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Original Article

Chylous Ascites After Gastric Cancer Surgery: Risk Factors and Treatment Results

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ABSTRACT

Purpose: Although chylous ascites is a frequent complication of radical gastrectomy for gastric cancer, proper diagnostic criteria and optimal treatment strategies have not been established. This study aimed to identify the clinical features of chylous ascites and evaluate the treatment outcomes.
Materials and Methods: We retrospectively analyzed the data of patients who underwent radical gastrectomy between 2013 and 2019. Diagnosis was made when milky fluid or elevated triglyceride levels (≥100 mg/dL) appeared in the drains without a preceding infection. The clinical features, risk factors, and treatment outcomes were assessed according to the initial treatment modalities for fasting and non-fasting groups.
Results: Among the 7,388 patients who underwent radical gastrectomy for gastric cancer, 156 (2.1%) experienced chylous ascites. The median length of hospital stay was longer in patients with chylous ascites than in those without (median [interquartile range]: 8.0 [6.0–12.0] vs. 6.0 [5.0–8.0], P<0.001). Low body mass index (adjusted odds ratio [aOR]=0.9; P<0.001), advanced gastric cancer (aOR=1.51, P=0.024), open surgery (reference: laparoscopic surgery; aOR=1.87, P=0.003), and extent of surgical resection (reference: subtotal gastrectomy, total gastrectomy, aOR=1.5, P=0.029; proximal gastrectomy, aOR=2.93, P=0.002) were associated with the occurrence of chylous ascites. The fasting group (n=12) was hospitalized for a longer period than the non-fasting group (n=144) (15.0 [12.5–19.5] vs. 8.0 [6.0–10.0], P<0.001). There was no difference in grade III complication rate (16.7% vs. 4.2%, P=0.117) or readmission rate (16.7% vs. 11.1%, P=0.632) between the groups.
Conclusions: A fat-controlled diet and medication without fasting provided adequate initial treatment for chylous ascites after radical gastrectomy for gastric cancer.

Keywords: Gastric cancer; Gastrectomy; Chylous ascites; Treatment

INTRODUCTION

Gastric cancer is one of the leading causes of cancer-related mortality worldwide [1]. Gastrectomy with systematic lymphadenectomy provides the best curative potential for patients with localized gastric cancer patients [2-4]. Adequate lymph node dissection with a negative resection margin is essential in radical gastrectomy. An oncologic surgery reported

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Conflict of Interest

Dr. Hyung WJ received research grants from Medtronic and GC Biopharma and is a stockholder and chief executive officer of Hutom. He provided consultancy services to Ethicon and SK Hynix outside the submitted work. All the other investigators have no potential conflicts of interest to declare.

Author Contributions

Conceptualization: K.Y.M., H.W.J.; Data curation: P.S.H., K.Y.M.; Formal analysis: P.S.H., K.Y.M., H.W.J.; Funding acquisition: H.W.J.; Methodology: P.S.H., K.Y.M., H.W.J.; Resources: H.W.J., K.H.I., K.Y.M., C.M.; Software: P.S.H.; Supervision: K.Y.M., H.W.J.; Validation K.H.I., C.M., K.K.Y.; Visualization: P.S.H.; Writing - original draft: P.S.H., K.Y.M.; Writing - review & editing: P.S.H., K.Y.M., H.W.J.

that, lymphatic structures were inevitably destroyed during lymph node dissection in radical gastrectomy [5-7]. If the lymphatic vessels lose their integrity by incomplete sealing or inappropriate coagulation during lymph node dissection, chyle leakage may occur, which is frequently reported after thoracic surgery, head and neck surgery, gynecology, urology, pancreatic surgery, vascular surgery, and colorectal surgery [8-17].

Chylous ascites is a common complication of gastric cancer surgery, but it is difficult to manage [18-24]. Chylous ascites is defined as the accumulation of milky fluid containing triglycerides in the intra-abdominal cavity [5]. Chylous ascites occasionally occurs after radical gastrectomy because radical gastrectomy requires systematic lymphadenectomy. Chylous ascites has not been of great interest to surgeons because it is not considered to cause serious problems compared to chylothorax or intractable chyle leakage after retroperitoneal organ surgery. However, chylous ascites after radical gastrectomy hinders early recovery and is associated with prolonged malabsorption and even sepsis [25].

To the best of our knowledge, there are no proper diagnostic criteria or optimal treatment strategies for chylous ascites after gastric cancer surgery. Moreover, no comprehensive study has assessed the risk factors and treatment results of chylous ascites after gastric cancer surgery. This study aimed to determine the incidence and risk factors of chylous ascites and treatment outcomes of patients who develop this condition after surgery for gastric cancer.

MATERIALS AND METHODS

Patients

After a retrospective review of a prospectively collected gastric cancer database, we identified 7,803 patients who had undergone gastrectomy for gastric cancer between 2013 and 2019. Patient demographics, tumor characteristics, surgical information, and pathological features were prospectively recorded. All postoperative complications during the hospital stay or readmission up to 90 days after gastrectomy were prospectively recorded. The exclusion criteria were 1) M1 disease, 2) non-curative resection, 3) wedge resection with sentinel lymph node biopsy, or 4) incomplete information on clinical or pathologic features (**Fig. 1**). We first identified the patients with chylous ascites from the prospective database, and peritoneal fluid triglyceride levels for the included patients were reviewed. The characteristics, risk factors, and treatment results of the patients diagnosed with chylous ascites were assessed. To identify the optimal management strategy, the outcomes were compared according to treatment modality (**Fig. 1**). The fasting group was defined as those who started fasting at the time of diagnosis of chylous ascites and fasted for at least 24 hours or three consecutive meals. This study was approved by the Institutional Review Board of Severance Hospital, Yonsei University Health System (2022-1561-001), which waived the need for informed consent owing to its retrospective nature.

Definition and diagnosis of chylous ascites

Chylous ascites is diagnoised upon the observation of a definite grossly-milky fluid appearing from the drains inserted into the peritoneal cavity or a triglyceride concentration of ≥100 mg/dL in the drain fluids [8-11]. Peritoneal fluid triglyceride levels were not checked in all patients with chylous ascites because chylous ascites is often diagnosed by gross inspection of drain fluids alone. Patients with preceding anastomotic leakage, pancreatic fistula, or other infectious conditions that could change the characteristics of the peritoneal fluid were

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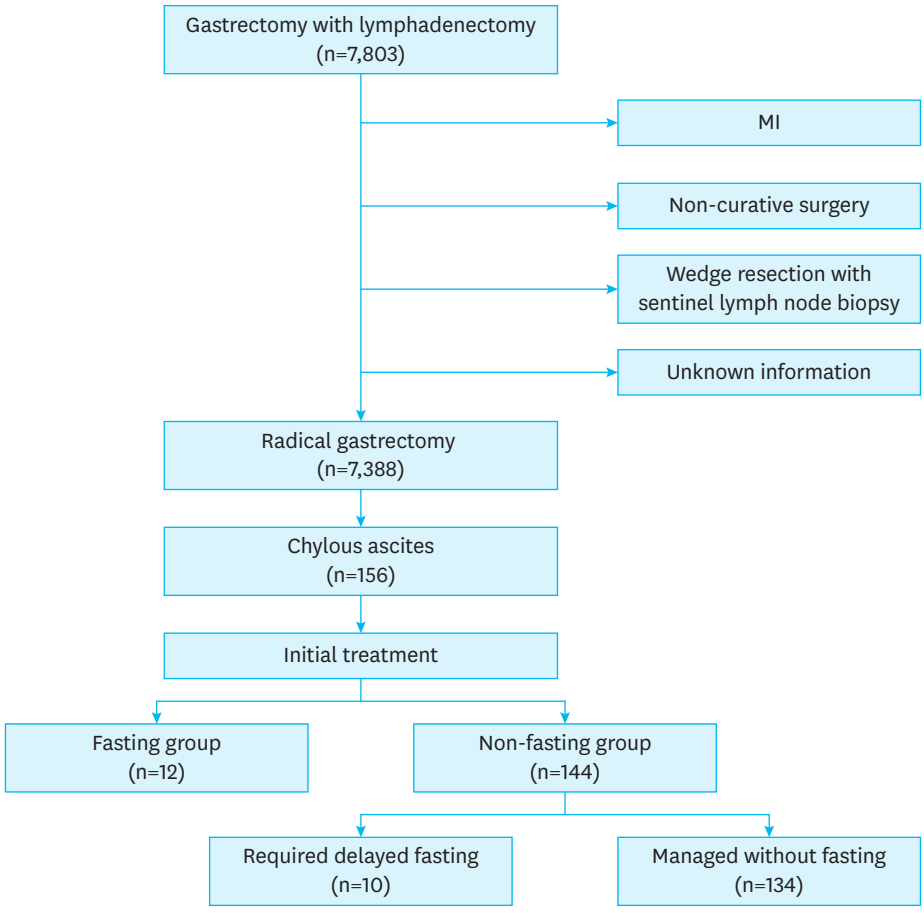

Fig. 1. Study profile.

not regarded as having chylous ascites. However, patients with chylous ascites as the cause of peritonitis or intra-abdominal abscess were not excluded.

Management

Once the diagnosis of chylous ascites was confirmed, the patients were treated with initial conservative treatment with dietary control and pharmacologic agents [12,24,26-29]. Percutaneous intervention alleviates the symptoms in some patients with signs of infection or persistent chylous ascites after surgical drain removal. Dietary control options included fasting with parenteral nutrition support and a low-fat or fat-free diet, with or without medium-chain triglyceride supplementation. Orlistat, somatostatin, and octreotide were prescribed as pharmacological agents for the treatment of chylous ascites. Dietary prescriptions during hospitalization or readmission were retrospectively reviewed to determine whether the patient had fasted because of chylous ascites.

Statistical analyses

Statistical analyses were performed using the R package (Version 4.2.0; R Foundation for Statistical Computing, Vienna, Austria). Continuous variables with a normal distribution were described as mean (standard deviation) or median (interquartile range, IQR). Categorical variables are represented as numbers (percentages). Student's t-test or Mann–Whitney U test was performed for continuous variables when comparing the groups. For

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categorical variables, χ^2 or Fisher's exact test was used. A multivariable logistic regression model was used to identify risk factors for chylous ascites. In the multivariate logistic regression model, variable selection was performed using a stepwise method. Statistical significance was set at P<0.05.

RESULTS

Incidence and features of patients with chylous ascites

Of the 7,803 patients who underwent gastrectomy for gastric cancer, 415 were excluded (**Fig. 1**). Among the 7,388 patients who underwent radical gastrectomy, chylous ascites occurred in 156 (2.1%) patients. Patients with chylous ascites were diagnosed after starting a semi-solid diet at a median postoperative day of 5 (4–7), and the median triglyceride concentration in the peritoneal fluid at diagnosis was 239.5 mg/dL (174.0–355.0) (**Table 1**). The median maximum triglyceride concentration in the drain fluid was 282.0 mg/dL (186.0–472.0).

Table 2 shows the clinicopathological features of patients with chylous ascites. Chylous ascites occurred in patients with large tumor sizes (P=0.002), high pathological T and N stages (pT, P<0.001; pN, P<0.001), total gastrectomy (P<0.001), and extensive lymph node dissection (P<0.001). As shown in **Table 3**, univariate analysis revealed that low BMI, advanced gastric cancer, open surgery rather than laparoscopic surgery, total or proximal gastrectomy, D2 lymph node dissection, total omentectomy, long anesthesia time, large tumor size, and large number of retrieved lymph nodes were associated with chylous ascites. The variables selected after stepwise multivariate logistic regression are presented in **Table 3**. The results of the multivariate analysis showed that low BMI (adjusted odds ratio [aOR]=0.9, 95% CI: 0.85–0.95; P<0.001), advanced gastric cancer (aOR=1.51, 95% CI: 1.05–2.15; P=0.024), open surgery (reference: laparoscopic surgery, aOR=1.87, 95% CI: 1.25–2.81; P=0.003), and extent of surgical resection (reference: subtotal gastrectomy, total gastrectomy; aOR=1.5, 95% CI: 1.04–2.17; P=0.029, proximal gastrectomy; aOR=2.93, 95% CI: 1.48–5.8; P=0.002) were factors associated with the occurrence of chylous ascites.

Table 1. Diagnosis and perioperative outcome of chylous ascites patient

Characteristics	Chylous ascites (n=156)	No chylous ascites (n=7,232)	P-value
Diagnosis period (POD) (day)	5.0 [4.0–7.0]		
Peritoneal fluid TG concentration* (mg/dL)			
At the time of diagnosis	239.5 [174.0–355.0]		
Maximum	282.0 [186.0–472.0]		
Management			
Dietary control	43 (27.6)		
Dietary control + orlistat	105 (67.3)		
Dietary control + somatostatin ± orlistat	8 (5.1)		
Hospital stay (days)	8.0 [6.0–12.0]	6.0 [5.0–8.0]	<0.001
≥Grade III complication†			0.814
No	148 (94.9)	6,805 (94.1)	
Yes	8 (5.1)	427 (5.9)	
90-day readmission			0.002
No	138 (88.5)	6,837 (94.5)	
Yes	18 (11.5)	395 (5.5)	

Data are presented as median [interquartile range] or number (percentage).
POD = postoperative day; TG = triglyceride.
*Peritoneal fluid triglyceride concentration information was available and analyzed in 146 patients; †Clavien–Dindo classification [30].

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Table 2. Clinicopathologic features associated with the presence of chylous ascites

Characteristics	Chylous ascites (n=156)	No chylous ascites (n=7,232)	P-value
Age (yr)	59.3 (11.9)	59.5 (11.9)	0.826
Sex			0.317
Male	91 (58.3)	4,506 (62.3)	
Female	65 (41.7)	2,726 (37.7)	
BMI (kg/m^2)	22.6 (3.1)	23.6 (3.1)	<0.001
ASA score			0.077
1	31 (19.9)	1,333 (18.4)	
2	78 (50.0)	4,063 (56.2)	
3	41 (26.3)	1,730 (23.9)	
4	6 (3.8)	106 (1.5)	
Preoperative CTx			0.238
No	151 (96.8)	7,091 (98.1)	
Yes	5 (3.2)	141 (1.9)	
Operation method			<0.001
Open	79 (50.6)	2,413 (33.4)	
Laparoscopy	46 (29.5)	3,250 (44.9)	
Robot	31 (19.9)	1,569 (21.7)	
Resection			<0.001
STG	95 (60.9)	5,489 (75.9)	
TG	51 (32.7)	1,482 (20.5)	
PG	10 (6.4)	261 (3.6)	
Dissection			<0.001
D1+	56 (35.9)	3,784 (52.3)	
D2 or more	100 (64.1)	3,448 (47.7)	
Operation time (min)	176.5 [153.0–230.0]	175.0 [143.0–212.0]	0.101
Anesthesia time (min)	210.0 [185.0–270.0]	210.0 [175.0–250.0]	0.095
Estimated blood loss (mL)	100.0 [40.0–200.0]	65.0 [30.0–150.0]	0.002
Gross type			<0.001
EGC	72 (46.2)	4,608 (63.7)	
AGC	84 (53.8)	2,624 (36.3)	
Histologic type			0.208
Differentiated	56 (35.9)	2,857 (39.5)	
Undifferentiated	91 (58.3)	4,132 (57.1)	
Other	9 (5.8)	243 (3.4)	
Lymphovascular invasion			0.176
No	103 (66.5)	5,160 (71.7)	
Yes	52 (33.5)	2,033 (28.3)	
Tumor size (mm)	41.9 (29.6)	34.3 (25.5)	0.002
No. retrieved LN	49.0 [35.0–61.0]	44.0 [33.0–57.0]	0.010
pT			<0.001
pT1	72 (46.2)	4,728 (65.4)	
pT2 or pT3	48 (30.8)	1,634 (22.6)	
pT4	36 (23.1)	870 (12.0)	
pN			0.006
pN0	94 (60.3)	5,210 (72.0)	
pN1	21 (13.5)	765 (10.6)	
pN2	15 (9.6)	551 (7.6)	
pN3	26 (16.7)	706 (9.8)	
Differentiation			0.208
AJCC 8th stage			<0.001
I	84 (53.8)	5,020 (69.4)	
II	30 (19.2)	1,078 (14.9)	
III	42 (26.9)	1,134 (15.7)	

Data are presented as median [interquartile range] or number (percentage).
BMI = body mass index; ASA = American Society of Anesthesiologists; CTx = chemotherapy; STG = subtotal gastrectomy; TG = total gastrectomy; PG = proximal gastrectomy; EGC = early gastric cancer; AGC = advanced gastric cancer; LN = lymph node; AJCC = American Joint Committee on Cancer.

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Table 3. Logistic regression models for risk factors of chylous ascites after radical gastrectomy

Characteristics	Univariate	Multivariate	
	P-value	aOR (95% CI)	P-value
Age			
Continuous	0.826		
Sex			
Male (reference)			
Female	0.312		
BMI* (kg/m^2)			
Continuous	<0.001	0.9 (0.85, 0.95)	<0.001
ASA score*			
1,2 (reference)		1	
3,4	0.180	1.31 (0.92, 1.86)	0.131
Gross type*			
EGC (reference)		1	
AGC	<0.001	1.51 (1.05, 2.15)	0.024
Preoperative CTx			
No (reference)			
Yes	0.270		
Operation method*			
Lapa (reference)		1	
Open	<0.001	1.87 (1.25, 2.81)	0.003
Robot	0.155	1.35 (0.85, 2.14)	0.211
Resection*			
STG (reference)		1	
TG	<0.001	1.50 (1.04, 2.17)	0.029
PG	0.019	2.93 (1.48, 5.8)	0.002
Dissection			
D1+ (reference)			
D2	<0.001		
Tumor size			
Continuous	<0.001		
No. retrieved LN			
Continuous	0.029		
Differentiation			
Differentiated (reference)			
Undifferentiated	0.497		
Lymphovascular invasion			
No (reference)			
Yes	0.153		
Omentectomy			
Partial (reference)			
Total	<0.001		
Operation time			
Continuous	0.053		
Anesthesia time			
Continuous	0.035		
Estimated blood loss			
Continuous	0.143		

aOR = adjusted odds ratio; CI = confidence interval; BMI = body mass index; ASA = American Society of Anesthesiologists; EGC = early gastric cancer; AGC = advanced gastric cancer; CTx = chemotherapy; Lapa = laparoscopic surgery; robotics = robotic surgery; STG = subtotal gastrectomy; TG = total gastrectomy; PG = proximal gastrectomy; LN = lymph node; AJCC = American Joint Committee on Cancer.
*Selected variables after the stepwise method of multivariable logistic regression model.

Management and treatment outcome

Among the 156 patients diagnosed with chylous ascites, 43 (27.6%) patients were managed with dietary control only, 105 (67.3%) patients had orlistat medication added to dietary control, and 8 (5.1%) patients were prescribed somatostatin (**Table 1**). Patients with chylous ascites were hospitalized longer than those without chylous ascites (median [IQR], 8.0

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[6.0–12.0] vs. 6.0 [5.0–8.0], P<0.001). Although the incidence rates of grade III or higher complications were not related to chylous ascites, patients with chylous ascites were more likely to require readmission within 90 days after surgery (11.5% vs. 5.5%, P=0.002) [30]. On the day of diagnosis of chylous ascites, 12 patients fasted as an initial treatment (fasting group), whereas the remaining 144 patients were treated with conservative care, including medication and a high-protein, low-fat, and medium-chain triglyceride supplementary diet (non-fasting group). Twelve patients in the fasting group initially fasted for a median of 4 days (range, 2.0–10.0 days). There were no differences in the dates of diagnosis (P=0.312) or peritoneal fluid triglyceride concentrations (P=0.351) between the fasting and non-fasting groups (**Table 4**). Only 10 (6.9%) patients in the initial non-fasting group required prolonged fasting to resolve chylous ascites. The fasting group had longer hospital stays than the non-fasting group (median [IQR], 15.0 [12.5–19.5] vs. 8.0 [6.0–10.0], P<0.001) as well as higher grade III complication rates (16.7% vs. 4.2%, P=0.117) and readmission rates (16.7% vs. 11.1%, P=0.632); the addition of orlistat to dietary control did not reduce the length of hospital stay, grade III complication rate, or readmission rate (**Table 5**). The 90-day mortality rate for the group of patients who experienced chylous ascites was 0%.

Table 4. Comparison of perioperative outcomes of initial treatment for fasting and non-fasting groups

Characteristics	Fasting group (n=12)	Non-fasting group (n=144)	P-value
Diagnosis period (POD) (days)	5.0 [5.0–7.0]	5.0 [5.0–8.0]	0.312
Peritoneal fluid TG concentration* (mg/dL)			0.351
At the time of diagnosis	315.5 [177.0–574.0]	234.5 [173.5–341.5]	
Hospital stay (days)	15.0 [12.5–19.5]	8.0 [6.0–10.0]	<0.001
Required delayed fasting			0.064
No	9 (75.0)	134 (93.1)	
Yes	3 (25.0)	10 (6.9)	
≥Grade III complication†			0.117
No	10 (83.3)	138 (95.8)	
Yes	2 (16.7)	6 (4.2)	
90-day readmission			0.632
No	10 (83.3)	128 (88.9)	
Yes	2 (16.7)	16 (11.1)	

Data are presented as median [interquartile range] or number (percentage).
POD = postoperative day; TG = triglyceride.
*Peritoneal fluid triglyceride concentration information was available and analyzed in 146 patients; †Clavien–Dindo classification [30].

Table 5. Comparison of perioperative outcomes according to prescribed medication

Characteristics	Dietary control (n=43)	Dietary control + orlistat (n=105)	Dietary control + somatostatin ± orlistat (n=8)	P-value
Diagnosis period (POD) (days)	5.0 [4.0–6.0]	5.0 [4.0–7.0]	4.5 [3.0–9.5]	0.890
Peritoneal fluid TG concentration (mg/dL)				0.124
At the time of diagnosis	202.0 [159.0–295.5]	259.0 [185.0–394.0]	228.0 [154.5–499.0]	
Hospital stay (days)	7.0 [6.0–10.0]	8.0 [6.0–12.0]	12.5 [8.5–15.5]	0.079
Required delayed fasting				0.001
No	42 (97.7)	97 (92.4)	4 (50.0)	
Yes	1 (2.3)	8 (7.6)	4 (50.0)	
≥Grade III complication†				0.067
No	41 (95.3)	101 (96.2)	6 (75.0)	
Yes	2 (4.7)	4 (3.8)	2 (25.0)	
90-day readmission				0.100
No	39 (90.7)	94 (89.5)	5 (62.5)	
Yes	4 (9.3)	11 (10.5)	3 (37.5)	

Data are presented as median [interquartile range] or number (percentage).
POD = postoperative day; TG = triglyceride.
*Peritoneal fluid triglyceride concentration information was available and analyzed in 146 patients; †Clavien–Dindo classification [30].

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DISCUSSION

This comprehensive study aimed to examine the incidence of chylous ascites after radical gastrectomy and treatment outcomes of the patients. The incidence of chylous ascites after radical gastrectomy is 2.1%. Even when chylous ascites occurs after radical gastrectomy, most patients are managed appropriately with conservative care. Although some patients required readmission or percutaneous drainage, none of them experienced reoperation or mortality. Low BMI, advanced gastric cancer, open surgery, and total or proximal gastrectomy are independent risk factors for the occurrence of chylous ascites. Fasting as an initial treatment at the time of diagnosis did not improve treatment outcomes.

The incidence of chylous ascites after major intra-abdominal surgery ranges from 0.2% to 11%, although it varies depending on the type of surgery [8-17]. Chylous ascites after radical gastrectomy is not a rare complication but prolongs hospitalization. However, there are no established diagnostic criteria or management recommendations for chylous ascites after gastrectomy. Grossly definite milky fluid and triglyceride concentrations greater than 100 mg/dL from peritoneal drains were used as diagnostic criteria for chylous ascites in this study. Chylous ascites occurred in most patients approximately 1 week after surgery, which is related to the patients' diet buildup period. The diagnosis of postoperative chylous ascites can be based on the characteristics of the drain fluid or triglyceride concentration, considering the timing when a patient is started on enteral feeding.

Chylous ascites is associated with extensive surgery for advanced gastric cancer. As the major cause of chylous ascites after intra-abdominal surgery is injury to the lymphatics or lymph node structure, a wider extent of lymph node dissection than necessary may be associated with the risk of developing chylous ascites. The risk of chylous ascites increases in patients with advanced gastric cancers because radical surgery requires extensive resection and lymph node dissection, according to the Korean Practice Guidelines for Gastric Cancer [2]. Furthermore, regarding the operative method, open surgery was associated with a higher risk of chylous ascites than laparoscopic surgery. Energy devices used in minimally invasive surgery, such as ultrasonic or bipolar vessel sealing devices, have a better sealing effect than electrocautery, which is the primary surgical tool used in open surgery.

Direct lymphatic injury from surgical trauma causes chylous leakage, including chylous effusion, chylothorax, and ascites. If prominent lymphatics near the aorta and inferior vena cava or thoracic duct are injured during a retroperitoneal or thoracic operation, chylous leakage may develop as a severe refractory complication even after conservative management [12,13,16,17,24]. However, chylous ascites after intraperitoneal surgery, including radical gastrectomy, is considered a complication that can be adequately managed without interventions.

In this study, the fasting approach with initial conservative care did not show any benefit compared with the non-fasting approach. Requirement of a percutaneous drainage and 90-day readmission rate did not reduce, and the duration of hospital stay was prolonged in fasting group. There was no difference in peritoneal fluid triglyceride concentrations between the fasting and non-fasting groups at the time of diagnosis, a low-fat, medium-chain triglyceride diet and medications, such as somatostatin and orlistat, could be used as the first-line management option rather than fasting. Conservative care should be provided as the first-line treatment, including enteral feeding, to patients with chylous ascites, and follow-up examinations must be carried out to check if the drainage has decreased or the drainage fluid has become serous.

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This study had several limitations. Regardless of how prospectively the patient database was compiled, comparisons of the treatment process and results may be biased because this was a retrospective review. Since triglyceride concentration was not measured in all patients, the drain concentration could not be used to categorize the severity of chylous ascites or to analyze treatment failure. Furthermore, there may have been other factors that influenced the patient to fast, such as the symptoms or amount of drainage, although there was no difference in triglyceride concentrations at the time of diagnosis between the fasting and non-fasting groups. A prospective study may be required to evaluate the serial changes in symptoms, daily drainage amounts, and triglyceride concentrations according to the management approach. Moreover, as a diagnostic criterion for chylous ascites, the drain triglyceride concentration was set at a lower level (100 mg/dL) than that in previous studies, and a cut-off value for the drainage volume was not determined. Therefore, the incidence of chylous ascites in this study may have been either overestimated or underestimated. Because the radical gastrectomy procedure manipulates the retroperitoneal space to a lesser extent than colorectal surgery, gynecologic surgery, or pancreatic surgery, we defined chylous ascites with a triglyceride concentration cutoff value of 100 mg/dL in the drainage fluid regardless of the drainage amount, which is a broader definition than that used in other studies. The diagnostic criteria for chylous ascites after radical gastrectomy should be established. Additionally, a postoperative surgical drain was not inserted in 876 (11.9%) of 7388 patients. Hence, the diagnosis of chylous ascites could have been underestimated in a patient without a drain. In addition, we were unable to suggest guidance on when patients should fast by judging the initial conservative care as ineffective. When chylous ascites is diagnosed, medications such as orlistat or somatostatin are usually prescribed; however, it remains unclear whether these medications improve the treatment outcomes. Further studies are required to make specific recommendations.

Despite these limitations, to the best of our knowledge, this is the largest comprehensive study to describe the treatment of chylous ascites after gastrectomy using data from a prospectively collected database. Moreover, we demonstrated that fasting, as a first-line treatment option, does not benefit these patients. Although chylous ascites has not received much interest, considering its relatively high incidence and tendency to prolong hospital stay, a proper understanding of chylous ascites is essential. Appropriate conservative management should be initially attempted when chylous ascites occurs. Nevertheless, future studies should investigate whether high protein, low fat, and enteral feeding is better than fasting with total parenteral nutritional support.

Most patients with chylous ascites after radical gastrectomy are cured with appropriate conservative management, although extended hospitalization and increased need for readmission influence the possibility of early recovery. Fasting as an initial treatment prolonged the hospital stay and did not reduce the rates of grade III or higher complications or readmission. A fat-controlled diet and medication without fasting appears to be the adequate treatment approach for chylous ascites after radical gastrectomy for gastric cancer.

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REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021;71:209-249.
PUBMED | CROSSREF
2. Guideline Committee of the Korean Gastric Cancer Association (KGCA), Development Working Group & Review Panel. Korean Practice Guideline for Gastric Cancer 2018: an evidence-based, multi-disciplinary approach. J Gastric Cancer 2019;19:1-48.
PUBMED | CROSSREF
3. Mocellin S. The effect of lymph node dissection on the survival of patients with operable gastric carcinoma. JAMA Oncol 2016;2:1363-1364.
PUBMED | CROSSREF
4. Songun I, Putter H, Kranenbarg EM, Sasako M, van de Velde CJ. Surgical treatment of gastric cancer: 15-year follow-up results of the randomised nationwide Dutch D1D2 trial. Lancet Oncol 2010;11:439-449.
PUBMED | CROSSREF
5. Cárdenas A, Chopra S. Chylous ascites. Am J Gastroenterol 2002;97:1896-1900.
PUBMED | CROSSREF
6. Kaas R, Rustman LD, Zoetmulder FA. Chylous ascites after oncological abdominal surgery: incidence and treatment. Eur J Surg Oncol 2001;27:187-189.
PUBMED | CROSSREF
7. Lizaola B, Bonder A, Trivedi HD, Tapper EB, Cardenas A. Review article: the diagnostic approach and current management of chylous ascites. Aliment Pharmacol Ther 2017;46:816-824.
PUBMED | CROSSREF
8. Baek SJ, Kim SH, Kwak JM, Kim J. Incidence and risk factors of chylous ascites after colorectal cancer surgery. Am J Surg 2013;206:555-559.
PUBMED | CROSSREF
9. Nishigori H, Ito M, Nishizawa Y, Koyama A, Koda T, Nakajima K, et al. Postoperative chylous ascites after colorectal cancer surgery. Surg Today 2012;42:724-728.
PUBMED | CROSSREF
10. Matsuda T, Fujita H, Kunimoto Y, Kimura T, Ogino K. Chylous ascites as a complication of laparoscopic colorectal surgery. Asian J Endosc Surg 2013;6:279-284.
PUBMED | CROSSREF
11. Lee SY, Kim CH, Kim YJ, Kim HR. Chylous ascites after colorectal cancer surgery: risk factors and impact on short-term and long-term outcomes. Langenbecks Arch Surg 2016;401:1171-1177.
PUBMED | CROSSREF
12. Evans JG, Spiess PE, Kamat AM, Wood CG, Hernandez M, Pettaway CA, et al. Chylous ascites after post-chemotherapy retroperitoneal lymph node dissection: review of the M. D. Anderson experience. J Urol 2006;176:1463-1467.
PUBMED | CROSSREF
13. Omloo JM, Lagarde SM, Vrouenraets BC, Busch OR, van Lanschot JJ. Compartimentalization for chylothorax originating from the abdomen after extended esophagectomy. Report of two cases and review of the literature. Dig Surg 2006;23:86-92.
PUBMED | CROSSREF
14. Tulunay G, Ureyen I, Turan T, Karalok A, Kavak D, Ozgul N, et al. Chylous ascites: analysis of 24 patients. Gynecol Oncol 2012;127:191-197.
PUBMED | CROSSREF
15. Sakran N, Parmar C, Ahmed S, Singhal R, Madhok B, Stier C, et al. Chyloperitoneum and chylothorax following bariatric surgery: a systematic review. Obes Surg 2022;32:2764-2771.
PUBMED | CROSSREF
16. Pan W, Yang C, Cai SY, Chen ZM, Cheng NS, Li FY, et al. Incidence and risk factors of chylous ascites after pancreatic resection. Int J Clin Exp Med 2015;8:4494-4500.
PUBMED
17. Li YZ, Yang J, Hu S, Zhan H. Progress in diagnosis and treatment of chylous leakage following pancreatic resection. Zhonghua Wai Ke Za Zhi 2021;59:316-320.
PUBMED
18. Du JJ, Li JP, Ding ZR, Zheng JY, Ji G, Gao ZQ, et al. Management of chylous leakage after radical operation of gastric cancer. Zhonghua Yi Xue Za Zhi 2007;87:1414-1416.
PUBMED

19. Griniatsos J, Dimitriou N, Kyriaki D, Velidaki A, Sougioultzis S, Pappas P. Chylorrhea complicating D2+a gastrectomy: review of the literature and clarification of terminology apropos one case. Chin Med J (Engl) 2010;123:2279-2283.
PUBMED

20. Kakinuma D, Kanazawa Y, Matsuno K, Masuda Y, Ando F, Hagiwara N, et al. Ligation and fibrin glue spraying for intractable chylous ascites after radical gastrectomy for gastric cancer: case report and literature review. J Nippon Med Sch 2021;88:242-247.
PUBMED | CROSSREF

21. Lu J, Wei ZQ, Huang CM, Zheng CH, Li P, Xie JW, et al. Small-volume chylous ascites after laparoscopic radical gastrectomy for gastric cancer: results from a large population-based sample. World J Gastroenterol 2015;21:2425-2432.
PUBMED | CROSSREF

22. Rajasekar A, Ravi NR, Diggory RT. Chylous ascites: a rare complication of radical gastrectomy. Int J Clin Pract 2000;54:201-203.
PUBMED

23. Yamada T, Jin Y, Hasuo K, Maezawa Y, Kumazu Y, Rino Y, et al. Chylorrhea following laparoscopy assisted distal gastrectomy with D1+ dissection for early gastric cancer: a case report. Int J Surg Case Rep 2013;4:1173-1175.
PUBMED | CROSSREF

24. Yol S, Bostanci EB, Ozogul Y, Ulas M, Akoglu M. A rare complication of D3 dissection for gastric carcinoma: chyloperitoneum. Gastric Cancer 2005;8:35-38.
PUBMED | CROSSREF

25. Al-Busafi SA, Ghali P, Deschênes M, Wong P. Chylous ascites: evaluation and management. ISRN Hematol 2014;2014:240473.
PUBMED | CROSSREF

26. Noji T, Nakamura T, Ambo Y, Suzuki O, Nakamura F, Kishida A, et al. Early enteral feeding after distal pancreatectomy may contribute to chyle leak. Pancreas 2012;41:331-333.
PUBMED | CROSSREF

27. Berzigotti A, Magalotti D, Cocci C, Angeloni L, Pironi L, Zoli M. Octreotide in the outpatient therapy of cirrhotic chylous ascites: a case report. Dig Liver Dis 2006;38:138-142.
PUBMED | CROSSREF

28. Zhou DX, Zhou HB, Wang Q, Zou SS, Wang H, Hu HP. The effectiveness of the treatment of octreotide on chylous ascites after liver cirrhosis. Dig Dis Sci 2009;54:1783-1788.
PUBMED | CROSSREF

29. Ilhan E, Demir U, Alemdar A, Ureyen O, Eryavuz Y, Mihmanli M. Management of high-output chylous ascites after D2-lymphadenectomy in patients with gastric cancer: a multi-center study. J Gastrointest Oncol 2016;7:420-425.
PUBMED | CROSSREF

30. 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;240:205-213.
PUBMED | CROSSREF