A New Perspective on Nerve-sparing Radical Hysterectomy: Nerve Topography and Over-preservation of the Cardinal Ligament

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Background: Nerve-sparing radical hysterectomy was established by Japanese gynecologists. They identified two parts of the cardinal ligament, namely the vascular part and the neural part, and postulated that the neural part contained the pelvic splanchnic nerves. However, our fresh cadaver studies demonstrated that these nerves ran dorsomedially in contrast to the classical concept. The aim of this study is to further validate this finding in clinical cases.

Methods: We examined the intraoperative biopsy specimens collected from the neural part of the cardinal ligament in four patients with cervical carcinoma who underwent nerve-sparing radical hysterectomy with dissection of the neural part.

Results: Careful dissections demonstrated that the pelvic splanchnic nerves arise from the dorsomedial side of the neural part at the bottom of the pararectal space. The neural part was composed of a connective tissue with focal positive staining by S-100 protein.

Conclusions: We propose that complete dissection of the cardinal ligament should be performed during nerve-sparing hysterectomy to increase its radicality.

Key words: nerve-sparing radical hysterectomy – cardinal ligament – pelvic splanchnic nerves

INTRODUCTION

Although radical hysterectomy for early uterine cervical cancer has a long history, Japanese gynecologists (1,2) have made great efforts to revise the classical Wertheim method (3) so as to preserve pelvic autonomic nerves while maintaining a high curability (the so-called Tokyo method). Japanese gynecologists focused their attention on the cardinal ligament of the uterus rather than that of the parametrium. Once the pararectal and paravesical spaces are developed, the cardinal ligament appears clearly between the two spaces. Japanese gynecologists identified two parts in the cardinal ligament, i.e. the vascular part and the ‘nerve’ part. They believed that the neural part of the cardinal ligament contained the pelvic splanchnic nerves. Today, the pelvic splanchnic nerves running along the cardinal ligament are even shown in a figure prepared by a Western gynecologist (Fig. 1a). Therefore, in the context of nerve-sparing treatment, the cardinal ligament has become one of the critical issues for the surgical procedure, at least in Japan. It is only recently that nerve-sparing radical hysterectomy has been introduced to Western (4) as well as to Asian countries (5). Thus, it took a surprisingly long time for the ‘Tokyo method’ to gain acceptance elsewhere in the world. In this paper, we take a new look at the ‘classical’ Tokyo method, because there is the possibility that we can achieve better radicality by correcting the current misunderstanding of nerve topography that leads to over-preservation of the cardinal ligament.

By dissection of fresh cadavers, we have demonstrated that the neural part of the cardinal ligament is not likely to contain the pelvic splanchnic nerves (Fig. 1b), but instead is composed of a collagenous connective tissue similar to the transverse cervical ligament (6). Therefore, we hypothesized that during nerve-sparing radical hysterectomy the pelvic splanchnic nerves are actually located in the medial wall of the pararectal space and covered with rectal retractor or are located in the floor of this space. We confirmed this hypothesis in recent clinical cases.
PATIENTS AND METHODS
Between November 1, 2001 and August 31, 2002 four patients with stage Ib–IIb cervical carcinoma underwent radical hysterectomy with the dissection of the neural part of the cardinal ligament at the Cancer Institute Hospital, Tokyo. The median age of the patients was 41 years (range 28–64 years). Intraoperative biopsy specimens were collected from the neural part of the cardinal ligament in all cases.

RESULTS
After ligation and division of the vascular part of the cardinal ligament, careful dissection demonstrated that the pelvic splanchnic nerves arise from the dorsomedial side of the neural part of the cardinal ligament at the bottom of the pararectal space (Fig. 2). The pelvic splanchnic nerves run dorsomedially, in contrast to the classical concept (Fig. 1a). The neural part of the cardinal ligament was composed of connective tissue with focal positive staining by S-100 protein (Fig. 2). The same histological findings were obtained in the remaining three cases.

DISCUSSION
Which part of the pelvic autonomic nerves should gynecologists preserve? The answer seems to be both the pelvic plexus and the entire course of its afferent and efferent nerves, i.e. the branches of the hypogastric (sympathetic) nerve and the pelvic splanchnic (parasympathetic) nerves running through from the pelvis to the bladder, rectum and vagina. Actually, those nerves seem to be well preserved when the Tokyo method is performed with careful handling of the dorsal part of the vesicouterine ligament. Thus, we agree that the Tokyo method has a great advantage over radical hysterectomy. An adequate surgical margin is provided by the dorsal half of the cardinal ligament, i.e. the neural part, which separates the vascular part from the pelvic splanchnic nerves. Therefore, the nerves are well preserved despite the probable misunderstanding of their anatomy. However, the current surgical margin might compromise radicality.

Trimbos et al. considered the lack of dissection of the most lateral and distal part of the parametrium (including the neural part of the cardinal ligament) as the major concern with the
Tokyo method in the case of stage II cervical cancer (4). However, Yabuki and colleagues obtained good results in stage II cervical cancer, even when removal of the parametrium or cardinal ligament was restricted to the ventral or superficial side of the deep uterine vein (7). The Tokyo method, i.e. the usual nerve-sparing procedure, also provided good results (2,8). Höckel et al. reported that pelvic side wall recurrence of cervical cancer showed the involvement of the perispinous adipose tissue in 37% of cases (9). MRI demonstrates a distinct region of perispinous adipose tissue, which is a triangular zone between the mesorectum (lower border), the uterovaginal venous plexus (upper border) and the obturator internus, coccygeus and iliococcygeus muscles (lateral border). According to their cadaver study, this perispinous adipose tissue corresponds to the neural part of the cardinal ligament and the so-called ‘lateral ligament of the rectum’ (9). If complete dissection of the cardinal ligament is accepted for nerve-sparing hysterectomy, which is our proposal, greater radicality would be obtained.

How should we handle or dissect the cardinal ligament and does extended surgery have any new disadvantages? Division of the neural part of the cardinal ligament should be performed immediately along the lateral pelvic wall and it should never be done at the medial part of the ligament, so that the floor or the dorsal aspect of the pararectal space are kept intact to avoid damage to the pudendal nerve and/or the nerves to the levator ani. The neural part of the cardinal ligament observed in our resected specimen (Fig. 2) may be part of these nerves. There is a risk that non-preservation of the neural part of the cardinal ligament may lead to too aggressive surgery such as complete dissection of the pararectal space and/or the visceral stump of the ligament. We usually perform gentle mobilization of the visceral stump of the cardinal ligament, so that the pelvic plexus and its visceral branches remain intact. To the best of our knowledge, the ideal method for dissecting the dorsal or deep layer of the vesicouterine ligament has not yet been established and it remains the ‘last problem’ for nerve-sparing radical hysterectomy. Even if aggressive dissection is performed at the floor of the pararectal space, we do not recommend taping the splanchnic nerves, because the tape might damage the nerve fibers. Likewise, overdissection of the pelvic floor should be avoided.

We believe that the Tokyo method will become better appreciated around the world if the handling of lateral wall recurrence is improved, based on the actual anatomy as validated in this report.

References