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The Culdotomy Two U Procedure for Vaginal Ovarian Cystectomy

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Abstract

When transvaginal removal of ovarian cysts is performed successfully, the procedure compares favorably with laparoscopy in terms of invasiveness. However, the approach into peritoneal cavity has been laborious. The objective was to evaluate feasibility of an ultrasound-guided culdotomy using a newly-developed umbrella needle. New culdotomy was performed on 36 patients with ovarian cysts. Each cyst was directly punctured by the needle from vagina under ultrasound guidance. The vaginal walls on both sides of the needle were incised with an electric scalpel. Through wound, cyst was exteriorized and enucleated. Preoperative characteristics of patients, outcome, operating time, blood loss, complications, and cyst histology were analyzed.

Culdotomy was performed successfully in all cases. Operating time was less than 10 minutes and blood loss was less than 10 ml. There were no culdotomy-associated complications. Culdotomy assisted by ultrasound imaging and an umbrella needle is a simple, safe, and reliable method for vaginal ovarian cystectomy.
Introduction

Since the establishment of minimally invasive surgery with the introduction of laparoscopy, new procedures following this concept have been developed. Natural orifice translumenal endoscopic surgery (NOTES) has become an area of great interest.\textsuperscript{1,2} In NOTES, natural orifices such as the mouth, anus, urethra, and vagina are used as ports of entry into the peritoneal cavity through which the flexible endoscopic devices are passed. Although NOTES currently has unresolved issues, the elimination of an abdominal incision is expected to result in the less invasive surgery. Among natural orifices, the transvaginal route is considered to be the most promising for the peritoneal cavity access.\textsuperscript{3}

In the gynecological arena, the use of the vaginal route for the removal of ovarian cysts is currently being reevaluated.\textsuperscript{4-7} In laparoscopically assisted vaginal ovarian cystectomy, following laparoscopic inspection, the ovarian cyst is enucleated via the vaginal route. Alternatively, the enucleation is done laparoscopically and the excised mass extracted vaginally. The merits of this procedure compared to a laparoscopic cystectomy are that it permits removal of larger ovarian cysts, has a shorter operating time, and results in less cyst spillage. In laparoscopically supported vaginal ovarian
cystectomy, the cystectomy is initially approached transvaginally, and in the cases in which a transvaginal extraction is impossible, laparoscopy is used to complete the operation.\textsuperscript{8} The merits of this system are that an abdominal incision can be avoided in most patients treated and the remaining patients can be salvaged by laparoscopy; thus, a laparotomy is avoided in all cases. In both NOTES and an ovarian cystectomy, the use of a vaginal route may greatly contribute to the progress in the minimally invasive surgery.

In an ovarian cystectomy using a transvaginal route, a culdotomy is one of the most important steps.\textsuperscript{9,10} Especially in the laparoscopically supported system beginning with a vaginal approach, a successful culdotomy is an essential step.\textsuperscript{11} The peritoneal cavity cannot be entered without an accurate vaginal wall incision, and a blind incision may occasionally injure the rectum.\textsuperscript{12} We previously presented the new culdotomy technique using an ultrasonographic guidance and a renal balloon dilator catheter; this procedure facilitates the flawless performance of a culdotomy.\textsuperscript{11} Visualization by ultrasound ensured safe entry into the cul-de-sac without complications. The drawback of this method, however, was that this multi-step procedure using a balloon dilator, took longer to perform than a traditional culdotomy; therefore, it was not
practical. Simplification of the technique was our next objective.

In this report, we present a novel, simplified culdotomy technique using a newly developed needle. The purpose of the present study was to evaluate the feasibility and effectiveness of this method, which we termed “Culdotomy Two U.”
Materials and Methods

We performed vaginal ovarian cystectomies via ultrasound-guided culdotomy with an umbrella Hakko needle on 35 patients with presumed benign unilateral ovarian cysts and one with bilateral cysts; the procedures were performed between June 2006 and March 2010 at Kanazawa University Hospital or Sagawa Clinic.

The patients were required to be non-virginal for employment of the transvaginal route. The inclusion criteria for patients with an ovarian cyst were: presumed to be benign; located in the cul-de-sac; and presumed absence of extensive adhesions. The presence of one or more of the following sonographic criteria was considered to increase the index of suspicion for a malignancy: multilocular appearance; irregular border; intracystic papillary vegetation; or the presence of ascites. In some cases magnetic resonance imaging (MRI) was used to distinguish mature cystic teratomas or endometriomas from other ovarian tumors (including malignancies). Teratomas with serum squamous cell carcinoma antigen (SCC) levels outside of the normal range (> 1.5 ng/ml) were excluded, because of the possibility that teratomas with a SCC beyond the normal value may have a malignant transformation. Teratomas with alpha-fetoprotein levels outside of the normal range were also excluded because of the
possibility of an immature cystic teratoma. Cyst location was determined by preoperative transvaginal sonography and patients with at least one ovarian cyst located in the cul-de-sac were included. The adhesion is examined on bimanual examination or pre-operative ultrasound examination. The cases of endometriomas in which the women without infertility and dysmenorrhea desires no scar and the cyst is deemed not to be adherent, were included.

For each patient, the following parameters were included in the analysis: age, body mass index, parity, the diameters of ovarian cysts, outcome of culdotomy, operating time for culdotomy, blood loss during culdotomy, complications of culdotomy, C-reactive protein (CRP) level on postoperative day 3, and histology. Some data were reported as mean ± standard deviation or n (%).

The following procedure was used for each culdotomy. Patients were administered enemas on both the day prior to and the day of surgery. The culdotomy was performed with the patient in the dorsal lithotomy position on the operating table, under general or spinal anesthesia. A speculum was placed in the vagina and the cervix was visualized and grasped with forceps. A vaginal ultrasound probe with a needle guide was then inserted into the vagina. The ovarian cyst was directly punctured under ultrasound
guidance with an umbrella Hakko needle via the center of the posterior vaginal fornix. Following ultrasonographic confirmation of the placement of the top of the umbrella needle into the cyst, the umbrella portion of the needle was opened and stabilized by forceps and an inner needle was inserted. Following the extraction of the ultrasound probe with a needle guide from the vagina, the needle remained, penetrating the center of the posterior vaginal fornix. While the needle was gently retracted towards the operator’s side, the vaginal walls on both sides of the needle were incised with an electric scalpel. Following an adequate incision of the vaginal wall, the ovarian cyst wall was visible in the cul-de-sac through the vaginal defect. By bluntly enlarging the defect in the vaginal wall with forceps, the culdotomy was completed.

The ovarian cyst was then partially exteriorized through the vaginal wall defect with gentle traction on the umbrella Hakko needle towards the operator’s side. The cyst contents were aspirated with another needle to reduce its volume and permit complete exteriorization. After the descent of the cyst into the vagina, a transvaginal ovarian cystectomy was performed in a manner similar to that of a laparotomy. The culdotomy was then closed with a suture.

The umbrella Hakko needle consists of a 19-gauge, 30-cm-long, metal needle with
an overcoat. The metal needle and the overcoat are fixed at the top of the needle.

The needle has four 10-mm, longitudinal slits beginning 2 mm below the overcoat tip. By moving the overcoat, these slits enable this portion of the needle to open in an umbrella-like fashion. The umbrella can then be held open by stabilizing the needle and the overcoat with forceps. This needle has two attachments. One is an inner needle and the other is a screw. The tip of the inner needle is dull to prevent injury to the bowel or other tissues in the cul-de-sac when it is inserted into the metal needle.

The screw is used to fix the metal needle to the overcoat prior to removal of the forceps.

The umbrella Hakko needle is a newly-developed device that is not yet approved for medical use. The Kanazawa University Hospital ethics committee authorized the experimental use of this device in our patients. A full explanation of the device was provided to the patients and all gave informed consent prior to participating in the study.
Results

The mean age was 32.3 years with a standard deviation of 5.7 years. The mean body mass index was 20.7 with a standard deviation of 3.1. Twenty-three patients (64%) were nulliparas. The mean maximum cyst diameter was 6.9 cm with a standard deviation of 2.1 cm.

In all cases, culdotomy was successfully performed; the operating time was less than 10 minutes and the blood loss was less than 10 ml. There were no culdotomy-associated complications, including rectal injury. The mean CRP value on postoperative day 3 was 1.47 mg/dl with a standard deviation of 1.25 mg/dl.

Histological examination of the resected specimens demonstrated eighteen teratomas, eleven serous cystadenomas, three endometriomas, and four mucinous cystadenoma. There were no cases of malignancy.
Discussion

Culdotomy for transvaginal removal of ovarian cysts is sometimes laborious. In a vaginal hysterectomy, the other operative steps can replace the unsuccessful culdotomy, and culdotomy can be re-challenged after several successful steps. Unlike a culdotomy for a vaginal hysterectomy, that step for an ovarian cystectomy must be successfully accomplished at the beginning of the operation; this is because the other operative steps cannot be started without the entering the cul-de-sac. A poorly-executed culdotomy should be avoided because the cicatrices in the cul-de-sac may cause subsequent dyspareunia. Needless to say, rectal injury must be avoided.

A reliable and safe culdotomy technique is needed for a vaginal ovarian cystectomy. Direct centesis of the ovarian cyst under ultrasound guidance is a marked characteristic of our culdotomy technique. We positively utilize the fact that most ovarian cysts are located in the cul-de-sac. In such cases, transvaginal ultrasound can easily visualize the safe vaginal area for the entry into the cul-de-sac; this area is between the cyst and the ultrasound probe. The needle penetrating from the vaginal side toward the cyst is a useful guide for the accurate incision of the vaginal wall. Visualization by ultrasound and direct centesis prevent intestinal and rectal injuries and
always lead to successful culdotomy.

The culdotomy technique described in this report employed a newly-developed device, the umbrella Hakko needle. This method simplifies our previously-developed method that uses a balloon dilator. The mean operating time was shortened from 23 minutes to less than 10 minutes. This is because culdotomy with the umbrella Hakko needle eliminates several steps required when the balloon dilator is used. Ultrasound guidance and centesis using the umbrella needle are key to this practical culdotomy procedure. Thus, we named this procedure “Culdotomy Two U,” for ultrasound and umbrella.

The umbrella Hakko needle has some noteworthy features. The most important feature is the guidance for cul-de-sac entry. If only we incise the vaginal wall on both sides of the needle, the intraperitoneal cavity can be opened without exception. In this technique, we do not have to possess any excellent skills in regard to experience and intuition. After the centesis of the cyst, the needle is fixed in an umbrella-like fashion and the top of the needle is maintained within the cyst. This prevents the cyst from withdrawing into the pelvic cavity and eliminates the difficulty of locating the cyst after culdotomy. The needle is gently pulled towards the operator’s side to incise the
vaginal wall. The opened umbrella is useful to prevent the needle from escaping.

Moreover, the traction of the opened needle is expected to fill in a tiny hole caused by
the centesis and to diminish the spillage of the cyst contents.

We must take into consideration the influences of intraperitoneal spillage of cyst
contents. When we perform an ovarian cystectomy, either laparoscopically or
transvaginally, it is theoretically impossible to avoid intraperitoneal spillage in all
cases. Thus, it is imperative to preoperatively minimize the possibility of an ovarian
malignancy. Meticulous preoperative studies, including ultrasound, MRI, and tumor
markers are essential; all cases of possible malignancy should be excluded. In
some cases in which preoperative examinations don’t perfectly deny the possibility of
malignancy, laparoscopy should be selected because laparoscopic inspection may be
useful to find Ic ovarian malignancy. Chemical inflammation after intraperitoneal
spillage also must be avoided. The mean CRP value on postoperative day 3 was 1.47
mg/dl and statistically equal to that of laparoscopic ovarian cystectomy cases (data not
shown). These results suggest that intraperitoneal spillage is minimal and chemical
inflammation does not occur. However, the degree of intraperitoneal spillage should
be estimated using a different method. Currently, in some cases, we perform the
intraperitoneal observation with a flexible culdoendoscope during a vaginal ovarian
cystectomy. Using this scope, it is possible not only to observe but also to irrigate the
pelvic cavity; thus, this method may become useful as a routine procedure for vaginal
ovarian cystectomy.

We cannot adopt the Culdotomy Two U procedure in all benign ovarian cysts. In
cases in which the ovarian cyst is out of cul-de-sac, we adopt either of the following two
methods. When the cyst is only a short distance from the cul-de-sac, the Culdotomy
FourS Two U procedure is selected; in this procedure, an artificially-developed, saline
solution space in the cul-de-sac is punctured by the umbrella needle. When the cyst is
located on the anterior surface of the uterus, we employ an anterior colpotomy, using the
traditional method of incising the anterior vaginal fornix.

When an ovarian cystectomy is successfully completed vaginally, it compares
favorably to laparoscopic surgery in terms of its invasiveness. Vaginal surgery has the
additional benefit of no visible scarring. The culdotomy is one of the most important
steps in completing the transvaginal removal of ovarian cysts; thus, we focused on
optimizing the culdotomy procedure. The Culdotomy Two U procedure provides a
simple, safe, and reliable method and we expect that a vaginal ovarian cystectomy will
become more accessible to both patients and gynecologists desiring minimally invasive surgery.
References


Figure Legends

Figure 1. Sagittal view of the pelvis illustrating the Culdotomy Two U procedure.

The ovarian cyst is directly punctured transvaginally with an umbrella Hakko needle under ultrasound guidance and the umbrella portion of the needle is opened.

c: ovarian cyst; us: ultrasound probe; um: umbrella Hakko needle

Figure 2. The Culdotomy Two U procedure.

A. With the patient in the dorsal lithotomy position, the ovarian cyst is punctured under ultrasound guidance through a needle guide; an umbrella Hakko needle is inserted at the center of the posterior vaginal fornix.

B. The ovarian cyst is punctured transvaginally under ultrasound guidance with an umbrella Hakko needle and the umbrella portion of the needle is opened within the cyst.

C. The umbrella Hakko needle penetrates the center of the posterior vaginal fornix.

D. With gentle traction on the needle towards the operator’s side, the vaginal walls on both sides of the needle are incised with an electric scalpel.
E. Following an adequate incision, the ovarian cyst wall is visible, punctured by an umbrella needle.

F. The cyst wall is enucleated transvaginally.

Figure 3. The umbrella Hakko needle.

A. The body and attachments; an inner needle with a screw.

B. The umbrella portion is closed.

C. The umbrella portion is opened.

D. An inner needle is inserted into the opened umbrella needle.