Laparoscopic nerve-sparing complete excision of deep endometriosis: is it feasible?

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BACKGROUND: Little is known about the morbidity associated with laparoscopic complete excision of endometriosis in terms of urinary, digestive and sexual function. METHODS: We performed a prospective non-randomized study in 45 patients with laparoscopic complete excision of all detectable foci of endometriosis with segmental bowel resection using a non nerve-sparing technique (control group–group A n = 20) and a nerve-sparing technique (case group–group B n = 25). At initial gynaecological evaluation, and at follow-up details on dysmenorrhoea, pelvic pain, dyspareunia and dyschezia were evaluated using an interview-based questionnaire (10-point analogue rating scale: 0 = absent, 10 = unbearable). RESULTS: The mean (±SD) follow-up period was 15.3 ± 10 months (range, 8.8–23 months) for group A and 3.5 ± 2.1 months (range, 0.3–5.2 months) for group B. In the immediate postoperative course, in group A three women required blood transfusion vs seven women in group B (P = 0.003). The median time to resume the voiding function was significantly shorter in group B (12.5 vs 3.0 days; P < 0.01). At the time of follow-up a higher proportion of patients in group B were ‘very satisfied’ than those in group A (87.7% vs 59.0%, P = 0.013). CONCLUSIONS: Laparoscopic nerve-sparing complete excision of endometriosis seems to be feasible and offers good results in terms of bladder morbidity reduction with apparently higher satisfaction than classical technique. Larger series with longer follow-up are needed to confirm our results.

Key words: complete excision/endometriosis/morbidity/nerve-sparing/voiding disorders

Introduction

Endometriosis is a severely debilitating disease which affects primarily women of reproductive age and is characterized by such symptoms as pelvic pain, dysmenorrhoea, dyschezia, dysuria and infertility.

Currently available medical approaches are equally effective in the treatment of endometriosis-associated pain, producing temporary relief of symptoms, but none has yet been shown to achieve a long-term cure. Indeed interruption of medical treatment is associated with a high risk of recurrence (Waller and Shaw, 1993; Miller et al., 1998). Overall, the evidence suggests that complete laparoscopic excision of endometriosis offers good long-term symptomatic relief, especially for those with severe or debilitating symptoms. To ensure complete removal of all the disease and the best results in terms of quality of life, intestinal surgery with or without segmental intestinal resection may be required (Redwine et al., 1996; Ford et al., 2004).

In our experience of >600 cases of laparoscopic complete excision of advanced endometriosis, the effect on bladder, rectal and subsequent sexual function can be significant. With the exception of two recent studies (Thomassin et al., 2004; Durai et al., 2005) this effect has not been reported. The pelvic autonomic nerves are the pathway for the neurogenic control of rectal, bladder and sexual arousal (lubrication and swelling of the vagina). Different nerve-sparing techniques have been adopted in radical surgery for rectal and early cervical cancer (Hoeckel et al., 1998; Maas et al., 1999; Possover et al., 2000b; Yabuki et al., 2000; Trimbos et al., 2001). They have proven successful in the prevention of urinary, rectal and sexual dysfunction without compromising surgical outcome (Yabuki et al., 1991, 1996; Maas et al., 1999). This led us to investigate the feasibility of a nerve-sparing procedure in patients with deep endometriosis and obliterated cul-de sac requiring segmental bowel resection. We performed a prospective, non-randomized study comparing laparoscopic complete excision of endometriosis using the technique reported by most of the authors with a nerve-sparing approach resembling that first described by Possover et al. (2000a). This paper also describes our approach to deep endometriosis preserving the hypogastric nerves and the inferior hypogastric plexus.
Laparoscopic nerve-sparing excision of endometriosis

Materials and methods
From December 9, 2003 to January 22, 2004, 45 consecutive patients referred to our specialized endometriosis unit of Sacro Cuore General Hospital in Negrar (Verona, Italy) who underwent laparoscopic complete excision of all detectable foci of endometriosis with segmental bowel resection using a non-nerve-sparing technique were enrolled in this feasibility study (control group: group A). From April 30, 2004 to September 30, 2004, 25 consecutive patients who underwent nerve-sparing laparoscopic complete excision of endometriosis with segmental bowel resection were included in the study (case group: group B). All patients had stopped medical therapy with progestins, GnRH agonist or birth control pills for ≥3–4 months before the procedure.

Data on patient age, parity, body mass index, previous abdominal laparoscopies or laparotomies, operating time, amount of blood loss, hospital stay, recovery of bladder and bowel function following surgery, time to stool, time to resume voiding function, intra- and early post-operative complications were prospectively recorded in a computerized database. Fluctuations in the amount of blood loss were estimated by measuring aspirated blood volume and adding the subtracted weight of gauze from separation of the blood. All women presented with a significant stenosis of the lumen of the bowel at double contrast barium enema and/or severe menstrual pain syndrome refractory to medical therapy.

At the time of the initial gynaecological evaluation, a careful detailed history was obtained and in particular dysmenorrhea, pelvic pain, dyspareunia and dyschezia were evaluated using an interview-based questionnaire (10-point analogue rating scale: 0 = absent, 10 = unbearable) and a rectovaginal examination was also performed. Transvaginal ultrasonography, ultrasonography of the bladder and ureters, double-contrast barium enema (DCBE), serum levels of CA-125 and CA-19.9 completed our pre-operative work-up. The women completed the same questionnaire with telephone interview at the time of follow-up in early November 2004. The women were also asked about post-operative conception, any further surgery, changes in bowel, urinary and sexual function. To assess the symptoms of sexual dysfunction such as altered responses to sexual arousal (vaginal lubrication and swelling of genitalia) we asked questions such as, ‘After surgery, have you noticed that the moistness and swelling of your vagina (lubrication) has not been sufficient for sexual intercourse?’. Patient satisfaction about outcome of surgery was scored from 0 to 10. A score of 0–4 was considered ‘dissatisfied’, 5–8 was ‘satisfied’, and 9–10 was ‘very satisfied’.

Preparation began 24 h before surgery. It consisted of oral intake of Phosfo-Lax (Sofar, Trezzano Rosa, Milano, Italy), 40 ml diluted in a glass of water, followed by 1 l of water at 14:00 and repeated at 16:00; or Selg-Esse 1000 (Promefarm, Milano, Italy), 2 l in the morning and 2 l in the afternoon as an alternative, and 40 oral tablets of Mylicon or Selg-Esse 1000 (Promefarm, Milano, Italy), 2 l in the morning and
ment with Cefazolin 2 g followed by 1 g twice/day and Metronidazole (Warner Lambert, Milano, Italy) once. Prophylactic antibiotic treatment with Cefazolin 2 g followed by 1 g twice/day and Metronidazole 500 mg three times/day for 3 days was administered post-operatively in all cases. Surgery was carried out with an indwelling Foley’s catheter in situ which was removed as soon as the patient could independently reach the toilet, which was usually the day following surgery. When the patient was voiding spontaneously the effect of surgery on bladder function was examined when the amount of residual urine was consistently <100 ml in two consecutive measurements. Patients experiencing significant residual urine volume after >3–4 days were instructed to perform self-catheterization at their home and then discharged. A second rectovaginal evaluation under general anaesthesia was always performed prior to laparoscopy.

Video-laparoscopy was initially performed with three 5 mm cannulas inserted under direct vision suprapubically and in each midquadrant of the abdomen both lateral to inferior epigastric vessels, with a 10 mm laparoscope in the standard umbilical position. Complete excision of pelvic endometriotic lesions was performed using 5 mm bipolar scissors. This was followed by the intestinal surgery performed by a colorectal surgeon assisted by one member of the gynaecology team. Copious lavage of the peritoneal cavity was performed with Ringer’s lactate solution, ~500 to 1 l. To prevent adhesion formation, hydroflotation leaving ≥500 ml 4% icodextrin solution (Adept; Shire Pharmaceuticals spa, Firenze) in the abdomen was done in 11 patients in the last part of the study. In these cases, a closed drainage catheter was left near the anastomosis as the abdomen was closed, and opened after 8–12 h. The drainage was withdrawn after the first bowel movement.

All the specimens excised were sent for histological examination. Nasogastric suctioning was not routinely used. Autologous blood was given liberally according to general surgeon evaluation. According to the anaesthesiologist’s judgement, some patients were monitored in the intensive care unit and transferred the following morning to the gynaecology ward. For approximately the first 24 h after surgery, each subject received post-operative analgesia by continuous epidural infusion with an elastomeric reservoir pump. Thereafter, analgesics consisting of i.v. ketoprofen (100 mg) with intramuscular tramadol (100 mg) or subcutaneous buprenorphin (0.3 mg) were administered upon patient request.

Clear fluids were allowed the day following surgery and oral intake started the next day following by graduate diet. All the patients were discharged with no particular recommendation about oral intake. Prior to the procedure all patients were counselled regarding the potential risks and benefits of such intervention and signed a written informed consent.

All patients were clinically evaluated 1 month after surgery. Follow-up consisted of pelvic examination, a simple questionnaire to determine time to reach subjective well-being, and the presence of short-term complications. Institutional review board permission was not considered necessary as treatments and study endpoints were similar to our usual clinical practice.

Statistical methods
Continuous variables are reported as mean ± 1 SD when a Gaussian distribution could be assumed; otherwise, they were reported as median (interquartile range). Categorical variables are reported as absolute values.

Continuous variables were compared by using Student’s t-test for unpaired data or the Wilcoxon rank sum test, as appropriate. Categorical variables were compared by using χ2-test.

Operative technique of ‘classic’ complete excision of endometriosis with segmental bowel resection (control group: group A)
Our surgical technique resembled that described by Redwine (2004). Surgery was obviously dictated by the depth of invasion and the topographic distribution of the disease; however, the ‘classical’ technical steps were as follows.

The laparoscopic procedure usually began with the lysis of adhesions, drainage and stripping of endometriomas, and excision of bladder endometriosis or other pelvic sidewall disease working retroperitoneally in the healthy tissue surrounding the disease. Following any ovarian surgery, the ovaries were temporarily suspended from the round ligaments using an absorbable suture in the early part of the study. In the last 25 cases, the ovaries were temporarily suspended using a 2/0 polypropylene non-absorbable suture and then removed on day 3 from surgery, accordingly to the technique first described by Abuzeid et al. (2002). These techniques both improve access to the posterior cul-de-sac and prevent the ovary becoming adherent to the denuded pelvis post-operatively. Commencing at the pelvic brim, the ureters and main vessels were identified and ureterolysis immediately
against the muscular wall of the ureter was performed along its course on the pelvic sidewall until healthy tissue was reached. When endometriosis extended deeply and laterally into the cardinal ligament it was necessary to sacrifice branches of the internal iliac artery, most commonly the uterine artery or simply to isolate the uterine vessel till its cross with the ureter.

In rare cases, the muscularis of the ureter was invaded by endometriosis causing partial occlusion. In such cases, resection of the involved portion of the ureter and reanastomosis was necessary.

The principle was to mobilize the obliterated cul-de-sac by an en bloc resection of invasive endometriosis of the pelvis. The line of incision in normal non-fibrotic peritoneum led lateral and parallel around the base of each uterosacral ligament, followed by blunt undermining of the uterosacral ligaments. A transverse incision was created across the cervix or uterine body above the point of adherence of the bowel, then a slightly intrafascial dissection was carried down the posterior cervix. The plane of dissection was continued caudally until the rectovaginal septum was reached to expose normal rectal wall distal to the rectal nodule. The uterosacral ligaments were consequently transected at their insertion into the posterior cervix. Often there were poor tissue planes and in such cases dissection was kept close to the nodule. Any fatty or fibrous attachments of the rectum to the lateral pelvic walls were progressively severed until sufficient mobility of the bowel had been achieved. In this way all the diseased area came to lie on the anterior wall of the bowel as one mass containing the uterosacral ligaments, the posterior cervix and the obliterated cul-de-sac. Where the deeply infiltrative disease penetrated through the posterior vaginal fornix, the vagina was entered. With involvement of the vaginal mucosa, often a vaginal approach prior to laparoscopy to outline the nodule by incision of the vaginal mucosa was used. The incision was then extended into the softer tissue of the rectovaginal septum followed by blunt finger dissection laterally and inferiorly.

In such way the laparoscopic dissection coming from above followed the posterior lip of the cervix at first, then the vaginal epithelial incision line ensuring that the vaginal lesion had been incorporated on to the mass which remained attached to the bowel wall.

At this point, intestinal surgery was performed. After the placement of a fourth trocar in the right upper quadrant, the abnormal bowel segment was mobilized laparoscopically using an Ultracision harmonic scalpel (LCS 10; Ethicon Endosurgery, Cincinnati, OH, USA).

The involved segment of the bowel was isolated from its mesentery by coagulating and severing the mesentery and its vessels adjacent to the bowel wall. Then the normal distal bowel wall was stripped of its enveloping fatty tissue so that clean muscularis was present 360° around the bowel in areas where sutures were to be placed. A Knight–Griffen circular stapled colorectal anastomosis was performed first using a linear endoscopic stapler to staple across the area of normal bowel wall ∼1 cm distal to the nodule. Then the proximal segment of rectosigmoid colon with the mass at its stapled end was delivered onto the abdomen usually through the suprapubic trocar incision extended horizontally. The affected bowel segment was transected ∼1 cm proximal to the mass, then the anvil of a circular endoscopic stapler was secured with a pure-string suture to the distal opening of the bowel and returned to the abdomen. Then a 28 or 32 mm circular end-to-end anastomosis (CEEA) stapling device (Autosuture Co., Norwalk, CT, USA) was inserted transanally to complete the procedure. Occasionally, for rectosigmoid lesions, a segmental bowel resection through a mini-Pfannenstiel incision with end-to-end hand-sewn anastomosis was performed under direct vision and control.

Alternatively a previous opening of the vagina was used to deliver vaginally the abnormal bowel segment to the introitus, to resect the bowel disease and complete the purse-string suture around the anvil. After returning the repaired bowel to the pelvis, the vagina was closed laparoscopically. An omental flap was prepared and placed between the vagina and the bowel so as to avoid direct contact among two sutures.

The integrity of the anastomosis was tested by filling the pelvic cavity with saline solution and insufflating air through the rectum with simultaneous occlusion of the proximal sigmoid.

**Nerve-sparing technique (study group: group B)**

This technique was developed in association with a skilled neuroanatomist (M.C.) with a special interest in parametrial and pelvic innervation. Each procedure was carried out under his supervision.

This technique does not differ from the classic one except for the following surgical steps which potentially carry a high risk of nerve injury (Figures 1–3).

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**Figure 1.** Panoramic view of the pelvis after complete excision of endometriosis just before the bowel anastomosis. Division of the superior hypogastric plexus (SHP) into left and right hypogastric nerves (LHN and RHN). LIIA = left internal iliac artery; P = promontorium; RIIA = right internal iliac artery; RU = right ureter; RS = rectal stump.

**Figure 2.** Right pelvic splanchnic nerves (PSN) branching to inferior hypogastric plexus as they appear developing the right pararectal fossa (PRS).
Preserving the rectal sympathetic fibres of the upper mesorectum: the superior hypogastric plexus, upper hypogastric nerves and lumbo-sacral sympathetic trunk

The superior hypogastric plexus is a triangular-shaped net of sympathetic fibres that lies in presacral space at the level of promontorium, covered by peritoneal sheet and by the anterior layer of the visceral pelvic fascia. It gives origin to the right and left hypogastric nerves, descending for ~8–10 cm along the lateral sides of mesorectum, into the bilayered visceral pelvic fascia, following the ureteral course in a dorsal and caudal direction. The identification of this fibre was possible after the opening of presacral space, subsequent to the incision of the peritoneum covering the promontorium. The blunt dissection of loose fatty tissue of rectosacral space, till the level of rectosacral fascia allowed a perfect identification of the ‘naked’ superior hypogastric plexus and hypogastric nerves, keeping their fibres close to the sacrum, far from the mesorectal planes, pushed ventrally and caudally with the rectum. In doing so, the dissection of upper mesorectum toward the mesorectal planes was safe, because of the complete preservation of its neural portion.

To mobilize the rectosigmoid completely and in order to access the lower mesorectum, till the level of rectal wings, both pararectal fossae were unified in the retrorectal space bluntly dissecting down along the so-called ‘holy plane of Heald’ on the midline. Once identified, the posterior and lateral mesorectal fascia were preserved by division of the filmy areolar tissue in the relatively avascular plane, between the visceral mesorectal fascia and the parietal endopelvic fascia. The middle and distal portions of hypogastric nerves adhere, at this level, to the mesorectal fascia and may be injured if care is not taken to identify them at this point. The dissection carried on till the level of the floor of pararectal spaces, staying close to the rectum for preservation of the superior hypogastric plexus and hypogastric nerves, more medially and cranially, and for preservation of the lumbo-sacral sympathetic trunks and ganglia, located more laterally and dorsally, close to the sacrum.

Preserving the sympathetic fibres of the lower mesorectum: lower hypogastric nerves and proximal part of the inferior hypogastric plexus

It is of utmost importance to identify the hypogastric nerves at their joining with the proximal part of the inferior hypogastric plexus and trying to keep these structures laterally. After opening the retroperito-
fibres from the medial efferent bundle of pelvic plexus, directed medi- ally toward the rectum, running through the mesorectum is performed. In fact, the rectal fibres of the resected segment of the bowel are cut, minimizing the rectal denervation.

Preserving the caudad part of the inferior hypogastric plexus
The distal part of the inferior hypogastric plexus is located in the pos- terior part of the vesicouterine ligament, lateral and caudal to the dis- tal ureter. To preserve it, after developing the ureteral tunnel and the so-called space of Morrow (Montz, 1998) medially and ventrally to the ureter, the lateral nervous portion and the medial vascular part of the posterior sheath of the vesicouterine ligament were dissected. Transsection of the fascia pubocervicalis which consists of the cranial and caudal portion of vesicouterine ligament and vesicovaginal liga- ments at its parametrial reflection forming ureteral tunnel, was neces- sarily performed. In such a way the surgeon gains a safe access to the paravaginal tissue.

Results
The mean follow-up period was 15.3 ± 10 months (range, 8.8– 23 months) for group A and 3.5 ± 2.1 months (range, 0.3–5.2 months) for group B. One woman (1.5%) in group A was lost to follow-up.

Mean age, body mass index (BMI), parity, mean value of serum CA-125, number of previous laparoscopies or laparotom- ies were similar in the two groups (Table I).

Similarly, the mean intestinal stenosis, as seen at double contrast barium enema (DCBE), expressed as percentage of the diameter of the normal adjacent lumen was similar in the two groups (47.7 ± 22.7 versus 47.1 ± 14.6; not significant).

The following concomitant procedures were performed, alone or in combination in the two groups without significant differences: unilateral adnexectomy (1.5%); neosalpingostomy (10.7%); unilateral or bilateral ovarian cystectomy (96.9%); appendectomy (1.5%); adhesiolysis (100%); bilateral ureterolysis (100%); full-thickness bladder resection (7.6%); and uni- lateral ureteral stenting (7.6%).

No minor or major surgical complications occurred during primary surgical procedure in either group.

| Table I. Main characteristics of the women in the two groups |
|---------------------------------|----------------|----------------|
| Variable                        | Group A (n = 45) | Group B (n = 20) |
| Mean age (years)                | 31.8 ± 3.8      | 31.3 ± 4.9      |
| Body mass index (kg/m²)         | 21.3 ± 2.8      | 22.0 ± 2.5      |
| Parity                          |                 |                |
| 0                               | 36              | 18             |
| 1                               | 6               | 2              |
| 2                               | 2               | 1              |
| CA-125 (IU/ml)                  | 59.6 (48.3–75.5)* | 63.9 (45.9–85.6)* |
| Previous laparoscopy            |                 |                |
| 0                               | 22              | 11             |
| 1                               | 15              | 6              |
| 2                               | 7               | 5              |
| 3                               | 0               | 1              |
| Previous laparotomy             |                 |                |
| 0                               | 17              | 10             |
| 1                               | 18              | 10             |
| 2                               | 9               | 1              |

Blood loss, operation time, drainage and time to discharge were similar between the two groups (Table II).

Overall, the immediate post-operative course was uneventful in 47 women (72.3%). In group A, three women required blood transfusion, one of these for a frank haemoperitoneum which required reintervention versus seven women in group B (P = 0.003), two of them requiring reintervention. Reintervention was necessary for four women in group A, two of whom had an anastomotic leakage that led us to perform a prompt diverting ileostomy versus two women in group B, for one of whom we had to perform a diverting ileostomy and the other a diagnostic laparoscopy. All but one of the fistulas healed without further complication, and ileostomy was subsequently closed. One of the two women in group A with ileostomy subsequently underwent segmental bowel resection. During hospital stay, temperature was >38°C for >2 days in 14 patients of group A versus two patients of group B.

All women were examined 1 month after surgery. In group B two women had pyrexia, one had cystitis. One patient in group A developed dehiscence of skin wound, one in group B a laparocèle.

Four women complained of localized pelvic pain in group A versus two in group B. One patient complained of mild and transitory hot flushes in group A.

The median time to resume the voiding function, calculated as the sum of the number of days with urinary catheterization plus number of days with self-catheterization, was significantly (P <0.01) shorter in group B. Three of 45 patients in group A experienced bladder self-catheterization for >50 days versus only one patient in group B, who underwent reintervention with a diverting loop ileostomy. Time to stool and time to full recovery were similar in the two groups (Table III).

Qualitative results for symptoms before and after surgery for both groups are shown in Table IV.

Pre- and post-operative symptom intensity scores for both groups are compared in Table V. All gynaecological symptoms

| Table II. Intra-operative and early post-operative findings of the two groups |
|-----------------------------------|---------|---------|
| Variable                           | Group A | Group B |
| Blood loss (ml)                    | 314.0 ± 201.3 | 328.6 ± 177.2 |
| Operation time (min)              | 347.1 ± 99 | 314.8 ± 64.7 |
| Drainage (days)                   | 4.5 ± 1.9 | 4.0 ± 2.5 |
| Time to discharge (days)          | 9.3 ± 4.0 | 7.9 ± 3.0 |
| Reintervention (no.)              | 2       | 2       |

There were no significant differences between groups.

| Table III. Post-operative comparison of bladder and bowel functions among the two groups |
|--------------------------------------|---------|---------|---------|
| Variable                             | Group A | Group B | P       |
| Time to stool (days ± SD)            | 3.3 ± 1.6 | 3.3 ± 1.9 | NS      |
| Mean time (days) to resume the voiding function in patients with self-catheterization [median (interquartile range)] | 12.5 (9.5, 45) | 3.0 (2.0, 6.8) | 0.01    |
| Time to full recovery (days ± SD)   | 15.85 ± 10.74 | 16.94 ± 7.89 | NS      |

NS = not significant.
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were improved by surgery but surgery in group B was more effective on dysuria than surgery in group A (Table V).

Long-term sequelae on bowel, bladder and sexual functions for both groups are shown in Table VI.

| Table IV. Qualitative results for symptoms after surgery for group A (non-nerve-sparing technique) and group B (nerve-sparing technique) |
|--------------------------------------------------|---------------------|---------------------|-----------------|------------------|
| Dysmenorrhoea | Dysuria | Dischetia | Dyspareunia |
| A | B | A | B | A | B | A | B |
| Disappeared (%) | 13 (29.6) | 6 (28.6) | 39 (92.9) | 18 (90) | 25 (60.9) | 16 (84.2) | 17 (43.6) | 11 (68.8) |
| Decreased (%) | 26 (59.1) | 11 (52.4) | 0 | 0 | 10 (24.4) | 2 (10.5) | 17 (43.6) | 4 (25.0) |
| Same (%) | 1 (2.3) | 0 | 1 (2.4) | 0 | 0 | 1 (5.3) | 1 (2.6) | 1 (6.3) |
| Increased (%) | 2 (4.6) | 1 (4.8) | 2 (4.7) | 2 (10) | 6 (14.6) | 0 (4.8) | 4 (10.3) | 0 (4.8) |

There were no significant differences between groups.

Severe or slow transit constipation was the most frequent complaint in both groups, but the worst consequences of our surgery were recorded in group A only.

In group A, one woman has required digital evacuation of the rectum, five women have been using enemas with two of them unable to defecate without their help, and one woman developed a neurogenic bladder dysfunction eligible for sacral pacemaker.

Patient satisfaction scores for both groups are summarized in Table VII. Patients of group B were more satisfied than patients of group A. Data on infertility and pregnancy outcome following this kind of surgery will be the subject of a further publication.

Histological examination of the surgical specimens confirmed endometriosis in all the women.

Discussion

Laparoscopic complete excision of endometriosis offers long-term pain relief in most patients and results in a low rate of minimal persistent/recurrent disease (Redwine and Sharpe, 1991; Redwine and Wright, 2001). Considering that endometriosis is a benign disease which affects women of young age, the knowledge of associated risks and post-operative morbidity of such surgery is of utmost importance.
Only one paper specifically addressed the risks of this kind of surgery (Koninckx et al., 1996), but despite exhaustive and reliable reports of all the complications, no mention was made of the morbidity associated in terms of sexual or urinary dysfunction. Classical technique appears to be inherently safe as nearly all the papers of laparoscopic complete excision of endometriosis with or without associated segmental bowel resection (Nezhat et al., 1992; Jerby et al., 1999; Redwine and Wright, 2001; Duepree et al., 2002; Varol et al., 2003) have not shown a significant impairment of urinary and digestive functions. Reassuring data also came from laparotomy (Urback et al., 1998). However, due to the nature of the potential reporting (complication rates) there may be a negative bias in reporting. Our experience as well as that of Darai et al. (2005) and Thomassin et al. seem to be different. The latter clearly recognize the risk of urinary and digestive side-effects and emphasize that "women must be informed that ... urinary or digestive complication can occur" (Thomassin et al., 2004). It is worth noting that post-operative urine retention and de novo dysuria are well-known after colorectal resection for digestive tract cancer, with an incidence reaching 60% (Zanolla et al., 1998). We tried to calculate the reasons for this difference recorded in post-operative morbidity. Possible explanations are a bias of study population, with our patients having more extensive endometriosis, a different and less aggressive surgery related to the subjective judgement of the degree of complete excision obtained, or small but significative differences in performing the 'classic technique'. In terms of the latter, we used 5 mm bipolar scissors which inherently carry a higher risk of lateral thermal damage than the 3 mm monopolar scissors used by Redwine or the CO2 laser used by Nezhat (Nezhat et al., 1992; Redwine and Wright, 2001). It has been suggested also that this kind of information has been underreported (Winkel and Scialli, 2001). However, these complications underline the need to respect the pelvic plexus nerves (Murakami et al., 2002). In many disciplines, there has been a move toward less radical and nerve-sparing treatment with the triple objectives of preserving function, reducing morbidity and maintaining cure rates. Such modifications in surgical management have been successfully adopted in radical surgery for rectal and early cervical cancer (Sato and Sato, 1991; Posover et al., 2000b; Yabuki et al., 2000; Trimbos et al., 2001). We first tried to assess the feasibility of a nerve-sparing radical approach for the treatment of deep endometriosis.

Given the fact that an intra-operative judgement of nerve-sparing is virtually impossible and subject to misunderstanding due to interobserver variability (we tried to reduce codifying our technique, performing a neuroanatomist-assisted surgery) we choose to assess the outcome of this kind of surgery, i.e. the possible impairment of bladder, bowel and sexual functions.

To assess the impairment of sexual function, we considered the differences in lubrication and swelling responses during intercourse as a predictor of damage of parasympathetic and sympathetic efferent fibres joining the inferior hypogastric plexus and reaching the internal and external genitalia autonomously or coursing along the pudendal nerves. Our study confirms the relief of painful symptoms following endoscopic surgery for endometriosis with no differences among the two groups. This could be used to confirm the completeness of surgical excision in group B. Apparently surgery was more effective on dysuria in group B, but this result is a consequence of the non-randomized nature of our study with women in group B experiencing statistically significantly less dysuria from the very beginning. The mean time to resume the bladder-voiding function was significantly shorter in group B. This, together with the occurrence of the most severe adverse events such as neurological bladder or severe constipation in group A, could be the reason why more women in group B claimed to be satisfied or very satisfied following the procedure. Considering that the nerve damage to perform bowel resection was the same among the two groups, no difference in time to stool between the two groups was detected. Though much of the past reluctance to resect intestinal endometrial lesions was based on fear of complications, modern surgical series have proven the safety and efficacy of the surgical treatment of intestinal endometriosis both by laparotomy and laparoscopy (Redwine and Sharpe, 1991; Varol et al., 2003; Ford et al., 2004; Thomassin et al., 2004). Our data, although limited by the small number of patients enrolled, confirm the safety of this procedure.

Efficient lower urinary tract, rectosigmoid and sexual functions rely on both autonomic and somatic nerve activity. Injury to the detrusor branches of the pelvic splanchnic nerves can cause detrusor denervation and urinary retention. Given the anatomical distribution of nerve fibres, the dissection of the most lateral part of the cardinal ligament put the inferior hypogastric plexus in secure jeopardy. Similarly, the dissection of the medial part of the inferior hypogastric plexus may lead to dysfunctional rectal morbidity. This could be prevented if rectal denervation is limited only to the fibres reaching the resected segment of the bowel. The poor quality of pre-operative data concerning constipation makes it difficult to make further comment on both techniques. However, it is likely that patients with extremely severe constipation had a wider destruction of these fibres than strictly necessary, possibly more related to the surgery per se than to the technique itself.

During the study it became evident that the nerve-sparing technique is not always feasible in the same way on both sides of the pelvis, particularly when endometriosis is deeply embedded in the parametrium. Considering the asymmetrical distribution of the endometriosis (Vercellini et al., 1998, 2000, 2003), it seems unlikely, and in our series it never happened, that complete excision of endometriosis could lead to a bilateral damage to the nerves and hence to bladder function. This is apparently a possible explanation of why in the control group, despite a non-nerve-sparing technique, the overall morbidity possibly related to nerve disruption did not reach 100%.

Considering that utero-sacral ligaments (USL) and cardinal ligaments (CL) are not merely connective tissue support for the uterus but contain extensions of the inferior hypogastric plexus whose concentration is significantly greater near the origin of these ligaments at the pelvic side wall (Butler-Manuel et al., 2000), the more endometriosis affects these ligaments the more morbidity is expected. In fact it is not possible to completely preserve the nerves when we have to transect the more lateral
and caudal part of the cardinal ligaments, but fortunately this is a rare case and usually monolateral. It is likely that the most frequent site of nerve injury in group A was the inferior hypogastric plexus during excision of endometriotic nodules of the USL extended laterally.

In less severe cases without CL involvement in which radical excision of endometriosis may involve only partial division of USL close to the cervix, no adverse effects on bladder and other pelvic functions are expected. The destruction of uterosacral tissue close to the cervix, as occurs in a laparoscopic uterine nerve ablation (LUNA), is neither lateral enough nor deep enough to destroy the majority of the nerve fibres.

Our study has methodological flaws with respect to collection of satisfactory outcome because we did not use a validated questionnaire. However, 90.5% of patients in group B were more satisfied than patients treated with the classical technique and this compares favourably with other studies (Jones and Sutton, 2003). Within the objective of the study, the shorter follow-up of group B is acceptable. The major decrease in pain has been reported to occur during the first 3 months (Jones and Sutton, 2003) but this observation may not apply to other parameters such as morbidity or patients’ satisfaction. Despite our encouraging results (we must remember that our data refers to a small study population), laparoscopic nerve-sparing complete excision of endometriosis seems to be feasible and offers good results in terms of bladder morbidity reduction with apparently higher satisfaction than the classical technique.

Larger series with longer follow-up are needed to confirm our results.

Considering that this kind of surgery requires uncommon surgical skills and anatomical knowledge, we think that it should be performed only in selected reference centres.

References


Laparoscopic nerve-sparing excision of endometriosis
