Pre and Postoperative Lower Urinary Tract Dysfunction Associated with Deep Infiltrating Endometriosis: A Prospective Observational Study

Wala Mehros¹, Henri Azaïs¹, Pierre Collinet¹,² and Chrystèle Rubod¹,²*

¹CHU Lille, Service de Chirurgie Gynécologique, Lille, France
²Faculté de Médecine, Université de Lille, Lille, France

*Corresponding Author: Chrystèle Rubod, Department of Gynecology, Jeanne de Flandre Hospital, University Hospital, Lille Cedex, France.

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Abstract

Objective: This study evaluates the impact of deep infiltrating endometriosis (DIE) surgery on lower urinary tract dysfunction for patient without preoperative lower urinary tract symptom or documented bladder endometriosis.

Design: A prospective observational study.

Method: We used a portable ultrasound device (bladder scan) to measure bladder post-voiding residual volume (PVR), before and after surgery for all patients undergoing surgery for DIE. Criteria of inclusion: patients older than 18 years-old diagnosed with DIE confirmed by pelvic magnetic resonance imaging (MRI) and required surgical intervention. Criteria of exclusion were patients with contraindication for laparoscopic surgery, patients with preoperative lower urinary tract symptom, patients diagnosed with DIE involving the bladder or the urological tract, patients with history of neurogenic bladder, patients with history of surgical treatment of endometriosis.

Result: 49 patients were included in the study. 9 of 49 patients (18.4%) presented with abnormal preoperative PVR. Among them, 5 patients (10.2%) had normal post-operative PVR and 4 (8.2%) were diagnosed with bladder atony before and after the surgical intervention. 40 patients (81.6%) had normal pre-operative PVR. Among them, 12 patients (24.5%) had abnormal PVR in post-operative period.

Conclusion: Endometriosis is a sever benign condition that could impair bladder function in totally asymptomatic patient. Preoperative PVR measurement is a simple and non-invasive tool to assess voiding function before surgery. Preoperative and postoperative voiding function assessment should be part of the management of patients undergoing surgery for DIE. Impact of DIE and surgery on voiding function should be part of the information given to patients.

Keywords: Deep Infiltrating Endometriosis; Pelvic Surgery; Nerve Sparing; Post-Voiding Residual Volume
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Introduction

Deep infiltrating endometriosis (DIE) can be defined as lesions presenting in pelvic and retro-peritoneum space with depth at least 5 mm [1,2]. It has been estimated that 7 - 10% of female population of reproductive age may have endometriosis [3,4]. Millions of women are affected with this disease in different stages. Therefore, considering the magnitude of incidence of the disease and its impact on quality of life, DIE could be considered as public health problem.

The autonomic nervous system of female pelvis involves both sympathetic and parasympathetic pathways [5-8]. The pelvis innervation is supply by parasympathetic fibers that arise from the S2-4 nerve roots and by sympathetic fiber from the superior hypogastric plexus. Sympathetic and parasympathetic fibers join to the inferior hypogastric plexus [5-7,9,10]. The bladder receives motor and sensitive innervation from both sympathetic and parasympathetic systems by inferior hypogastric nerve and splanchnic nerves respectively. Therefore, bladder function may be impaired in patients due to endometriosis lesions or fibrotic neural involvement that caused by the deep infiltration of endometriosis in pelvic organs and retro-peritoneum spaces [2,11,12].

Bladder atony is a common complication that may occurred after surgical interventions that require extensive dissection into the lateral and the posterior pelvic wall and parametria [7,12-16]. This condition is most often transitory but may be persistent in 3.5 - 14.3% of cases [12].

Nerve-sparing surgery developed in surgical oncology has also been advocated for DIE [17]. This type of surgery is usually used in excision of utero-sacral ligament and recto-vaginal endometriosis. Although, its benefit is still unclear, many publications justify the feasibility and better outcome with this type of procedure [6,10,18].

Aim of the Study

The aim of this study is to focus on perioperative bladder function in patients diagnosed with DIE without any lower urinary tract symptom or history of bladder endometriosis lesions to precise the existence of preoperative asymptomatic bladder dysfunction in patients who might present with postoperative voiding complications.

Materials and Methods

We conducted a monocenter prospective observational study for one-year duration.

We included all patients who match the following inclusion criteria: Patients older than 18 with DIE confirmed by pelvic magnetic resonance imaging (MRI) and requiring surgical treatment according to clinical recommendation.

The criteria of exclusion were a contraindication for laparoscopic surgery, active lower urinary tract symptom before surgery, lower urinary tract endometriosis lesion, neurogenic bladder and history of surgical treatment of endometriosis.

The clinical bladder assessment was performed by measuring the post-voiding residual volume (PVR) by using portable ultrasonic bladder scan (bladder scan) the day before surgical intervention and after removing the indwelling bladder catheter after the surgery.

There is no consensus concerning the definition of bladder atony on measurement of PVR volume in comparison with voided volume. The diagnosis of bladder atony in this study was confirmed if one of the following criteria met the diagnosis:

- Patients unable to void at all.
- PVR more or equal to one third of total micturition volume.

No further investigation was performed for evaluation of the bladder atony before the surgery. According to French policies, no ethical committees' agreement was necessary to undergo the study, as the evaluated intervention was non-invasive, without any impact on patients care, and perform in the context of routine practice. Patients were asked to sign a consent after information before being enrolled in the study.

Results

We included 49 patients who met the inclusion criteria. The duration of the inserted indwelling bladder catheter was 24h - 72h. The mean age was 33.6 +/- 6.2 years and the average body mass index (BMI) was 24.4 +/- 5.1. Nine patients (18.4%) presented with abnormal preoperative PVR. Among them, four patients (8.2%) were diagnosed with bladder atony before and after the surgery (Table 1), among these four patients, only one had endometriotic lesion that affects the uterosacral ligament and could increase the risk of bladder atony. Five patients (10.2%) were diagnosed with abnormal preoperative PVR and normal postoperative PVR (Table 2). 40 patients had normal pre-operative PVR, within those cases, and 12 patients had abnormal PVR in postoperative period (Table 3). All patient underwent surgery had no intra-operative or post-operative complication.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>BMI (Kg/m²)</th>
<th>Site of DIE</th>
<th>Surgical intervention</th>
<th>Pre-operative Micturition volume (mL)</th>
<th>Pre-operative PVR (mL)</th>
<th>Post-operative Micturition volume (mL)</th>
<th>Post-operative PVR (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>21.4</td>
<td>Para-Rectal fossa</td>
<td>Adhesiolysis, Tubal permeability, Unilateral Salpingectomy, Resection of Retropertoneal Cyst in the space para-rectal</td>
<td>125</td>
<td>258</td>
<td>75</td>
<td>70</td>
</tr>
<tr>
<td>34</td>
<td>20.3</td>
<td>Ovarian fossa and uterus</td>
<td>Adhesiolysis Abdomen-pelvic, Tubal permeability</td>
<td>100</td>
<td>143</td>
<td>180</td>
<td>106</td>
</tr>
<tr>
<td>27</td>
<td>30.9</td>
<td>Uterosacral Ligament (bilateral)</td>
<td>Abdomen-pelvic Adhesiolysis, Tubal Permeability, Resection of Uterosacral Ligaments</td>
<td>70</td>
<td>59</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>22</td>
<td>21.3</td>
<td>Ovarian fossa and uterus</td>
<td>Adhesiolysis Abdomen-pelvic, Tubal Permeability</td>
<td>25</td>
<td>10</td>
<td>50</td>
<td>18</td>
</tr>
</tbody>
</table>

Table 1: Patients with abnormal voiding function before and after surgery.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>BMI (Kg/m²)</th>
<th>Site of DIE</th>
<th>Type of surgery</th>
<th>Pre-operative Micturition volume (mL)</th>
<th>Pre-operative PVR (mL)</th>
<th>Post-operative Micturition volume (mL)</th>
<th>Post-operative PVR (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>21.7</td>
<td>Ovarian Fossa and Uterus</td>
<td>Tubal and Pelvis Adhesiolysis, Tubal Permeability Test</td>
<td>100</td>
<td>55</td>
<td>130</td>
<td>22</td>
</tr>
<tr>
<td>36</td>
<td>21.1</td>
<td>Recto-Vaginal Space</td>
<td>Abdominal and Pelvis Adhesiolysis, Tubal Permeability Test, Removal of Recto-vaginal septum, Sigmoidectomy with bowel anastomosis</td>
<td>75</td>
<td>64</td>
<td>250</td>
<td>30</td>
</tr>
<tr>
<td>33</td>
<td>21.1</td>
<td>Ovarian and Sigmoid Infiltrated Endometriosis</td>
<td>Pelvis Adhesiolysis, Tubal Permeability, Ovarian cystectomy Recto-Sigmoid Resection with Colo-rectal Anastomosis</td>
<td>125</td>
<td>92</td>
<td>320</td>
<td>60</td>
</tr>
<tr>
<td>43</td>
<td>29.9</td>
<td>Recto-vaginal space Endometriosis lesion</td>
<td>Total hysterectomy with Bilateral Salpingectomy, Resection of Recto-Vaginal Lesion, Rectal Resection and Anastomosis</td>
<td>125</td>
<td>93</td>
<td>439</td>
<td>55</td>
</tr>
<tr>
<td>37</td>
<td>23.44</td>
<td>Uterosacral ligament endometriosis lesion (unilateral)</td>
<td>Tubal and Pelvis Adhesiolysis, Tubal Permeability, Resection of Uterosacral ligament</td>
<td>250</td>
<td>139</td>
<td>329</td>
<td>52</td>
</tr>
</tbody>
</table>

Table 2: Patients with abnormal urinary activity before surgery and normal urinary activity after surgery.
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<table>
<thead>
<tr>
<th>Age (years)</th>
<th>BMI (Kg/m²)</th>
<th>site of DIE</th>
<th>Type of the intervention</th>
<th>Pre-operative Micturition volume (mL)</th>
<th>Pre-operative PVR (mL)</th>
<th>Post-operative Micturition volume (mL)</th>
<th>Post-operative PVR (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>23.3</td>
<td>Ovaries, broad Ligament and Uterosacral Ligament's</td>
<td>Total hysterectomy with Bilateral Salpingectomy, Left Cystectomy and Right Oophorectomy</td>
<td>450</td>
<td>83</td>
<td>310</td>
<td>110</td>
</tr>
<tr>
<td>28</td>
<td>37.3</td>
<td>Ovarian Fossa and Uterus</td>
<td>Tubal and Pelvis Adhesiolysis, Tubal Permeability test</td>
<td>150</td>
<td>37</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>37</td>
<td>23.7</td>
<td>Recto-Vaginal Space and the base of the Uterus</td>
<td>Total hysterectomy with bilateral salpingectomy, rectal shaving</td>
<td>400</td>
<td>60</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>37</td>
<td>26.9</td>
<td>Base of Uterus, Sigmoid, Recto-Vaginal Space</td>
<td>Total hysterectomy with Bilateral Salpingectomy, Recto-Sigmoid Resection with Anastomosis</td>
<td>400</td>
<td>80</td>
<td>400</td>
<td>200</td>
</tr>
<tr>
<td>28</td>
<td>24.7</td>
<td>Left uterosacral Ligament</td>
<td>Adhesiolysis, Tubal Permeability, Resection of Left Uterosacral Ligament</td>
<td>125</td>
<td>0</td>
<td>150</td>
<td>70</td>
</tr>
<tr>
<td>42</td>
<td>19.5</td>
<td>Ovarian Fossa, Uterus and Sigmoid</td>
<td>Adhesiolysis, tubal permeability test, resection of sigmoid with anastomosis</td>
<td>290</td>
<td>44</td>
<td>130</td>
<td>80</td>
</tr>
<tr>
<td>24</td>
<td>18.5</td>
<td>Recto-Vaginal Space</td>
<td>Adhesiolysis, Shaving Rectal with Colectomy, Rectal Resection and Anastomosis</td>
<td>250</td>
<td>65</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

In our study 9 out of 49 (18.4%) presented with abnormal preoperative PVR without any involvement of the lower urinary tract by DIE. All of those patients did not have any urological symptom before surgery. Endometriosis lesions were spotted in the posterior pelvic compartment in all cases (recto-vaginal septum, uterosacral ligament, ovarian fossa, pararectal space, and bowel infiltration).

\textbf{Table 3: Patients with normal urinary activity before surgery who shows abnormal result after surgery.}

\textbf{Discussion}

In our study 9 out of 49 (18.4%) presented with abnormal preoperative PVR without any involvement of the lower urinary tract by DIE. All of those patients did not have any urological symptom before surgery. Endometriosis lesions were spotted in the posterior pelvic compartment in all cases (recto-vaginal septum, uterosacral ligament, ovarian fossa, pararectal space, and bowel infiltration).
Little data has been reported concerning preoperative bladder atony and DIE. It has quite believed that infiltrating endometriosis lesion could affect the autonomic nerves system of the bladder. This is probably due to endometriosis or fibrotic involvement of the inferior hypogastric plexus that run in the uterosacral ligament, near the rectum and the vaginal fornix [25].

In a retrospective study from our team, among 16 cases of persistent urinary retention after surgery for DIE 18.8% of patients reporting one preoperative lower urinary tract symptom [12]. This rate is consistent with the observation of the current study.

In a prospective study published by Panel., et al and was conducted on 30 patients with DIE presented that all patients underwent preoperative standardized investigation including detailed evaluation of lower urinary tract symptom and urodynamic studies. Twenty-three patients (76.7%) had one or more lower urinary tract symptoms and 29 patients (96.7%) had one or more abnormalities at urodynamic examination. All patients had posterior endometriosis and a third has also an involvement of the anterior pelvic compartment. Nevertheless, in their experience, voiding symptoms (60.0%), impairment of flowmetry (30.0%) and increased maximum urethral closure pressure (90.0%) were frequent and not correlated with any specific location. Those findings suggest that dysfunctional voiding may be secondary to an impairment of the inferior hypogastric plexus by posterior DIE [11].

Serati., et al. stated that there is a significant impairment of detrusor function in a prospective study of 25 asymptomatic endometriosis patients, 12 with DIE and 13 with ovarian endometriosis. All patients underwent a preoperative urodynamic evaluation and authors observed that detrusor overactivity was correlated with the presence of deep infiltrating endometriosis (91.7% of the DIE group versus 7.7% in the group with ovarian endometriosis) [2]. Their study gives some evidence of the effect of endometriosis on bladder activity even in asymptomatic patients. Urodynamic evaluation seems to be an acceptable clinical exam for evaluating the impact of DIE, but in our (experimental study) experience, it is difficult to be offered to patient without lower urinary tract symptoms or documented endometriosis in urinary tract. Portable ultrasound bladder scanner is a non-invasive approach that may be useful in this context.

Post-operative bladder atony is quite frequent after surgical intervention due to extensive surgical dissection into the lateral and the posterior pelvic wall and parametria [7,12-16]. Such complication most likely occurs due to injury of the hypogastric nerve which carries the sympathetic and sensory fibers to pelvis organs as bladder and rectum. Excision of pelvic endometriosis lesion especially in posterior pelvic wall could lead to bladder and rectum dysfunction [7]. Dysuria is most often transitory but may be persistent [12]. When a colorectal resection is performed, almost 30% of patients need intermittent bladder self-catheterization after surgery [17,19-21].

Some authors defined bladder atony as a PVR > 100 mL [12]. In this study the diagnosis of bladder atony was confirmed when the PVR was less or equals of one third of total micturition or when patient was unable to urinate before and after the surgery. Measuring the PVR is an important evaluation in the postoperative clinical assessment, the portable ultrasound bladder scanners use had been widely accepted [22]. It has been demonstrated that the accuracy of these devices is acceptable [22-24] and more comfortable with less complication than indwelling bladder catheterization [25].

During our observation we demonstrate that five patients had preoperative bladder atony and showed normal result after surgery. This result where difficult to interrupt and may be due to decrease infiltration and inflammation of endometriosis lesions after surgical excision which could explain the normalization of urinary activity. In the other hand, within 40 patients with normal pre-operative PVR, 12 patients had abnormal PVR in post-operative period. This observation is essential for patient information and we have to keep in mind that surgery may be related to post-operative voiding dysfunction but could also enhance bladder function, even if we have no possibility to predict the positive or negative impact of surgery on bladder function.

Transient atony after radical endometriosis surgery has been reported in about 20 - 25% of cases. This might be due to the transient inflammatory reaction and tissue edema. Most of these resolve in few days and last up 7 days +/- 3 days [15,26]. While persistent lower urinary tract dysfunction will concern 3.3 to 14% of patients who will undergo surgery for DIE [15,16,26-29]. The duration of atony may

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differ, and it is difficult to know if the bladder normal function will return to normal. Dubernard., et al. reported that the mean duration of catheterization of 85 days (range 10 - 420 days) [19], while Minelli., et al. reported that less than 1% of patients would not recover from bladder retention (median follow-up 19.6 month range 6 - 48 month). In this study most of bladder activity return to normal in two days except for 3 patients where it takes 7 days to recover.

Laparoscopic nerve sparing surgery has been suggested to decrease the risk of bladder atony and self-catheterization [10] and it is recommended whenever possible [30]. Indeed, when feasible, it is likely to significantly improve postoperative lower urinary tract function compared to a conventional technique. Nerve visualization is possible during surgery for DIE in high rate of patients depending on the distribution and extent of endometriosis, but careful technique is necessary and may be difficult to undergo in case of severe tissue retraction and nerve or perineural involvement [17,18,30].

Overall, we have to point out the fact that even documented on a urodynamic evaluation, preoperative lower urinary tract dysfunction is often asymptomatic and then, the benefit of surgery on PVR would be less appreciate by patients than a postoperative deterioration of voiding function. Nevertheless, preoperative urodynamic evaluation may have the advantage to assess the preoperative voiding impairment in case of postoperative bladder atony that could not be considered as a complication solely related to surgery.

Conclusion

Endometriosis is a sever benign condition which could affect the bladder function in totally asymptomatic patient by local infiltration of the pelvic nerves by the lesions. Measuring the PVR before surgery is recommended especially in severe cases of DIE. The observation of abnormal lower urinary tract function in pre-operative consultation is important as it may provide some information about an existent neural involvement and is crucial in the pre-operative information given to patients related to the risk of post-operative voiding complication. Portable ultrasound bladder scanner is a non-invasive approach to diagnose pre-operative voiding dysfunction especially for patient without lower urinary tract symptom and its use does not require special training. It can give a simple and precise evaluation of the bladder activity before and after the surgery. Further investigations should be considered to study the physiopathological aspects of preoperative and asymptomatic lower urinary tract dysfunction in patients with DIE and the interest of its preoperative diagnosis and evaluation.

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Disclosure of Interests

None.

Bibliography


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