Original Article
Laparoscopic inguinal lymphadenectomy: a new minimally invasive technique to treat vulva carcinoma

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Abstract: Purpose: At present, there are no clear guidelines for the treatment of the patients with vulva carcinoma. The aim of this study was to examine our experience with laparoscopic inguinal lymphadenectomy in women with vulva cancer. Methods: From November 2010 to December 2013, 15 patients with vulvar carcinoma underwent laparoscopic inguinal lymphadenectomy following radical local vulvectomy or, pelvic lymphadenectomy if necessary. Results: All patients underwent abdominal endoscopic inguinal lymphadenectomy. The median age was 50.7 years (range 31-73) and the mean weight was 45.7 kg (range 39.5-63). Mean operative time was 91 minutes (range 80-130) with amedian estimated blood loss of approximately 6.3 mL (range 5-10), and the mean number of harvested lymph nodes was 7.4. Mean time of the drainage tube removal was 6.7 days. At the follow up of 4-41 months, 4 patients exhibited inguinal lymph nodes metastases, 1 women with diabetes mellitus demonstrated vulvar wound infection, necrosis and dehiscence but without wound dehiscence in inguinal region. No skin necrosis was observed in inguinal region for all patients. Conclusion: The preliminary results reveal that radical vulvectomy combined with laparoscopic inguinal lymphadenectomy is a safe and feasible technique that appears to diminish the wound-related complications and sequelae in patients with vulvar carcinoma.

Keywords: Laparoscopic inguinal lymphadenectomy, vulvar carcinoma, radical vulvectomy, inguinal lymph nodes

Introduction

Vulva primary malignant tumors account for 2%-5% of all gynecologic cancer and approximately 3.5% of female genital tumor. 90% of vulvar carcinoma is squamous cell carcinoma and usually happens after menopause [1]. Currently, the inguinal lymph nodes of patients are the common sites with metastatic lesion, the surgical approach remains the first choice for treatment of invasive vulvar carcinoma. The inguinal lymphadenectomy is necessary.

However, the conventional method of inguinal lymphadenectomy still remains many defects, such as the large soft-tissue defects. On the other hand, the method is also associated with lymphatic and wound-related complications, such as long incision, delay healing of incision, and the incidence is more than 50%. In order to reduce postoperative complications, some researchers have developed the approach in the endoscopic excision of inguinal lymph nodes which significantly reduced the inci-

dence of postoperative groin wound necrosis and infection. Therefore, we have carried out radical local vulvectomy combined with laparoscopic inguinal lymphadenectomy to treat vulvar carcinoma with satisfactory curative effect.

Material and methods

Demographic and clinicopathologic data for patients

From November 2010 to December 2013, 15 patients with vulvar carcinoma underwent radical local vulvectomy and laparoscopic inguinal lymphadenectomy, and pelvic lymphadenectomy if necessary at the department of Gynecology at Guangxi Tumor Hospital. The patients' data were collected from the patient file. The mean age was 50.7 years (range 31-73) and the mean weight was 45.7 kg (range 39.5-63) (**Table 1**).

Before surgery, vulvar carcinoma was confirmed via biopsy. According to the Federation of

Table 1. Demographic and clinicopathologic data of 15 patients

Variable	Value
Mean age (range), yr	50.7 (31-73)
Mean weight (range), kg	45.7 (39.5-63)
Pathological type	
Squamous cell carcinoma	14
Sarcoma	1
FIGO stage	
Ib	8
II	5
III	2
Tumor growth area	
Labia	12
Clitoris	2
Monsveneris	1
Complications	
Diabetes	1

Gynecology and Obstetrics (FIGO 2000) classification, primary vulvar cancer stage Ib (n=8), stage II (n=5), stage III (n=2). Of 15 patients, squamous cell carcinoma (n=14), sarcoma (n=1), and 1 had diabetes mellitus. The demographic and clinicopathologic data were given in **Table 1**.

Laparoscopic bilateral inguinal lymph nodes dissection

First, the study was approved by the Institutional Review Boards of the Hospitals. Medical ethics committee of Tumor Hospital Affiliated to Guangxi Medical University had granted permission. Written informed consent was obtained from all the participants in this study.

At the beginning of surgery, the patient was placed in the lithotomic position, and the camera was on the contralateral side of the surgeon.

Below the umbilicus region, first we made one 1 cm incision, and made three additional 5 mm incisions, one at the middle point between the umbilicus and public symphysis , the other two at McBurney's point. One trocar was inserted through umbilical region incision and passed subcutaneous tissue plane, and blunt dissection was performed to separate it. The objective was to create subcutaneous space. This space was then expanded with carbon dioxide insufflation at a pressure of 15 mmHg. Laparo-scope was inserted, and one trocar and operating equipment was introduced into the working space through a 5 mm incision. After the working space was created, the insufflation pressure was reduced to 5 mmHg to prevent widespread subcutaneous emphysema.

Dissection and separation of Camper's fascia and fascia of the oblique externus the muscle of abdominis were performed by using the Harmonic scalpel to expose inguinal ligament, and medial and lateral boundaries were public tubercle and anterior superior iliac spine, respectively. Subsequently, the dissection proceeded downward to expose the inguinal triangle. Peripheral adipose tissue and the superficial lymph nodes were dissected from the top down to the inguinal ligament.

Dissection was carried up to approximately 3 cm beneath the public tubercle, beginning at the surface and running closely along the fasica lata under inguinal ligament. At this point, saphenous vein was exposed, and then the surgeon continued to dissect and separate the tissue of the respective left and right sides of saphenous vein to expose the adductor longus muscle and the sartorius muscle. At the moment, femoral triangle was fully exposed. The borders of femoral triangle were the sartorius muscle laterally, the adductor longus muscle medially, and the inguinal ligament.

We dissected carefully inguinal ligament to expose the oval foramen and tributary veins. All tributary veins were then dissected including the superficial epigastric, superficial iliac circumflex, superficial medial femoral vein, superficial lateral femoral vein and superficial external pudendal veins, reserving them as much as possible. All of the lymph nodes and adipose tissue around the saphenous vein and the oval foramen were removed until the apex of the femoral triangle. The skeleton saphenous vein was reserved. Femoral vascular sheath was isolated through saphenous vein to expose the border of saphenous vein and femoral vein. Lymph nodes of the medial side of femoral vein above and below the border were resected. The specimen was removed through umbilical region incision. The resection of lymph nodes was performed approximately 3 cm above the inguinal ligament, down to the vertex of the femoral triangle, medial to adductor midline, and lateral to sartorius muscle midline. Subcutaneous fat thickness of about 0.5-1.0 cm was reserved.
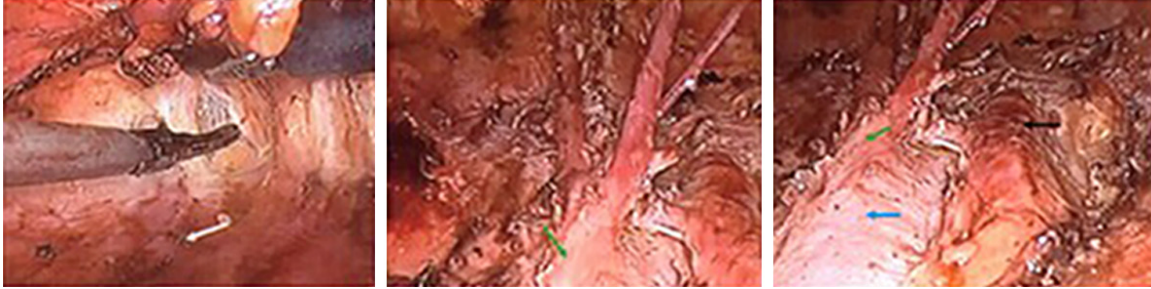
Figure 1. Laparoscopic view of bilateral groin area and pelvic lymph nodes. White arrow: Fascia of the oblique externus abdominis muscle; Dark green arrow: great saphenous vein; Black arrow: Arteria femoralis; Blue arrow: Femoral vein.

Table 2. Operative data for patients

Variables	Value
Operative time, mean (range, min)	91 (80-130)
Operative blood loss, median (range, ml)	6.3 (5-10)
Average removal node count	
Left side	7.4 (6-10)
Right side	7.4 (3-11)
Patients with node metastasis count	2
Drainage tube removal time, median (range, d)	6.7 (6-8)
Complications	
The groin skin necrosis (No.)	0
Infection	2 (13.33%)
Cellulitis	1 (6.67%)
Lymphatic fistula	0

The wound was flushed by physiological saline. Drains were placed at the lowest position of femoral triangle. The surgical incisions were closed and were oppressed with saline soft bags immediately after the surgical procedure. The contralateral incision was performed in the same way (**Figure 1**).

Laparoscopic pelvic lymphadenectomy

Carbon dioxide was infused through the infra-umbilical incision, and pneumoperitoneum was established at a pressure of 12-14 mmHg. Patients with inguinal lymph node metastasis underwent laparoscopic pelvic lymphadenectomy. The resection of lymph nodes was performed, down to deep iliac circumflex vein, lateral to psoas major midline, medial to lateral ureter, deep to nervus obturatorius.

According to the conventional vulvar carcinoma procedure, standard radical vulvectomy was performed. The compression bandage was applied immediately after the surgical proce-

dure, and then a drainage tube was inserted. The drainage tube should be unobstructed.

Results

A total of 15 patient were performed between 2010 and 2013. The patients characteristics are given in **Table 1**. The mean operative time for the unilateral laparoscopic inguinal lymphadenectomy was 91 minutes (80-130 minutes). The average estimated blood loss was approximately 6.3 mL (5-10 mL). The average lymph node yield was 7.4. The mean time of the drainage tube removal was 6.7 days.

Of the 15 patients, 4 patients exhibited inguinal metastases, 1 patient who was with diabetes mellitus, demonstrated vulvar wound necrosis, lymphedema and wound infections in inguinal region, and 1 patient was unable to suture after removal of lesions, because lesions were in monsveneris, and then lesions were reconstructed with medial thigh flap. The vulvar and inguinal region occurred with cellulitis, but without wound dehiscence. No skin necrosis and lymphatic fistula were observed in inguinal region for all patients. **Table 2** describes the operative details.

All patients were followed up for 4-41 months. 7 patients (50%) developed lightly lymphoedema of the legs. After having a rest, the physical status was improved. No patient needed stretch hosiery to relieve symptoms. 4 patients (27%) with inguinal lymph node metastasis received adjuvant radiotherapy. The 4 patients were followed up, with no recurrence of cancer and metastasis. 1 patient suffered from vulvar

carcinoma recurrence, who did not obey doctor's advice to undergo adjuvant chemotherapy.

Discussion

Currently, the conventional surgical procedure for vulva cancer includes radical vulvectomy, bilateral inguinal lymphadenectomy and pelvic lymphadenectomy if it is necessary for some special parts. This procedure is widely applied in different stage, different histological types of vulvar cancer. Although classic open inguinal lymphadenectomy is routinely performed, this procedure is still associated with a complications rate as high as 50%. The postoperative complications such as inguinal wound infection, flap necrosis and lymphatic fistula may influence postoperative recovery and subsequent treatment of patients. Up to now, there is no effective approach to prevent the occurrence of complications. These complications will compromise therapeutic efficacy of treatment of invasive vulvar cancer.

On account of high complications rate of open conventional inguinal lymphadenectomy, some alternatives were proposed to decrease complications. With the development of endoscopic technique, eseveralinvestigators have performed VEIL to treat vulvar cancer. The VEIL technique is a new minimally invasive approach for inguinal lymphadenectomy which allows the radical removal of inguinal lymph nodes at the same dissection template as open inguinal lymphadenectomy [2, 3]. Preliminary results suggest that this technique can reduce surgical morbidity and enhance the quality of life in patients. The advantages of this procedure were as follows: lower postoperative morbidity, shorter hospital stay, less time for recovery, less postoperative pain and better cosmetic appearance. Furthermore, preservation of the saphenous vein will relieve edema of the legs. Currently, carcinoma of penile squamous cell and melanoma were treated using VEIL, and results demonstrated with decreased complications [4-6]. The VEIL surgical procedure can be used as the treatment for vulvar cancer.

Tobias-Machado et al. recruited 15 patients with penile squamous cell carcinoma into two groups [6]. Of these, 10 patients were performed standard lymphadenectomy in one limb and VEIL on the contralateral side, and 5

patients were performed VEIL on both sides. The incidence of complications related to VEIL was 20% vs. 70% for open surgery. With VEIL the frequency of skin related complications was 0%, while with the conventional technique the frequency was 50%. There was a statistically significant difference between them. Mean hospital stay was 24 hours for patients who underwent bilateral VEIL, which was significantly shorter than it for patients who underwent an open dissection in addition to contralateral VEIL. The results demonstrated that VEIL may decrease postoperative morbidity and shorten hospital stay without compromising oncological control. Sotelo et al. performed endoscopic lymphadenectomy for eight patients with penile carcinoma. No wound-related complications were seen in the study [5]. In Master's research, 25 groin dissections were undertaken in 16 patients. The incidence of cellulitis was 8% (2/25). None of the patients developed a wound dehiscence and local wound care was needless [8]. Keith A. et al. selected 32 patients with inguinal metastases from varied malignancies to perform VEIL [9]. Wound complications were observed in 8 cases (18%). Of the 8 patients, 6 patients suffered from cellulitis without any wound dehiscence, 1 patient suffered from hematoma and 1 patient with diabetes developed mild skin flap necrosis, which was healed by minimal local care. 18 patients developed lymphedema, but only 2 of them (11%) needed stretch hosiery.

In our research, 1 patient with diabetes developed wound infection and inguinal region inflammation (without wound dehiscence). The skin of inguinal region healed well after blood glucose controlling, anti-infection treatment and effective care. 1 patient whose lesions were at monsveneris accepted reconstruction with medial thigh flap. The vulvar and inguinal region occurred with cellulitis, but without wound dehiscence. The incisions healed well after anti-infection treatment. None of the rest occurred cutaneous complications such as wound infection, wound dehiscence and lymphatic fistula. The rate of postoperative complications related to skin was 20% and the rate of cellulitis was 10% which was significantly lower that associated with conventional technique. The results of contemporary researches about the application of VEIL for inguinal lymphadenectomy are inspiring for surgeons with poten-

tial to decrease postoperative complications. These results suggest feasibility of VEIL for vular cancer.

VEIL surgical procedure is performed in small working space. VEIL should only be performed by surgeons with expertise in laparoscopic techniques and familiarity with open inguinal lymphadenectomy. In the literature VEIL was performed in patients with penile squamous cell carcinoma or melanoma and all the incisions were located in lower limbs [6, 9]. A 2 cm incision was made 2 cm distal to the lower vertex of the femoral triangle. The other two incisions were located in 6 cm laterally and 6 cm medially to the femoral triangle vertex respectively. Nevertheless, the incision locations may result in movement disorder of lower limbs.

In our research, we designed a novel abdominal approach. The trocars were placed in the inferior abdominal wall to initially resect the superficial inguinal lymph nodes, and subsequently the deep inguinal and pelvic nodes through the original incision when necessary. The puncture was located in inferior abdominal wall of the novel approach, which reduced the rate of lower limbs movement disorder. The approach signifies less surgical trauma and shorter operation time because it allows surgeons resect the inguinal and pelvic lymph nodes at the same time.

Lymph nodes in the groin area comprise inguinal lymph node and femoral lymph node. Both of them should be removed, otherwise it is easy to be recurrent. Deep lymph nodes are medial to the femoral vein. The border of saphenous vein and femoral vein was exposed intraoperatively. Lymph nodes of the femoral vein medialis above and below the border were resected. We did not need to resect cribriform fascia. Separation of arteria femoralis and the upper lateral or stripping beyond the inferior margin oval foramen was needless. Therefore, the surgery did not result in much tissue damage for patients. We should pay attention to electrocautery and ligature during the operation, especially numerous lymphatic vessels around the great saphenous vein, which will lead to lymphatic fistula after fracture. For the sake of safety, drainage tube was removed when drainage volume was less than 20 mL per day. Mean time of the drainage tube removal was 6.7 days, which was shorter than correlational studies. If the drainage volume was less than 20 mL/d three days after surgery, solution with bleomycin 15 mg and normal saline 3 ml was infused into drainage tube. Drainage tube was closed for 2-3 hours, and then opened it. Bleomycin and normal saline was infused again after 1 week if necessary. Our observation implied the method was valid. It showed us short time of tube removal, less time for recovery and lack of lymphatic fistula. Therefore, we consider it a new method which is worthy to be recommended.

Tobias-Machado et al. demonstrated that there was no local or systemic recurrence observed for patients who underwent VEIL during a mean follow-up 31.93 months [6]. 31.93 months were not yet long enough to confirm excellent oncologic results and to exclude the aerosol phenomenon related to CO_2 in malignant cells. In a follow-up of 4-41 months for postoperative patients in this study, no recurrence or metastasis is observed. The recent effect is still encouraging. And the results in the present report suggest that intraoperative and postoperative measures can decrease complication rates. However, because of short follow-up time and less sample size, long-term outcomes are not yet confirmed. A long follow-up period and larger sample are involved in this study to observe the incidence of complications and confirm the efficacy of VEIL. However, debate continues as to VEIL technique. For example, can VEIL be applied to dissection of palpable lymph nodes? Will the VEIL technique increase the risk of cancer metastasis potentially after dissection of metastasized lymph nodes? These problems may be solved by long period and larger sample cohort study.

VEIL makes surgical incision away from inguinal folds and shortens surgical incision, with no need for conventional sartorius muscle conversion. VEIL decreases the postoperative incidence of complications in comparison with conventional open technique, enhances the survival quality and reduces the postoperative complications. According to some studies and our surgical operation cases analysis, we conclude that VEIL is a safe and feasible technique. However, there are still some problems remain to be solved for VEIL now. Randomized and prospective clinical trial should be initiated to compare VEIL and open technique.

Disclosure of conflict of interest

None.

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