

Intraoperative electrical stimulation of the pelvic splanchnic nerves during nerve-sparing radical hysterectomy

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Abstract

Objectives. This study sought to determine whether intraoperative electrical stimulation (IES) of pelvic splanchnic nerves (PSNs) while monitoring bladder contraction was useful to predict postoperative bladder function during conventional nerve-sparing radical hysterectomy.

Methods. Seventeen patients with stage Ib or IIa cervical cancer underwent conventional radical hysterectomy. IES was performed in all cases, stimulating the roots of PSN, the posterior sheath of the vesicouterine ligament (PVL) and the dorsal area of the ligament. After resection of the uterus, the PSN roots were stimulated again. Bladder function was evaluated by urodynamic study (UDS) preoperatively and 3 months after surgery.

Results. The results of IES were consistent with bladder function evaluated by postoperative UDS. In 13 of 17 cases, an increased intravesical pressure was observed with IES of the PSN roots after uterus resection. Nine of 13 cases showed marked detrusor contraction with UDS 3 months after surgery and were able to void without using abdominal pressure except in one case. In the remaining 4 of 17 cases, no response could be detected to IES on either side. Three cases voided using abdominal pressure and one used clean intermittent self-catheterization without spontaneous voiding.

Conclusions. IES while monitoring intravesical pressure during radical hysterectomy represents a technically simple and useful procedure for the prediction of postoperative bladder function.

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Keywords: Electrical stimulation; Nerve-sparing radical hysterectomy; Urodynamic study; Pelvic autonomic nerve

Introduction

Radical hysterectomy has been performed to treat stage Ib, IIa and IIb cervical cancer in Japan. Recently, nerve-sparing procedures during radical hysterectomy for early cervical cancer have become accepted because they can preserve bladder function [1–6]. However, the nerve-sparing procedures need improvement since many patients still suffer from various levels of neurogenic bladder after radical hysterectomy. To improve nerve-sparing procedures, it is important to establish precise methods of intraoperative evaluation of nerve preservation. Kuwabara et al. [7]

reported a method to identify pelvic autonomic nerves during radical hysterectomy by using intraoperative electrical stimulation (IES) while monitoring intravesical pressure. They showed that autonomic nerve branches ran from the pelvic plexus to the bladder via the lateral and dorsal surfaces of the posterior sheath of the vesicouterine ligaments (PVL) and published a new method of nerve sparing based on these findings [7].

In nerve-sparing operations on other organs, such as radical prostatectomy [8,9] and total mesorectal excision [10], IES of pelvic autonomic nerves has been used as a simple and reliable method to demonstrate the preservation of autonomic nerves.

In this study, we determined whether postoperative bladder dysfunction could be evaluated using IES in

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accordance with Kuwabara's procedure [7]. We evaluated whether IES of the PSN roots while monitoring bladder contraction is useful to identify pathways from the PSN roots (S2–4) to the bladder and to predict postoperative bladder dysfunction.

Patients and methods

Patient characteristics

Seventeen patients with stage Ib or IIa cervical cancer, 11 with squamous cell carcinoma and six with adenocarcinoma, were enrolled sequentially in this study. Subjects with a median age of 49 years (range, 27 to 70 years) underwent type III radical hysterectomy [2,3,5] at the Tohoku University Hospital during the period from July 2002 to December 2003. Informed consent was obtained from each patient. The additional time required for IES was approximately 30 min and the mean operation time was 272 min. Eight cases received adjuvant therapy with concurrent chemoradiotherapy and one with radiotherapy (Table 1).

Nerve-sparing radical hysterectomy

We performed nerve-sparing surgery as follows: After pelvic lymphadenectomy, only the vascular part of the cardinal ligament was clamped and severed. The hypogastric nerves were identified and separated under the ureter in the layer that borders the pararectal space on the rectal side. During the subsequent dissection of the rectovaginal ligament, care was taken not to damage the pelvic plexus.

Table 1
Characteristics of patients who underwent nerve-sparing radical hysterectomy

No	Age	Stage	Pathology	Blood loss(g)	Adjuvant therapy
1	61	Ib1	SCC	1166	None
2	27	Ib1	SCC	1907	CCR
3	44	Ib1	Adeno	1000	CCR
4	35	Ib1	SCC	1350	None
5	74	IIa	SCC	2525	CCR
6	31	Ib1	SCC	1167	None
7	55	Ib1	Adeno	587	CCR
8	46	Ib1	Adeno	865	CCR
9	51	Ib1	SCC	905	CCR
10	70	Ib1	Adeno	928	CCR
11	53	Ib1	SCC	1910	CCR
12	31	Ib1	SCC	1590	None
13	35	Ib1	Adeno	560	None
14	65	IIa	SCC	1340	None
15	42	Ib1	Adeno	1012	None
16	37	Ib2	SCC	562	None
17	70	Ib2	SCC	1542	RT

SCC: squamous cell carcinoma; adeno: adenocarcinoma.
CCR: concurrent chemoradiotherapy; RT: radiotherapy.

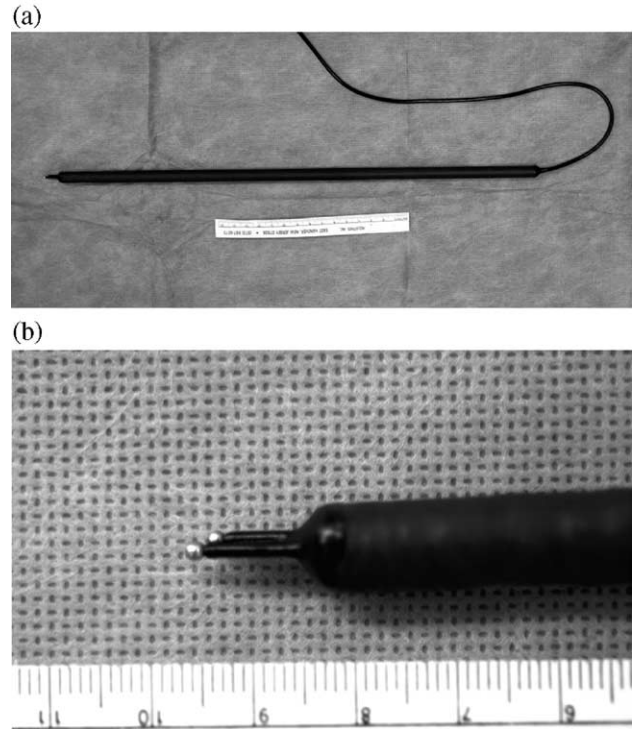


Fig. 1. (a) Long-handled pair of bipolar electrodes. (b) Tip of the bipolar electrodes.

The anterior sheath of the vesicouterine ligament was treated in the conventional manner. With the bladder pressed downward and the ureter retracted laterally, a triangular-shaped recess was clearly seen and a forceps was placed below the PVL and turned upwards. The PVL was lifted in front of the cardinal ligament and marked with surgical tape.

IES during surgery

The bladder was filled with 100 ml of saline. A Neuropack Sigma apparatus (Nippon Khoden, Tokyo, Japan) was used for IES. IES of the autonomic pelvic nerve fibers was performed with a single long-handled bipolar electrode (handle of 8 mm in diameter and 40 cm in length) (Fig. 1) [6,7]. IES was maintained at 30 mA for 10 s using 10 Hz monophasic rectangular pulses with a pulse duration of 1.0 ms. The following structures were stimulated bilaterally before resection of uterus: the bilateral roots of PSN (S2–S4), the bilateral PVL marked with surgical tape, and the dorsal part of the vesicouterine ligaments (Fig. 2). The stimulation points on the PSN roots were marked by blue dye. The marked points were stimulated again after resection of the uterus. The change of intravesical pressure with IES was monitored on a chart recorder (Matsushita Electric, Osaka, Japan). In this study, we defined the preservation of PSN function as an increase of intravesical pressure by at least 3 cm H₂O in accordance with Kuwabara's method [7] (Fig. 3).

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