

Factors Associated with Need for Drainage of Pleural Effusion after Diaphragm Surgery

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Received 17 April 2014; revised 15 May 2014; accepted 22 May 2014

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Abstract

Background: Diaphragm surgery is common with advanced ovarian malignancies. The purpose of this study is to determine associated factors with the need for drainage of pleural effusion after diaphragm surgery. **Methods and Materials:** A retrospective chart review was undertaken in all women undergoing debulking surgery for stage IIIc/IV ovarian cancer from 2007-2009. **Results:** One hundred and eight patients were found to be eligible for the study, but 73 were the primary focus of this paper due to having undergone debulking surgery, including diaphragmatic surgery, from 2007-2009. All 73 had ablation with the argon beam coagulator, 7 had a full thickness resection, and 7 had extensive peritoneal peel. Five patients had preoperative effusions. Only 7 patients required chest drainage postoperatively. Pre-operative ascites correlated closely with postoperative effusion (p-value = 0.031) but not with drainage (p-value = 0.068). The mean age of patients requiring drainage was significantly older (73 years) than that of patients who did not require drainage (60 years) (p-value = 0.002). **Conclusion:** Older patients undergoing diaphragm surgery are more likely to require chest tube or thoracentesis due to concurrent symptoms. Pre-operative ascites correlates closely with the development of postoperative effusion after diaphragm surgery.

Keywords

Pleural Drainage, Diaphragm Surgery, Ovarian Cancer

1. Introduction

Primary cytoreductive surgery followed by adjuvant chemotherapy remains the most accepted method of management of ovarian cancer, with the goal of no residual cancer after the procedure [1] [2]. The majority of pa-

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tients with ovarian cancer present in FIGO stage III or IV, and most patients are offered this management. This procedure often includes upper abdominal surgery to reduce tumor burden. Ovarian cancer cells travel along with peritoneal fluid, and during its clockwise movement, the cancer cells may get deposited in the upper abdomen. Because of this, the right hemidiaphragm is a common place to find ovarian cancer [3]. There are several different methods to rid the diaphragm of disease, including diaphragmatic ablation (DA), diaphragmatic resection (DR), and peritoneal peel or peritonectomy (PP).

Cytoreductive surgery including the diaphragm and upper abdomen is feasible with good success [3] [4]. However, upper abdominal surgery, specifically diaphragmatic surgery, is associated with some morbidity [3] [5]. A common postoperative morbidity encountered is the development of pleural effusion. Another relatively known morbidity is pneumothorax. Postoperative pleural effusion is usually seen within a few days of surgery. Effusions may present as dyspnea, decreased pulse oximetry, and decreased breath sounds on the affected side. Computed tomographic scan or a plain chest radiograph is usually diagnostic. Management of pleural effusion may require drainage using thoracentesis or a chest tube if the patient is symptomatic.

Currently, there is no consensus as to whether all the patients undergoing radical debulking, including diaphragmatic surgery, require a prophylactic chest tube placement in the operating room. There is also no consensus on whether or not scans should be performed in postoperative asymptomatic patients. To address the need for prophylactic chest tubes, we undertook a retrospective analysis looking at the outcomes and morbidity following diaphragmatic surgery in our gynecologic cancer population.

2. Methods and Materials

This study was approved by the institutional review board. All patients with ovarian, fallopian tube, or primary peritoneal cancer undergoing primary debulking surgery from January 2007 through December 2009 were retrospectively analyzed, totaling 108. Patients undergoing diaphragmatic surgery were the primary focus of this analysis. No patients were knowingly excluded. We defined diaphragmatic surgery as diaphragmatic resection (Figure 1), diaphragmatic ablation and/or diaphragmatic peel/peritonectomy of the diaphragm.

Seventy three patients were identified to meet the above criteria. Charts on all 108 patients were then analyzed for demographic data, stage of cancer, histological type of cancer, type of surgery, extent of surgery, tumor burden after surgery, preoperative pleural effusion, preoperative CA125, prealbumin level, postoperative evidence of pleural effusion (confirmed by radiological testing), use of thoracentesis or chest tube placements, and postoperative complications. All pulmonary complications were attributed to the surgery. All postoperative pleural effusions were radiologically confirmed. The decision to ablate, peel, or resect the diaphragm was made by the attending gynecologic oncologist at the time of surgery.

3. Results

One hundred eight patients underwent primary debulking surgery, and the 73 patients who underwent primary cytoreductive surgery including diaphragmatic surgery were analyzed. Demographic characteristics of all patients undergoing primary surgery are shown in Table 1.

The mean age in years of patients undergoing diaphragm surgery was 61, with median of 63. The mean preoperative CA 125 was 564 IU/dl and the median was 189 IU/ml. The mean of the preoperative prealbumin was 16 mg/dl and the median was 14 mg/dl. Five of the 7 patients requiring chest drainage had documented preoperative effusion. The average patient undergoing diaphragm surgery was obese, with a mean BMI of 34 kg/m² and a median of 32 kg/m². Preoperative ascites correlated with postoperative effusion (p-value = 0.031), but not with the need for drainage (p-value = 0.068). The mean age of patients requiring drainage was significantly older (73 years) than those not requiring it (60 years) (p-value = 0.002). There was no correlation between postoperative effusion and the extent of diaphragm surgery. There was also no correlation between performance of other upper abdominal surgery (liver resection, splenectomy, gastrectomy, pancreatectomy) and postoperative effusion.

Seventy-three of 108 patients undergoing primary surgical debulking had diaphragmatic ablation of a portion of the diaphragm with the argon beam coagulator, 7 patients (9.5% of the 73) had full thickness diaphragmatic resection, and 7 patients (9.5%) had a diaphragm peel/peritonectomy. Table 2 documents the differences in survival and other characteristics between those who underwent diaphragm surgery and those who did not. During the debulking procedures, 27.4% of those undergoing diaphragm surgery had colon resection while 12.3% patients had small bowel resection, compared to 17.1% and 8.6% of those not requiring diaphragm surgery (p

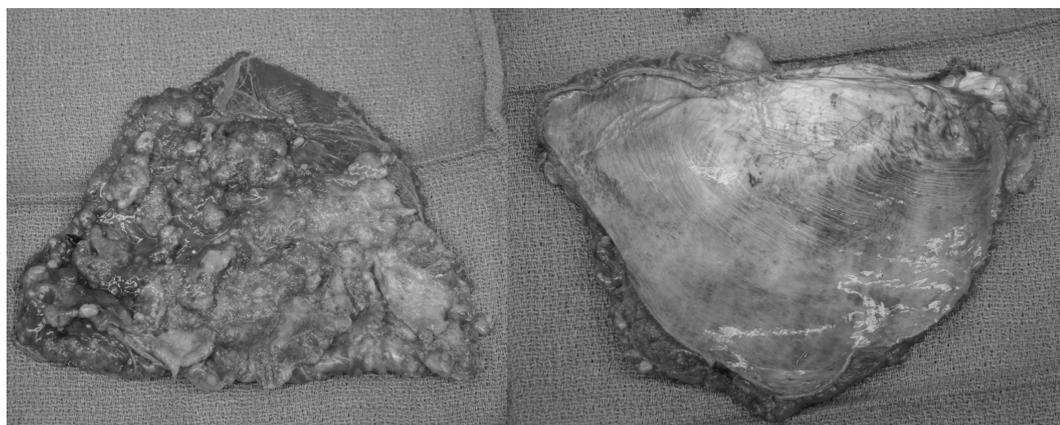


Figure 1. Left side show a 10 cm (maximal diameter) piece of the diaphragm looking at the peritoneal surface. The right side of the figure shows the same piece of resected diaphragm from the pleural surface. The defect was closed primarily with 2-0 polydioxanone suture on a taper needle and a post-operative chest tube was not needed.

Table 1. Demographic characteristics.

	No diaphragm surgery required	Diaphragm surgery required	p value
Age	60	61	0.55
BMI kg/m ²	33	34	0.79
CA 125 IU/ML	709	564	0.65
Prealbumin	15.9	16.2	0.80

Table 2. Correlation with diaphragm surgery.

	No diaphragm surgery required	Diaphragm surgery required	p value
Alive at 50 months	68.6%	71.2%	0.78
Ascites	60.0%	59.0%	0.91
Pre-operative effusion	5.7%	6.8%	0.82
Post-operative effusion	65.7%	68.5%	0.77
Chest drainage required	5.7%	9.6%	0.50
Small bowel resection	8.6%	12.3%	0.89
Colon resection	17.1%	27.4%	0.24

value = 0.24 and 0.89, respectively). All 108 patients (100%) were optimally cytoreduced at the end of the primary surgery. Preoperative effusion was identified in 5 (6.8%) patients while postoperative effusion was diagnosed in 68.5% patients. Forty-three (59%) had ascites preoperatively. Seven (9.6%) patients had drains placed postoperatively for treatment of pleural effusions after diaphragm surgery compared to 5.7% not requiring diaphragm surgery.

4. Discussion

Primary optimal cytoreduction before chemotherapy has been shown to improve survival in patients with advanced ovarian cancer [1]-[3]. The right hemidiaphragm has been shown to be a common site for metastases in the upper abdomen in women with advanced ovarian cancer [6] [7]. Upper diaphragmatic surgery has been described in detail [8]-[13]. It has been shown to be safe and to help improve long-term outcome. This is due to the decreased tumor burden at the end of the case [14]. Remarkably, however, according to a Society of Gynecologic Oncologists' survey, 76% of the gynecologic oncologists queried stated that diaphragmatic disease was a barrier to complete cytoreduction [14]. There is increasing evidence that diaphragmatic surgery can be per-

formed with acceptable morbidity and mortality.

Pleural effusion is one of the most common postoperative complications after diaphragmatic surgery. Liver mobilization alone appears to be a reason for pleural effusion. Other causes include full thickness diaphragmatic resection, diaphragmatic ablation, and peritoneal peel [15] [16]. There is still debate whether to place a chest tube before or during surgery to avoid postoperative complications [17] [18]. Tsolakidis *et al.* stated that patients who had chest tubes placed intraoperatively subjectively felt better due to absence of dyspnea [19]. The tubes remained in place 5 - 10 days after surgery. Regarding the use of chest tube or thoracentesis in their series, only 1 (3%) patient required chest tube (coagulation group) drainage for 19 days and the other 3 patients (9%) underwent thoracentesis. On the contrary, in the group undergoing more extensive diaphragm procedures, 7 (24%) chest tube drains were required for approximately 11 days (5 - 48), 2 of them for severe pneumothorax, and another 5 (16%) patients needed thoracentesis. Although Chereau *et al.* and Cliby both recommended the use of prophylactic chest tube placement, they concluded that this approach still needs further evaluation [8] [19]. The relatively low rate of thoracentesis or pleural effusion drainage (9.5%) concurs with other studies. The rate of pleural effusion is significantly high (40% - 60%) in diaphragmatic surgery patients; however, placing chest tubes on every patient after diaphragmatic surgery would increase the morbidity of the procedure overall. Our study indicates that whether or not a patient undergoes diaphragm surgery, the rate of symptomatic effusion requiring drainage is below 10% (Table 2). Significantly, patients requiring drainage were over a decade older than those who did not require drainage (Table 2).

Seneff *et al.* showed that out of 125 thoracenteses performed, 11% had pneumothorax as a major complication of the procedure while 22% had severe pain as a minor complication [20]. The largest study currently for diaphragmatic surgery (89 patients) by Tsolakidis *et al.* showed that the incidence of pleural effusion was 52.8% and chest tube in only 13% of patients [14]. In his follow-up study, Tsolakidis showed that less extensive procedures were needed for the diaphragm in women undergoing an interval cytoreduction compared to a primary cytoreduction [21].

Although the pleural space is always violated in a full thickness resection of the diaphragm, a persistent pneumothorax is not common. This is due to two reasons. First, it is a common surgical technique to drain the pneumothorax with the patient under positive pressure ventilation as the diaphragm is closed. Second, and probably more importantly, there is normally no violation of the lung parenchyma during a diaphragm resection. Therefore, there is not a persistent air leak into the space once the diaphragm is closed. Hence, this is a reason not to place a chest tube.

Although chest tube placement on patients undergoing diaphragm surgery remains debatable, the literature clearly demonstrates the advantages of complete cytoreduction including diaphragm surgery. With less morbidity associated with diaphragmatic surgery, the authors strongly suggest that all patients undergoing cytoreductive surgery should be evaluated and treated for upper abdominal disease. This is evidenced by over 70% of patients surviving alive with a median follow-up of over 50 months. Diaphragm disease should not be a reason that a patient cannot undergo optimal or complete cytoreduction.

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