

COMPARATIVE STUDY OF LAPAROSCOPIC AND OPEN REPAIR OF DUODENAL ULCER PERFORATION

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ABSTRACT

BACKGROUND

Laparoscopic Cholecystectomy (LC) is one of the most common laparoscopic procedures being performed by general surgeons all over the world. Preoperative prediction of the risk of conversion is an important aspect of planning laparoscopic surgery. The purpose of our prospective study was to analyse various risk factors based clinical history, laboratory investigations and imaging and their association with conversion to open. With the help of accurate prediction, high-risk patient maybe informed beforehand regarding the probability of conversion and hence they may have a chance to make arrangements accordingly. On the other hand, surgeons also may have to schedule the time and team for the operation appropriately. Surgeons can also be aware about the possible complications that may arise in high-risk patients.

MATERIALS AND METHODS

Patients who presented to the Emergency Department in Government Rajaji Hospital with clinical diagnosis of duodenal ulcer perforation during the period of 6 months from March 2015 to August 2015 were prospectively nonrandomised (by consent and cafeteria method) to undergo either laparoscopic or open repair of duodenal ulcer perforation.

RESULTS

There was no significant difference in duration of symptoms, mean age, ASA grade and mean perforation size in both groups. Analgesic requirement was significantly lower in the laparoscopy group (3.39 ± 0.58 vs. 4.84 ± 0.66 days). Our patients who underwent laparoscopic repair were enabled to be discharged significantly earlier from the hospital (8.6 ± 2.3 vs. 10.5 ± 3.9 days). We found that laparoscopic repair did result in earlier return to normal diet (4.26 ± 0.81 vs. 4.87 ± 0.86 days). Time required for mobilisation of patients was also significantly lower (3.3 ± 0.7 vs. 4.34 ± 0.62 days).

CONCLUSION

Laparoscopic repair of duodenal ulcer perforation is as safe and effective as open repair has the advantages of less wound-related complications, early recovery and return to normal activity.

KEYWORDS

Duodenal Ulcer Perforation, Laparoscopy, Omental Patch Closure.

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BACKGROUND

Duodenal ulcer perforation is one of the common complications of peptic ulcer, a disease despite the use of various antiulcer agents and eradication therapy. It is one of the most common causes of admission in casualty worldwide and more in developing nations. Important aetiological factors of peptic ulcer disease are H. Pylori infection, chronic NSAIDs intake, chronic alcohol intake, cigarette smoking, intake of smoked foods, spicy foods and

irregular diet intake and in type A personalities. Identification of aetiological factors is important as preventive measures can be taken to avoid or prevent the complications of peptic ulcer disease.

Common sites for peptic ulcers are the first part of duodenum and the lesser curvature of the stomach, they may also occur on the stoma after gastric surgery, oesophagus and even in Meckel's diverticulum. With time, there has been a steady increase in the age of the patients and the number of females affected with peptic ulcer perforation. Duodenal ulcer perforation is an abdominal emergency and is in third in frequency after acute appendicitis and acute intestinal obstruction. Prompt early diagnosis and early intervention are needed to decrease the still high mortality of this disease.

Perforation and peritonitis are immediate threats to life, the ulcer itself is not. Thus, therapeutic priorities are treatment of peritonitis and securing the closure of

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perforation, which may be achieved with surgical procedure, open or laparoscopic.

The conventional open technique deals well with the perforation and peritoneal lavage, but has the disadvantages of large upper abdominal incision, wound infection, wound dehiscence, prolonged hospitalisation and pulmonary complications and late complications of incisional hernias. Perforated peptic ulcers (PPU) is a condition in which laparoscopic repair is an attractive option. Not only is it possible to identify site and pathology of the perforation, but the procedure also allows closure of the perforation and peritoneal lavage, just like conventional open repair, but without a large upper abdominal incision.

But, the effects of laparoscopy in the setting of generalised peritonitis, physiological disturbances, which are unpredictable need to be balanced with the advantages of faster recovery. This study is an effort to compare the efficacy and safety of laparoscopic and conventional methods of closure of duodenal ulcer perforation.

Aim and Objectives

To compare the effectiveness and postoperative outcomes of laparoscopic and open repair of duodenal ulcer perforation.

Objectives- The present study is undertaken to compare the outcomes of laparoscopic and open repair of duodenal ulcer perforation in terms of-

- Duration of surgery,
- Time to resume oral feeds.
- Analgesic requirement,
- Hospital stay,
- Postoperative complications, and
- Time to return to normal activity.

MATERIALS AND METHODS

Patients who presented to the Emergency Department in Government Rajaji Hospital with clinical diagnosis of duodenal ulcer perforation during the period of 6 months from March 2015 to August 2015 were prospectively nonrandomised (by Consent and Cafeteria Method) to undergo either laparoscopic or open repair of duodenal ulcer perforation.

Inclusion Criteria

All patients with diagnosis of duodenal ulcer perforation undergoing emergency surgery during the study period.

Exclusion Criteria

- Patients presenting with shock, defined as systolic BP less than 80 mm of Hg.
- Patients with past history of upper abdominal surgery.
- Patients with gastric perforation.
- Patients with size of perforation >15 mm.
- Patients with suspicion of malignancy, and
- Patients in laparoscopic group converted to open surgery.

A detailed clinical history regarding age, sex, occupation, clinical presentation, symptoms, past history of chronic duodenal ulcer was obtained once the patient was stabilised.

All patients had an x-ray erect abdomen, USG abdomen and routine surgical examination to confirm the diagnosis. A nasogastric tube and Foleys catheter were placed. A dose of prophylactic antibiotic was given 30 minutes before surgery.

Patients underwent emergency surgery after preoperative assessment for definitive diagnosis, closure of perforation and peritoneal toilet. Laparoscopic or open surgery was performed upon obtaining informed consent from the patient.

All patients were started on IV antibiotics for a minimum of 5 days. All patients were placed on injectable analgesics, tapered as they recovered. All patients were started on proton pump inhibitors. Nasogastric tube was placed. Continuous drainage was done till the secretions were less than 150 mL in 24 hrs. Patients were allowed to take liquid diet once the bowel sounds returned. Solid diet was allowed as the patient tolerated. Abdominal drains were monitored and removed when collection was less than 50 mL in 24 hrs. Patients were encouraged to move about as their condition allowed. Patients were monitored for fever, postoperative complications and respiratory infection. Patients were discharged once they were free of postoperative complications, able to move about comfortably and the sutures healed. Patients were prescribed.

Three drug anti-H. pylori regimen at the discharge and were advised to come for follow up at 2 weeks, 1 month and 3 months from discharge.

The patients in the laparoscopic and the open group were studied for-

- Duration of surgery.
- Analgesia required (number of days parenteral analgesics were required).
- Time to resume orals (number of days to resume solid diet).
- Time to mobilise the patient (number of days for the patient to move about in the ward).
- Duration for which drains were kept.
- Postoperative complications-
 - Fever.
 - Wound infection.
 - Wound dehiscence.
 - Bile leak.
 - Intraperitoneal collection.
 - Prolonged ileus.
 - Respiratory infection.
 - Duration of hospital stay.
- Patients were followed up for a period of 3 months, for-
 - Wound pain.
 - Time to return to work.
 - Incisional hernia.

Statistical Methods

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (M and results on categorical measurements are presented in number (%). Student's t-test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups.

Chi-square/Fisher exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

P-value 0.05 is considered as significant.

Statistical Software- The statistical software namely SPSS 15.0, Stats Direct and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables.

OBSERVATION AND RESULTS

This prospective comparative study consisted of patients who underwent emergency surgery for duodenal ulcer perforation repair either open or laparoscopic in Government Rajaji Hospital, Madurai, during March 2015 to August 2015.

A total of 50 patients underwent surgery for duodenal ulcer perforation during the period of 6 months.

A total of 50 patients were included in the study. 30 were treated by conventional open method and 20 were treated by laparoscopic closure of duodenal ulcer perforation.

All cases underwent preoperative assessment in the emergency department. Their preoperative findings and postoperative complications were meticulously recorded as per protocol. The findings were tabulated and the following observations were made.

20 patients in the laparoscopic group and 30 patients in the open group were studied to compare the effectiveness and postoperative outcomes in terms of-

- Duration of surgery.
- Time to resume orals.
- Analgesic requirement.
- Hospital stay.
- Postoperative complications.
- Time to return to normal activity.
- Descriptive statistical analysis was carried out in the study.

Age Distribution of the Patients

Age of patients of both open and laparoscopic groups ranged between 14 to 70 years with a mean age of 41.86 yrs. in the open group and 48.04 yrs. in the laparoscopic group.

The difference was not statistically significant as the p-value by Student's t-test was 0.656.

Laparoscopy		
Age	Open (30)	Laparoscopy (20)
Mean	41.8	43.5
S.D.	12.9	13.5
P value	0.656	Not significant

Table 1. Age of the Patients Studied

Sex	Open (30)	Laparoscopy (20)	Total
Male	22	14	36
Female	8	6	14
		P value	0.017 Significant

Table 2. Sex Distribution

Majority of patients were males with male-to-female ratio in the open is 2.8:1 and in lap is 2.2:1.

Duration of Symptoms

Duration of symptoms ranged from 1 to 4 days in both groups with a mean duration of 1.56 ± 0.86 days in the open group and 1.95 ± 1.1 days in the laparoscopic group. There was no statistical significance as the p-value was 0.146.

	Open (30)	Laparoscopy (20)
Mean	1.56	1.95
SD	0.86	1.1
P Value	0.146	Not significant

Table 3. Duration of Open Laparoscopy Symptoms

Intraoperative Findings

The size of ulcer perforation in the open group was a mean of 5.39 mm and that of the lap group was 5.95 mm. The difference was not statistically significant.

Duration of Operation

The mean skin-to-skin time was 96.41 minutes in the open group and 113.91 minutes in the lap group.

The difference was statistically significant with a p-value of 0.0083. The lap group had longer mean operative time.

Duration of Operation	Open (30)	(20)
Mean	96.41	113.9
SD	13.4	12.8
P value	<0.001	Significant

Table 4. Laparoscopy

Postoperative Outcomes

The patients in the open group needed NG tube for a mean of 3.43 ± 0.65 days and those in the lap group for 3 ± 0.6 days. The difference was significant with a p value of 0.008.

The patients in the open group needed intravenous fluids for a mean of 4.17 ± 0.52 days and those in the lap group for 3.47 ± 0.66 days, the difference was significant favouring the lap group.

Analgesic Usage

The patients in the laparoscopy group needed injectable analgesics for a significantly less duration than those in the open group.

Duration of Requirement of Parenteral Analgesics		
	Open (30)	Laparoscopy (20)
Mean	4.84	3.39
SD	0.66	0.58
P Value	<0.001 significant	

Table 5. Comparison of Duration of Requirement of Parenteral Analgesics

Time to Mobilisation

Patients in the lap group were able to move about in the ward earlier than those in the open group.

Days	Open (30)	Laparoscopy (20)
Mean	4.34	3.30
SD	0.62	0.70
P value	<0.001	Significant

Table 6. Time to Mobilisation

Time to Resume Orals- Patients in the lap group were able to tolerate orals earlier than those in the open group.

Time To Resume Normal Diet Open		
(Days)	Open (30)	
Mean	4.87	
S.D.	0.86	
P value	0.005 significant	

Table 7. Comparison of Time to Resume Normal Diet

Hospital Stay in Days	Open (30)	Laparoscopy (20)
Mean	10.5	8.6
S.D.	3.6	2.4
P value	0.044	Significant

Table 8. Duration of Hospital Stay

Patients in the lap group needed a mean hospital stay of 8.6 days, where those in the open group needed 10.5 days. The difference was statistically significant favouring the lap group with shorter hospital stay.

Postoperative Complications

Patients in open group had significantly higher rates of wound infection. There was no significant difference between both groups in terms of other complications like fever, intraperitoneal collection, pulmonary infection and prolonged ileus. There was one death in open group. Three patients in each group had intraperitoneal collections. They were treated conservatively and by USG-guided aspiration of the collection.

Postoperative Complications	Open (30)	Laparoscopy (20)	P value
Fever	8	4	0.752
Leak	0	0	
Wound infection	14	2	0.043
Wound dehiscence	5	0	0.106
Intraperitoneal collection	3	3	0.364
Pulmonary infection	7	2	0.808
Prolonged ileus	6	1	0.59
Death	1	0	1

Table 9. Postoperative Complications

Followup

There was one death in open group. The patients in each group were followed up for a maximum of 3 months, 5 patients from the open group and 3 from the lap group did not come for follow up. 14 patients in the open group and none in the lap group had pain at the suture site during the

follow up. 2 patients from the open group developed incisional hernia. None of the patients had complications due to intraperitoneal collections or adhesions.

Followup	Open	Laparoscopy	P value
Wound pain	14	0	0.0029
Incisional hernia	2	0	0.310
Complications due to adhesions	0	0	0

Table 10. Followup

DISCUSSION

Perforated peptic ulcer disease needs immediate surgical intervention within 24 hours since the onset. There are various methods including definitive radical ulcer surgery (e.g. vagotomy with antrectomy) and simple closure. There has been a great advance in development of medications, such as H2-antagonists and proton pump inhibitors in eradicating *Helicobacter pylori*. More than 90% of perforated peptic ulcer can be treated with only simple closure due to such medications. Laparoscopic simple closure has been performed in many centers since Nathanson et al¹ 52, 1990 and Mouret et al² 14, 1990 first reported their cases. It is now believed that radical ulcer surgery is not required, but it is rather equivocal to simple closure and eradicating *Helicobacter pylori* with medication.

In this study, conducted in Government Rajaji Hospital, Madurai, during March 2015 to August 2015, 50 patients undergoing either laparoscopic or open surgery for duodenal ulcer perforation were included.

There was no significant difference in duration of symptoms, mean age, ASA grade and mean perforation size in both groups.

The mean operation time in the laparoscopic group was 113.9 minutes, which was significantly greater than that of the open group (96.41 mm). The longer operation time is consistent with other studies. Median operation time in laparoscopy group was 120 m (60-180 m). The longer operation time was a disadvantage, but this had no impact on the outcomes.

Major disadvantage of laparoscopic repair is that specific training in laparoscopic suturing technique is needed and this handling is associated with surgeon's experience. Only efforts in learning practice of laparoscopy offer shorter operative time and patient's safety. In addition, there are different methods of ulcer closure introduced other than suturing such as gelatine sponge and fibrin glue and stapled omental patch repair. These methods are easier to perform and contribute to shorten operative time.

Analgesic requirement was significantly lower in the laparoscopy group (3.39 ± 0.58 vs. 4.84 ± 0.66 days). Wound pain at follow up was also significantly lower. There was no statistical significance in hospital stay and time to normal diet in previous studies of Johansson et al³ 1996, Lau et al⁴ 1996, Miserez et al⁵ 1996, Druart et al⁶ 1997 and Lee et al 2009. However, our patients who underwent laparoscopic repair were enabled to be discharged

significantly earlier from the hospital (8.6 ± 2.3 vs. 10.5 ± 3.9) days.

In addition, more recent randomised-controlled trials have shown that laparoscopic repair reduced hospital stay and induced earlier return to normal diet. We found that laparoscopic repair did result in earlier return to normal diet (4.26 ± 0.81 vs. 4.87 ± 0.86 days). Time required for mobilisation of patients was also significantly lower (3.3 ± 0.7 vs 4.34 ± 0.62 days). Early return to work after laparoscopic surgery for perforated peptic ulcer offsets the cost incurred in performing laparoscopic repair.

The results of this study are compared with the results of studies by Sreeramulu P et al⁷ (A Comparative Study of Laparoscopic vs. Open Surgery for the Management of Duodenal Ulcer Perforation) and Gyon Ra Lee et al (laparoscopic primary closure- a better method of treatment in perforated peptic ulcer disease than open repair).

The main concern previously was that whether the peritoneal lavage in laparoscopic method was adequate. Many reports about laparoscopic treatment have shown that peritoneal lavage can be done effectively and perforation can be cured safely. It is beyond doubt laparoscopy offers better cosmetic results. Moreover, it is also shown that fewer postoperative complications, such as wound infection and wound pain, occur in laparoscopy patients. However, the number of complications in laparoscopic surgery was small compared with open group. Therefore, laparoscopic method is now an option chosen by many surgeons, which avoids wound complications and allows easier and more comprehensive cleansing of the entire peritoneal cavity.

Laparoscopic repair can be as effective as open method in treatment of perforated peptic ulcer, but there are still limitations. First of all, laparoscopic simple closure is not available in all hospitals especially primary hospital centre. It is also reasonable that further studies are still needed to compare the late follow-up results (ulcer recurrence, incision hernias and adhesions) following different surgical approaches. Total number of patients needs to be larger to make generalised analysis. However, laparoscopic simple closure of perforated peptic ulcer disease is safe and may be the first and suitable method of treatment up to now.

Not only operative time, but postoperative complications could be diminished with various methods that make laparoscopy easier. Previous studies have shown a suture leak rate of 7% with laparoscopic repair; however, we demonstrated that this can be completely abolished and can be superior to open surgery, for which a leak rate of 0% has been reported. Leakage maybe due to technical error or friability of the patients' tissue. Omentopexy can be used to reinforce the sutures. Newer methods like use of biodegradable patch for closure of perforation need further studies. There still needs improvement in surgical materials

and more investigations should be followed for far better outcome treating perforated peptic ulcer.

CONCLUSION

This study included 50 patients with duodenal perforation, 20 had laparoscopic repair and 30 patients had conventional open repair. Patients in both groups were compared for effectiveness and postoperative complications.

This study showed significantly longer operation time than the laparoscopy group. Postoperative complications like wound infection and wound pain were significantly higher in the open group, whereas there was no significant difference in postoperative fever, respiratory infections, prolonged ileus and intraperitoneal collections.

Time to resume normal diet, analgesic requirement, duration of hospital stay and time to return to normal activity were significantly lower in the laparoscopy group.

Complications related to intraperitoneal collection and adhesions were nil in both groups during the follow-up period. Further studies are still needed to compare the late follow-up results.

Laparoscopic repair of duodenal ulcer perforation is as safe and effective as open repair and has the advantages of less wound-related complications, early recovery and return to normal activity.

Longer operation times implies the need for surgeons' expertise in intracorporeal suturing or use of quicker methods like stapling or use of biodegradable patches, but the efficacy of these methods need further studies.

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