J Gynecol Oncol Vol. 21, No. 1:24-28, March 2010 DOI:10.3802/jgo.2010.21.1.24

Original Article

Obesity does not affect the number of retrieved lymph nodes and the rate of intraoperative complications in gynecologic cancers

Mehmet Coskun Salman[1], Alp Usubutun[2], Tulay Ozlu[1], Kubra Boynukalin[1], Kunter Yuce[1]

Departments of [1]Obstetrics and Gynecology, [2]Pathology, Hacettepe University Faculty of Medicine, Ankara, Turkey

Objective: Lymphadenectomy, in general, is a safe and well-tolerated procedure in gynecologic oncology. However, some technical difficulties may be experienced in obese women which may result in inadequate lymphadenectomy and increased complications. The purpose of this study is to retrospectively evaluate the effect of obesity on lymph node counts retrieved and complication rates observed during lymphadenectomy in gynecologic cancers.
Methods: Patients with ovarian, endometrial or cervical cancers treated with initial surgery including bilateral pelvic and paraaortic lymph node dissection were grouped as non-obese and obese. These two groups were compared in terms of the number of retrieved lymph nodes and the rate of intraoperative complications directly related to lymph node dissection.
Results: One hundred twenty-three patients were eligible with a mean age of 55.1 years and mean body mass index of 29.2 kg/m^2. Fifty-nine patients were obese while 64 were non-obese. Lymph node counts obtained in different stations and in total were similar among non-obese and obese patients. Rates of lymphadenectomy-related intraoperative complications including vascular, neural, intestinal, and bladder injury were also similar in non-obese and obese patients.
Conclusion: The obesity does not affect the lymph node counts and intraoperative complication rates adversely in women with gynecologic cancers. Therefore, adequate lymph node dissection should not be omitted based solely upon obesity in gynecologic oncology patients.

Key Words: Obesity, Body mass index, Lymphadenectomy, Lymph node count, Complication, Gynecologic cancer

INTRODUCTION

Gynecologic cancers commonly involve pelvic and paraaortic lymph nodes. Detection of this involvement provides important prognostic information and significantly impacts postoperative treatment decisions.[1,2] At present, the best method available for the detection of nodal involvement is lymph node dissection (LND) with histopathological examination.[3] In general, LND is a safe and well-tolerated surgical procedure.[4-6] Also, failure to perform LND may adversely affect the oncologic prognosis.[7] However, difficulties may sometimes be experienced during LND due to some factors. Among such factors, obesity is a well-recognized one because it may act as a potential impediment to proper surgical therapy.[6,8] This may result from multiple factors. In addition to increased incidence of comorbid medical problems related with complications observed during the postoperative course, obesity also negatively influences the surgical management of gynecologic malignancies due to technical difficulties with exposure which may result in inadequate LND and increased intraoperative complications.[9-13] As a result, obese women are less likely to undergo a LND compared to non-obese women despite its documented benefits in gynecologic cancers.[10,14-16] Nevertheless, it is evident that the necessity of performing an adequate operation is the same for obese women even if their body habitus causes technical difficulties.

The aim of this article was to retrospectively investigate whether body mass index (BMI) or obesity affects the number of lymph nodes retrieved or the frequency of intraoperative complications experienced during LND performed via laparotomy in women with gynecologic cancers.

Received August 23, 2009, Revised December 6, 2009, Accepted December 6, 2009

Correspondence to **Mehmet Coskun Salman**
Department of Obstetrics and Gynecology, Hacettepe University Faculty of Medicine, 06100 Sihhiye, Ankara, Turkey
Tel: 90-312-305-3128, Fax: 90-312-311-6372
E-mail: csalman@hacettepe.edu.tr

MATERIALS AND METHODS

The study group consisted of women with ovarian, endometrial or cervical cancers who were consecutively subjected

to initial surgery including systematic bilateral pelvic and paraaortic LND. The exclusion criteria included patients who had lymph node sampling and those who were subjected to extraperitoneal LND. The surgeries were performed by two co-author gynecologic oncologists at Hacettepe University Hospital between January 2007 and June 2009. Data were retrospectively abstracted from patients' charts and pathology reports.

It is our institutional practice to perform a systematic pelvic and paraaortic LND in all patients with ovarian, endometrial or cervical cancers undergoing initial surgery. Thus, a complete pelvic and paraaortic LND was performed for each patient in study group. In an attempt to standardize the surgical technique, all surgical procedures were performed by the attendance of both or at least one of the co-author gynecologic oncologists. Therefore, all patients in the study group were subjected to similar procedures by means of surgical technique and the operative stages.

All patients underwent laparotomy with midline vertical incision. The LND was carried out after the completion of other surgical procedures. Systematic pelvic and paraaortic LND was performed by skeletonizing vessels and removing lymph nodes with the surrounding fat tissue. Electrocautery and cold scissors were used during LND which began with right pelvic lymphadenectomy followed by left pelvic lymphadenectomy. Paraaortic lymphadenectomy was performed lastly. After completing LND, the retroperitoneum was left open and a sump drain was placed into the pelvis just before the closure of abdomen.

The pelvic LND consisted of external iliac lymphadenectomy followed by obturator lymphadenectomy. In order to retrieve external iliac lymph nodes, the external iliac vessels were skeletonized from its part just beneath the inguinal ligament where it enters the thigh and becomes the femoral artery up to the bifurcation of the common iliac artery. The fat tissue located between the obturator nerve and external iliac vein were collected for obturator LND. The paraaortic lymphatic dissection consisted of removal of the lymphatic pads from the common iliac vessels to inferior mesenteric artery in patients with endometrial or cervical cancer and up to left renal vein in patients with ovarian cancer. Paraaortic LND included both right and left sided nodes.

The intraoperative complications directly related to LND were defined as the visceral injuries occurred during LND itself performed by the primary surgeon or the injuries occurred during the retractions performed by the other attending surgeons to improve retroperitoneal field of view for the primary surgeon. These complications included vascular, neural, intestinal and bladder injuries.

The preoperative weight and height of patients were used to calculate the BMI by dividing the weight in kilogram (kg) by the square of the height in meter (m). Patients were categorized according to their BMI as non-obese (BMI <30.0 kg/m^2) and obese (BMI ≥ 30.0 kg/m^2) in consistence with the recommendations of World Health Organization.[17]

Pathological examination was performed by the co-author pathologist on formalin fixed specimens. For each nodal station, single lymph nodes were identified by palpation, isolated from surrounding fat tissue and counted. Lymph nodes were embedded in paraffin and 5 μm thick sections were obtained and stained with hematoxylin-eosin. In the final pathology reports, the lymph node counts were reported both in total and separately as obturator and external iliac lymph nodes at left and right sides, and paraaortic lymph nodes.

The lymph node counts obtained in different stations and in total as well as intraoperative complications directly related with LND were compared among groups. The statistical software SPSS ver. 11.5 (SPSS Inc., Chicago, IL, USA) was used to perform the statistical analyses. Independent samples t-test was used to compare the results between groups, and chi-square test or Fisher's exact test was used to compare the complication rates observed among patients in different BMI categories. The results were considered statistically significant if p-value was <0.05.

RESULTS

One hundred twenty-three women with gynecologic cancers were eligible. Of them, 61 (49.6%) had ovarian cancer, 48 (39.0%) had endometrial cancer, and 14 (11.4%) had cervical cancer. Mean age of the patients was 55.1±14.2 years (range, 15 to 80 years). Mean BMI was 29.2±4.9 kg/m^2 (range, 20.2 to 39.7 kg/m^2). Basic characteristics of patients are shown in Table 1.

According to preoperative BMIs, 64 patients (52.0%) were classified as non-obese and 59 (48.0%) as obese. 64.6% of patients with endometrial cancer were obese while the rates of obesity were 41.0% and 21.4% in patients with ovarian and cervical cancer, respectively. Mean number of lymph nodes retrieved in obese and non-obese groups is shown in Table 2. The lymph node counts obtained in different stations and in total were all similar among non-obese and obese patients. However, only a marginal significance in favor of non-obese group was detected in total paraaortic lymph node counts be-

Table 1. Characteristics of patients

Characteristics	Non-obese (N=64)	Obese (N=59)	Total (N=123)
Age, yr	51.0±16.1 (15-76)	59.6±10.2 (32-80)	55.1±14.2 (15-80)
Weight, kg	63.5±7.8 (48-83)	81.5±7.3 (70-99)	72.1±11.8 (48-99)
Height, m	1.58±0.07 (1.43-1.75)	1.56±0.06 (1.42-1.70)	1.57±0.06 (1.42-1.75)
BMI, kg/m^2	25.3±2.6 (20.2-29.9)	33.5±2.6 (30.0-39.7)	29.2±4.9 (20.2-39.7)

Values are presented as mean±SD (range).

Table 2. The number of lymph nodes retrieved in non-obese and obese patients

Lymph node station	Number of lymph nodes		p-value*
	Non-obese (N=64)	Obese (N=59)	
Right external iliac	7.4±4.0 (2-18)	8.0±4.6 (2-26)	0.43
Right obturator	5.5±3.8 (1-22)	6.0 ± 2.7 (1-12)	0.39
Right pelvic	12.9±6.3 (4-38)	13.9±5.7 (4-38)	0.37
Left external iliac	7.8±3.7 (2-18)	8.3±4.2 (3-23)	0.46
Left obturator	6.9±4.1 (1-19)	7.5±6.0 (1-35)	0.50
Left pelvic	14.6±5.9 (4-34)	15.8±8.8 (4-51)	0.40
Total pelvic	28.1±11.1 (11-72)	30.7±13.5 (9-89)	0.24
Paraaortic	10.4±6.8 (2-38)	8.4±4.3 (2-18)	0.06
Total pelvic-paraaortic	38.8±15.8 (14-98)	38.7±14.0 (11-93)	0.95

Values are presented as mean±SD (range).
*Independent samples t-test was used to compare the results between groups.

tween groups (10.4±6.8 vs. 8.4±4.3 lymph nodes in non-obese and obese patients, respectively, p=0.06).

Any form of intraoperative complications resulting directly from LND was observed in 12 patients (9.8%) including vascular injury in 9 patients, neural injury in 1, small intestinal injury in 1, and bladder injury in another. In study group, deaths directly attributed to LND were not observed. All injuries were managed by the gynecologic oncologists without any need to assistance of surgeons from related disciplines.

Vascular injuries included inferior vena cava perforation in 5 women, left common iliac vein perforation in 3, and inferior vena cava with left common iliac vein perforation in 1. All vascular injuries were milimetric in dimension. They all occurred during paraaortic LND and were subjected to primary repair using 5.0 polypropylene sutures while pressing on both sides of the injury using sponge sticks. None of the patients required transfusions due to these vascular injuries.

Neural injury consisting of right obturator nerve transection with electrocautery was experienced during right obturator LND. The nerve edges were re-approximated end-to-end using 6.0 polypropylene sutures. Postoperatively, the patient experienced painless numbness of the right thigh with slight difficulty in adduction although she was ambulating without assistance. Physical therapy was initiated during the hospitalization period and continued after discharge from hospital. Nine months postoperatively, the patient reported minimal motor deficit with occasional, transient numbness in her left leg without adversely affecting her daily activities.

Table 3. Intraoperative complications related solely to lymphadenectomy in non-obese and obese patients

Type of intraoperative complications	Observed complications		p-value*
	Non-obese (N=64)	Obese (N=59)	
Vascular injury	3 (4.7)	6 (10.2)	0.24
Neural injury	1 (1.6)	0 (0)	1.00
Intestinal injury	0 (0)	1 (1.7)	0.48
Bladder injury	1 (1.6)	0 (0)	1.00
Any complications	5 (7.8)	7 (11.9)	0.45

Values are presented as number (%).
* Chi-square test or Fisher's exact test was used to compare the results between groups.

Small intestinal injury occurred during retraction for paraaortic LND. The injury involved the full thickness of jejunal wall and was approximately 1 cm in length. It was managed with primary repair using 3.0 polyglactin sutures and the patient was not given orally for 5 days postoperatively. Total parenteral nutrition was used during this period. Thereafter, oral intake was initiated and was increased gradually without any signs or symptoms of intolerance.

Injury to urinary bladder resulted from retraction during right obturator LND. It involved the dome of bladder and was repaired primarily using 3.0 polyglactin sutures. Foley catheter was kept in place for 7 days on postoperative period to allow healing process without distention.

Intraoperative complication rates resulting solely from lymph node dissection were similar in non-obese and obese patients (7.8% and 11.9%, respectively, p=0.45). When visceral injuries were evaluated separately as vascular, neural, intestinal, and bladder injuries, they were seen in similar rates in these two groups (Table 3).

DISCUSSION

Obesity, defined as an excess of adipose tissue and quantified by body mass index, is a major public health problem with gradually increasing prevalence in many countries.[9,17] It is associated with a greater incidence of medical conditions including severe cardiovascular and pulmonary diseases. Even if these co-morbid problems rarely render the patient inoperable, they may complicate the postoperative course in patients who were subjected to surgical approach. Furthermore, obesity may cause technical difficulties due to limited exposure during surgery which may consequently lead to less extensive surgical interventions or higher incidence of intraoperative complications.[9-11]

Obesity appears to be especially important in gynecologic oncology because surgery is considered the cornerstone in the treatment of various gynecologic malignancies.[12] Several attempts were performed to minimize the adverse effects of

obesity on surgical management in women with gynecologic cancers. These include modifications in surgical incision, panniculectomy, and use of self-retaining retractors and instruments of adequate length.[18,19] All these surgical adaptations actually aim to perform an adequate surgery. In gynecologic oncology, the adequacy of surgery is usually determined by the number of lymph nodes retrieved, the negativity of surgical margins, and finally the survival of patients.[12] Among them, the number of lymph nodes retrieved is considered to be an objective measure of the thoroughness and radicalness of the surgery.[20] Also, the extent of LND is directly associated with oncological prognosis since a more extensive lymph node resection was shown to be associated with an improved survival in patients with endometrial, ovarian, and cervical cancers.[14-16] The potential benefits of extensive LND by means of survival may be explained by several mechanisms. First of all, the probability of finding a lymph node metastasis is significantly higher when more lymph nodes are removed. Also, micrometastatic nodal disease is removed by a more extensive LND. The undetected micrometastatic nodal disease may worsen prognosis because it may be missed during routine hematoxylin-eosin analyses and it may be resistant to adjuvant therapies. Furthermore, LND significantly impacts postoperative treatment decisions in clinically early stage disease due to upstaging solely resulting from lymph node involvement.[2,7,14,21-26] Therefore, the surgeon should make an effort to retrieve as many lymph nodes as possible even in obese patients. Unfortunately, obese women were less likely to undergo a surgical assessment of their lymph nodes than non-obese women in the past.[10] In fact, it was later demonstrated that the ability to perform adequate LND was not significantly impaired in most morbidly obese patients and median lymph node yields were similar between ideal body weight and morbidly obese patients.[6] This was also confirmed even when pelvic and paraaortic yields were examined separately.[8] In our study population, the mean number of lymph nodes removed was not affected by the BMI of patients and similar lymph node counts could be achieved in total and separately in different stations when patients were classified as non-obese and obese.

On the other hand, the safety of the surgery is even more important than its adequacy in most instances. The surgical intervention should not expose the patient to increased rates of intraoperative complications while the surgeon is making efforts to perform a more extensive LND. Because the lymph nodes are located adjacent to important structures including great vessels and nerves, some injuries may be seen during LND. Some viscera may also be injured due to retractions performed to aid LND. Such injuries could be expected to occur more often in obese patients due to limited exposure of surgical field. Fortunately, LND itself or comprehensive surgical staging including LND was shown to be performed safely in obese patients without any difference in intraoperative complication rates.[6,26] This was also confirmed in our study where the intraoperative complication rates were similar in patients with different BMI categories. Most of the complications observed in our study group were vascular injuries, especially the venous injuries which occurred during paraaortic LND. However, none of them required transfusion and all were repaired primarily by the gynecologic oncologist. Among other three intraoperative injuries, injuries of urinary bladder and jejunum occurred due to retractions performed by attending surgeons via Deaver retractors and obturator nerve transection was experienced inadvertently with electrocautery during a right obturator LND.

There are some limitations of this study. First, it was designed retrospectively and investigated specifically and solely the numbers of lymph nodes retrieved and the rates of intraoperative complications experienced. It involved relatively low number of patients and the patients had different types of gynecologic malignancies. Also, none of the patients were morbidly obese. However, all lymphadenectomies were performed by the same team using the same surgical technique in a single institution to avoid the possible effects of different surgical techniques on lymph node yield and complication rates. In addition, the lymph node stations were described in detail and the number of lymph nodes was determined by the same pathologist. Therefore, the study may document that BMI is not the only factor that determines the adequacy and safety of the operation in terms of lymph node yield and intraoperative complications in women with gynecologic cancers.

Several variables other than BMI and obesity may definitely affect the number of retrieved lymph nodes in women with gynecologic cancers. These variables include but are not limited to the age and performance status of the patient, the type and the stage of the malignancy. Also, major surgical outcomes such as operation time and amount of intraoperative blood loss as well as intraoperative and postoperative complications may differ in patients with different BMIs as clearly shown in some other studies.[8,11-13] Nevertheless, current study was not designed in an attempt to investigate those issues.

In conclusion, the obesity per se should not be considered as a factor that forces the gynecologic oncologist to perform a more conservative surgery due to technical difficulties. Given the benefits of an extensive or adequate LND and in order to prevent undertreatment, the procedure should not be omitted based upon obesity alone. The obese women with endometrial, ovarian or cervical cancer may safely undergo staging or debulking surgery including extensive LND via laparotomy without significantly increasing the rates of intraoperative complications.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Zivanovic O, Sheinfeld J, Abu-Rustum NR. Retroperitoneal lymph node dissection (RPLND). Gynecol Oncol 2008; 111(2 Suppl): S66-9.
2. Ben-Shachar I, Pavelka J, Cohn DE, Copeland LJ, Ramirez N, Manolitsas T, et al. Surgical staging for patients presenting with grade 1 endometrial carcinoma. Obstet Gynecol 2005; 105: 487-93.
3. Goff BA, Muntz HG, Paley PJ, Tamimi HK, Koh WJ, Greer BE. Impact of surgical staging in women with locally advanced cervical cancer. Gynecol Oncol 1999; 74: 436-42.
4. Larson DM, Johnson K, Olson KA. Pelvic and para-aortic lymphadenectomy for surgical staging of endometrial cancer: morbidity and mortality. Obstet Gynecol 1992; 79: 998-1001.
5. Homesley HD, Kadar N, Barrett RJ, Lentz SS. Selective pelvic and periaortic lymphadenectomy does not increase morbidity in surgical staging of endometrial carcinoma. Am J Obstet Gynecol 1992; 167: 1225-30.
6. Everett E, Tamimi H, Greer B, Swisher E, Paley P, Mandel L, et al. The effect of body mass index on clinical/pathologic features, surgical morbidity, and outcome in patients with endometrial cancer. Gynecol Oncol 2003; 90: 150-7.
7. Kilgore LC, Partridge EE, Alvarez RD, Austin JM, Shingleton HM, Noojin F 3rd, et al. Adenocarcinoma of the endometrium: survival comparisons of patients with and without pelvic node sampling. Gynecol Oncol 1995; 56: 29-33.
8. Pavelka JC, Ben-Shachar I, Fowler JM, Ramirez NC, Copeland LJ, Eaton LA, et al. Morbid obesity and endometrial cancer: surgical, clinical, and pathologic outcomes in surgically managed patients. Gynecol Oncol 2004; 95: 588-92.
9. Executive summary of the clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. Arch Intern Med 1998; 158: 1855-67.
10. Anderson B, Connor JP, Andrews JI, Davis CS, Buller RE, Sorosky JI, et al. Obesity and prognosis in endometrial cancer. Am J Obstet Gynecol 1996; 174: 1171-8.
11. Soisson AP, Soper JT, Berchuck A, Dodge R, Clarke-Pearson D. Radical hysterectomy in obese women. Obstet Gynecol 1992; 80: 940-3.
12. Papadia A, Ragni N, Salom EM. The impact of obesity on surgery in gynecological oncology: a review. Int J Gynecol Cancer 2006; 16: 944-52.
13. Erkanli S, Kayaselcuk F, Bagis T, Kuscu E. Impact of morbid obesity in surgical management of endometrial cancer: surgical morbidity, clinical and pathological aspects. Eur J Gynaecol Oncol 2006; 27: 401-4.
14. Chan JK, Cheung MK, Huh WK, Osann K, Husain A, Teng NN, et al. Therapeutic role of lymph node resection in endometrioid corpus cancer: a study of 12,333 patients. Cancer 2006; 107: 1823-30.
15. Chan JK, Urban R, Hu JM, Shin JY, Husain A, Teng NN, et al. The potential therapeutic role of lymph node resection in epithelial ovarian cancer: a study of 13918 patients. Br J Cancer 2007; 96: 1817-22.
16. Leblanc E, Narducci F, Frumovitz M, Lesoin A, Castelain B, Baranzelli MC, et al. Therapeutic value of pretherapeutic extraperitoneal laparoscopic staging of locally advanced cervical carcinoma. Gynecol Oncol 2007; 105: 304-11.
17. World Health Organization. Obesity: preventing and managing the global epidemic: report of a WHO consultation. Geneva: World Health Organization; 1998.
18. Gal D. A supraumbilical incision for gynecologic neoplasms in the morbidly obese patient. J Am Coll Surg 1994; 179: 18-20.
19. Kohorn EI. Panniculectomy as an integral part of pelvic operation is an underutilized technique in patients with morbid obesity. J Am Coll Surg 1995; 180: 279-85.
20. Panici PB, Scambia G, Baiocchi G, Matonti G, Capelli A, Mancuso S. Anatomical study of para-aortic and pelvic lymph nodes in gynecologic malignancies. Obstet Gynecol 1992; 79: 498-502.
21. Lentz SE, Muderspach LI, Felix JC, Ye W, Groshen S, Amezcua CA. Identification of micrometastases in histologically negative lymph nodes of early-stage cervical cancer patients. Obstet Gynecol 2004; 103: 1204-10.
22. Chan JK, Munro EG, Cheung MK, Husain A, Teng NN, Berek JS, et al. Association of lymphadenectomy and survival in stage I ovarian cancer patients. Obstet Gynecol 2007; 109: 12-9.
23. Girardi F, Petru E, Heydarfadai M, Haas J, Winter R. Pelvic lymphadenectomy in the surgical treatment of endometrial cancer. Gynecol Oncol 1993; 49: 177-80.
24. Carnino F, Fuda G, Ciccone G, Iskra L, Guercio E, Dadone D, et al. Significance of lymph node sampling in epithelial carcinoma of the ovary. Gynecol Oncol 1997; 65: 467-72.
25. Burghardt E, Winter R. The effect of chemotherapy on lymph node metastases in ovarian cancer. Baillieres Clin Obstet Gynaecol 1989; 3: 167-71.
26. Baiocchi G, Grosso G, di Re E, Fontanelli R, Raspagliesi F, di Re F. Systematic pelvic and paraaortic lymphadenectomy at second-look laparotomy for ovarian cancer. Gynecol Oncol 1998; 69: 151-6.