

Clinical significance of preservation of the superior and inferior vesical arteries in the recovery of bladder function after radical operation for uterine cervical cancer

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In order to increase the 5 year survival rate, lessening the incidence of urogenital complication by facilitating the recovery of bladder function is one of the important factors. For this purpose, two techniques—preservation of the pelvic splanchnic nerves and of the superior and inferior vesical arteries—were devised. Both were proved satisfactorily effective in facilitating the recovery of bladder function. We rather prefer the latter to the former because the arteries are strong enough to tolerate cleansing of the attached parametrial or areolar tissues possibly harboring more or less cancer cells, particularly because of the frequent permeation of cancer cells alongside the perineural tissue. The clinical significance should be evaluated on the basis of the 5 year survival rate. Our clinical experiences indicate that not only the pelvic splanchnic nerves but also the plexus uterovaginalis, the plexus vesicalis, the balance of the tonus between the detrusor and the internal sphincter, pelvic infection, and the blood circulation of the bladder are related to the recovery of bladder function.

THE ACTION OF micturition involves action of the detrusor and the sphincters. The basis of detrusor contraction is a stretch reflex arc subject to inhibition and facilitation from higher centers. However, much is still unsettled concerning the true mechanism of micturition.

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The paraganglionic fibers arising from S₂ to S₄, mainly from S₂ (sacral parasympathetic nerve) traverse the pelvic nerves (nervi splanchnici, nervi erigentes) and the inferior hypogastric plexus to synapse with postganglionic neurons in the ganglion clumps lodged in the bladder wall. These fibers constitute the efferents for the detrusor muscle and the internal sphincter. The plexus uterovaginalis located at the junction of the cardinal ligament and rectovaginal ligament, an extension of the sacrouterine ligament, and the plexus vesicalis located in the posterior sheath of the vesicouterine ligament lateral to the ureterovesical junction are also connected to the extra- and intra-mural ganglion cells of the bladder. The external sphincter is innervated by a somatic nerve derived from S₂ to S₄ through nervus puden-

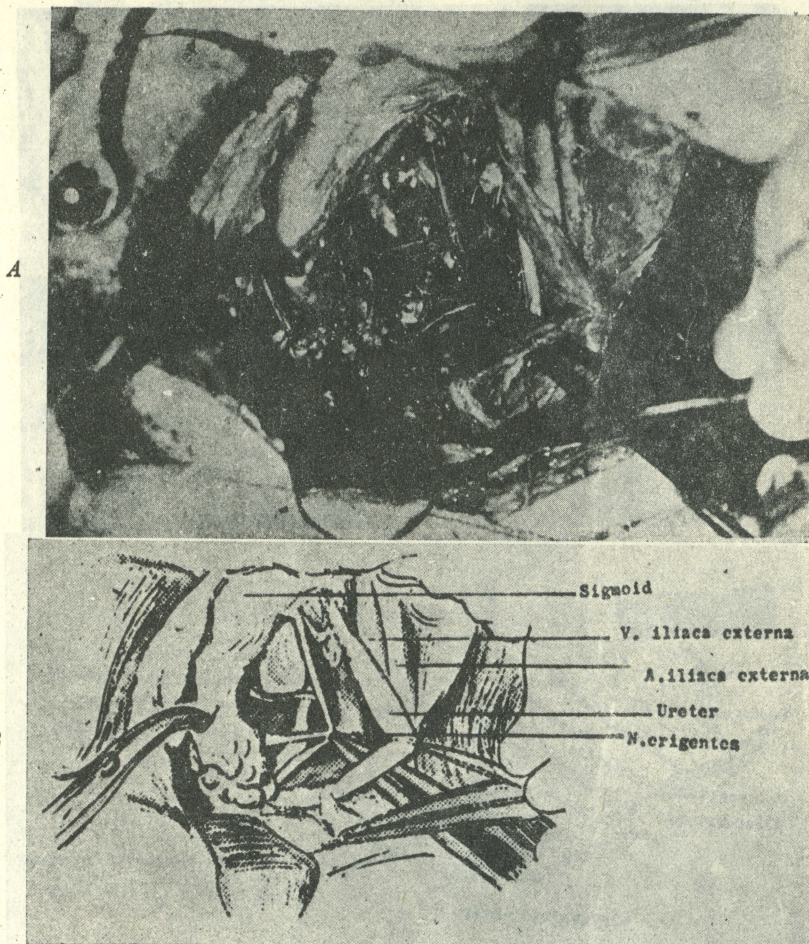


Fig. 1, A and B. The pelvic splanchnic nerves preserved in the whole course.

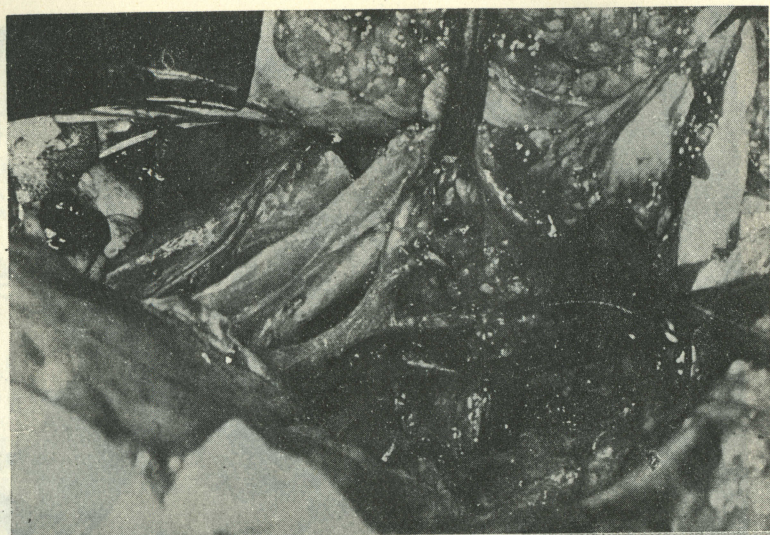
dal. The sympathetic fibers appear to play little or no role in micturition.

The Okabayashi operation is one of the most radical types of operation for uterine cervical cancer. However, the parasympathetic nerves containing parametrial tissues are necessarily severed during this operation, resulting in atonic bladder paralysis, which may give rise to urinary retention and infection. These complications are frequently so severe as to cause debility of the patients or impairment of renal function, thus counteracting the advantage of the extensiveness and thoroughness of the operation, which promises a high 5 year survival rate. In an attempt to minimize the disadvantage of the operation and to increase the 5 year survival rate, the operative techniques at our clinic

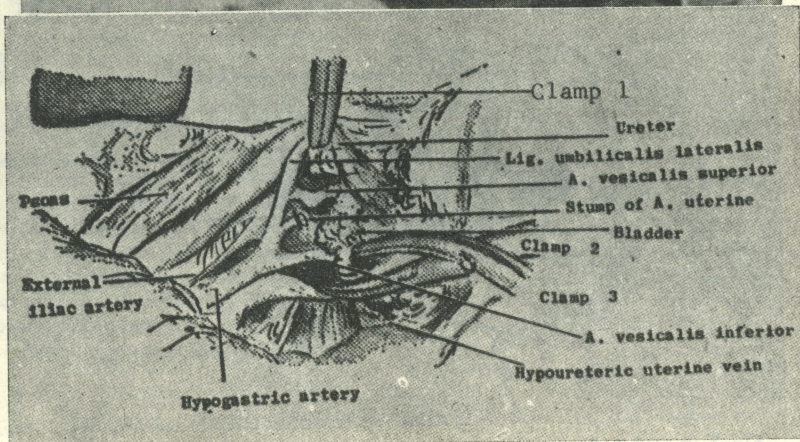
have been structured to accelerate recovery of bladder function after an operation.

Material and methods

Stage I and Stage II uterine cervical cancer cases were allocated at random to regular Okabayashi operation without preservation of the pelvic splanchnic nerves or vesical arteries, Okabayashi operation with preservation of the pelvic splanchnic nerves but without preservation of the superior and inferior vesical arteries, and Okabayashi operation with preservation of the superior and inferior vesical arteries but without preservation of the pelvic splanchnic nerves. To gain more insight into these problems, a few instances of Okabayashi operation with total vaginectomy for Stage III uterine cervical



A



B

Fig. 2, A and B. The surgical anatomy of the superior and inferior vesical artery. Clamp 2 presses the hypoureteric uterine vein downward, and Clamp 3 indicates the inferior vesical artery located directly above the hypoureteric uterine vein. Clamp 1 lifts the lateral umbilical ligament and the ureter. The superior vesical artery and the stump of the uterine artery are seen in the operative field.

cancer and Te Linde operation for Stage 0 were included in this study.

Operative techniques.^{2, 3, 5} The pelvic splanchnic nerve lies in the lowest vegetative portion of the cardinal ligament, and its whole course can be preserved by dissecting it carefully from the vascular portion of the cardinal ligament, sacrouterine, rectovaginal ligament, and then paracolpium (Fig. 1).

The anatomy of the superior vesical artery is rather simple, branching out as it does from the lateral umbilical ligament distal to the uterine artery. During operation, it is rarely severed unless it is mistaken for the uterine artery. However, the inferior vesical

artery is subject to individual anatomical variations. The anatomical relationship can be divided into 3 types. In Type 1 (40 per cent), it stems from the internal iliac artery proximal to the uterine artery; in Type 2 (24 per cent), from the obturator artery; and in Type 3 (36 per cent), indirectly from the hypogastric artery through a common stem shared with the uterine artery. When the thin fascia of the pelvic wall together with the areolar tissue is separated from the pelvic wall, a depression will be noted between the profound uterine vein (hypoureteric uterine vein) and the inferior vesical artery (Fig. 2). A long, curved Kelly

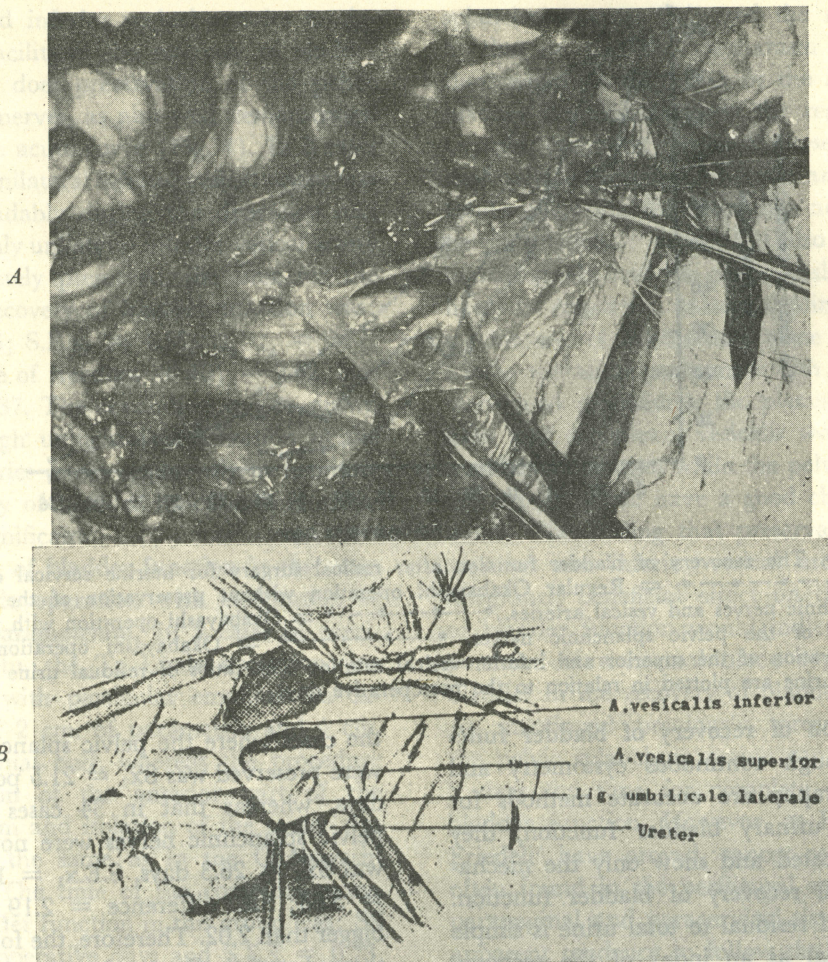


Fig. 3, A and B. Preservation of the inferior vesical artery. Two clamps are applied on the completely isolated vesicouterine ligament. The inferior vesical artery is completely saved from the clamping and attaching to the bladder as clearly seen.

clamp is put through the depression from the mesial and cranial to the lateral and caudal site, and then the Kelly clamp is opened and widened softly and gently. By hanging up the hypogastric artery, inferior vesical artery, and the ureter with a small retractor, there will be created without any bleeding a space, which is sufficient to allow a clamp to be applied on the cardinal ligament containing mainly the hypoureteric uterine vein⁴ and one to three small arteries. The inferior vesical artery is usually easily preserved in Type 1, while in Type 3, without special caution, it will frequently be sacrificed, being mistaken for a double uterine artery.

Paramount importance is, however, attached to the further dissection of the inferior vesical artery. On dissection of the anterior part of the parametrium (vesicouterine ligament), the inferior vesical artery is subject to severance at the point where it is going to supply the bladder unless much caution is exercised in dissection. If the artery were inadvertently severed or injured, the meticulous care given hitherto to isolation would come to naught (Fig. 3).

It is very interesting to note that despite its arterial nature occasionally its color and appearance rather look like a vein; therefore, this should be kept in mind during dissection.

superior and inferior vesical arteries as significantly facilitates the recovery of bladder function as does preservation of the pelvic splanchnic nerves, as also well demonstrated by the more acute curve (Fig. 4). In 8 cases where the unilateral inferior vesical artery was torn unavoidably during the dissection and therefore only unilateral inferior vesical artery was completely preserved, the time for the complete recovery of bladder function was: $S\bar{x}_3 = 24.6$; $S.E.x_3 = 4.16$, $t_{\bar{x}_2 - \bar{x}_3} = 0.37$; $t_{0.05}$ (degree of freedom = 40) = 2.02, bigger than 0.37. The conclusion can be drawn that although unilateral preservation of the vesical arteries seems apparently to facilitate the recovery of bladder function it is statistically insignificant.

Recovery of bladder function in the cases of Te Linde operation with extirpation of 2 cm. of parametrium. In 5 cases of carcinoma in situ, the Te Linde operation was performed with particular emphasis on extirpation of 2 cm. of parametria and 4 cm. of the vaginal cuff, whereas the procedure of dissection of the anterior part of the parametrium and isolation of the ureter was completely the same as in the Okabayashi operation. The time of the complete recovery of bladder function in this group was: $S\bar{x} = 30$ postoperative days and $S.E.\bar{x} = 0.73$. Compared with the cases of the Okabayashi operation with preservation of the pelvic splanchnic nerves, S.E. difference = 1.3 and $t = 6.54$, bigger than 4.59 ($p 0.001$), which means that the patients with the Okabayashi operation with preservation of the pelvic splanchnic nerves made a more rapid recovery of bladder function by 8.5 days than the patients with the Te Linde operation. Compared with the patients with the regular Okabayashi operation, S.E. difference was 2.1, which means there was no significant difference in the recovery of bladder function between the patients with Okabayashi operation without preservation of the pelvic splanchnic nerves and those with the Te Linde operation.

Comment

The facilitation of recovery of bladder function by preservation of the pelvic

splanchnic nerves indicated the role played by that nerve in the mechanism of micturition, while no difference in the recovery of bladder function between the regular Okabayashi operation without preservation of the pelvic splanchnic nerves and the Te Linde operation indicates that not only the pelvic splanchnic nerves but also the plexus uterovaginalis and the plexus vesicalis would likely be important factors dealing with the mechanism of micturition, since in the Te Linde operation performed with the above-mentioned procedures, the plexus uterovaginalis and the plexus vesicalis would be unavoidably damaged while the pelvic splanchnic nerves would have a good chance to be saved. The finding that preservation of the superior and inferior vesical arteries could have such beneficial effect on the recovery of bladder function would indicate the importance of a normal blood supply to the bladder in the recovery of bladder function. As mentioned previously, preservation of the pelvic splanchnic nerves can shorten by 5 days the time for complete recovery of bladder function. However, as Parsons and Friedell⁸ have proved, cancer cells are very often found in the perineural spaces of the paravaginal and paracervical tissues with an apparent tendency to follow the pathway of the parasympathetic nerves. On the other hand, the development of the nerve is subject to individual variations, particularly the ending of the nerve near the bladder and rectum; the fibers are always so weak and vague that enthusiastic preservation would inevitably be linked with the risk of leaving with the nerve cancer cells containing parametrial tissue. The defect of this technique may outweigh its benefit.

The superior vesical artery is distant from the cardinal ligament and very easy to preserve.⁵ The inferior vesical artery traverses the upper part of the cardinal ligament and then the outer third or middle part of the anterior part of the parametrium to reach the bladder. It is for technical convenience severed routinely⁸ during dissection or isolation of the parametria. Although the vesical arteries are also subject to variation in size, they are clearer than the nerve and their

walls are thick and strong enough to tolerate clean-up of the attached adipose or connective tissues. It is evident that, as compared with preservation of the pelvic splanchnic nerves, preservation of the vesical arteries would minimize the risk of leaving the cancer cells harboring parametrial tissues attached to the blood vessels. On the contrary, however, the chance of bleeding would be much greater with preservation of the vesical arteries than with preservation of the pelvic splanchnic nerves, because the nerves are located in the blood vessel-free lower part of the cardinal ligament, while the vesical arteries traverse the blood vessel rich upper third of the cardinal ligament.

Weighing the advantages and disadvantages of the two techniques, we are rather inclined to favor preservation of the superior and inferior vesical arteries and in fact have now abandoned preservation of the pelvic nerves. However, great caution should be exercised in complete isolation of the blood vessel from the parametria, particularly from the anterior parametrium, and tracing its whole course to the bladder; otherwise, the

inferior vesical artery might be clamped and severed together with the anterior parametrium, thereby resulting in failure of preservation at the last moment after a long dissection.

It seems very likely that preservation of the pelvic splanchnic nerves as well as the superior and inferior vesical arteries facilitates the complete recovery of bladder function; however, one must use other criteria to evaluate the clinical significance of these techniques. An increase of the 5 year survival rate should be the definite criterion for the evaluation of the clinical significance of these techniques. At this moment no definite answer can be given to this question since these techniques have been devised recently.

Any malignant tissue remaining in the pelvis as a result of preservation of the vesical arteries would affect the 5 year survival rate. In this connection, great caution should be exercised so that preservation of the vesical vessels does not accompany any attachment of parametrial tissues to them.

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