

# Omentopexy versus falciformopexy for peptic ulcer perforation

İD Aydemir Ölmez, M.D.,<sup>1</sup> İD Egemen Çiçek, M.D.,<sup>2</sup> İD Cemalettin Aydın, M.D.,<sup>2</sup>  
İD Kuntay Kaplan, M.D.,<sup>2</sup> İD Cüneyt Kayaalp, M.D.<sup>2</sup>

<sup>1</sup>Department of General Surgery, Mersin University Faculty of Medicine, Mersin-Turkey

<sup>2</sup>Department of General Surgery, İnönü University Faculty of Medicine, Malatya-Turkey

## ABSTRACT

**BACKGROUND:** Open or laparoscopic Graham's omentopexy is frequently used in the treatment of peptic ulcer perforation (PUP). The technical difficulty of applying the omental plug, especially in patients with previous omentum resection, has led to the use of falciform ligament for the PUP, and some studies have reported that PUP may even be a more advantageous technique than omentopexy. Here, in this study, we aimed to compare the retrospective results of patients who underwent falciformopexy or omentopexy for PUP.

**METHODS:** Between 1999 and 2018, 303 patients who were followed-up and treated for PUP were included in this study. Patients who had malignancy, gastric resection, definitive ulcer surgery, laparoscopic surgery and nonoperative treatment were excluded from this study. In the remaining patients, either open omentopexy or falciformopexy were applied based on the surgeon's choice. These two techniques were compared for intraoperative and postoperative outcomes.

**RESULTS:** Falciformopexy (n=46) and omentopexy (n=243) groups had similar demographics, but ASA scores were lower in the falciformopexy group. For ulcer size and localization, duration of operation, no difference was found between the groups. There was no significant difference between the groups concerning general postoperative morbidity and mortality. However, atelectasis was more frequently observed in the omentopexy group, whereas the pexia failure was more frequent in the falciformopexy group (2.6% and 8.7%, p=0.04).

**CONCLUSION:** Falciformopexy is an alternative technique that can be used in situations where it is not possible to use the omentum. Falciformopexy is not superior to omentopexy for the repair of the PUP.

**Keywords:** Duodenal ulcer; falciform ligament; gastric ulcer; peptic ulcer; perforated; repair failure.

## INTRODUCTION

In peptic ulcer disease, elective surgery has lost importance today and surgical procedures are mostly applied for ulcer complications. The important complications of peptic ulcers are bleeding, stenosis and perforation. Peptic ulcer perforation (PUP) is the most important emergency pathology of a peptic ulcer due to the risk of development of preventable patient mortality. Mortality can be reduced by early diagnosis and treatment. Currently, some studies report no-mortality following PUP surgeries. However, morbidity, urgent surgical

need and hospital stay are not reduced yet.<sup>[1]</sup> Non-surgical interventions are rarely used for PUP treatment today and surgical treatment is the essential treatment modality. The standard method for PUP surgery is repairing with omentopexy, which can be applied by open or laparoscopic methods. The use of falciform ligament instead of omentum has been applied in a small number of cases. The present study aims to evaluate the efficacy and feasibility of falciformopexy in comparison to omentopexy.

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Address for correspondence: Egemen Çiçek, M.D.

İnönü Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Malatya, Turkey

Tel: +90 422 - 377 40 01 E-mail: dregemencek@gmail.com

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## MATERIALS AND METHODS

Between 01.01.1999 and 24.04.2018, 303 patients who were diagnosed and treated for peptic ulcer perforation were retrospectively analyzed in this study. Ethical approval was obtained from the institutional review board for ethical research conduct. Patients who underwent primary repair using omentopexy or falciformopexy were included in this study. Patients who were operated for malignancy, patients who underwent gastric resection or definitive ulcer surgery (truncal vagotomy and drainage), patients who received laparoscopic surgery or non-operative management were excluded from this study. Patients who received omentopexy and falciformopexy were evaluated for homogeneity based on age, gender, systolic and diastolic blood pressure at the time of admission, hemoglobin, white blood cell, urea, creatinine and concurrent illness (hypertension, diabetes, malignancy story, ulcer story, heart failure and coronary artery disease, chronic obstructive pulmonary disease, neuropsychiatric disease, chronic renal failure) of the patients at the time of admission.

Based on the surgeon's preference, either open omentopexy or open falciformopexy were applied. These two techniques were investigated for its effects on postoperative mortality, repair site leakage, duration of hospitalization, the interval to oral intake, wound infection rate, evisceration, atelectasis, pneumonia and ileus rate.

## Statistical Analysis

Descriptive parameters were used in statistical analysis. Median and range were used for heterogeneous distributions where mean and standard deviation were used for homogeneous distributions. Student's t-test or Mann-WhitneyU test was used to compare continuous variables, and Chi-squared or Fisher exact test was used to compare categorical variables.  $P < 0.05$  was considered significant. SPSS 17.0 was used in the analysis.

## RESULTS

Nine patients who underwent total gastrectomy and/or definitive surgery, one patient with medical treatment, one pa-

**Table 1.** Preoperative data and patient characteristics

	Total	Omentopexy (n=243)	Falciformopexy (n=46)	p
Age, years, median (range)	57 (16–95)	58 (16–95)	53 (19–90)	0.19
Gender, n (%)				
Male	241 (83.4)	202 (83.1)	39 (84.8)	0.78
Female	48 (16.6)	41 (16.9)	7 (15.2)	
Comorbidity, n (%)				
Diabetes mellitus (n=135) <sup>#</sup>	12 (8.9)	12 (9.7)	0 (0)	0.34
Hypertension (n=127) <sup>*</sup>	34 (26.8)	33 (28.0)	1 (11.1)	0.25
Cardiovascular disease (n=125) <sup>o</sup>	15 (12.0)	13 (11.3)	2 (20.0)	0.34
COPD (n=136) <sup>°</sup>	19 (14.0)	16 (12.9)	3 (25.0)	0.22
History of a malignancy (n=135) <sup>‡</sup>	13 (9.6)	12 (9.7)	1 (9.1)	0.71
Chronic renal disease (n=17) <sup>¶</sup>	10 (58.8)	10 (62.5)	0 (0)	0.41
ASA score, n (%) (n=206) <sup>*</sup>				
I	98 (47.6)	80 (44.4)	18 (69.2)	0.04
II	62 (30.1)	57 (31.7)	5 (19.2)	
III	35 (17.0)	33 (18.3)	2 (7.7)	
IV	10 (4.9)	9 (5.0)	1 (3.8)	
V	1 (0.5)	1 (0.5)	0 (0)	
Laboratory values, median (range)				
White blood cell, 10 <sup>9</sup> /L, (n=281)	13.5 (1.3–47.8)	13.4 (1.6–34)	14.2 (1.3–47.8)	0.27
Hemoglobin, g/dL, (n=251)	14.5 (6.8–20.8)	14.7 (7.1–20.8)	15.6 (6.8–20)	0.21
Creatinine, mg/dL, (n=246)	1.0 (0.1–10.48)	1.0 (0.1–10.48)	0.96 (0.1–2.35)	0.65
Blood urea nitrogen, mg/dL, (n=245)	23.0 (5–168)	23.5 (5–168)	23.0 (10–134)	0.86
Albumin, g/dL, (n=180)	2.7 (0.7–4.6)	2.7 (0.7–4.5)	2.8 (1.2–4.6)	0.39

COPD: Chronic obstructive pulmonary disease. <sup>\*</sup>Data regarding ASA scores could be obtained in 206 patients. <sup>#</sup>Data regarding diabetes mellitus could be obtained in 135 patients. <sup>\*</sup>Data regarding hypertension could be obtained in 127 patients. <sup>o</sup>Data regarding cardiovascular disease could be obtained in 125 patients. <sup>°</sup>Data regarding COPD could be obtained in 136 patients. <sup>‡</sup>Data regarding the history of malignancy could be obtained in 135 patients. <sup>¶</sup>Data regarding CRD could be obtained in 17 patients.

tient with laparoscopic repair, three patients with lack of data were excluded (in total 14 patients) from this study. Analyses

were performed on a total of 289 patients, of whom 243 underwent omentopexy and 46 underwent falciformopexy. The

**Table 2.** Perioperative data of the patients included in this study

	All patients	Omentopexy	Falciformopexy	p
Perforation diameter (n=276) <sup>*</sup> , cm, median (range)	0.5 (0.1–7)	0.5 (0.2–7)	0.5 (0.1–2)	0.66
Site of perforation (n=286) <sup>†</sup> , n (%)				
Duodenum	225 (78.7)	184 (76.3)	41 (91.1)	0.11
Pre-pyloric	18 (6.3)	15 (6.2)	3 (6.7)	
Pyloric	9 (3.1)	8 (3.3)	1 (2.2)	
Cardia, corpus	31 (10.8)	31 (12.9)	0 (0)	
Gastroenterostomy site	3 (1)	3 (1.2)	0 (0)	
Operative time (n=124) &, minute, median (range)	70 (30–210)	70 (30–210)	65 (45–130)	0.76

<sup>\*</sup>Data regarding perforation diameter could be obtained in 276 patients. <sup>†</sup>Data regarding the site of perforation could be obtained in 286 patients. <sup>‡</sup>Data regarding operative time could be obtained in 124 patients.

**Table 3.** Postoperative data and complications encountered in the patients

	All patients	Omentopexy (n=243)	Falciformopexy (n=46)	p
Hospital stay (n=261) <sup>*</sup> , days, median (range)	6 (1–67)	7 (1–67)	6 (4–16)	0.17
Oral intake (n=225) <sup>‡</sup> , days, median (range)	4 (2–13)	4 (2–13)	4 (3–8)	0.32
30-day mortality (n=282) <sup>‡</sup> , n (%)	29 (10.3)	25 (10.6)	4 (8.7)	0.7
Leak (n=279) <sup>§</sup> , n (%)	10 (3.6)	6 (2.6)	4 (8.7)	0.04
Ileus (n=274) <sup>¶</sup> , n (%)	9 (3.3)	6 (2.6)	3 (6.7)	0.16
Evisceration (n=274) <sup>¶</sup> , n (%)	13 (4.7)	11 (4.8)	2 (4.5)	0.95
Atelectasis (n=276) <sup>¶</sup> , n (%)	20 (7.2)	20 (8.7)	0 (0)	0.04
Pneumoniae (n=274) <sup>¶</sup> , n (%)	28 (10.2)	26 (11.3)	2 (4.5)	0.17
Wound infection (n=273) <sup>¶</sup> , n (%)	22 (8.1)	19 (8.3)	3 (6.8)	0.74

<sup>\*</sup>Data regarding hospital stay could be obtained in 261 patients. <sup>‡</sup>Data regarding oral intake could be obtained in 261 patients. <sup>§</sup>Data regarding 30-day mortality could be obtained in 282 patients. <sup>¶</sup>Data regarding leak could be obtained in 279 patients. <sup>¶</sup>Data regarding ileus could be obtained in 274 patients. <sup>¶</sup>Data regarding evisceration could be obtained in 274 patients. <sup>¶</sup>Data regarding atelectasis could be obtained in 276 patients. <sup>¶</sup>Data regarding pneumoniae could be obtained in 274 patients. <sup>¶</sup>Data regarding wound infection could be obtained in 273 patients.

**Table 4.** Review of the literature regarding falciformopexy for peptic ulcer perforation

	Article type	Number of cases	Indication	Localization and perforation size (mm)	Failure
Fry DE., 1978 <sup>[8]</sup>	Case	1	Thin and poor omentum	Duodenum (15)	0
Costalat G., 1995 <sup>[11]</sup>	Retrospective	12	New technique	Not available	0
Munro WS., 1996 <sup>[13]</sup>	Case	6	New technique	Duodenum	0
Wijegoonewardene SI., 2012 <sup>[15]</sup>	Case	1	Not available	Pre-pyloric	0
Bingener J., 2013 <sup>[14]</sup>	Case	1	More suitable	Duodenum (4)	0
Boshnaq M., 2016 <sup>[10]</sup>	Case	1	Pan-proctocolectomy	Pre-pyloric (30)	0
Calis H., 2016 <sup>[16]</sup>	Case	1	Previous gastrectomy with omentectomy	Gastroenterostomy (10)	0
This study	Series	46	New technique	Duodenum (5)	4 (8.7%)

mean age of the patients was  $54.8 \pm 20.4$  (median and range 57 and 16–95) years. Two-hundred and forty-one patients (83.4%) were male. Preoperative gender, age, duration of hospitalization, laboratory values, ASA scores, comorbid factors were evaluated (Table 1). When the omentopexy and falciformopexy groups were compared preoperatively, the ASA score was higher in the omentopexy group ( $p=0.04$ ). In evaluating intraoperative data, ulcer diameter, localization of perforation and duration of operation were evaluated, and there was no difference among the groups (Table 2). In the analysis of postoperative data, mortality, wound infection, pneumonia and atelectasis rate, evisceration rate, duration of hospitalization and interval to oral intake were evaluated (Table 3). Atelectasis was more frequent in omentopexy group ( $p=0.04$ ). The rate of pexia leakage was 2.6% in the omentopexy group and 8.7% in the falciformopexy group ( $p=0.04$ ).

## DISCUSSION

Elective surgery for peptic ulcer is rarely performed due to effective medical treatment options. Bleeding, obstruction and perforation are important complications of the peptic ulcer. Perforation is the most important cause of morbidity and mortality. Although there are predictive parameters and risk factors for predicting morbidity and mortality, medical and/or surgical early intervention is the only parameter reducing mortality.<sup>[2,3]</sup>

There is a relationship between patient age, admission time and mortality in PUP.<sup>[4]</sup> Among the treatment options of PUP, non-invasive management, including medical treatment and follow-up is a method that can be tried, especially in patients without an acute abdomen. In the study of Cao et al.,<sup>[5]</sup> it was emphasized that clinical features are important for radiological findings and whether APACHE scoring should be performed nonoperatively in patients. Partial gastrectomy is a preferred method, especially in the treatment of large ulcer perforations. Fortunately, due to the increasing use of H2 receptor blockers and proton pump inhibitors, the frequency of giant ulcers decreases, which results in a decrease in the use of partial gastrectomy.<sup>[6]</sup> Although surgical methods, such as resection- anastomosis and truncal vagotomy, had been used frequently in the past, Graham omentopexy is currently the most frequent technique that was first described in 1937.<sup>[7]</sup> This technique includes coverage of the perforated area with omentum using sutures. Despite the long and safe application history of this technique, there are technical difficulties in applying this technique in some patient groups. These patients include patients who have undergone previous omentectomy for several reasons, cachectic patients whose omental tissue is deficient, and cases where omentum cannot be used due to adhesions.<sup>[8–10]</sup> As there is no adequate and/or effective omentum in these patients, it has been reported that alternatively falciform ligament can be used for reinforcement of the repair site.<sup>[8]</sup> Costalat and Alquier<sup>[11]</sup> aimed to apply laparoscopic-endoscopic falciformopexy in 15 PUP cases. In their

study, falciformopexy could be performed in 12 patients. In one patient, the perforation site diameter was 15mm. Thus, resection instead of the repair was performed. In the remaining two cases, falciformopexy was not preferred because generalized peritonitis was observed.<sup>[11]</sup> In the evaluation, it was argued that this technique was less aggressive than open surgery and was an alternative to non-operative treatments. They concluded that falciformopexy could be preferred in younger patients and cases where perforation was detected early. Furthermore, it is a simple, effective, easier alternative, especially in closed perforations and in ulcers with hard or brittle edges.<sup>[12]</sup> Munro et al.<sup>[13]</sup> stated that using the falciform ligament in laparoscopic PUP repair was advantageous compared to omentopexy for falciformopexy resulted in tension-free repair of the perforation site.<sup>[13]</sup> In a prospective study of Bingener et al.,<sup>[14]</sup> the falciform ligament in a patient who underwent transluminal PUP repair was used because it was more appropriate than omentum and no leakage occurred during follow up.<sup>[14]</sup> Wijegoonewardene et al.<sup>[15]</sup> applied laparoscopic falciformopexy for PUP of the patient with the diagnosed intraoperative. Calis et al.<sup>[16]</sup> reported the use of falciform ligament in a case of marginal ulcer perforation. The literature on falciformopexy is mostly based on case studies, in which a small number of patients is included, and these studies generally yield positive results. In a critique of Lewis et al.<sup>[17]</sup> and Costalat et al., it was emphasized that omentum is more effective than falciform ligament due to its ability to retain leaks, adhesiveness, lymphocyte rich vascular feeding and ability to adhere to the area of inflammation and falciform ligament should be preferred in cases where omentum cannot be used. To our knowledge, there is no study comparing falciformopexy with omentopexy, which includes a large number of patients who have undergone PUP with falciformopexy/ and omentopexy in the literature (Table 4). Given that our study had a high number of pexia leakage in the group of falciformopexy indicated that falciformopexy should be an option when omentopexy cannot be performed.

## Conclusion

In cases with falciformopexy, it was observed that the repair failure was more common than omentopexy cases. Falciformopexy should be kept in mind as an alternative and feasible method that should be preferred when the omentum cannot be used for technical reasons.

**Conflict of interest:** None declared.

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## ORIJİNAL ÇALIŞMA - ÖZET

### Peptik ülser perforasyonunda omentopeksi ile falsiformopeksinin karşılaştırılması

Dr. Aydemir Ölmez,<sup>1</sup> Dr. Egemen Çiçek,<sup>2</sup> Dr. Cemalettin Aydın,<sup>2</sup> Dr. Kuntay Kaplan,<sup>2</sup> Dr. Cüneyt Kayaalp<sup>2</sup>

<sup>1</sup>Mersin Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Mersin

<sup>2</sup>İnönü Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Malatya

**AMAÇ:** Peptik ülser perforasyonunda (PÜP) açık veya laparoskopik Graham omentopeksi sıklıkla uygulanan tedavi şeklidir. Özellikle omentum rezeksiyon öyküsü olan hastalarda uygulanmanın teknik zorluğu, PÜP'de falsiform ligament kullanımına yol açmış olup bazı çalışmalarda omentopeksi'den daha avantajlı bir teknik olabileceği bildirilmiştir. Bu çalışmada, PÜP onarımında falsiformopeksi veya omentopeksi uygulanan hastalarımızın geriye dönük sonuçlarını karşılaştırmayı amaçladık.

**GEREÇ VE YÖNTEM:** 1999–2018 yılları arasında PÜP nedeniyle takip ve tedavi edilen 303 hasta çalışmaya alındı. Malignite, gastrik rezeksiyon, definitif ülser cerrahisi, laparoskopik cerrahi ve ameliyat dışı tedavi alan hastalar çalışma dışı bırakıldı. Kalan hastalara omentopeksi veya falsiformopeksi uygulandı. Bu iki teknik ameliyatta ve ameliyat sonrası sonuçlar açısından karşılaştırıldı.

**BULGULAR:** Falsiformopeksi (n=46) ve omentopeksi (n=243) grupları benzer demografik özelliklere sahipti, ancak ASA skorları falsiformopeksi grubunda daha düşüktü. Ülser boyutu ve lokalizasyonu, operasyon süresi açısından gruplar arasında fark saptanmadı. Genel postoperatif morbidite ve mortalite açısından gruplar arasında anlamlı fark yoktu. Bununla birlikte, omentopeksi grubunda atelettazi daha sık görülürken, peksi başarısızlığı falsiformopeksi grubunda daha sıkı (%2.6 ve %8.7, p=0.04).

**TARTIŞMA:** Falsiformopeksi, omentumu kullanmanın mümkün olmadığı durumlarda kullanılacak alternatif bir tekniktir. PÜP onarımı için omentopeksi'den daha üstün değildir.

**Anahtar sözcükler:** Duodenal ülser; falsiform ligaman; gastrik ülser; onarım yetmezliği; peptik ülser; perforasyon.

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