



## Urodynamic study of bladder function following nerve sparing radical hysterectomy

**Francesco Maneschi**

Department of Gynecology & Obstetrics, S. Maria Goretti Hospital, Latina; Department of Gynecology & Obstetrics, Sapienza University of Roma, Roma, Italy

See accompanying article by Kanao and colleagues on page 198.

Postoperative bladder dysfunction has been reported to occur in up to 85% of patients [1] treated with radical hysterectomy. Urinary symptoms include stress incontinence, sensory loss, bladder voiding dysfunction as hypotonic and hypertonic detrusor function [1]. These symptoms may affect the quality of life of patients surviving cervical cancer. Voiding disorders have been related to the damage of the hypogastric nerve and of the inferior hypogastric plexus due to the radical resection of the parametrial tissue. The hypogastric nerve section may occur at the level of the utero-sacral ligament and of the deep layer of the cervico-vesical ligament; the damage of the hypogastric plexus occurs at the level of the cardinal ligament. Urodynamic studies carried out after radical hysterectomy have shown that postoperatively both in the short and long term, bladder compliance is decreased, and residual volume is increased [1,2]. Major changes in bladder function are mainly observed within 12 months from surgery, when vesical function may be restored after adequate bladder care [1]. Nevertheless, significant long-term bladder dysfunction may persist in up to 80% of patients [1].

In order to preserve the bladder function following radical hysterectomy, Raspagliesi et al. [3] and Fuji [4] separately reported on a surgical technique aimed to resect the parametrium radically, while preserving the autonomic hypogastric nerve until the bladder. More recently a detailed laparoscopic nerve sparing radical hysterectomy has been reported [5]. It has been shown that utilizing the nerve sparing technique the bladder resumes a normal voiding function faster than with the traditional technique [3-5]. These promising results

have led to an increasing interest toward the nerve sparing technique and to a large body of literature. Nevertheless, few data have been reported about the urodynamic profile of the bladder following nerve sparing radical hysterectomy [6-8]. As a consequence the bladder function following the preservation of the hypogastric nerve and plexus during radical hysterectomy it is only partially known.

The nerve sparing technique, by laparotomic or laparoscopic route, includes 4 main steps: the preservation of the superior hypogastric plexus at the level of the presacral area during the presacral lymphadenectomy; the preservation of the hypogastric nerve dorsal to the ureter and lateral to the utero-sacral ligament during the section of the utero-sacral ligaments; the preservation of the inferior hypogastric plexus during the section of the cardinal ligament, since the plexus lie dorsal to the parametrial vessels at the level of the deep uterine vein; and the preservation of the bladder branch during the section of the deep layer of the cervico-vesical ligament. Two main approaches have been proposed: (1) the identification of the hypogastric nerve followed by the section of the parametria medial to the nerve [9], this obtains a type 2 or class B radicality; (2) the identification, clipping and section of the parametrial vessels at the level of the pudendal vessels, followed by the identification of the hypogastric nerve near to the utero-sacral ligaments and its separation from the fibrous part of the cardinal ligament, until the fourth space is achieved in order to obtain an adequate resection margin of the cardinal ligament and paracolpium; this technique obtains a type 3-4 or C1 radicality [3,4,8].

As regards the urodynamic aspect, despite the fact that the functional stabilization of the bladder, following radical hysterectomy, is achieved after 12 months from surgery [1], one study reported the bladder function in the early postoperative

**Correspondence to** Francesco Maneschi

Department of Gynecology & Obstetrics, S. Maria Goretti Hospital, via Canova, 04100 Latina, Italy. E-mail: francesco.maneschi@tin.it

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period, in order to assess the functional impact of the nerve sparing [8]. This study compared pre- and early postoperative (within 6 months from surgery) urodynamic results, showing that: the bladder voiding function was moderately impaired; the bladder compliance was unaltered and only 12% of patients showed a high residual urine volume. The most evident finding of the postoperative urodynamic study, when compared to the preoperative one, was the reduced detrusor activity observed during the filling phase, as expressed by the significant increase of the maximum cystomanometric capacity, and during the voiding phase, as expressed by the significant increase of flow time and time to max flow. Nevertheless, the clinical impact of these urodynamic changes were minimal: the catheter was removed in the fourth postoperative day and the patients perceived the bladder fullness and resumed spontaneous micturition. In another study, from Todo et al. [6], where the urodynamic study was carried out before and 3, 6, and 12 months after surgery, the authors concluded that their surgical technique did not cause a functional impairment of the bladder when evaluated at 12 months from surgery. A closer analysis of the urodynamic study performed at 3 and 6 months from surgery, showed a statistically significant differences for the bladder compliance, the maximum flow rate and the post-void residual urine, suggesting a transient impairment of the bladder storage and voiding function, no more evident at 12 months. These data have been confirmed in a larger study of the same authors [7]. The different results from the urodynamic studies published so far, may be related to the variations in surgical technique. However, all the studies showed a transient and moderate defect of the bladder voiding function.

The study published in this issue of *Journal of Gynecologic Oncology* by Kanao et al. [10] offers new insights on the bladder function following different approaches at the conservation of the hypogastric nerve and of the deep hypogastric plexus during laparoscopic radical hysterectomy. For a clearer understanding of the radical surgery effect on bladder function, the authors proposed to compare pre and postoperative urodynamic results, evaluated at 3, 6, and 12 months from surgery. Bladder function was evaluated by means of a ratio of the preoperative and postoperative values of the first desire to void (FDV) and detrusorial pressure at the maximal urine flow (PdetQmax). Comparing 3 different groups of patients, one treated with nerve-sparing radical hysterectomy, the second where only the deep hypogastric plexus and the roots coming from the presacral foramina were preserved, and the third treated with the classical radical hysterectomy, they were able to demonstrate that the section of the hypogastric nerve impaired bladder motor function by reducing the PdetQmax, and the section of the deep hypogastric plexus impaired the

bladder sensitivity as showed by the increase of the volume at FDV.

When considering all the urodynamics studies together, the common finding following the nerve sparing radical hysterectomy, is the mild to moderate bladder voiding function impairment observed at 3 and 6 months from surgery, and a significant recovery at 12 months. The only section of the hypogastric nerve, when preserving the deep hypogastric plexus, impaired significantly the bladder voiding function as shown by Kanao et al. [10].

Another question that Kanao et al. [10] raise is the effect of the nerve sparing technique on the oncological radicality, for this reason they carried out the nerve sparing only in patients with tumor diameter <3 cm and no evidence of extrauterine disease. It has been shown that when the tumor is smaller than 2 cm a reduced radicality, even a fertility sparing technique, can be the treatment of choice, with a good survival [11], in these patients the nerve sparing is obtained with a type 2 or class B radicality, taking care not to cut the hypogastric nerve at the level of the utero-sacral ligament. The open question is if an adequate radicality can be obtained with the nerve sparing technique in more advanced tumors. Two points have to be discussed: the first is related to the amount of parametrial tissue we can remove sparing the nerve; the second the survival data of these patients. As regards the first issue, the vascular part of the lateral parametrium and the superficial part of the cervico-vesical ligament can be entirely removed; by mobilizing the nerve and the deep hypogastric plexus the fibrous part of the cardinal ligament can be removed at the pelvic wall; the lympho-fatty tissue and the blood vessels of the deep layer of the cervico-vesical ligament can be removed; hence the radicality is not impaired if an adequate dissection can be obtained. The feasibility of all the 4 steps has been reported in the literature [3-5,12], therefore it is strongly questionable the section of the hypogastric nerve as proposed by Kanao [10]. Unresolved issue is if tumor cells invades the hypogastric nerve and plexus. If the disease has spread into the parametria and the tissues are adherent, the nerve sparing is not feasible, and should be abandoned. In this case the disease, most likely invaded the nervous structures. Thus, the main limitation is not the diameter of the tumor, but the parametrial spread of the disease. As regards the second issue, recent nonrandomized studies on the survival of patients operated on with the nerve sparing technique reported relapse and survival rates similar to the state-of-the art of classical type 3 radical hysterectomy [12]. From this point of view a randomized study of C1 versus C2 radical hysterectomy to compare the outcome in terms of relapse rate and survival is warranted, though the functional results obtained with the nerve sparing technique

make strongly questionable a comparative study with several hundreds of patients to demonstrate a similar outcome.

In summary, nerve sparing radical hysterectomy has become a widespread technique, with evident clinical benefits in terms of postoperative bladder function. As regards the urodynamic aspect, all the studies published so far showed a mild impairment of the bladder voiding function with a significant recovery at 12 months postoperatively, confirming the clinical evidences of a prompt postoperative recovery of bladder storage and voiding functions. From the surgical point of view, radicality seems to be adequate, and the nerve sparing technique has been proposed even in locally advanced cervical cancer, with good oncological results and significantly lower functional damages [12]. Thus the nerve sparing radical hysterectomy seems to be at least equally effective, safer in terms of bladder function, and able to improve patient's experience, and could be proposed in all cervical cancer patients candidate to surgery.

#### CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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