31	100.00%	23	71.88%	54	85.71%	
YES		0.00%	9	28.13%	9	14.29%	0.0046
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**	

11) PURULENT WOUND INFECTION-

In the present study, 12 cases out of 32 cases in the open surgery group developed purulent wound infection whereas no cases in the laparoscopic group developed wound infection. In comparison, the p-value is found to be 0.0005 and this is significant.

In our study, more incidence of wound infection is observed in patients with open repair of perforation.

	LAPAROSCOPIC		OPEN		Total		p-value
PURULENT WOUND INFECTION	**N**	**%**	**N**	**%**	**N**	**%**	
ABSENT	31	100.00%	20	62.50%	51	80.95%	0.0005
PRESENT		0.00%	12	37.50%	12	19.05%	
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**	

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12) POSTOPERATIVEATIVE FEVER-

The incidence of fever in the postoperative period is more in the open group (8 out of 32 cases) than in the laparoscopy group (only 1 out of 31 cases). The result is statistically significant as the p-value is 0.0135 (<0.05).

These results show that the incidence of fever is high among the open surgery group in postoperative period.

FEVER IN POST OPERATIVE PERIOD	LAPAROSCOPIC		OPEN		Total		p-value
	N	%	N	%	N	%	
ABSENT	30	96.77%	24	75.00%	54	85.71%	0.0135
PRESENT	1	3.23%	8	25.00%	9	14.29%	
Grand Total	**31**	**100.00%**	**32**	**100.00%**	**63**	**100.00%**	

13) LENGTH OF HOSPITAL STAY

In the present study average length of hospital stay is 8±1 days in the laparoscopy group and it was 14±s3 days in the open group which is statistically significant (p-value 0.0001).

Patients who have undergone laparoscopic repair of perforation can be discharged earlier from the hospital than open one as observed in our study.

LAPAROSCOPIC Average DURATION OF HOSPITAL STAY (IN DAYS)	OPEN Average DURATION OF HOSPITAL STAY (IN DAYS)	Total	p-value
8±1	14±3	11±4	0.0001

IV. CONCLUSION-

From the present study, it can be concluded that the laparoscopic approach for duodenal ulcer perforation repair is a safe and favorable option. Laparoscopic repair of duodenal ulcer is superior to open repair in terms of recovery like an early return to normal diet, early removal of Ryles tube, better postoperative analgesia, less amount of abdominal drain collection, and minimal post-operative complications like minimal wound dehiscence, less incidence of wound infection, less incidence of fever and earlier discharge from hospital.

Laparoscopy as the first policy can be adopted in selected cases of duodenal ulcer perforation for a better outcome

This study is done over a limited period of time and a small number of cases. A better-planned study with a bigger sample size is required to give a clear picture.

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