The Assessment of Unilateral Uterine Artery Ligation in Radical Abdominal Trachelectomy with Three-dimensional Power Doppler Ultrasonography

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SUMMARY

The conservation of uterine arteries during radical trachelectomy has led to considerable debate among gynecologic oncologists. Some authors have reported successful case studies of the ligation of bilateral uterine arteries, but other authors remain unconvinced of the artery ligation procedure. We report a case that employed three-dimensional power Doppler ultrasonography (3D-PDUS) to assess the microvascular pattern of uterine blood circulation after the ligation of a unilateral uterine artery during radical abdominal trachelectomy. The assessment of the uterine vascular circulation via the 3D-PDUS revealed no significant differences in the vascular blood supply of bilateral uterine arteries 4 months postoperatively. [International Journal of Gerontology 2008; 2(1): 22–25]

Key Words: radical abdominal trachelectomy, three-dimensional power Doppler ultrasonography, uterine artery ligation

Introduction

Despite advances in screening, cervical cancer is among the most common malignancy in women worldwide. Early cervical carcinoma is treated conventionally by surgical or radiation therapy. However, these approaches often result in barrenness, which is an important concern for young female patients who desire to retain fertility. The current literature confirms many clinical case studies of pregnancies among patients recovering from early-stage cervical cancer¹–⁴. Among these case studies, the therapeutic method advocated by Dargent et al.¹, which involves laparoscopic radical vaginal trachelectomy (RVT) with pelvic lymphadenectomy (PL), is the most well-known procedure. Another important method was described by Smith et al.⁵, who employed radical abdominal trachelectomy (RAT) with the conservation of the uterus and the associated bilateral uterine arteries. The method of RAT not only is familiar to most gynecologic oncologists, but also renders several benefits, including wider parametrial resection and possible lower intraoperative complication rates than RVT. Nevertheless, the identification of both uterine arteries during surgery is difficult and time-consuming. Alternatively, a simpler procedure that ligates bilateral uterine arteries may achieve similar surgical outcome⁶. Here, we present a case of early-stage cervical cancer,
Unilateral Uterine Artery Ligation Assessment with 3D-PDUS

Case Report

The patient was a 36-year-old female, gravida 2, para 0, who was still menstruating. The past medical history was unremarkable. Routine Papanicolaou screening revealed a high-grade squamous intraepithelial lesion. A cold knife conization was performed, and the surgical specimen was examined microscopically. The pathologic findings were consistent with a diagnosis of microinvasive squamous cell carcinoma, which had a measured invasion of more than 3 mm and a horizontal spread of less than 7 mm. Preoperative evaluations with magnetic resonance imaging and computed tomography of the abdomen showed that the lesion was confined to the cervical region without radiographic evidence of parametrial invasion and grossly enlarged lymph nodes. The cervical cancer was clinically staged as FIGO IA2. A RAT with PL was performed upon the patient’s desire to retain fertility. The initial step of this procedure was to perform bilateral pelvic node dissection, and the resection nodes were free of tumor upon frozen section analysis. The right uterine artery was preserved, but the left uterine artery was ligated as a result of excessive bleeding. Trachelectomy was then performed, and the upper resection margin was free of tumor as confirmed by the frozen section analysis. The estimated blood loss was approximately 1,000 mL. The entire procedure took 310 minutes. There were no immediate postoperative complications. The trachelectomy specimen revealed residual high-grade squamous intraepithelial lesion with no evidence of stromal invasion or capillary–lymphatic space permeation, and the lymph nodes were negative for cancer. The postoperative course was uneventful, and the patient was discharged after 15 days. No postoperative adjuvant treatment was performed. The patient had a subsequent return of menstruation 2 months postoperatively. Clinical and sonographic follow-up examinations were carried out every 3 to 4 months and were to be continued for a 2-year duration after surgery. She was still alive without any evidence of disease after 14 months.

The 3D-PDUS assessment of the uterine vascular circulation was performed using the Voluson 730 Pro ultrasound system by GE Medical Systems (Zipf, Austria). This ultrasound system is equipped with a mechanized transvaginal probe that employs a high frequency (7.5 MHz) curvilinear transducer. The sonograms generated by the 3D-PDUS are shown in Figures 1 and 2. Figure 1 shows the sonogram of uterine arteries 2 weeks postoperatively. The vascularity indices of the right and left uterine arteries were 0.078 and 2.298, respectively. VI was defined as the number of colored pixels divided by the number of total pixels in the defined section.

![Corpus Left E Right](image1)

**Figure 1.** Sonogram of the uterine arteries generated by three-dimensional power Doppler ultrasonography 2 weeks postoperatively (separated from the endometrium, E). The vascularity indices of the right and left uterine arteries were 0.078 and 2.298, respectively.

![Corpus Left E Right](image2)

**Figure 2.** Sonogram of the uterine arteries generated by three-dimensional power Doppler ultrasonography 4 months postoperatively (separated from the endometrium, E). The vascularity indices of the right and left uterine arteries were 0.452 and 0.599, respectively.
About 4 months postoperatively (on day 7 of the menstrual cycle), the sonogram showed that the differences in uterine blood supply of both sides were negligible (VI of the right vs. left side, 0.452 vs. 0.599; Figure 2).

Discussion

Traditionally, the surgical treatment for FIGO stage IA2 squamous cervical cancer has been radical hysterectomy with pelvic node dissection. However, the hysterectomy approach often gives rise to infertility. RVT and RAT are alternative surgical procedures that have emerged for young women who desire to preserve future fertility, without considerable adverse effect on the cure rates. RVT with PL is currently the procedure that preserves fertility in young woman, with most available data supporting its use, and has a recurrence rate comparable to those offered by radical hysterectomy (including those with lymph–vascular space invasion) for early-stage invasive cervical carcinoma. Several investigators have reported their experience in treating FIGO stage IA2 and small IB1 (<2 cm) invasive cervical cancer patients who wish to retain fertility via RVT with bilateral PL, and subsequent pregnancies have been reported since 1995. However, this procedure has not only a significant morbidity and learning curve, but also intraoperative surgical complications with cystotomy (18%), enterotomy and external iliac artery injury. RAT with PL is the other alternative treatment that has received important recognition. This surgical method is very similar to radical abdominal hysterectomy (RAH). A clear technical advantage of the abdominal approach over the vaginal approach is that the parametrial and upper vaginal resection can be carried to its fullest extent just as is performed in RAH.

The present case study describes the RAT with ligation of the left uterine artery. The ligation of uterine arteries during RAT has led to considerable debate among gynecologic oncologists. Smith et al. insisted on the necessity to preserve bilateral uterine arteries during RAT for the preservation of fertility. The ligation and reconnection of bilateral uterine arteries is a complex surgical procedure. The 3D-PDUS equipped with a mechanized transvaginal probe was utilized to assess the change in vascular drainage of the uterine corpus postoperatively. The detection of blood flow via the 3D-PDUS allows the depiction of the uterine vascular circulation three-dimensionally and extracts volume image of the target organ, providing information on the detailed uterine conditions. This technology is easy, noninvasive and reproducible, which offers comprehensible and objective information on the targeted entity. The sonograms generated by the 3D-PDUS are shown in Figures 1 and 2. VI is defined as the number of colored pixels divided by the number of the total pixels in the defined section. VI is a useful parameter for the in vivo assessment of global tumor angiogenesis. The vascular supplies of the bilateral uterine arteries were significantly different 10 days postoperatively. The VI of the right uterine artery was 0.078, and the VI of the left uterine artery was 0.298 (separated from the endometrium). The vascular supply of the left uterine artery was abundant because of collateral circulation. However, the vascular supplies of the bilateral uterine arteries exhibited no significant differences about 4 months postoperatively. The VI of the right uterine artery was 0.452, and the VI of the left uterine artery was 0.599 (separated from the endometrium). The closeness in VI indicated that the ligation of a unilateral uterine artery during RAT obviously did not influence the lateral blood supplies to the uterus. The uterus remained viable via collateral circulation. This result complements the findings of Rodriguez et al. and Palfalvi et al., in which the ligation of uterine arteries did not affect the surgical outcome of RAT. Normal menstruation returned in the patient 2 months postoperatively. Although this patient did not show any signs of pregnancy at that point, subsequent pregnancy following RAT has been reported by Palfalvi et al.

In conclusion, the 3D-PDUS has established itself as a useful adjunctive tool for monitoring the quantitative changes of the uterine corpus postoperatively. As far as we are aware, this is the first case report that assesses the microvascular pattern of uterine vascular circulation using 3D-PDUS after the ligation of a unilateral uterine artery during RAT. Since no significant differences in vascular circulation of the uterine corpus were observed between the ligated left and the unaltered right uterine arteries, we may infer that the ligation of uni- or bilateral uterine arteries does not influence the surgical outcome of RAT and preserves the uterus via collateral circulation. We may further reach a bold assumption that the ligation of bilateral uterine arteries during RAT can become an appropriate treatment for selected young patients with early-stage cervical cancer who wish to preserve their fertility. The ligation of bilateral uterine arteries during RAT not only simplifies
the procedure, but also limits blood loss during surgery. The return of subsequent menstrual function and fertility is to be expected for the patient. However, more studies will be required to establish the place of RAT with ligation of bilateral uterine arteries in early-stage cervical cancer. Prospective data must be obtained prior to proposing any recommendations in this clinical setting.

References