

## Comparison of Graham Omentoplasty and Modified Graham Omentopexy in Perforated Duodenal Ulcer: A Prospective Cohort Study

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### Abstract:

**Background:** Duodenal perforation is a surgical emergency and accounts for the majority of the causes of death in the elderly population. Various treatment modalities have been enrolled in the management. Still, the management of the cases is under debate. We aimed to prospectively analyse the outcome and complications of Graham Omentoplasty (GO) and Modified Graham Omentopexy (MGO).

**Methodology:** It was a prospective cohort study that was carried out in the tertiary care teaching hospital for a period of six months. A total of 60 patients were included and randomised using sealed envelope techniques, as group GO (n = 30) underwent GO surgical procedures and group MGO (n = 30) underwent MGO procedures. Patients were analysed for outcome and complications between both types of procedures.

**Results:** Age, sex, comorbid conditions, ventilatory support, return to normal bowel function, Mannheim peritonitis index, and average duration of hospital stays were statistically insignificant between GO and MGO. Duration of surgery (96 minutes in GO vs. 113 minutes in MGO) and surgical site infection (26.67% in GO vs. 20% in MGO) were found to be higher in GO than MGO but not significant. Postoperative systemic complications (6.67% in GO vs. 6.67% in MGO) and mortality (13.33% in GO vs. 13.33% in MGO) were similar in both groups and did not have a statistical difference.

**Conclusions:** Perforated duodenal ulcer cases can be effectively managed with either GO or MGO. Both procedures have equivalent outcomes and choices based on surgeon preference in the available clinical settings.

**Keywords:** Duodenal ulcer perforation, Graham Omentoplasty, Modified Graham Omentopexy, Peptic ulcer disease, Reperforation, Mannheim peritonitis index.

### Introduction

Duodenal ulcer perforation (DUP) is the second most common complication of Peptic ulcer disease (PUD) and frequent cause of hospitalization.<sup>1,2</sup> The global prevalence of PUD was approximately 8.08 million, a 25.82% increase from 1990.<sup>3</sup> While, the perforation affects around 2-10% of the patients with peptic ulcer and the 30-day mortality was 23.5% after perforation.<sup>4,5</sup> PUD leading to perforation inextricably link with two main factors area Helicobacter pylori (HP) infection, and drug-induced such as corticosteroids and excessive use of non-steroidal anti-inflammatory drugs (NSAIDs), especially in the elderly.<sup>1,6-8</sup> Other factors include hyperparathyroidism, male gender, smoking, advanced age, irregular and spicy food habits, stressful lifestyle, chronic liver and kidney disease.<sup>8-10</sup> Delay in treatment increase the risk for mortality, which requires an immediate radiological evaluation and urgent surgical attention.<sup>1,10,11</sup> Therefore, it necessitates meticulous monitoring, rapid resuscitation, and appropriate surgical management to overcome this life-threatening complication.<sup>2,5</sup>

DUP develops when the duodenum's full thickness is compromised by the ulcer. It is characterized by the presence of a well demarcated full thickness break in wall and located either in the anterior or posterior wall.<sup>12,13</sup> Most cases diagnosed with chest x-ray (CXR) with the presence of bilateral free air under diaphragm.<sup>13</sup> In 20-30% of the cases the diagnosis is missed by it and may require additional imaging.<sup>8</sup>

In the current era of extensive pharmacotherapy, ulcerative disease has been well controlled.<sup>7</sup> Yet, for duodenal perforation which is on the debatable issues, considering the most accepted method is the surgical closure known as omental patch repair (OPR).<sup>14,15</sup> The most accepted OPR till date was Graham Omentoplasty (GO), by Roscoe Graham in 1937.<sup>16,17</sup> Recently Modified Graham Omentopexy (MGO) was suggested by the surgeons where a second set of knots is done to secure the omentum over the duodenal perforation closure after the omental patch has been applied to the suture.<sup>17,18</sup> There is cause for concern since the omentum won't be as precisely adhered to the duodenal perforation and might not provide as good a seal as when

it is laid directly on the exposed ulcer bed.<sup>2,5,17</sup>With this background, our aim of the study was to assess the outcome and complications of GO and MGO in the management of PDU.

## Methodology

**Study design and setting:** The present prospective cohort study was conducted in the Department of General Surgery, in a tertiary teaching hospital, Tamil Nadu, from April to September 2018. This study was approved by the Institutional Ethical Committee, and all ethical standards of the Declaration of Helsinki were followed. Informed and written consent was obtained from all participants.

**Study population:** All patients aged above 12 years diagnosed with perforated duodenal ulcer with the size of <20cm, and who are willing for definitive surgery were included in the study. Perforation was defined by presence of pneumoperitoneum on imaging. Patients with >80 years, ulcer >20cm, posterior duodenal perforation, other hollow viscous perforation, neoplastic origin, multiple and recurrent perforation were excluded from the study.

**Study procedure:** Among 72 patients, 10 patients were presented with other hollow viscous perforation and two patients with recurrent perforation were excluded. Then the remaining 60 patients were randomized into group GO (n = 30) and group MGO (n = 30) using a serially numbered opaque sealed envelope technique. Patients were resuscitated using standard techniques and optimized for emergency open surgery.

**Surgical techniques:** Optimized Patients were explored by laparotomy under general anesthesia, intraoperatively diagnosis was confirmed, and adequate peritoneal lavage done.

**Group GO:** In GO group, after refreshing the margin, perforation was patched with adjacent well vascularized omental pedicles and closed with three to four interrupted full thickness 2-0 vicryl absorbable sutures.

**Group MGO:** In this, the perforation closed with three to four 2-0 vicryl absorbable sutures between the edges of perforation and tied to close the perforation. This was followed by placement of omental pedicle based on the

right omental artery brought between sutured site and tied snugly using absorbable sutures again with the pedicle of omentum between knots over the perforation. Thus, the omentum remains as the sandwich between the two levels of secured knots. In both cases extreme care was taken not to strangulate and ensured adequate pedicle vascularity.

**Post operative care:** Patients were gradually weaned and resumed to normal diet. All patients were treated with standard two-weeks OCA regimen (omeprazole clarithromycin amoxicillin) for HP eradication also. Follow up was done for one year to assess the eradication of HP using upper gastrointestinal endoscopy (UGIE) at six-week intervals and to ensure the patency and for recurrence.

**Data collection:** Data was collected and entered in specified proforma at surgical care admission. Variables including demographics, detailed clinical history, physical examination, complete blood analysis, urea, creatinine, blood grouping, CXR, ultrasonography, duration of surgery, ventilatory support, return of bowel function, post operative complications, average duration of hospital stay, mortality and Mannheim peritonitis index were obtained.

## Statistical analysis

Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) (Version 24.0) software. Data were analyzed for normality before analysis. Descriptive statistics were calculated for all categorical variables and measured in terms of frequencies and percentages. Continuous variables which followed normal distribution were calculated and presented as mean and standard deviation (SD) or median with interquartile range (IQR). Data were analyzed based on the type of variables and the normal distribution between two groups. Categorical variables which follow nonparametric distribution were analyzed using Pearson's Chi-square test or two-tailed Fisher's exact test to test the significance of difference. Statistical significance was considered when the p value of <0.05.

## Results

The demographic and clinical features were presented in **table 1**. The age and sex distribution between the groups was statistically insignificant (p>0.05).

**Table 1: Demographic and clinical features of the study participants [N = 60]**

Parameters	GO (n = 30)	MGO (n = 30)
Age in years (mean [SD])	40.7 (15.02)	40.83 (23.18)
<b>Sex</b>		
Male	28 (93.3)	23 (76.7)
Female	2 (6.7)	7 (23.3)
Duration of symptoms (mean [SD] days)	2.03 (0.88)	1.33 (0.80)
<b>Co-morbidities</b>		
Diabetes Mellitus	7 (23.3)	2 (6.7)

Hypertension	3 (10.0)	5 (16.7)
<b>Risk factors</b>		
Smoking and alcohol usage	21 (70.0)	20 (66.7)
NSAID <sup>a</sup> usage	5 (16.7)	4 (13.3)

<sup>a</sup>NSAID - Non-steroidal anti-inflammatory agents; data are presented as categorical values given in number (frequency); while continuous variables that follow normal distribution are presented in mean ± SD (Standard deviation).

**Average duration of surgery and ventilatory support:** The mean duration of surgery for group GO

was approximately 1.60hours and for group MGO was 1.88 hours. Duration of surgery did not have a statistical difference (p0.70) between the groups. The mean duration of ventilator support was 0.37 days and 0.43 days in group GO and MGO. On comparing between two groups, results were not statistically significant (p0.94)(Table 2).

**Table 2: Surgical features of the patients in both groups (N = 60)**

Parameters	GO (n = 30)	MGO (n = 30)	P - value <sup>#</sup>
Mannheim peritonitis index (mean ± SD)	4.17 ± 3.80	4.67 ± 3.46	-
Duration of surgery (mean ± SD hours)	1.61 ± 0.23	1.88 ± 0.50	0.706 <sup>a</sup>
Ventilator support (mean ± SD days)	0.37 ± 3.53	0.43 ± 3.39	0.940 <sup>a</sup>
Surgical site infection (SSI)	8 (26.7)	6 (20.0)	0.541
Systemic complication	4 (13.3)	4 (13.3)	1.000
Return of bowel function (mean ± SD days)	3.43 ± 1.25	3.97 ± 3.04	0.378 <sup>a</sup>
Hospital stay (mean ± SD)	9.91 ± 20.56	8.53 ± 19.76	0.784 <sup>a</sup>
Mortality rate	4 (13.3)	4 (13.3)	1.000
Recurrence at the end of one-year follow-up	2 (6.7)	0 (0)	0.245

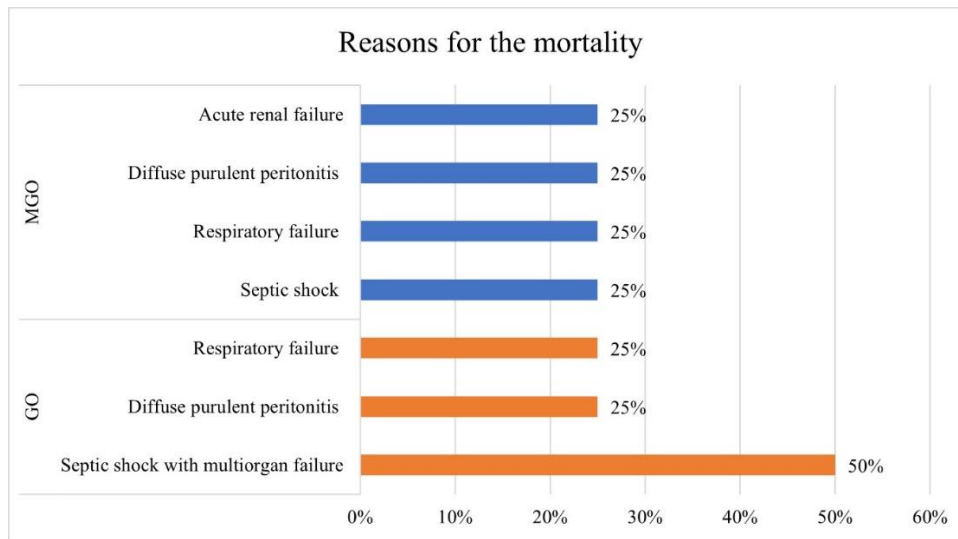
<sup>#</sup>Pearson's chi-square test;<sup>a</sup>Independent t-test; p-value <0.05 were statistically significant; data are presented as categorical values given in number (frequency); while continuous variables that follows normal distribution presented in mean ± SD (Standard deviation).

**Post operative complications:** Eight out of 30 (26.7%) patients in group GO developed SSI and group MGO had six out of 30 (20%) patients and it was statistically not significant (p 0.541). Also, it has been found that patients underwent GO had a risk of 0.37 times for developing SSI when compared to the patients underwent MGO ( $\chi^2 = 0.372$ ). Similarly, 13.3% patients in group GO developed systemic complications post operatively and group MGO had 13.3% patients and found to be statistically non-significant (p 1.00)(Table 2).

**Average days of hospital stays:** In group GO, the average days were 9.9 days and group MGO had 8.47 days, and statistically insignificant (p0.784)(Table 2). All patients were followed up for one year with UGIE. None of the surviving patients develop recurrence.

**Mortality rate:** Among the patients in both groups, four (13.3%) patients in GO died during hospital stay. These patients included two patients with septic shock with multiorgan failure, one patient with diffuse purulent peritonitis and one patient with respiratory failure. Similarly, four (13.3%) patients in MGO expired during their hospital stay and due to one patient with septic shock, one patient with respiratory failure, one patient with diffuse purulent peritonitis and one patient with acute renal failure. On comparing both groups, the results were statistically insignificant (p < 0.05)(Table 2 and figure 1).

**Figure 1: Reasons for the mortality.**



**The reasons for the mortality in both procedures (GO and MGO) were presented in this figure, blue represents mortality reasons for the procedure MGO, and orange represents mortality reasons for the procedure GO.**

**Recurrence:** It has been found that two patients underwent GO, had the recurrence of the perforation at the end of one-year follow-up (6.7%), while we found no recurrence among the MGO group. (Table 2)

### Discussion

DUP is one of the common surgical emergencies encountered in young adults and accounting for 2-10% cases.<sup>2</sup> It has been associated with 10% mortality and reported incidence of 1.3 to 25% by various literature.<sup>1,4,8,19</sup> Most of the perforation were due to underlying PUD.<sup>1</sup> Common etiological factors for duodenal ulcer includes usage of NSAIDs and HP infection. Diligent care and urgent intervention are needed in almost all perforated cases to alleviate the high mortality and morbidity associated with it.<sup>8</sup>

DUP develops when the duodenum's full thickness is compromised by the ulcer. It is characterized by the presence of a well demarcated full thickness break in wall, and located either in the anterior or posterior wall.<sup>12,13</sup> Most cases diagnosed with CXR with the presence of bilateral free air under diaphragm.<sup>13</sup> In 20-30% of the cases the diagnosis is missed by it and may require additional imaging.<sup>8</sup> Inconclusive cases needed contrast enhanced computed tomography (CT) for accurate diagnosis with the accuracy of 98%,<sup>20</sup> while for the difficult cases in the presence of diffuse generalized peritonitis, diagnosis confirmed by either laparoscopy or laparotomy.<sup>13,21</sup>

DUP was considered common among the young population and in our study, the highest number of cases (28.3%) were noted in the age group of 21 to 30 years.

In groups GO and MGO, the mean age was 40.7 and 40.8 years. These results were similar to the study done by Akshay et al,<sup>22</sup> had reported mean age 43.80 years in MO and 43.30 years in MGO group. Comparing the incidence in western statistics, Indian's data showed most cases seen in the age group of 40-60 years.<sup>22</sup> Perforation is more common in male which may be related to altered dietary pattern, high stress and unhealthy lifestyle. We had found male female ratio of 5.67:1 and this was similar to the study done by VarcusF et al,<sup>23</sup> who had noted 83.8:16.2% ratio.

Most commonly presentation was pain abdomen and peritonitis, and the mean day of presentation is 1.68 days among the patients. This was comparable to studies in which 36.1% of patients were admitted after 24 hours of onset of peritonitis.<sup>24</sup> In our study, we found that 15% of patients had diabetes and 13.3% patients had hypertension. Similar to our findings, 26.25% had associated with co-morbidities in a study by Abdallah et al.<sup>2</sup> All these findings showed that the associated comorbidities and the duration of the presentation had an impact on recovery and outcome of the procedure. Most of the patients presented to our hospital belong to the lower socioeconomic group and did not have regular follow-up for associated medical ailments.

Considering the risk factors, smoking and alcohol usage has linear impact in the etiology of DU.<sup>25,26</sup> In our study 68.33% patients had smoking and alcohol consumption in history. Our results were comparable to a study by Lohsiriwat V et al,<sup>27</sup> where 57% was regular alcohol consumer and 53% was active smoker. Another study found that 62% smokers and 29% alcohol users were presented with perforated ulcer.<sup>28</sup> While, among the other etiology NSAID has a potential role in DU formation and perforation especially elderly aged population who had a high percentage of chronic usage to alleviate pain.<sup>29</sup> In studies by Lohsiriwat V et al,<sup>27</sup> had 24% of NSAID or steroid user which was comparable to

our study had 15% of NSAID user. On contrary 67% were consuming NSAID at the presentation in a study by Bhogal RH et al.<sup>30</sup> All these implies that risk factors such as smoking, alcohol, NSAID usage had a greater impact on the perforation of the ulcer site.

Duration of surgery depends on multiple intraoperative factors during the procedure. These include early presentation, presence of previous laparotomy scar, dense adhesion to adjacent structures, diffuse purulent peritonitis and need of additional procedure like feeding jejunostomy. In our study, MGO group had a longer operative time than that of GO. A study by Agaba EA et al had a mean duration of operative time was 75 minutes in laparoscopic group and 60 minutes was in open group.<sup>11</sup> Stepanyan SA et al,<sup>24</sup> conducted a study had 132 minutes of operative time. Teaching of surgical residents in our institute consumed longer operative time when compared to surgery done by chief surgeons. Added to that the mean duration of ventilator support was 0.37 days and 0.43 days in GO and MGO. Most of the patients were extubated on OT and the rest were on post-operative period.

As for the complications, surgical site infections (SSI) were developed in 26.67% among Group GO patients, and 20% in group MGO in our study. These results were similar to a study by Satapathy et al, where 24.6% patients had wound infection in GO and 26.22% had in MGO group.<sup>17</sup> In our study 6.67% patients in group GO developed systemic complications post operatively and 6.67% in group MGO. In a study by Bertleff et al,<sup>28</sup> had 6.12% of wound infection, 6.12% of abscess, 10.2% of pulmonary complications, 2.44% of cardiac problems, 2% of sepsis, 4% of UTI, 2% incisional hernia and 2% of stroke in open repair. Based on all these observations, it has been found that compared to open surgery laparoscopic omentopexy had less post operative complications. Also, it inherently had less hospital stay, less post operative discomfort, less wound related complication, lower pulmonary manifestation, and lesser incisional hernia formation.

Patients in group GO had a return of bowel function in an average of 3.43 days and group MGO had 3.966 days. In a study by Vaidya et al,<sup>31</sup> 3.22% of patients developed prolonged ileus followed laparoscopic surgery and the average days of hospital stay in GO and MGO had 9.9 and 8.47 days, respectively. In a study by Ates et al,<sup>14</sup> had mean hospital stay of 5.33 days in open surgical group. Similarly, the mean hospital stay of 15.1 (7-58) days in primary open approach has been reported by Muller et al.<sup>32</sup> These long hospital occupancy in our cases mainly due to poor and lower income patients who preferred to stay more periods in view of better social support in the institution.

The overall mortality rate did not differ in GO and MGO group. In our study 13.33% patients in group GO died during hospital stay and 13.33% patients in group MGO.

Our study results were in concordance with the study done by Muller et al,<sup>32</sup> where a total of 8.57% patient died in primary open approach group. This mortality was attributed to suture insufficiency, pneumonia, and purulent peritonitis.<sup>32</sup> Also, in another study 0.81% patients had biliary fistula, 2.45% had burst abdomen and 4.09% had mortality.<sup>17</sup> While, another study reported 13.3% mortality in DU, mainly contributed by delayed presentation and septic shock.<sup>33</sup> The high mortality rate in our study were due to septic shock, acute renal failure, pulmonary complications, and diffuse purulent peritonitis. The mortality significantly rose after the initial 24 hours of the surgery.

The shortcomings of this study were the smaller sample size. Since the study was done in the single hospital-based, the result cannot be generalized to the other population. Also, we haven't found any statistically significant between the two groups, might be due to smaller sample size. Further study with a larger sample size is required to evaluate the suitable methods for treating this life-threatening condition.

### Conclusions

Based on our results, it has been found that PUD can be effectively managed in an emergency with GO or MGO in terms of morbidity and mortality. Each procedure has equivalent results and complications. Although MGO remains a treatment with appreciable complication whose benefits outweighs the complication than GO, yet no significant result shown. Finally, the choice of the procedure based on surgeon preference, and availability of laparoscopic facility in emergency setting.

### Abbreviations:

Graham Omentoplasty - GO; Modified Graham Omentopexy - MGO; Duodenal ulcer perforation - DUP; Peptic ulcer disease - PUD; Helicobacter pylori - HP; Non-steroidal anti-inflammatory drugs - NSAIDs; Chest X-ray - CXR; Computed tomography - CT; Omental patch repair - OPR; omeprazole clarithromycin amoxicillin - OCA; Upper gastrointestinal endoscopy - UGIE; Ultrasonography - USG; Statistical Package for the Social Sciences - SPSS; Standard deviation - SD; Interquartile range - IQR; Surgical site infection - SSI.

### Footnotes:

**Ethical issues:** The study was approved by the Institutional Human Ethics Committee and followed the principles laid down in the declaration of Helsinki.

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**Conflicts of interest:** No potential conflicts of interest

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