—Original—

Endoscopic Video-Assisted Breast Surgery: Procedures and Short-Term Results

Koji Yamashita[1] and Kazuo Shimizu[2]

[1]Department of Surgery, Musashikosugi Hospital, Nippon Medical School
[2]Division of Endocrinology, Department of Surgery, Nippon Medical School

Abstract

Background: We devised a new endoscopic operation for breast diseases. We report the aesthetic and treatment results of this procedure.

Methods: A 2.5-cm axillary skin incision was made for a single approaching port, and a working space was created by retraction. Under video assistance, we resected the mammary gland partially or totally, and in the case of malignant diseases we also performed a sentinel lymph node biopsy and dissected axillary lymph nodes (levels I and II).

Results: From December 2001 through April 2005, we performed endoscopic video-assisted breast surgery (VABS) in 100 patients with breast diseases. The diseases were benign in 18 patients and malignant in 82 patients. Of the malignant diseases, 80 underwent breast-conserving surgery and 2 underwent skin-sparing mastectomy. There was no significant difference in operation time, blood loss, or blood examinations related with the acute phase reaction between VABS and conventional breast-conserving procedures. All surgical margins were negative on examination of permanent histological preparations. The wounds healed without noticeable scarring. The original shapes of the breast were preserved. All patients expressed their great satisfaction with VABS.

Conclusions: VABS can be considered as a surgical option and can provide aesthetic advantages for patients with breast disease.
(J Nippon Med Sch 2006; 73: 193–202)

Key words: endoscopic surgery, breast-conserving therapy, breast reconstruction, cosmetic outcome, breast cancer

Introduction

We devised a new endoscopic surgical procedure for breast diseases which was named video-assisted breast surgery (VABS). It has three main features: working space is created with the retraction method, almost all surgical procedures are performed through a single small axillary incisional port, and the breast is reconstructed simultaneously to preserve the preoperative breast shape. It can be used for many breast diseases, including large benign tumors and diffuse malignant disease without skin invasion. It will prove improve the disease the quality of life of patients with breast.

Breast-conserving therapy has replaced modified

Correspondence to Koji Yamashita, MD, Department of Surgery, Musashikosugi Hospital, Nippon Medical School, 1–396 Kosugi-cho, Nakahara-ku, Kawasaki, Kanagawa 211–8533, Japan
E-mail: yamasita@nms.ac.jp
Journal Website (http://www.nms.ac.jp/jnms/)

Table 1 Patient characteristics

Characteristics		VABS number	VABS %	Conventional number	Conventional %	p
Age, (years)	mean	53.7		50.7		0.893
	range	19 ～ 87		33 ～ 77		
Tumor Size, (cm)	mean	1.8		1.7		0.737
	range	0.1 ～ 6.5		1.5 ～ 4.0		
Benign		18	18	0	0	0.007
Malignant		82	82	34	100	
Stage						
	0	5	6	1	3	0.468
	I	46	56	15	44	
	IIA	21	26	13	38	
	IIB	10	12	5	15	
ER						
	+	72	88	19	76	0.198
	−	10	12	6	24	
PgR						
	+	68	83	19	76	0.558
	−	14	17	6	24	
HER2						
	0	25	31	4	17	0.001
	1 +	32	40	4	17	
	2 +	18	23	16	66	
	3 +	5	6			

ER: Estrogen Receptor, PgR: Progesteron Receptor,
HER2: Human Epidermal Growth Factor Receptor, type 2
The chi-square test was performed for evaluating the differences for the significance.

radical mastectomy as the standard treatment for early breast cancer[1]. The same treatment results can be obtained both from total mastectomy and from lumpectomy plus irradiation[2]. The less-invasive surgery would be the obvious choice by patients. Since breast-conserving therapy is less invasive and maintains the appearance of the breast, it becomes the preferred option. However, even though the original shape of the breast is preserved, the operative wound scar often becomes an unattractive keloid. Preservation of the skin over the tumor is possible because no tumor invades the skin and no tumor implantation to the skin during needle aspiration cytologic examination and biopsy has been observed. The location of the skin incision can be changed to the axillary area, where the wound scar is inconspicuous, by using an endoscopic technique. All surgical procedures can be performed through this 2.5-cm-long axillary port. We present here the surgical method of VABS and its aesthetic and treatment results.

Patients and Methods

Patients

From December 2001 through April 2005, 299 patients with breast disease were surgically treated at the Department of Surgery of the Nippon Medical School Second Hospital. Of these patients, 102 were selected as candidates for VABS according to the following criteria. Patients with early breast cancer and benign breast disease without severe complications were chosen as candidates. Only patients who had no tumor extension to the nipple and no direct invasion to the skin were eligible for this study, to preserve the nipple and the skin over the tumor. Patients who had advanced cancer with axillary lymph node metastasis and those who had severe co-morbid conditions, such as heart disease, renal failure, liver dysfunction, and poor performance status, were excluded from the study. In 2 patients, VABS was converted to ordinary modified radical mastectomy due to diffuse ductal

Table 2 Histopathology

Malignant	82
DCIS	2
Non-invasive ducatal	3
Invasive ductal ca.	
Solid-tubular ca.	11
Papillo-tubular ca.	20
Scirrhous ca.	36
Invasive ca.	
Mucinous ca.	3
Tubular ca.	1
Apocrine ca.	1
Invasive lobular ca.	5
Benign	18
Mastopathy	7
Fibroadenoma	8
Phyllodes	1
Hamartoma	2

DCIS: ductal carcinoma in situ, ca.: carcinoma

spread and direct skin invasion. VABS was accomplished in 100 patients.

Conventional breast-conserving therapy had been performed in 34 patients with early breast cancer during the same period. They were also met the eligibility criteria for VABS but chose conventional therapy. Surgical stress and postoperative complications in these patients were compared with those in patients undergoing VABS.

The patients' characteristics are shown in **Table 1**. The average age was 53.7 years. The average and maximum tumor sizes were 1.9 cm and 6.5 cm, respectively. The Japanese version of the TNM classification[3] was used. Axillary lymph node metastasis was observed in 19 patients, and distant metastasis was not observed in any patient. Disease in all patients was classified as earlier than stage IIB. Overexpression of HER2/neu was observed in 23 patients (28.8%). The histopathological diagnoses of the treated diseases are listed in **Table 2**.

Surgical Technique

The patient was placed in the flat supine position. The arm was abducted 90° without disturbing the operative maneuver, particularly toward the caudal direction. Video monitors were set on both the sides of the patient's head and were watched by 2 surgeons. The endoscopic monitoring system is a

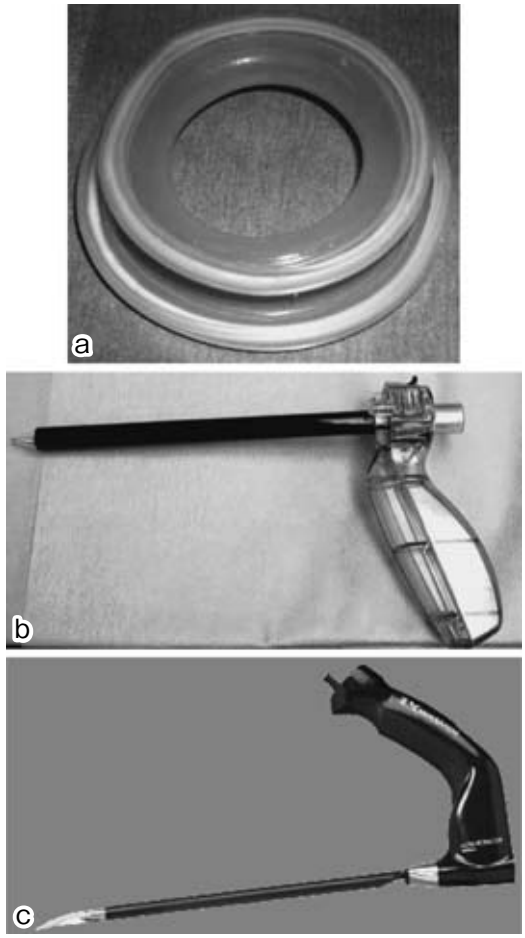

Fig. 1 Operative Instruments
a: Lapprotector for wound protection
b: OptiView for penetration of subcutaneous tissue
c: Ultra Retractor for dissection from pectoral muscle fascia

product of the Olympus Optical Co. (Tokyo, Japan). The endoscope is rigid and straight, 5 mm in diameter, and oblique at 30°.

The operative procedures were as follows: skin incision, skin flap formation (tunnel method[4]), pectoral muscle fascia dissection, vertical section of the mammary gland, sentinel lymph node biopsy by the dye-staining method guided by preoperative three-dimensional computed tomographic (3D-CT) lymphography marking, and axillary lymph node dissection (levels I and II). Radiotherapy and chemotherapy were performed for malignant diseases.

We tried to use conventional tools wherever possible. However, we had to use the following specific endoscopic surgical instruments (**Fig. 1**): Lap protector (Hakko Co., Nagano, Japan), OptiView

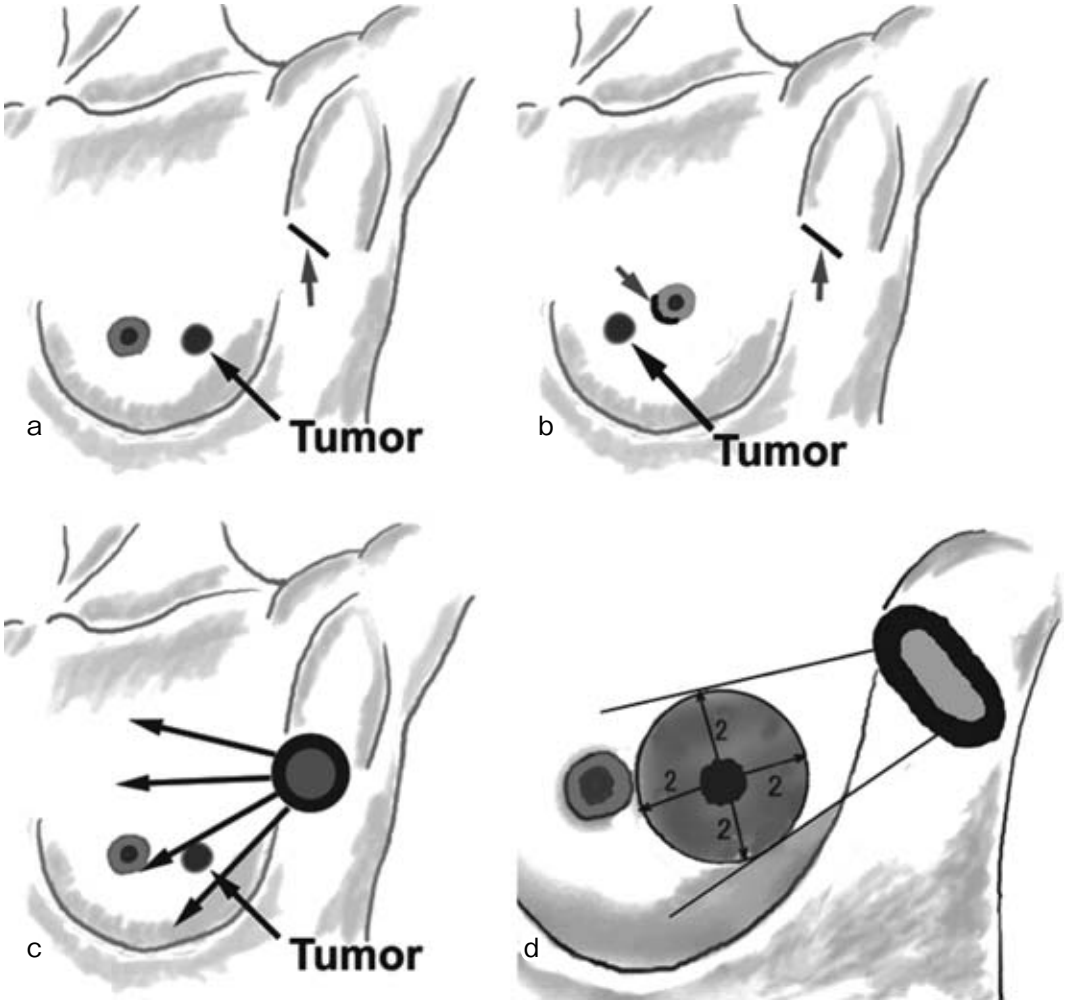

Fig. 2 Operating Procedures
a: Axillary skin incision
b: Periareolar and axillary skin incisions
c: Subcutaneous penetration by Optiview (tunnel method)
d: Partial resection of mammary gland from the axillary wound

(Johnson & Johnson KK, Tokyo, Japan), and Ultra Retractor (Johnson & Johnson KK).

Preoperatively the tumor margin was determined with magnetic resonance. The surgical margin was marked 2 cm away from the tumor margin by the subcutaneous injection of the blue dye gentiana violet.

The skin incision was made most often along wrinkles in the axilla and was 2.5 cm long **(Fig. 2a)**. When a tumor is near the nipple and in the medial or inferior part of the breast, a 2.5-cm-long skin incision should be made in the periareola region and in the axilla for sentinel lymph node biopsy and axillary lymph node dissection **(Fig. 2b)**. The relationship between tumor location and the skin incision for the approaching port is shown in **Table 3**. The Lap protector for the breast **(Fig. 1a)** is inserted into the incisional port for wound protection. The Lap protector is a silicon rubber wound protector and is optimized for breast surgery. It has diameters of 2.5 cm and 3.5 cm and a height of 1 cm. It is used for the thin skin flap. For skin-sparing total mastectomy, a 5-cm-long lateral chest incision was made, and simultaneous reconstruction with the silicon gel prosthesis (Mentor Co., Santa Barbara, CA, USA) was performed. All operative procedures were performed through these ports under video assistance.

A thin skin flap was constructed by the tunnel

Table 3 Relationship between the tumor location and the incisional site

Location	Ax	Ax + Areola	Areola	Lateral
A	5	7	1	
AC	6	7	1	
B		7		
BD		2		
C	36	2		
CD	6	2	1	
D	3	2		
E		5	3	
diffuse		2		2
Total	56	36	6	2

Ax: axilla

method[4] (**Fig. 2c**). Multiple parallel tunnels were created at intervals of 1 cm at a fixed depth of the subcutaneous tissue by blunt thrusting of the 10-mm-diameter endoport (OptiView, **Fig. 1b**). We could observe the injected blue-dye marks of the surgical margin in the subcutaneous fat tissue by the video monitor through the OptiView to confirm the excisional margin. The blood vessels were observed to be collected in the septa between the penetrated tunnels. These septa were cut with a harmonic scalpel (Johnson & Johnson KK), which could easily coagulate and cut the vessels in the septa.

To dissect the reverse side of the mammary gland, we peeled the pectoral muscle fascia by passing an Ultra Retractor vein harvester (**Fig. 1c**) along the muscle bundle under video assistance (**Fig. 2d**). The penetrating arteries should be coagulated with the harmonic scalpel or an electrocoagulator and be sutured when they appear, because the hemorrhage obstructs the visual field and complicates hemostasis. The skin was pulled up with slender muscle clasps or the Ultra Retractor with an endoscope and a suction tube to create a sufficient working space and to evacuate mist and smoke.

To section the mammary gland vertically, bipolar scissors (PowerStar, Johnson & Johnson KK) and a harmonic scalpel were used at the dye-marking points. The mammary gland was partially removed with a free surgical margin 2 cm away from the tumor edge. This procedure is occasionally difficult when the mastopathic mammary gland is extremely hard. In such cases, the Naginata blade for the harmonic scalpel (Johnson & Johnson KK) is helpful. The resected gland was brought to the pathology department; a fast frozen section was examined to confirm whether the margins of the resection were free of cancerous invasion in the gland, skin, and muscles. If cancer invasion was present, the additional resection is performed until no cancer invasion is confirmed.

Sentinel lymph node biopsy was performed with the dye staining method at the beginning of the operation, before gland resection. Two milliliters of 1% indocyanin green was injected subcutaneously in the periareolar region and over the tumor. Visiport (Tyco Healthcare Japan, Inc., Tokyo, Japan) was inserted from the small axillary incision after 20 min, and the stained lymph nodes were found by following the dye in lymph ducts. Recently, we have used the multidetector 3D-CT lymphography to mark the sentinel lymph node position on the skin before surgery[5–7]. Axillary lymph node dissection was performed at levels I and II with bipolar scissors through the same incision. The inferior pectoral nerve, the long thoracic nerve, the second and third intercostobrachial nerves, and the thoracodorsal nerve, artery, and vein were observed and preserved. The lateral pectoral artery was preserved for the lateral tissue flap.

Breast reconstruction was simultaneously performed with the following 3 methods: mobilization of the remnant mammary gland, filling of the lateral thoracic fat tissue flap, and filling with an absorbent synthetic fiber mesh (Dexon mesh, 18 × 23 cm, Tyco Healthcare Japan Inc.), which was proposed by Dr. Fukuma of Kameda General Hospital as an FSM method for filling the affected part of the gland[8]. The method was selected on the basis of tumor location and the resected volume (details are described in the results).

Hemostasis was carefully performed by ligation and electrical coagulation. A 5-mm round Blake silicon drain J-VAC (Johnson & Johnson KK) was inserted and left in the dissected axillary cavity when the axillary lymph node dissection was performed. The wound was closed with a subcutaneous reversed suture using monofilament absorbable thread 4-0 PDS-II (Johnson & Johnson

Table 4 Operative Methods

Procedures	Case
Extirpation	8
Wide excision	10
Lumpectomy + Ax	80
Skin-sparing total mastectomy	2
Switch to MRM	2
Sentinel LN biopsy	51

Ax: Axillary lymph node dissection (level Ⅰ + Ⅱ)
MRM: modified radical mastectomy
LN: lymph node

KK). The skin was fixed with an adhesive agent (Dermabond, Johnson & Johnson KK).

Skin-sparing total mastectomy with the preservation of the skin and nipple for widespread ductal carcinoma in situ (DCIS) was performed in the same manner. One patient underwent simultaneous breast reconstruction with a silicon gel prosthesis. A 5-cm-long skin incision was made in the lateral chest area. All surgical procedures were performed only through this incision. The penetrating arteries on the inner side of the pectoral muscle were carefully ligated.

To detect local recurrence after surgery, ultrasonography was performed every 3 months and breast magnetic resonance was performed every 6 months. All the patients with cancer had received radiotherapy 50 Gy (+ 10 Gy for boost), hormone therapy (tamoxifen and goserelin for premenopausal patients ; anastrozol and toremifene for postmenopausal patients) and chemotherapy (anthracyclin + cyclophosphamide or a taxane or both) in accordance with St. Gallen's recommendation[9].

Operative Methods

Of the 100 patients who underwent VABS, 82 had malignant disease and 18 had benign disease. The selected operative methods are shown in **Table 4**. Extirpation was performed for benign diseases. A wide excision was created in patients in whom malignancy was suspected. Lumpectomy with axillary lymph node dissection at levels I and II was performed for 80 patients with breast cancer. The maximum resected volume was up to two-thirds of the total gland. Skin-sparing total mastectomy was performed in 2 patients with widespread DCIS. One patient underwent simultaneous reconstruction with a silicon gel prosthesis. Sentinel lymph node biopsy was performed in 51 patients. Of these, 3D-CT lymphography was performed in 11 patients.

Surgical Stress

Surgical stress was defined as the physical disturbance directly or indirectly caused by surgery. We estimated surgical stress by measuring the operating time, blood loss, total amount of lymph drainage volume, and duration of drainage tube insertion, and laboratory data, such as the maximal leukocyte count and creatine kinase level at within 1 week after surgery.

Cosmetic Evaluation and Patient Satisfaction

All the patients were regularly examined and questioned about their satisfaction with the aesthetic results every 6 months after surgery. We devised a scoring system with the 5-item-by-4-step method (ABNSW)[10] for evaluating cosmetic outcomes. The scoring system consists of 5 items: asymmetry (A), breast shape (B), nipple shape (N), skin condition (S), and wound scar (W). Each item is evaluated by 4 steps (0: poor, 1: fair, 2: good, 3: excellent). These scores are then totaled. On a scale of 15 points, the results were defined as follows: excellent, 15 points; good, 11～14 points; fair, 6～10 points; and poor, <5 points. Photographs of the breasts of all the patients were taken at 8 angles every 6 months. Patient satisfaction was evaluated using the scores of the QOL-ACD-B questionnaire[11].

Statistical Analysis and Informed Consent

All statistical analyses were performed with the SPSS 11.5J statistical software system (SPSS Inc., Chicago, IL). The degree of significance was set at $P < 0.05$. Comparisons between groups were performed with the unpaired Student's *t*-test. The chi square exact test was used for comparison of categorical data. Informed consent was obtained from all patients before surgery.

Table 5 Comparisons of VABS with the conventional breast-conserving therapy (BCT) in terms of surgical stress

	VABS (n = 80)	Conventional BCT (n = 34)	p
Age (y/o)	53.7 ± 13.1	50.7 ± 13.0	0.893
Tumor Size (cm)	1.8 ± 0.76	1.7 ± 0.77	0.737
Operating Time (min.)	173 ± 45	149 ± 32	0.131
Blood loss (g)	174 ± 118	147 ± 118	0.909
Drainage duration (day)	4.06 ± 2.01	3.25 ± 1.19	0.034
Drainage volume (m*l*)	421 ± 263	259 ± 165	0.097
Creatine kinase (IU/*l*)	280 ± 158	245 ± 161	0.955
WBC (/mm^3)	10,523 ± 2,886	10,347 ± 3,247	0.870

VABS: video-assisted breast surgery, WBC: white blood cell count
Data are presented as mean ± SD. The degree of significance was set at $P<0.05$.
Comparisons between the two groups were performed using unpaired Student's t test.

Fig. 3 Postoperative Breast Shape
The tumor was in right-DE area, 2.3×1.8 cm, classified as p-T2N0M0, stage IIA.
The skin incision was in the axillary area.

Results

Almost all surgical procedures could be performed through only the axillary incision port (**Table 3**). The skin incisional site of the approaching port was restricted to some extent by tumor location and tumor extension. Tumors in the medial or inferior parts of the breast (A and B areas) or near the nipple (E area) required a periareolar incision, particularly when the surgical margin toward the nipple was important. The length of the incisional wound was usually 2.5 cm; the length was 4 cm when we first began to perform this procedure but gradually decreased to 2.5 cm as we gained experience and skill. When the resected gland and fat tissue were larger than the incisional port and could not be removed through it, we were forced to extend the wound.

Thin skin flaps were easily created with the tunnel method, even by inexperienced surgeons. The depth under the skin of the penetrating tunnel could be controlled on the basis of the translucence of the endoscopic light. The distance of penetration could be verified with the endoscopic observation of dye marks. Blood loss was less than 20 m*l* because blood vessels were collected in the septa and were cut by the harmonic scalpel. If care was taken, the time required was only 10 minutes, and a uniform thickness could easily be maintained.

The early postoperative complications are as follows: subcutaneous hemorrhage in 7 patients and hematoma in 2 patients. Reoperation was not required as the volume was not very large; however, puncture was required. Burns were the second most common complication and occurred in 4 patients. In one patient, a burn occurred during skin flap formation near the nipple for the skin-sparing total mastectomy. In the other 3 patients, burns occurred during additional resection for the positive surgical

Table 6 Cosmetic evaluation by ABNSW

Item	0	1	2	3	Average
A	4	6	8	62	2.60
B	4	12	10	54	2.43
N	0	6	18	56	2.61
S	0	4	4	72	2.85
W	0	0	2	78	2.98

Total	9	10	11	12	13	14	15	Average
number	4	4	10	2	10	12	38	13.5

A: asymmetry, B: breast shape, N: nipple shape,
S: skin condition, W: wound scar

margin observed with intraoperative fast-frozen sections. Therefore, the thickness of the skin and the heat damage due to coagulation should be carefully monitored. The burn was of second degree and was less than 1 cm in diameter. It changed to an inconspicuous white scar. All these complications were less severe than those of conventional surgery. The surgical margin, as observed with permanent histological sections, was negative within 5 mm from the stump. No locoregional recurrence was observed on follow-up study for up to 50 months (mean, 25 months).

The comparisons of surgical stress between VABS and conventional breast-conserving therapy are shown in **Table 5**. Age, tumor size, operation time, and blood loss were not significantly different. Only lymph drainage duration was longer with VABS, and drainage volume was relatively large. White blood cell count, creatine kinase level, and the other laboratory data did not differ.

The cosmetic results were good **(Fig. 3)**. The mean total score of ABNSW was 13.5 **(Table 6)**. By comparing with the 4-step method, scores greater than 11 points were considered good or excellent; subsequently, 90% of the evaluated cases had good or excellent results. Therefore, VABS is a very effective method of surgery in terms of aesthetics. The degree of satisfaction was evaluated with the QOL-ACD-B questionnaire. Almost all patients were satisfied with this surgery.

Discussion

Breast diseases appear on conspicuous body surfaces. In women, the surgical wound scar on the breast causes anxiety and discomfort because the beauty of the breast is important. Better cosmetic outcomes improve the patient's quality of life of after surgery. Endoscopic surgery has been established for abdominal and thoracic diseases[12,13]. This endoscopic technique has been applied to breast surgery as well. We changed the location of the skin incision to the inconspicuous axillary area. All the surgical procedures are performed through this port by endoscopic or direct vision, i.e., under video assistance.

In conventional breast-conserving therapy, the skin over the tumor must be removed because of possible implantation of cancer cells on the skin during needle aspiration cytologic examination and biopsy. However, skin removal itself causes distortion and deformation of the breast. Skin preservation is necessary to maintain the shape of the breast. A goal of VABS is to preserve the skin. We examined the skin of the surgical edge of the tumor during surgery by fast-frozen section analysis. Cancer invasion was not found on the skin side of the surgical margin. No local recurrence, including that on the preserved skin, was observed. We think it is important to reconstruct the conserved breast simultaneously in VABS. In conventional surgery, simultaneous reconstruction has been often omitted, and cosmetic outcomes have been neglected[14,15]. These are possible reasons why VABS achieves excellent cosmetic results.

Almost all surgeries can be performed through a single small axillary incisional port[16]; the exceptions are resection of tumors of the medial or inferior

parts of the breast (A and B areas) and under the nipple (E area)[17]. However, a periareolar incision should be made if the surgical margin toward the nipple is crucial on suspicion of the tumor extension or ductal spread to the nipple. The nipple-side margin can be cut more precisely through its port. Fukuma et al[18] and Yamagata et al[4] have proposed periareolar skin incisions for endoscopic breast surgery. They make semicircular incisions along the periareolar ring and a axillary incision similar to ours and perform surgical procedures through these two ports. However, the periareolar wound scar is more conspicuous than the axillary wound scar and often distorts the nipple and the areola. The periareolar wound scar causes sensory disturbance around the areola which results in numbness, pain, and, sometimes, unendurable discomfort. It may injure the blood vessels around the areola and cause necrosis or wound dehiscence. Therefore, we prefer to make only an axillary incision. Even if we must make a periareolar incision, we attempt to make it smaller than 2.5 cm to avoid these sequelae. On the other hand, the distance to the tumor site from the axillary port may be longer than that from the periareolar port. This greater distance complicates some surgical procedures, such as sectioning the gland vertically and achieving hemostasis. To section the gland vertically we used a harmonic scalpel with a Naginata blade and PowerStar bipolar scissors and retracted the gland to keep the sectioned portion in sight. Special operative skills may be required. When the tumor is on the medial side of the gland (B area), the transaxillary approach cannot be used to reach beyond the nipple. In such cases, we made smaller periareolar incisions to section the gland.

Lymph node dissection was performed at levels I and II, through the small axillary wound port under direct vision and endoscopic assistance[19]. It was relatively easier to preserve the vessels and the nerves with video assistance[20]. The number of removed lymph nodes did not differ from that with conventional surgery[21].

The cosmetic results and patient satisfaction were very good and justified the time and effort spent to perform VABS. As the induration due to postoperative inflammation become softer with time, the cosmetic results and satisfaction improve. We are now improving the methods of breast reconstruction to improve outcomes further.

The early postoperative complications were less severe than those with conventional surgery and were acceptable. Locoregional recurrence was not observed. However, strict follow-up is needed because the average follow-up time was on average and 50 months at most. Therefore this operation is adequate as a breast cancer therapy.

VABS has mainly been performed for patients with early breast cancer. However, the patients with multiple or large benign tumors are also good candidates for this surgery[22]. The largest tumor we treated with VABS was a fibroadenoma 6.5 cm in diameter. VABS is a good surgical procedure for such benign diseases, because the patients are young and conventional surgeries produce multiple or long, unattractive wound scars on the breast skin. VABS makes only a small wound scar in the inconspicuous axillary area.

Diffuse DCIS is an early breast cancer; however, it spreads to the entire mammary gland and requires mastectomy for cure. Skin-sparing total mastectomy has become a standard therapy[23]. Diffuse DCIS is also a good candidate for VABS[24]. We performed VABS skin-sparing total mastectomy in 2 patients. One patient underwent simultaneous breast reconstruction with a silicon gel prosthesis.

We will perform VABS in more patients with breast cancer, if it is able to consistently achieve complete recovery.

VABS is an effective method of surgery for breast diseases and achieves good aesthetic results. Furthermore, the early and late postoperative complications associated with this procedure are acceptable.

References

1. Veronesi U, Cascinelli N, Mariani L, et al.: Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. N Engl J Med 2002; 347: 1227–1232.
2. Fisher B, Anderson S, Bryant J, et al.: Twenty-year

follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. N Engl J Med 2002; 347: 1233–1241.
3. General Rules for Clinical and Pathological Recording of Breast Cancer 2005. Breast Cancer 2005; 12: S6–S7.
4. Yamagata M, Takasugi T, Takayama T: Partial mastectomy by the periareolar incision. Geka Chiryo 2002; 86: 932–940.
5. Suga K, Ogasawara N, Okada M, et al.: Interstitial CT lymphography-guided localization of breast sentinel lymph node: preliminary results. Surgery 2003; 133: 170–179.
6. Tangoku A, Yamamoto S, Suga K, et al.: Sentinel lymph node biopsy using computed tomography-lymphography in patients with breast cancer. Surgery 2004; 135: 258–265.
7. Minato M, Hirose C, Sasa M, et al.: 3-Dimensional computed tomography lymphography-guided identification of sentinel lymph node in breast cancer patients using subcutaneous injection of nonionic contrast medium. A clinical trial. J Comput Assist Tomogr 2004; 28: 46–51.
8. Saeki J, Higa K, Wadamori K, Fukuma E: Filling method to defect part of mammary gland after breast-conserving therapy by using polyglycol mesh. J Jpn Surg Soc 2003; 104: 243.
9. Goldhirsch A, Wood WC, Gelber RD, Coates AS, Thurlimann B, Senn HJ: Meeting Highlights: Updated International Expert Consensus on Primary Therapy of Early Breast Cancer. JCO 2003; 21: 3357–3365.
10. Yamashita K: Cosmetic assessment. J Jpn Soc Endosc Surg 2005; 10: 165–170.
11. Okamoto T, Shimozuma K, Katsumata N, et al.: Measuring quality of life in patients with breast cancer: a systematic review of reliable and valid instruments available in Japan. Breast Cancer 2003; 10: 204–213.
12. Perissat J, Collet D, Belliard R, et al.: Laparoscopic cholecystectomy: the state of the art. A report on 700 consecutive cases. World J Surg 1992; 16: 1074–1082.
13. McKneally MF, Lewis RJ, Anderson RJ, et al.: Statement of the AATS/STS Joint Committee on Thoracoscopy and Video Assisted Thoracic Surgery. J Thorac Cardiovasc Surg 1992; 104: 1.
14. Penzer RD, Patterson MP, Lipsett JA: Factors affecting cosmetic outcome in breast conserving cancer treatment — objective quantitative assessment. Breast Cancer Res Treat 1992; 20: 85–92.
15. Bajaj AK, Kon PS, Oberg KC, Miles DA: Aesthetic outcomes in patients undergoing breast conservation therapy for the treatment of localized breast cancer. Plast Reconstr Surg 2004; 114: 1442–1449.
16. Tamaki Y, Nakano Y, Sekimoto M: Transaxillary endoscopic partial mastectomy for comparatively early-stage breast cancer. Surg Laparosc Endosc 1998; 8: 308–312.
17. Tamaki Y, Sakita I, Miyoshi Y, et al.: Transareolar endoscopy-assisted partial mastectomy : a preliminary report of six cases. Surg Laparosc Endosc Percutan Tech 2001; 11: 356–362.
18. Fukuma E, Wadamori K, Higa K, et al.: Endoscopic surgery for the breast diseases. Geka Chiryo 2002; 86: 941–948.
19. Malur S, Bechler J, Schneider A: Endoscopic axillary lymphadenectomy without prior liposuction in 100 patients with invasive breast cancer. Surg Laparosc Endosc Percutan Tech 2001; 11: 38–41.
20. Yamagata M, Mikami M, Hasegawa T, et al.: The axillary lymph node dissection by endoscopic surgery. J Jpn Soc Endosc Surg 2001; 6: 163–167.
21. Harder F, Zuber M, Kocher T, et al.: Endoscopic surgery to the axilla—a substitute for conventional axillary clearance? Recent Results Cancer Res 1998; 152: 180–189.
22. Kitamura K, Hashizume M, Kataoka A, et al.: Early experience of endoscopic extirpation of benign breast tumors via an extra-mammary incision. Am J Surg 1998; 176: 235–238.
23. Cheung KL, Blamey RW, Roberton JFR, Elston CW, Ellis IO: Subcutaneous mastectomy for primary breast cancer and ductal carcinoma in situ. Eur J Surg Oncol 1997; 23: 343–347.
24. Ho WS, Ying SY, Chan AC: Endoscopic-assisted subcutaneous mastectomy and axillary dissection with immediate mammary prosthesis reconstruction for early breast cancer. Surg Endosc 2002; 16: 302–306.

(Received, March 20, 2006)
(Accepted, May 31, 2006)