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Postoperative outcomes among patients undergoing thoracostomy tube placement at time of diaphragm peritonectomy or resection during primary cytoreductive surgery for ovarian cancer

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HIGHLIGHTS

- Diaphragm peritonectomy or resection can often lead to moderate to large pleural effusions.
- Intraoperative chest tube placement decreased the incidence of pleural effusions in patients with ≥10 cm resection specimens after diaphragm peritonectomy/resection.

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ABSTRACT

Objective. Primary cytoreductive surgery in patients with stage IIIC–IV epithelial ovarian cancer frequently includes diaphragm peritonectomy or resection, which can lead to symptomatic pleural effusions when the resection specimen is ≥10 cm. Our objective was to evaluate whether the placement of an intraoperative thoracostomy tube decreased the incidence of symptomatic pleural effusions in these cases.

Methods. We identified 156 patients who underwent primary debulking surgery involving diaphragm peritonectomy or resection for stage III–IV ovarian cancer from 1/01–12/09. Using standard statistical tests, the incidence of symptomatic pleural effusions and other variables were compared between patients who did and did not have intraoperative chest tubes placed.

Results. Forty-nine patients had a resected diaphragm specimen ≥10 cm in largest dimension; 28 (57%) did not undergo chest tube placement (NCT group) while 21 (43%) did (CT group).
Mediastinal lymph node dissection (0% vs 19%, P = 0.028) and liver resections (11% vs 38%, P = 0.037) were higher in the CT group.
Postoperatively, 57% of the NCT group developed a moderate or large pleural effusion compared to 19% of the CT group (P = 0.007). Thirteen patients (46%) in the NCT group developed respiratory symptoms requiring either placement of a postoperative chest tube or thoracentesis compared to 3 patients (14%) in the CT group (P = 0.018).

Conclusions. Diaphragm peritonectomy or resection can often lead to moderate or large pleural effusions that may become symptomatic. In these patients, intraoperative chest tube placement may be considered to decrease the incidence of symptomatic effusions and the need for postoperative chest tube placement or thoracentesis.

Introduction

Ovarian cancer continues to be the leading cause of death from gynecologic malignancies in the United States, with 22,240 new cases and 14,030 projected deaths in 2013 [1]. The majority of patients present with advanced-stage disease (III/IV) often involving the upper abdomen. Spread by either direct extension or via peritoneal implantation can result in metastases to the diaphragm, as seen in up to 40% of patients with advanced disease [2].

Standard treatment of advanced-stage disease includes primary cytoreductive surgery followed by combination platinum-taxane chemotherapy. Optimal cytoreduction to ≤1 cm disease has repeatedly been shown to be associated with improved survival [3,4]. Historically,

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diaphragm involvement was considered one of the most frequent obstacles to achieving optimal cytoreduction. The right diaphragm is more frequently and extensively involved than the left diaphragm; however, bilateral involvement is not uncommon. Various studies have advocated and reported the feasibility of diaphragmatic surgery in achieving optimal cytoreduction [5–7]. Additionally, extensive upper abdominal procedures, including splenectomy, distal pancreatectomy and partial liver resections, are being incorporated into the surgical repertoire of many gynecologic oncologists worldwide.

Extensive upper abdominal surgery involving diaphragmatic peritonectomy/resection and liver mobilization may both contribute to the development of symptomatic pleural effusions. Eisenhauer et al. previously reported the incidence and management of pleural effusions after diaphragmatic surgery in patients with advanced ovarian cancer [8]. Fifteen patients had pleural drainage performed by either thoracentesis or chest tube. Seven patients had a chest tube placed intraoperatively. Postoperative pleural drainage was performed in 8 patients, with symptomatic pleural effusion being the most common reason for drainage (7/8, 87%). The mean specimen diameter in patients with an ipsilateral postoperative effusion was 9 cm compared to 5 cm in the group with no postoperative effusions ($P = 0.03$). Our objective was to evaluate if the placement of an intraoperative chest tube decreased the incidence of symptomatic pleural effusions in patients with ≥10 cm resection specimens after diaphragm peritonectomy/resection.

Methods

After Institutional Review Board (IRB) approval was obtained, we identified all patients with epithelial ovarian cancer treated at our institution who underwent primary debulking surgery involving diaphragm peritonectomy or resection for stage III–IV ovarian cancer between 1/12/2001 to 12/08/2009. The incidence of symptomatic pleural effusions was compared between patients who underwent intraoperative chest tube placement versus those with no intraoperative intervention. Clinicopathologic, intraoperative, and postoperative variables were obtained from the medical records, including operative reports, pathology reports, and radiology reports. These included: age, body mass index (BMI), history of pulmonary disease or congestive heart failure, American Society of Anesthesiologists (ASA) class, stage of disease, tumor grade, tumor histology, and the size of the diaphragm specimen. Based on the previous study from our institution by Eisenhauer et al., the routine placement of chest tubes was not warranted, as the incidence of symptomatic effusions was not high enough in the overall cohort of patients [8]. It was noted that postoperative pleural drainage was performed in 8 patients, with symptomatic pleural effusion being the most common reason for drainage. The mean specimen diameter in patients with ipsilateral postoperative pleural effusion was 9 cm. For this analysis we concentrated on cases in which a diaphragm specimen ≥10 cm in largest dimension was noted in the pathology report. Additionally, patients in whom intraoperative video-assisted thoracic surgery (VATS) was performed and those without any postoperative imaging were excluded. Postoperatively, pleural effusions were documented either by chest radiograph or computed tomography. Laterality and size (categorized as small, moderate, or large by imaging) of the pleural effusions were recorded. Immediate postoperative complications, as well as those occurring during the follow-up period, were recorded. Results were compared using the Mann Whitney *U* test, and nominal data were compared using the Chi square or Fisher's test as appropriate for category size. The SPSS 19.0 statistical software package was used for all statistical analyses.

Results

We identified 156 patients who underwent diaphragm peritonectomy or resection for stage III–IV ovarian cancer between 1/12/2001 and 12/08/2009. Clinicopathologic characteristics of the overall cohort are listed in Table 1. There were no significant differences in patient age, BMI, ASA class, history of pulmonary disease, tumor grade, or histology between patients who did not undergo intraoperative chest tube placement (NCT group) versus patients who underwent chest tube placement (CT group). Stage distribution was different between the NCT and CT groups: 83% vs 46%, respectively, had stage IIIC disease, and 16% vs 54%, respectively, had stage IV disease. Fifty-seven patients had a resected diaphragm specimen ≥10 cm in largest dimension. From this cohort, 4 patients underwent intraoperative VATS and 4 patients had no postoperative chest imaging, leaving 49 patients available for analysis: 28 (57%) patients in the NCT group and 21 (43%) in the CT group.

Preoperative laboratory values including CA-125, hemoglobin, albumin, and platelets were similar in both groups (Table 2). Mediastinal lymph node dissection (0% vs 19%, $P = 0.028$), pelvic lymph node dissection (25% vs 57%, $P = 0.022$), para-aortic lymph node dissection (21% vs 57%, $P = 0.010$), and liver resections (11% vs 38%, $P = 0.037$) were all performed more frequently in the CT group (Table 3). Operative variables, including volume of ascites, estimated blood loss, operative time, and perioperative fluids, were similar between the groups (Table 4). Optimal cytoreduction was achieved in 96% of the NCT group compared to 100% of the CT group.

Among the 49 patients with a diaphragm specimen ≥10 cm in largest dimension, 57% of the NCT group compared to 19% of the CT group developed a moderate or large pleural effusion ($P = 0.007$) postoperatively (Table 5). Thirteen patients (46%) in the NCT group compared to 3 patients (14%) in the CT group developed respiratory symptoms requiring either placement of a postoperative chest tube or thoracentesis ($P = 0.018$). There was no difference in the length of hospital stay between the two groups ($P = 0.911$).

Discussion

Debulking surgery for advanced cancer resulting in either no residual tumor or disease ≤1 cm has been shown to result in better overall survival [9,10]. Diaphragm involvement is commonly seen in advanced disease stages as malignant cells in the peritoneal fluid circulate clockwise toward the diaphragm and implant in areas of stasis [11,12]. Cytoreductive surgery involving upper abdominal procedures, such as

Table 1
Clinicopathologic characteristics of overall cohort (N = 156).

Variable	(−) Chest tube (N = 108)	(+) Chest tube (N = 48)	P value
Age (years)			
Median (range)	60.7 (32–82)	58.8 (23–80)	0.251
BMI (kg/m^2)			
Median (range)	24.3 (18–42)	25.2 (16–49)	0.925
Preop Albumin			
Median (range)	4 (2–5)	4 (3–5)	0.385
Stage of disease			
IIIB	1 (1%)	0	<0.001
IIIC	89 (83%)	22 (46%)	
IV	18 (16%)	26 (54%)	
Tumor grade			
1	2 (2%)	1 (2%)	0.933
2	6 (6%)	2 (4%)	
3	100 (93%)	45 (94%)	
Histologic type			
Serous	105 (97%)	46 (96%)	0.644
Mixed	3 (3%)	2 (4%)	
ASA class			
<2	75 (69%)	30 (63%)	0.393
≥2	33 (31%)	18 (37%)	
Pulmonary disease	6 (6%)	1 (2%)	0.439
Congestive heart failure	0	0	N/A
Preop pleural effusion	28 (26%)	20 (44%)	0.049
Diaphragm Resection ≥10 cm	33 (31%)	24 (50.0%)	0.020

ASA, American Society of Anesthesiologists.