

Chylous Leak Management in Gastric Cancer Patients After D2 Dissection

Mide Kanserli Hastalarda D2 Diseksiyon Sonrası Şilöz Kaçak Yönetimi

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Abstract

Objective: Gastric cancer is the fifth most prevalent cancer and the third leading cause of cancer-related deaths. After gastric cancer surgery, 1.99% of patients developed chylous leaks after dissections of D1 and D2 and 6.3% after dissections of D3 and D4. The milky discharge from the abdominal drains following enteral feeding indicates chylous leak. After cancer surgery, diagnosis and treatment of chylous leaks are crucial. This study aimed to guide the treatment of chylous leaks.

Methods: A total of 213 patients (147 men, 66 women) underwent D2 lymph node dissection after total or subtotal gastric resection. Age, gender, tumor location, type of surgery, number of resected lymph nodes, metastatic lymph nodes, day of lymphatic discharge, diagnosis of chylous leak, treatment, morbidity, mortality, fistula closure, and length of hospital stay were evaluated.

Results: The mean number of lymph nodes removed during surgery was 39 (16-87). Thirteen patients developed chylous leaks, with an average detection time of 5 days (3-7). At the outset of the study, total parenteral nutrition was administered to patients with chylous leaks. The patients were then given a low-fat diet with medium-chain triglycerides (MCT).

Conclusion: The Tg was 230-3497 mg/dL in our study. The chylous leak group had more lymph nodes dissected than the non-chylous leak group, but the difference was not statistically significant. Chylous leaks are associated with preoperative anemia, hypoalbuminemia, and lymph node resection. After drain output dropped below 300 cc/day, a middle-chain triglyceride diet was administered. None of our patients underwent surgery due to chylous leaks, and we can confidently state that patients with chylous leaks can be followed up with the MCT diet.

Keywords: Gastric cancer, surgery, D2 dissection, chylous leak

Öz

Amaç: Mide kanseri en sık görülen beşinci kanser olup, kanserden ölümlerin üçüncü ana nedenidir. Mide kanseri ameliyatı sonrası hastaların %1,99'unda D1 ve D2 diseksiyon sonrası, %6,3'ünde D3 ve D4 diseksiyon sonrası şilöz kaçak görülmektedir. Enteral beslenmeyi takiben abdominal drenlerden gelen süt benzeri sıvı şilöz sızıntıları oluşturur. Kanser ameliyatından sonra şilöz kaçaklarının teşhisi ve tedavisi çok önemlidir. Bu çalışma şilöz kaçaklarının tedavisine rehberlik etmeyi amaçlamaktadır.

Yöntem: Total veya subtotal mide rezeksiyonu sonrası 207 hastaya (142 erkek, 65 kadın) D2 lenf nodu diseksiyonu uygulandı. Yaş, cinsiyet, tümörün yerleşim yeri, ameliyat tipi, çıkarılan lenf nodu sayısı, metastatik lenf nodu, lenfatik kaçağın günü, şilöz kaçığı tanısı, tedavi, morbidite, mortalite, fistül kapanması ve hastanede kalis süresi değerlendirildi.



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Öz

Bulgular: Ameliyat sırasında çıkarılan ortalama lenf nodu sayısı 39 (16-87) idi. On üç hastada ortalama tespit süresi 5 gün (3-7) olan şilöz kaçak mevcuttu. Çalışmanın başında şilöz kaçağı hastalarına total parenteral beslenme verildi. Daha sonra hastalara orta zincirli trigliserit (MCT) içeren düşük yağlı bir diyet verildi.

Sonuç: Çalışmamızda Tg 230-3497 mg/dL idi. Şilöz kaçak olan grupta istatistiksel anlamlılık olmaksızın normalden daha fazla lenf nodu disesse edildi. Şilöz kaçaklar preoperatif anemi, hipoalbuminemi ve lenf nodu rezeksiyonu ile ilişkilidir. Dren çıkışı 300 cc/gün'ün altına düşüktürken sonra orta zincirli trigliserit diyeti uygulandı. Hiçbir hastamız şilöz kaçağı nedeniyle ameliyat edilmemi ve şilöz kaçağı olan hastaların MCT diyeti ile takip edilebileceğini rahatlıkla söyleyebiliriz.

Anahtar Kelimeler: Mide kanseri, cerrahi, D2 diseksiyon, şilöz kaçak

Introduction

Gastric cancer is the fifth most commonly diagnosed malignancy and the third leading cause of cancer-related deaths worldwide⁽¹⁾. Gastric resection with D2 lymphadenectomy is a standard surgical procedure for gastric cancer patients^(2,3).

Developing surgical techniques and more aggressive dissections improved the survival of patients with gastric cancer. In addition to this improvement in survival, complications related to these interventions have increased over the past 20 years⁽⁴⁾.

After gastric cancer surgery, chylous leaks can be seen in 1.99% of patients after D1 and D2 dissection and 6.3% after D3 and D4 dissection^(5,6). The cytoskeleton is lymphatic fluid and is rich in triglyceride (Tg) and lymphocytes. A chylous leak is usually encountered after enteral feeding as a milky discharge from the abdominal drains, which is sterile and rich in Tg. Tg levels are set as ≥ 110 mg/dL by some authors and ≥ 200 mg/dL by others, to name it chylous fluid^(7,8). Diagnosis and management of chylous leaks after cancer surgery are essential^(9,10).

Lymphatic damage and lymph fluid pressure $>$ abdominal pressure are prerequisites for chylous leakage. Cisterna chyli, which drains intestinal and celiac lymph nodes, is located on the right side of the aorta at the level of L1-L2. Variations in the anatomy may be a reason for the injury, with normal anatomy found only in 50% of patients⁽¹¹⁾. After abdominal cancer surgery, it is observed in approximately 1.1% of cases and can also be observed after donor nephrectomy, abdominal aortic surgery, and trauma other than cancer patients⁽¹²⁻¹⁴⁾.

Materials and Methods

Ethical approval was obtained from University of Health Sciences Türkiye, Prof. Dr. Cemil Taşçıoğlu City Hospital

Ethical Committee (number: 2022/30, date: 14.02.2022). All interventions were performed by surgeons experienced in gastric cancer surgery. A total of 213 patients (147 men, 66 women) underwent D2 lymph node dissection after total or subtotal gastric resection. Energy devices are used for the ligation of small vessels and lymphatic vessels. When a large lymph vessel is encountered, it is either ligated with a suture or hemoclip. Patients were analyzed according to age, sex, body mass index (BMI), tumor location, type of surgery, number of resected lymph nodes, metastatic lymph nodes, day of lymphatic discharge, diagnosis of the chylous leak, type of treatment, morbidity, mortality, day of fistula closure, and duration of hospital stay. Data of patients who underwent surgery between January 2011 and September 2021 at University of Health Sciences Türkiye, Prof. Dr. Cemil Taşçıoğlu City Hospital in the Gastrointestinal Surgery Department were retrospectively analyzed. Detailed consent was not obtained from the patients because it was a retrospective study and no interventional procedure was performed. A total of 207 patients were enrolled in the study. One hundred and forty-two (42) were male (68.6%), and 65 were (31.4%) female. The mean age of the patients was 60.9 (29-94). All patients underwent D2 lymph node dissection after either total or subtotal gastric resection. A total of 137 patients (66.2%) underwent total gastrectomy, and 70 (33.8%) underwent subtotal gastrectomy with D2 dissection. The mean BMI of the patients was 26.09 kg/m² (18-43). Tumor localization was in the cardia in 58 (28%), in the corpus in 72 (34.8%), in the antrum in 73 (35.3%), and diffuse in 4 (1.9%). The mean number of lymph nodes harvested during surgery was 39 (16-87). Among all patients, 76 had no lymph node metastasis and 131 had lymph node metastasis (Table 1).

Statistical Analysis

Descriptive statistics of continuous variables were reported as mean \pm standard deviation or median (min-max) depending on the data distribution. The normality

Table 1. Comparison of patient characteristics

	n	%
Age	60.9 (29-94)	
Gender		
Male	142	68.6
Female	65	31.4
Tumor location		
Cardia	58	28
Corpus	72	34.8
Antrum	73	35.3
Diffuse	4	1.9
Operation type		
Subtotal	70	33.8
Total	137	66.2
T stage		
T1	43	20.8
T2	29	14
T3	90	43.5
T4	45	21.7
N stage		
N0	76	36.7
N1	29	14
N2	43	20.8
N3	59	28.5
Tumor differentiation		
Well-differentiated	34	16.4
Moderate differentiated	79	38.2
Poor differentiated	94	45.4
Lymphatic invasion		
Present	124	59.9
Absent	83	40.1

distribution of the data was evaluated using the Kolmogorov-Smirnov test. Mann-Whitney U test was used to compare non-normally distributed data. Relationships or proportion comparisons between categorical variables were performed using the chi-square test or Fisher's exact test. The statistical significance level was set as $p<0.05$.

Results

Total gastrectomy was performed in 140 patients and subtotal gastrectomy in 73 patients. Of the total gastrectomy group, 11 (7.9%) patients, and of the subtotal gastrectomy group, 2 (6.1%) patients had a chylous leak without statistical significance ($p=0.22$). Patients were given a liquid diet on

postoperative day 1. We have 13 patients with chylous leaks. Of the leak group, four were in the N0 group, three in the N1, one in the N2, and 5 in the N3 group. The mean time to leak detection was the 5th (3-7) postoperative day. Routine drain amylase and Tg tests were not performed. When milky white discharge from abdominal drains was detected with high Tg levels, chylous leaks were considered. Biochemical analysis of drain fluid revealed Tg levels between 230 and 3.497 (mean: 843.5). We did not use lymphoscintigraphy for either the diagnosis or treatment of chylous leaks. After detecting chylous leaks, total parenteral nutrition (TPN) was introduced at the beginning of the study; with increasing experience, patients were started on a low-fat diet with medium-chain Tg (MCT). Six patients received TPN and seven received an MCT diet. None of the patients underwent surgery due to chylous leak. All patients recovered with TPN and MCT diet treatment. None of the patients in the MCT arm switched to TPN. Complications related to chylous leak were evaluated according to Clavien-Dindo (CD) classification⁽¹⁵⁾. Nine patients had CD 2 complications, and four patients had CD 1 complications (Table 2).

Discussion

The number of patients with gastric cancer who undergo radical surgery with aggressive lymph node dissection is increasing. As the number of harvested lymph node increases, the chylous leak also increases with more aggressive surgery, presenting a challenging clinical entity⁽⁵⁾. The standard method of tumor surgery is to remove the tumor with adequate margins and extend lymphadenectomy. For gastric cancers, subtotal or total gastrectomy with D2 resection is the preferred surgical intervention for potentially curable cT2-T4 and cT1N+ tumors. D2 lymphadenectomy should be performed whenever the possibility of nodal involvement can not be dismissed. In addition to the positive effects of extended lymph node dissection, it is associated with an increased risk of complications. The incidence of chylous leaks after major abdominal surgeries varies between 0.17% and 1.1%^(16,17). It is as high as 7.4% after retroperitoneal and esophageal cytoreductive surgeries^(12,17). Chylous fluid, chyliform or pseudochylous fluid, and lymphorrhea explain the nature of fluid from abdominal drains. Lymphorrhea is yellow in color, isosmotic to interstitial fluid, and has nearly equal Tg levels with serum due to injury to prenodal ducts. It occurs in approximately 7.4% of patients after abdominal oncologic surgery. The criteria to name it a chylous leak are a milky appearance, a sterile and odorless character with increased Tg level $2\geq$ two times of serum Tg level or

Table 2. Characteristics of patients with chylous leak

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11	Case 12	Case 13	Mean
Age	66	41	57	63	61	36	72	65	60	61	54	59	67	58.6 (36-72)
Gender	M	F	M	F	M	F	M	M	M	F	M	M	M	
BMI	24	24	26	28	25	25	23	18	20	25	25	26	24	24.07
Albumin	2.8	2.5	2.9	3.05	3.6	3.2	3.1	3.8	3.1	4.3	2.4	2.6	2.28	3.04 (2.2-4.3)
Hemoglobin	11.6	10.9	10.1	10.9	16	12.3	11.5	9.4	15.2	14.4	11.2	16	13.1	12.5 (9.4-16)
Localization	Antrum	Corpus	Cardia	Corpus	Corpus	Diffuse	Cardia	Corpus	Cardia	Corpus	Corpus	Antrum	Cardia	
Surgery type	STG+D2 LND	TG+D2 LND	STG+D2 LND	TG+D2 LND										
Resected lymph node no	28	35	51	31	52	17	27	57	36	78	41	20	20	40.3 (17-78)
Metastatic lymph node no	1	22	1	8	0	20	5	0	7	0	1	15	0	6.15 (0-22)
Start time of LL (day)	7	7	7	4	5	3	4	7	5	5	3	4	4	5 (3-7)
Diet with MCT	No	No	No	Yes	No	No	No							
TPN	Yes	Yes	Yes	No	Yes	Yes	Yes							
Fistula closure day	15	10	8	35	5	5	8	5	5	3	30	23	13	12.6 (3-35)

BMI: Body mass index, STG: Subtotal gastrectomy, TG: Total gastrectomy, LND: Lymph node dissection, LL: Lymph leakage, MCT: Middle chain triglycerides, TPN: Total parenteral nutrition

Tg >200 mg/dL. The risk of chylous leaks increases in proximally located tumors. In our study, there were four tumors in the cardia, six in the corpus, two in the antrum, and one diffuse tumor in the chylous leak group. The lowest Tg level was 230 mg/dL, and the highest was 3.497 mg/dL. We obtained a chylous leak ratio of 6.1%, which is compatible with the literature.

Assumpcao et al.⁽¹⁸⁾ determined that after pancreatic surgery of 3.532 patients, postoperative chylous ascites were associated with the number of resected lymph nodes after pancreatic surgery in 3.532 patients. The number of dissected lymph nodes was higher than average (>39) in the chylous leak group, without statistical significance.

All complications were less than CD 3 in our study. No mortality was observed. Most patients recovered after MCT diet intake. The shortest hospitalization period after the detection of the chylous leak was 2 days, whereas the longest was 30 days (mean: 10.3 days). After a decrease in drain discharge below 300 cc/day, if the patient had no symptoms, the drain was withdrawn, and the patient was discharged with the recommendation of a middle-chain Tg diet. Regardless of whether the patients had complaints, they were called for control on the post-op 14th day. If not diagnosed earlier and managed properly, morbidity and mortality can occur.

Preoperative anemia, hypoalbuminemia, and the number and extent of resected lymph nodes are associated with a chylous leak⁽¹⁹⁾. Patients' BMI with the chylous leak was lower than the mean BMI of all patients (24.07 vs. 26.09). This result was statistically significant ($p=0.03$). The mean Hgb level was 12.5 (9.4-16) and the albumin level was 3.04 (2.2-4.3) in the chylous leak group. The relationship between preoperative hemoglobin and albumin levels and chylous leakage was not significant. Manipulation of

the para-aortic area and early enteral feeding were identified as independent risk factors for chylous leaks, as described by Kuboki et al.⁽¹¹⁾ before. Patients were started on a liquid diet on postoperative day 1. Previously, after cessation of oral intake, we were administering TPN with somatostatin. TPN administration has its own vascular and infectious complications. We began administering the MCT diet to these patients after they gained more experience. Our study found no complications following MCT feeding in patients with chylous leaks.

Study Limitations

The patient number in our study is not high enough to make thorough suggestions. This is a limitation of our study.

Conclusion

Surgery may be considered in cases of a chylous leak volume of more than 1000 mL/day for 5 days and a persistent leak for two weeks, but none of our patients were operated on due to a chylous leak. After all, we can confidently state that patients with chylous leaks can be followed up with the MCT diet.

The number of patients in our study was not high enough to prompt thorough suggestions. This is a limitation of our study.

Ethics

Ethics Committee Approval: Ethical approval was obtained from University of Health Sciences Türkiye, Prof. Dr. Cemil Taşçıoğlu City Hospital Ethical Committee (number: 2022/30, date: 14.02.2022).

Informed Consent: Detailed consent was not obtained from the patients because it was a retrospective study and no interventional procedure was performed.

Footnotes

Authorship Contributions

Surgical and Medical Practices: A.A., Concept: A.A., Design: M.G.D., Data Collection or Processing: M.G.D., A.A., Analysis or Interpretation: A.A., Literature Search: M.G.D., Writing: M.G.D., A.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021;71:209-49.
2. Japanese gastric cancer treatment guidelines 2018 (5th edition). *Gastric Cancer.* 2021;24:1-21.
3. Smyth EC, Verheij M, Allum W, et al. Gastric cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol.* 2016;27(Suppl 5):v38-49.
4. Doran H, Mihalache O, Bîrligea A, Cîrstea MO, Pătrășcu T. Early complications after gastrectomies for locally advanced gastric cancer. *Chirurgia (Romania).* 2021;116:294-9.
5. Maeta M, Yamashiro H, Saito H, et al. A prospective pilot study of extended (D3) and superextended para-aortic lymphadenectomy (D4) in patients with T3 or T4 gastric cancer managed by total gastrectomy. *Surgery.* 1999;125:325-31.
6. Bostancı EB, Yol S, Kayaalp C, et al. Comparison of complications after D2 and D3 dissection for gastric cancer. *Eur J Surg Oncol.* 2004;30:20-5.
7. Almakdisi T, Massoud S, Makdisi G. Lymphomas and chylous ascites: review of the literature. *Oncologist.* 2005;10:632-5.
8. Cardenas A, Chopra S. Chylous ascites. *Am J Gastroenterol.* 2002;97:1896-900.
9. İlhan E, Demir U, Alemdar A, et al. Management of high-output chylous ascites after D2-lymphadenectomy in patients with gastric cancer: a multi-center study. *J Gastrointest Oncol.* 2016;7:420-5.
10. Weniger M, D'Haese JG, Angele MK, et al. Treatment options for chylous ascites after major abdominal surgery: a systematic review. *Am J Surg.* 2016;211:206-13.
11. Kuboki S, Shimizu H, Yoshidome H, et al. Chylous ascites after hepatopancreatobiliary surgery. *Br J Surg.* 2013;100:522-7.
12. Evans JG, Spiess PE, Kamat AM, et al. Chylous ascites after post-chemotherapy retroperitoneal lymph node dissection: review of the M. D. Anderson experience. *J Urol.* 2006;176:1463-7.
13. Olthof E, Blankensteijn JD, Akkersdijk GJM. Chyloperitoneum following abdominal aortic surgery. *Vascular.* 2008;16:258-62.
14. Kaas R, Rustman LD, Zoetmulder FAN. Chylous ascites after oncological abdominal surgery: incidence and treatment. *Eur J Surg Oncol.* 2001;27:187-9.
15. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg.* 2004;240:205-13.
16. Ijichi H, Soejima Y, Taketomi A, et al. Successful management of chylous ascites after living donor liver transplantation with somatostatin. *Liver Int.* 2008;28:143-5.
17. Yilmaz M, Akbulut S, Isik B, et al. Chylous ascites after liver transplantation: incidence and risk factors. *Liver Transpl.* 2012;18:1046-52.
18. Assumpcao L, Cameron JL, Wolfgang CL, et al. Incidence and management of chyle leaks following pancreatic resection: a high volume single-center institutional experience. *J Gastrointest Surg.* 2008;12:1915-23.
19. Lu J, Wei ZQ, Huang CM, et al. Small-volume chylous ascites after laparoscopic radical gastrectomy for gastric cancer: results from a large population-based sample. *World J Gastroenterol.* 2015;21:2425-32.