



A narrative review on the impact of nerve sparing surgery on urinary function in pelvic surgery for endometriosis

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Abstract: Endometriosis is an all too common benign inflammatory condition that impacts the lives of countless women around the world. Not only is there typically a delay in diagnosis of this devastating condition, but women are often mismanaged until they reach a provider with expertise in the condition. Endometriosis can be associated with a multitude of different symptoms most common cyclical pelvic pain, painful intercourse, pain with urination or defecation, and chronic pelvic pain. First line therapy for this condition is often hormonal therapy, however, surgery may be indicated for the appropriate patient. Deeply infiltrating endometriosis is often refractory to medical therapy and usually surgery is the only reasonable treatment approach. Deeply infiltrating disease can involve sensory nerves in the pelvis believed to be attributed to many symptoms. Furthermore, inadvertent or unrecognized damage to these nerves during surgery can lead to many unwanted complications following surgery for endometriosis. Nerve sparing surgery for endometriosis has been well defined and is associated with improved functional outcomes for women. Appropriate training and understanding of pelvic neuroanatomy are needed to perform these nerve sparing procedures and this review serves to highlight the benefits of nerve sparing procedures on functional urinary outcomes following surgery.

Keywords: Endometriosis; nerve sparing surgery; urinary function; deeply infiltrating endometriosis; pelvic nerves

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Introduction

Endometriosis is a common medical condition adversely affecting women throughout their reproductive years, and impacting their personal and professional lives (1,2). Endometriosis is often defined as heterotopic endometrial-

like tissue present outside of the uterine lining often found on the ovary, in the posterior cul-de-sac, and sometimes even within the bowel and bladder (*Figures 1-3*).

Women experience significant pelvic and abdominal pain, nausea, and bowel and bladder dysfunction often, but not always, during their menstrual cycles. Often this leads to

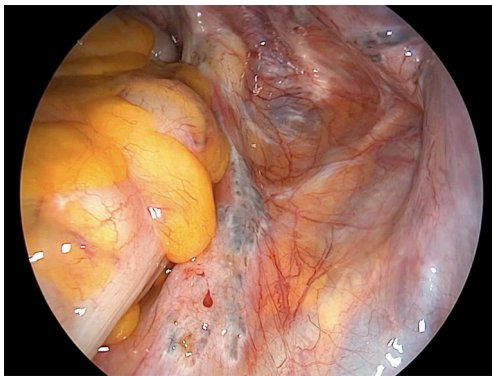


Figure 1 Endometriosis overlying the ureter at the level of the pelvic brim.



Figure 3 Intentional cystotomy created in the surgical excision of deeply infiltrating bladder endometriosis.



Figure 2 Deeply infiltrating endometriosis of the urinary bladder.

need for surgical intervention. Surgical intervention often can have profound impact both beneficial and detrimental for the patient. This paper will explore the benefits of nerve sparing surgery for endometriosis patients on the urinary tract. Deeply infiltrating endometriosis (DIE) is commonly defined as endometriosis that penetrates beyond 5 mm on peritoneal and visceral surfaces (3). DIE often requires radical surgical intervention for those patients who fail expectant or medical management. The most common locations of endometriosis are in the posterior cul-de-sac and on the ovaries. Both obliterative and excisional procedures are often used for treatment of endometriosis. Efficacy of excisional procedures *vs.* fulguration of surface endometriosis is often debated; however, studies have found that complete excision of DIE improves pain outcomes (4). We present the following article in accordance with the Narrative Review reporting checklist (available at <https://gpm.amegroups.com/article/view/10.21037/gpm-20-52/rc>).

Pelvic nerves and endometriosis

There are several nerves involved in pelvis that can be affected by excisional procedures for endometriosis. These nerves are the superior hypogastric plexus, the inferior hypogastric nerve, hypogastric nerve, and the pelvic splanchnic nerves, which are all involved in proper urinary function. Non-nerve sparing surgeries are associated with incomplete bladder emptying, frequency and incontinence (5-10). The purpose of this narrative review will be to outline the benefits associated with nerve sparing surgery for endometriosis from the perspective of functional urinary outcomes. This narrative review was performed by searching PubMed, Medline, and Google Scholar for relevant studies from inception to June, 2020. Search terms included “endometriosis,” “deeply infiltrating endometriosis,” “nerve sparing surgery,” “urinary retention,” “bladder dysfunction,” and “laparoscopic surgery.” We present the following article in accordance with the Narrative Review reporting checklist.

The superior hypogastric plexus is part of the autonomic nervous system and contains purely sympathetic nerves. It originates from the intermesenteric plexus and the L3 and L4 splanchnic nerves. They are located within the abdomen at the bifurcation of the abdominal aorta and descends into the pelvis inferiorly and bifurcates as the right and left hypogastric nerves. The inferior portion of the SHP can be found posterior to the sigmoid colon and upper mesorectum. Many different morphologic configurations exist and surgeons should be aware of these in order to avoid complications associated with injuries to these nerves (11). Injuries associated with these nerves can occur during lymph node dissection, or more commonly during surgery

for DIE during uterosacral or cardinal ligament dissection (8,9,11-13). Neurostimulatory studies on the SHP revealed its involvement in urinary bladder emptying by detrusor muscle relaxation and urethral smooth muscle contraction when stimulated (14). Therefore, when injured it is associated with urinary frequency and control of bladder function.

The inferior hypogastric plexus contains parasympathetic nerve fibers from the pelvic splanchnic nerves that run along the lateral pelvic walls and on either side of the rectum and vagina. The parasympathetic fibers cause the bladder muscles to contract and relaxation of the urethral sphincter. The pelvic splanchnic nerves originate from the S2-S4 sacral rami. The sympathetic component of this plexus originates from the superior hypogastric plexus (8,9,13). Injury to the inferior hypogastric plexus nerves occurs mostly during lateral side wall dissection and dissection of the uterosacral ligaments. The inferior hypogastric plexus is also located below the medial cardinal ligament. When injury to this complex is noted patients can complain of both urinary retention or urinary frequency, or issues with bladder emptying. Dysuria can also be associated with injury to this nerve complex.

The hypogastric nerve is the confluence of the inferior and superior hypogastric plexuses and contains both sympathetic and parasympathetic fibers. Landi *et al.* described the course of the bilateral hypogastric nerves as running lateral to the uterosacral ligament approximately 5 to 20 mm below the pelvic portion of the ureter (8). The two nerves join at the anterosuperior angle of the pelvic plexus and reach the medial part of the cardinal ligament. Injury to these nerves can cause issues with bladder emptying, urinary frequency, incontinence or dysuria depending on the fibers most affected.

Nerve sparing surgery in pelvic surgery

Nerve sparing surgery in endometriosis was developed from surgeries for cervical and rectal cancer (8,12,13,15,16). These techniques were developed after a high incidence of urinary and sexual dysfunction were reported in postoperative patients with either radical hysterectomies or rectal excisions from rectal cancers. Following the oncologic studies, studies also looked into urinary dysfunction post radical excisional procedures for endometriosis. Surgeries that involved radical dissection of the uterosacral ligaments could lead to unintended injury to the HN and inferior

hypogastric plexus.

Nerve sparing surgery and urinary function

A wide range of urinary issues are reported in women who have DIE affecting the genitourinary system (*Figure 1*). Postoperatively from radical dissection from DIE without nerve sparing women experienced dysuria, incontinence, retention and frequency simply. Some women would need to have prolonged or permanent self-catheterization secondary to injury in non-nerve sparing surgeries. Kavallaris *et al.* found that up to 25% of patients undergoing non-nerve sparing surgery reported incomplete bladder emptying and required self-catheterization postoperatively (9). They found that bladder dysfunction usually resolved within 3 months, but that there were 2 patients that required permanent self-catheterization. Urinary frequency was also reported, but less commonly.

Nerve sparing surgery requires significant skill and surgical precision in order to complete specific anatomical planes and landmarks must be identified in order to achieve optimal results. This often requires significant adhesiolysis, ureterolysis and dissection of avascular planes. Nerve sparing surgery was found to be achievable in most patients and Landi *et al.* found that it could be achieved in on average in 82 minutes (8). The benefits of nerve sparing surgery on the urinary system were profound. Fewer patients require postoperative self-catheterization and those that do require it need it for a shorter period of time. Studies have even shown that patients undergoing nerve sparing surgery have normal voiding function on postoperative day 1 the vast majority of the time. Kavallaris *et al.* found that even those who require bladder or ureteral resection achieved normal voiding function by postoperative day 9 (9). Other studies have found no difference in bladder function pre and post NSS for DIE. Landi *et al.* also found that patients who underwent NSS were overall more satisfied with their outcomes (8).

Conclusions

Overall, the urinary system can be deeply affected by radical dissection for DIE. Surgical technique and knowledge of landmarks have been shown to be effective in reducing postoperative functional morbidity involving the urinary tract. While not all cases of DIE will require this level of surgical knowledge and expertise, if significant and radical dissection is expected then surgeons capable

and trained in NSS should perform these procedures to optimize outcomes. Further prospective data are needed to definitively demonstrate the benefit in functional urinary outcomes with NSS compared to surgical excision of DIE without expertise in pelvic neuroanatomy.

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