

Urinary Satisfaction of Patients Who Underwent Robot-Assisted Nerve-Sparing Radical Hysterectomy

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ABSTRACT

The purpose of this study was to understand the actual situation of urination impairment to understand whether a robot-assisted nerve-sparing radical hysterectomy (RA-NSRH) is superior to an open radical hysterectomy (RH) in point of nerve sparing. The outcomes of the operation and urination were compared between patients who had undergone an open NSRH (n = 7) in the same period as RA-NSRH (n = 7) and patients who had undergone RH without the consideration of nerve sparing (n = 20). In addition, a questionnaire survey was conducted concerning urination, including presence or absence of a desire to urinate, urinary straining, and urinary incontinence, as well as a urinary satisfaction, in 36 patients who had undergone a robot-assisted hysterectomy, including seven patients who had undergone RA-NSRH and 22 patients who had undergone an open RH without intermittent self catheterization. Although the surgical time of RA-NSRH was significantly longer than that of open RH, the amount of bleeding was significantly less and the days of hospitalization were significantly fewer in RA-NSRH. The completion rates of both the

surgeries were similar from the viewpoint of the number of pelvic lymph nodes removed. The period to complete spontaneous urination was significantly shorter in the RA-NSRH group than that in the open NSRH and normal RH groups. There was no difference in the post-operative urinary satisfactions of patients between the RA-NSRH (75.0 points) and open RH groups (including NSRH) (71.1 points) if the pre-operative urinary condition was defined as 100. Ganglion cells were found in the posterior layer part of vesicouterine ligament of patients in the RA-NSRH group and an autonomic nerve was partly spared. RA-NSRH could not improve a long-term urinary satisfaction. Therefore, more improvement of the operative method will be required to enhance the quality of life (QOL).

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Key words: Robot-assisted nerve-sparing radical hysterectomy; Open nerve-sparing radical hysterectomy; Urinary Satisfaction; Posterior layer part of vesicouterine ligament

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INTRODUCTION

Worldwide, 470,000 women develop cervical cancer annually, of which 230,000 women die of the disease^[1]. It has been clarified that the etiology of cervical cancer is a persistent infection of the carcinogenic human papillomavirus (HPV), and HPV vaccines have been developed. Although the spread of cervical cancer examination and decrease in the number of birth reduces the number of patients with cervical cancer, the number of young women in their 20s-30s with cervical cancer has rapidly increased since the late 1980s, with a

peak of the morbidity from their late 30s to their early 40s recently^[2]. Therefore, the development of a more effective prophylaxis and examination, as well as the introduction of therapeutic strategies taking into account of sparing the fertility, sexual function, and bladder function of young women with cervical cancer to a high degree are required.

An open radical hysterectomy (RH) for cervical cancer was arranged as a modern operative method by Wertheim in 1912^[3], and later Okabayashi heightened its completeness of recovery to perfect RH, of which the extent of resection ranges over vesicouterine ligament, cardinal ligament, sacrouterine ligament, and paracolpium^[4]. While the treatment outcome improved, post-operative impairment of urination and defecation frequently occurred as the pelvic plexus was also abscised. Sparing the autonomic nerve system, particularly the hypogastric nerve, pelvic splanchnic nerve, and pelvic plexus and its vesical branch, is required to prevent the post-operative impairment of urination. An operative method of nerve sparing (NS) was proposed in 1961, with which only a blood vessel part of the cardinal ligament was abscised to spare the pelvic splanchnic nerve^[5,6]. Improvement of the operative method was reported thereafter and the indication extended from stage IB to stage IIA^[7,8].

A robot-assisted surgery means an operation using the da Vinci surgical system (manufactured by Intuitive Surgical, Inc.). The da Vinci surgical system was approved as a medical device by the Food and Drug Administration (FDA) in 2000 in the US and urologic surgeries were approved as the indications by the FDA in 2001. Thereafter, in obstetrics and gynecology area, hysterectomy and enucleatic myomectomy were approved as the indications by the FDA in 2005^[9]. In 2009, 85% or more of radical prostatectomy in the US adopted the operative method using the da Vinci surgical system. However, the surgeries in obstetrics and gynecology area in the world accounted for 45% of the cases using the da Vinci surgical system in 2010, exceeding those in urological area, which made obstetrics and gynecology the department mostly using the system^[10]. The number of cases in the world using the da Vinci surgical system in obstetrics and gynecology area was 125,000 in 2010, of which 78,000 cases were hysterectomy, 32,000 cases were malignant uterus tumor, and others^[11]. Such a rapid diffusion of the da Vinci surgical system has a background of its excellent functions; that is, the clamp operation with high degree of freedom as if an operator could move it with his or her fingertips and no transfer of hand movement. In addition, this may be the result of matching the system to the gynecological surgeries mainly with deep intrapelvic operation because of its broad visual field using three-dimensional images and magnification of up to 10 times.

Our department initiated a robot-assisted nerve-sparing radical hysterectomy (RA-NSRH) in 2013. Is a robot-assisted surgery with both operability by computer control and low invasiveness superior to an open RH in point of NS? The purpose of this study was defined to understand the actual situation of urination impairment in patients who had undergone a robot-assisted RH or an open RH.

SUBJECTS AND METHOD

Robot-assisted surgeries with the indication to benign uterus tumor, cervical cancer, and cancer of uterine body were approved by the Ethics Committee in November 2011. Moreover, investigations of the safety and quality of life (QOL) of patients who underwent a robot-assisted surgery were approved. The robot-assisted surgery was started in December 2011, and seven cases of RA-NSRH were

conducted from March 2013 to October 2014. The indication of an open NSRH or a robot-assisted NSRH was defined to the cases of stage IB1 without the enlargement of bilateral pelvic lymph nodes or common iliac lymph nodes and with a 3 cm or smaller diameter tumor, even cases of stage IIA1 with mild vaginal wall infiltration. The cases undergoing neoadjuvant chemotherapy were excluded. Age and type of cancer did not matter. Gynecologic Cancer Group of the European Organization of Research and Treatment of Cancer (GCG-EORTC) type III was adopted in RH conducted in our department. The outcomes of the operation and urination were compared between patients who had undergone an open NSRH in the same period of a RA-NSRH ($n=7$) and patients who had undergone a RH without consideration of NS ($n=20$).

Furthermore, a questionnaire survey was conducted concerning urination, including presence or absence of a desire to urinate, urinary straining, and urinary incontinence, as well as a urinary satisfaction in 36 patients who had undergone a robot-assisted hysterectomy, including seven patients who had undergone a RA-NSRH and 22 patients who had undergone an open RH without intermittent self catheterization.

Statistical analyses were carried out by Student's t-test, Chi square test or Fisher's exact probability test using SPSS (version 21, SPSS Inc., Chicago, IL, USA). A result was deemed significant at $P<0.05$.

RESULTS

Outcome of Operation

The way of NS was defined as detaching the vesical branch and uterine branch of the pelvic plexus from the vaginal wall into the outside to selectively abscise only the uterine branch, and finally a nerve was spared as a nerve plane, which comprised a hypogastric nerve, pelvic splanchnic nerve, and vesical branch of pelvic plexus (Figure 1).

No case was changed into an open surgery during the operation in seven cases of RA-NSRH. Although the surgical time of RA-NSRH was significantly longer than that of an open RH, the amount of bleeding was significantly less and the days of hospitalization was significantly fewer in RA-NSRH (Table 1). There was no case of blood transfusion in the RA-NSRH group (Table 1). The completion rates of both surgeries were similar from the viewpoint of the number

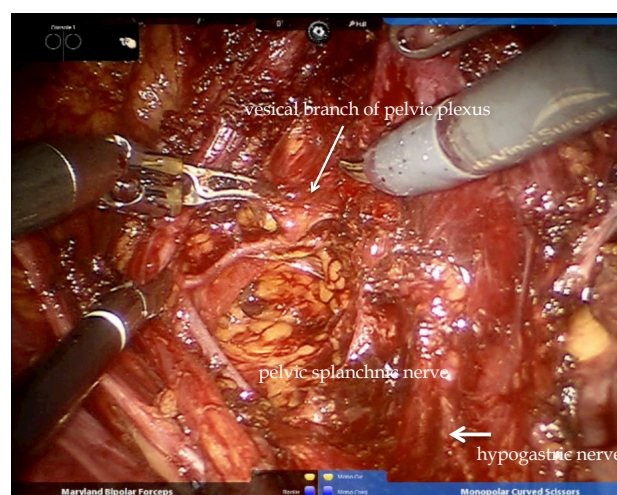


Figure 1 Nerve sparing radical hysterectomy. A nerve was spared as a nerve plane, which comprised a hypogastric nerve, pelvic splanchnic nerve, and vesical branch of pelvic plexus.

of pelvic lymph nodes removed (Table 1). There was one case of vaginal stump recurrence during the observational period in the open surgery group, whereas there was no case of that in the RA-NSRH group.

Outcome of Urination

There were no patients who required self catheterization for three months or longer in the RA-NSRH and open NSRH groups, whereas there were five cases (25%) in the normal RH group (Table 2). Although there was no difference in a desire to urinate among the groups since early postoperative period, the period to complete spontaneous urination was significantly shorter in the RA-NSRH group than in the other two groups (Table 2).

Result of the Questionnaire Survey Concerning Urination

There was no difference between the RA-NSRH and open RH groups (including NSRH) in the presence or absence of a desire to urinate (Table 3). There was a tendency to have many cases of urinary incontinence in the open RH group (Table 3). When the post-operative urinary satisfactions of patients were scored, there was no difference between the robot-assisted surgery group (75.0 points) and open surgery group (71.1 points) if the pre-operative urinary condition was defined as 100 (Table 3). Comparison among the patients who had undergone a robot-assisted surgery showed that only two patients in 29 patients of the GCG-EORTC type I group/type II group (7%) had a urinary straining, whereas four patients in seven patients of the RA-NSRH group (57.1%) had urinary straining (Table 4). There was a significant difference in the post-operative urinary satisfactions of patients between the RA-NSRH group and GCG-EORTC type I group/type II group (Table 4).

Pathological Consideration

When a posterior layer of the vesicouterine ligament of patients in the RA-NSRH group was pathologically searched, ganglion cells were found, as shown in Figure 2. It was clarified that a part of the vesical

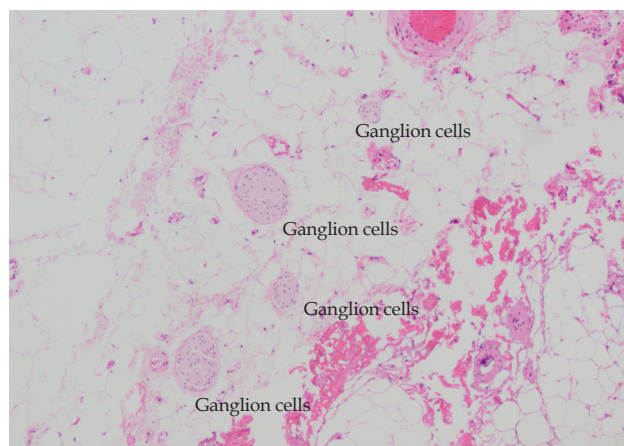


Figure 2 Abscission of autonomic nerve related to urination. Ganglion cells were found in a part of the vesical branch of the pelvic plexus. Magnification of a photomicrograph is $\times 200$.

branch of the pelvic plexus was abscised by abscising a posterior layer of the vesicouterine ligament of patients, even if NSRH was performed.

DISCUSSION

Residual urine volume is a numerical factor and the desire to urinate decreases, which may lead to a urinary straining. Then, we investigated a long-term urinary satisfaction in patients with the post-operative complete spontaneous urination. The period to complete

Table 1 Comparison of outcome of operation between robot and open Radical hysterectomies.

	Robot (n=7)	Open(n=27)	P value
Operation time (min)	326.4 \pm 25.7	238.0 \pm 45.7	<0.001
Console time (min)	275.8 \pm 26.9		
Blood loss (g)	72.9 \pm 50.4	908 \pm 413.8	0
Blood transfusion	0	5 (18.5%)	n.s.
Number of excised lymph nodes	31.2 \pm 9.0	35.9 \pm 7.1	n.s.
Days of hospitalization	6.5 (6-8)	45.0 (19-97)	0
Relapse	0	1 (3.7%)	n.s.

n.s.: not significant.

Table 3 Result of the questionnaire survey concerning urination.

	Question items	RA-NSRH (n=7)	Open RH (n=22)
Desire to urinate	Normal	4 (57%)	15 (68%)
	Weak	3 (43%)	6 (27%)
	Absence	0	1 (5%)
Urinary straining	Unnecessarily	3 (43%)	9 (41%)
	Weakly	4 (57%)	9 (41%)
	Strongly	0	3 (13%)
	As needed to push the abdomen	0	1 (5%)
Urinary incontinence	No	6 (86%)	12 (55%)
	Sometimes yes	1 (14%)	8 (36%)
	Frequently yes	0	2 (9%)
Urinary satisfaction	Scores if preoperative condition was defined as 100	75.0 \pm 15.2	71.1 \pm 24.5

RA-NSRH: robot assisted nerve-sparing radical hysterectomy.

Table 4 Result of the questionnaire survey concerning urination among the patients who had undergone a robot-assisted surgery.

	Question items	RA-NSRH (n=7)	GCG-EORTC I/II (n=29)
Desire to urinate	Normal	4 (57%)	23 (68%)
	Weak	3 (43%)	6 (27%)
	Absence	0	0
Urinary straining	Unnecessarily	3 (43%)	27 (93%)
	Weakly	4 (57%)	2 (7%)
	Strongly	0	0
	As needed to push the abdomen	0	0
Urinary incontinence	No	6 (86%)	21 (72%)
	Sometimes yes	1 (14%)	7 (24%)
	Frequently yes	0	1 (4%)
Urinary satisfaction	Scores if preoperative condition was defined as 100	75.0 \pm 15.2*	92.0 \pm 7.5

RA-NSRH: robot assisted nerve-sparing radical hysterectomy; GCG-EORTC I/II: Gynecologic Cancer Group of the European Organization of Research and Treatment of Cancer; type I/II. * < 0.05.

Table 2 Comparison of outcome of urination among robot assisted nerve-sparing radical hysterectomy (NSRH), open NSRH and open RH.

	RA-NSRH (n=5)	Open NSRH(n=7)	Open RH (n=20)	P value
Self catheterization for three months or longer	0	0	5 (25.0%)	n.s.
Period to complete spontaneous urination (days)	15.0 (5-23)*, **	20.3 (9-36)	34.9 (14-125)	* < 0.05, ** < 0.01
Desire to urinate since early postoperative period	5 (100%)	6 (85.7%)	15 (75%)	n.s.

* versus open NSRH, ** versus open RH. n.s.: not significant.

spontaneous urination was significantly shorter in the RA-NSRH group than that in the open NSRH group, whereas there was no difference in the long-term urinary satisfaction. This investigation clarifies that complete spontaneous urination does not necessarily lead patients to the complete recovery of the pre-operative condition. The reason is because NSRH does not completely spare an autonomic nerve related to urination. This study clarifies that a part of the vesical branch of the pelvic plexus was abscised by abscising a posterior layer of the vesicouterine ligament of patients. More improvement of the operative method will be required for improvement of the QOL.

A remarkable difference was found between the RA-NSRH group and GCG-EORTC type I group/type II group with robot-assisted surgeries in a urinary satisfaction. A simple hysterectomy was performed in GCG-EORTC type I, whereas blood vessels of the cardinal ligament or a posterior layer of the vesicouterine ligament of patients were not abscised in the hysterectomy of GCG-EORTC type II. We investigated the infiltration of parametrium in 6 cases of advanced stage IB1 and being pathologically diagnosed as stage IIB (pT2b) after the surgery. As the result, the infiltrations of parametrium in all of the 10 cases were metastases to cardinal ligament lymph nodes (unpublished data). This possibly means that the abscission of the blood vessels of the cardinal ligament (deep uterine veins) is not required if all of the cardinal ligament lymph nodes can be removed, which can also spare a posterior layer of the vesicouterine ligament. Then, it may be possible to perform the operative method to remove all of the cardinal ligament lymph nodes under the magnified visual field, an advantage of a robot-assisted surgery, and to spare the blood vessels of cardinal ligament and a posterior layer of vesicouterine ligament in patients with stage IB1 of cervical cancer. It was reported that there was no infiltration of the cardinal ligament in the examination of 201 cases with stage IB1 of cervical cancer, wherein the diameter was 2 cm or smaller^[12]. Therefore, the possibility is suggested in the case of cervical cancer, wherein the diameter was 2 cm or smaller, to spare pelvic splanchnic nerve, vesical branch of pelvic plexus, and hypogastric nerve and to avoid urination impairment by keeping the completeness of recovery from cervical cancer, if a lymph node dissection, including cardinal ligament lymph nodes, is performed with a robot-assisted surgery and the modified radical hysterectomy of GCG-EORTC type II is adopted.

Japan has had a history with increasing improvement of the nerve-sparing operative methods by further examination of the transition of a pelvic autonomic nerve using unfixed subjects of dissections [5-8]. In the research of NSRH using intraoperative electrical stimulation (IES), an urodynamic study demonstrated that the rate of sparing of an autonomic nerve was increased along with more experiences to use IES, and this method can also be a useful operative method in the future^[13,14]. However, a long-term follow-up of patients' satisfaction with these operative methods has not been conducted yet, and the patients' satisfaction was low in this survey, even when NS was considered to be successfully performed. Thus, a long-term follow-up of urination may be an examination subject in the future.

A robot-assisted surgery can bring a magnified visual field, excellence in the identification of membrane structure and layers, and micro operation. Although a robot-assisted surgery seems to be suitable to spare an autonomic nerve, selection of a limited surgery such as hysterectomy of GCG-EORTC type II or an examination including the long-term prognosis, may be an important theme in the future to consider the QOL seriously, in the case of cervical cancer,

wherein the diameter was 2 cm or smaller with little possibility of infiltration of the cardinal ligament.

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CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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