Anatomical distribution of deeply infiltrating endometriosis: surgical implications and proposition for a classification

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BACKGROUND: Deeply infiltrating endometriosis (DIE) is recognized as a specific entity responsible for pain. The distribution of locations and their contribution to surgical management has not been previously studied. METHODS: Medical, operative and pathological reports of 241 consecutive patients with histologically proven DIE were analysed. DIE lesions were classified as: (i) bladder, defined as infiltration of the muscularis propria; (ii) uterosacral ligaments (USL), as DIE of the USL alone; (iii) vagina, as DIE of the anterior rectovaginal pouch, the posterior vaginal fornix and the retroperitoneal area in between, and (iv) intestine, as DIE of the muscularis propria. RESULTS: A total of 241 patients presented 344 DIE lesions: USL (69.2%; 238); vaginal (14.5%; 50); bladder (6.4%; 22); intestinal (9.9%; 34). The proportion of isolated lesions differed significantly according to the DIE location: 83.2% (198) for USL DIE; 56.0% (28) for vaginal DIE; 59.0% (13) for bladder DIE; 29.4% (10) for intestinal DIE (P < 0.0001). The total number of DIE lesions varied significantly according to the location (P < 0.0001). In 39.1% of cases (9/23) intestinal lesions were multifocal. Only 20.6% (seven cases) of intestinal DIE were isolated and unifocal. CONCLUSIONS: Multifocality must be considered during the pre-operative work-up and surgical treatment of DIE. We propose a surgical classification based on the locations of DIE. Operative laparoscopy is efficient for bladder, USL and vaginal DIE. However, indications for laparotomy still exist, notably for bowel lesions.

Key words: deep endometriosis/deeply infiltrating endometriosis/operative laparoscopy/surgery

Introduction

Deeply infiltrating endometriosis (DIE) is a specific entity (Koninckx *et al*., 1991). DIE is responsible for pain whose intensity is correlated with the depth of infiltration (Koninckx *et al*., 1991). Although hormonal treatment (progestational hormones or GnRH analogues) is efficient with respect to the pain (Olive and Pritts, 2001), the side-effects of the various products and the risk of recurrence when administration ceases (Redwine, 1992b) mean that surgery is the treatment of reference in this context (Garry, 1997).

Several studies in the literature have addressed the topography of endometriotic lesions (Gruppo dell'endometriosi, 1994; Jenkins *et al*., 1986; Redwine, 1987). In these publications the majority of the lesions were superficial peritoneal lesions and ovarian endometriomas, with very few instances of deep endometriosis. To our knowledge no study has specifically addressed the topography of DIE lesions.

Since 1992, we have made continuous assessment by collection of data concerning the patients operated in our department for DIE. Results of routine clinical examination of the first 160 patients were previously published (Chapron *et al*., 2002a). The aim of this study, based on a homogeneous population of patients consulting in a context of pelvic pain, is to ascertain if knowledge of the DIE lesion locations might lead to recommendations for surgical management of these patients.

Materials and methods

Between June 1992 and December 2000, a continuous series of 241 patients suffering from pelvic pain underwent complete surgical management (operative laparoscopy or laparotomy) for DIE. The diagnosis of DIE was histologically proven. For each patient, medical, operative and pathological reports were re-examined retrospectively in blinded fashion by two authors (A.F. and M.V.). For each patient a diagram with an anatomic drawing of DIE lesions was included in the operative report. Disagreements were resolved by discussion with a third gynaecologist author (C.C.). DIE lesions were classified according to four locations: (i) bladder, when lesions infiltrated the

bladder muscularis propria (Chapron and Dubuisson, 1999); endometriosis located solely in the serosa was not considered as DIE of the bladder as the serosa lies outside the bladder wall (Reuter, 1992); (ii) uterosacral ligament (USL), when lesions only infiltrated the USL(s) (Chapron and Dubuisson, 1996); (iii) vagina, when lesions infiltrated the anterior rectovaginal pouch, posterior vaginal fornix and retroperitoneal area between the anterior rectovaginal pouch and posterior vaginal fornix (Chapron *et al.*, 2001; Martin and Batt, 2001) and (iv) intestine, when lesions involve the muscularis propria of the bowel.

When a patient presented multiple DIE locations, we classified her in the category corresponding to the worst one. According to the definition, we classified lesions in the following order from least to worst: USL, vagina, bladder and intestine. For example, a patient presenting with posterior vaginal fornix infiltration associated with disease of the left USL was classified as being in the 'vaginal' group. Similarly a patient presenting rectal disease associated with bladder endometriosis and bilateral infiltration of the USL was classified in the 'intestinal' one. A DIE lesion was defined as being isolated when not associated with any of the three other DIE locations. In parallel, and again by definition, we classified DIE lesions into two groups: anterior compartment which corresponded to bladder DIE, and posterior compartment which corresponded to USL, vaginal and intestinal disease.

We studied the DIE location(s) for each patient according to the above criteria (USL, vagina, bladder, intestine) and also as to whether it was isolated or not. For each patient, general data were assessed [age, parity, gravidity, body mass index (BMI)]; together with the existence of pelvic pain (dysmenorrhoea, deep dyspareunia, chronic pelvic pain), past history of medical or surgical treatment for endometriosis, stage of the disease according to the revised American Fertility Society (1985) classification and the main surgical procedure performed to achieve complete exeresis of DIE lesions (uterosacral resection, posterior colpectomy, partial cystectomy, digestive surgery, etc.).

Statistical tests

Pearson's χ^2-test was used for comparison of categorical data and Kruskal–Wallis one-way analysis of variance for testing heterogeneity between quantitative and categorical data. All analyses were performed with StatView 5.0 software (SAS Institute, Inc.).

Results

Patient characteristics are presented in Table I. Patient distribution, according to the DIE lesion classification, was as follows: USL (65.6%; 158 patients); vagina (17.4%; 42 patients); intestine (9.5%; 23 patients); bladder (7.5%; 18 patients). These 241 patients presented 344 histologically proven DIE lesions (Table II). The DIE lesions observed most frequently were the USL group (69.2%; 238 lesions). Bladder, vaginal and intestinal DIE lesions were observed respectively in 6.4% (22 lesions), 14.5% (50 lesions) and 9.9% (34 lesions) of cases.

For these 241 patients, the mean number of DIE lesions per patient was 1.43 ± 0.77 (range 1–6). Total number of DIE lesions per patient was significantly correlated with the DIE location (Kruskal–Wallis, $P < 0.0001$) (Table III). Bladder DIE lesions presented in every case in the form of a single nodule infiltrating the bladder wall muscularis. The 23 patients with intestinal DIE lesions presented 34 histologically proven

lesions infiltrating the bowel muscularis. Nine (39.1%; 9/23) patients presented multifocal bowel disease. The mean number of intestinal DIE lesions per patient was 1.48 ± 0.73 (range 1–3). The 34 intestinal DIE lesions were located as follows:

Table I. Deeply infiltrating endometriosis: baseline characteristics

Patients' characteristics ($n = 241$)	
Age (years)[a]	31.6 ± 5.5 (19–51)
Parity[a]	0.31 ± 0.7 (0–4)
Gravidity[a]	0.57 ± 0.8 (0–4)
Body mass index (kg/m^2)[a]	20.8 ± 2.9 (13.7–33.2)
Previous treatment for endometriosis (%)	
Hormonal treatment	66.7
Surgery	59.7
Pre-operative symptoms (%)[b]	
Chronic pelvic pain	91.5
Dysmenorrhoea	89.2
Deep dyspareunia	75.3
Mean score rAFS[a,c]	30.5 ± 25.8 (4–116)
rAFS stage (%)	
I	13.5
II	38.1
III	24.2
IV	24.2

[a]Data are presented as mean $\pm$ SD (range).
[b]Sometimes more than one for the same patient.
[c]Score according to the revised American Fertility Society Classification (1985).

Table II. Deeply infiltrating endometriosis ($n = 241$ patients): anatomic distribution

Main lesion	Patients (n)	Locations						
		USL			V	B	I	Total lesions
		R	L	Bl				
Anterior location								
Bladder	18	0	1	3		3	18	28 (8.1)
Posterior locations								
USL	158	41	77	40				198 (57.6)
Vagina	42	4	3	7	42			63 (18.3)
Intestine	23	2	2	4	5	4	34	55 (16.0)
Total	241	47	83	54[a]	50	22	34	344

Values in parentheses are percentages.
[a]Each lesion of bilateral pair counted as part of pair, so total number of individual lesions = 108.
USL = uterosacral ligament; V = vagina; B = bladder; I = intestine; R = right; L = left; Bl = bilateral.

Table III. Deeply infiltrating endometriosis (DIE) ($n = 344$ locations): total number and proportion of isolated DIE lesions

DIE location	N	Total no. of DIE lesions[a]	Isolated DIE lesion[b] n (%)
Bladder	22	1.56 ± 1.04 (1–4)[c]	13 (59.0)
USL	238	1.25 ± 0.44 (1–2)[c]	198 (83.2)
Vagina	50	1.50 ± 0.77 (1–3)[c]	28 (56.0)
Intestine	34	2.39 ± 1.37 (1–6)[c]	10 (29.4)

[a]Data are presented as mean $\pm$ SD.
[b]Without any other associated DIE lesions.
[c]$P < 0.0001$ (Kruskal–Wallis test).
USL = uterosacral ligament.

rectum (20 lesions; 58.9%); sigmoid (seven lesions; 20.6%); colon (three lesions; 8.8%); ileocaecum (two cases; 5.9%); appendix (one lesion; 2.9%); omentum (one lesion; 2.9%).

The proportion of isolated DIE lesions varied in statistically significant fashion according to their location ($P < 0.0001$) (Table III). When DIE was found infiltrating the USL ($n = 238$ lesions), the lesion was most often isolated, i.e. in 83.2% of cases (198 lesions) it was not associated with any other DIE locations. In the remaining 40 cases (16.8%), the DIE lesions associated with USL DIE were as follows: vagina (21 cases); bladder (seven cases); intestine (12 cases). Taking into account all the cases of vaginal, bladder and intestinal DIE ($n = 106$), the lesions were isolated in only 48.1% of cases (51 lesions). Vaginal DIE lesions were isolated in 28 cases (56.0%). DIE lesions associated with vaginal DIE were as follows: USL (21 lesions); bladder (three cases); intestine (five cases). Bladder DIE lesions were isolated in 13 cases (59.0%). DIE lesions associated with bladder DIE were as follows: USL (seven lesions); vagina (three cases); intestine (four cases). Intestinal DIE lesions were isolated in only 10 cases (29.4%). DIE lesions associated with intestinal DIE were as follows: USL (12 lesions); vagina (five cases); bladder (four cases). Three out of the 10 isolated intestinal DIE were multifocal, meaning that only 20.6% (seven cases) of intestinal DIE lesions ($n = 34$) were both isolated and unifocal (Table III).

Surgical procedures carried out for complete exeresis of DIE lesions are presented in Table IV. For the 218 patients treated by operative laparoscopy (90.5%), 239 operative procedures were performed. For the 23 patients operated by laparotomy (9.5%), 46 operative procedures were performed.

Table IV. Surgical management of deeply infiltrating endometriosis (DIE): operative procedure specifically performed for complete excision of DIE[a]

Surgical procedures	n
Procedures performed by laparoscopy ($n = 218$ patients)	
Uterosacral resection	
Right uterosacral resection	45
Left uterosacral resection	81
Bilateral uterosacral resection	50
Excision of DIE infiltrating the posterior vaginal wall[b]	45
Partial cystectomy	18
Procedures performed by laparotomy ($n = 23$ patients)	
Uterosacral resection	
Right uterosacral resection	3[c]
Left uterosacral resection	3[c]
Bilateral uterosacral resection	4
Excision of DIE infiltrating the posterior vaginal wall	7[d]
Partial cystectomy	4
Intestinal surgery	
Appendicectomy	1
Small bowel resection	1
Ileocaecal resection	1
Sigmoid resection	1
Full-thickness rectal disk excision	2
Resection with colorectal anastomosis	13
Resection with coloanal anastomosis	6

[a]Sometimes more than one procedure for the same patient.
[b]Laparoscopically assisted vaginal procedure (Chapron et al., 2001).
[c]One case with no histologically proven DIE.
[d]Two cases with no histologically proven DIE.

Discussion

These data suggest that DIE lesions are multifocal in a large number of patients. This observation is in agreement with results recently reported by Redwine and Wright (2001) for patients presenting complete obliteration of the pouch of Douglas associated with endometriosis. As the efficiency of surgical treatment depends on the radicality of exeresis (Garry, 1997), the location of the DIE lesions must dictate the choice of operating technique. In multifocal cases, several surgical procedures must be associated. For bladder DIE, the standard treatment is partial cystectomy which can be performed by operative laparoscopy (Nezhat et al., 1996; Chapron and Dubuisson, 1999). For DIE infiltrating the USL, it has been shown that laparoscopic surgical resection is efficient (Redwine, 1991a; Koninckx et al., 1996; Chapron, et al., 1999; Garry et al., 2000). For vaginal DIE, numerous authors have demonstrated that operative laparoscopy is efficient using various techniques (electrosurgery, sharp dissection or laser CO_2; exclusively laparoscopic procedure or laparoscopically assisted vaginal surgery) (Martin, 1988; Reich et al., 1991; Redwine, 1992a; Wood et al., 1993; Donnez et al., 1995; Koninckx et al., 1996; Garry et al., 2000; Anaf et al., 2001; Chapron et al., 2001). The different topographical location of USL and vaginal DIE requires specific operating techniques. Lesions strictly located on the USL require, in the majority of patients, ureterolysis without associated exeresis of the upper part of the posterior vaginal wall (Chapron et al., 2001). In cases of isolated vaginal DIE, dissection of the latero-rectal fossae is necessary in >80% of cases (Chapron et al., 2001) and exeresis of the upper part of the posterior vaginal wall is essential (Donnez et al., 1995; Chapron et al., 2001). The reason for this is that vaginal DIE most often does not infiltrate the rectovaginal septum which is located lower down (Cunéo and Veau, 1899; Tobin and Benjamin, 1945; Uhlenhuth et al., 1948; Milley and Nichols, 1969), but rather the upper third of the posterior vaginal wall (Chapron et al., 2002b).

The question of operative technique is far more complex when the digestive tract is involved. Before clarifying the methods of surgical treatment in the case of intestinal DIE, a definition of the latter must first be agreed upon. In our opinion, lesions of the serosa without infiltration of the muscularis should not be considered as intestinal DIE. Logically speaking, these superficial lesions do not justify any specific intestinal procedure since from the histological point of view there is no deep infiltration into the intestine. Therefore, for the purposes of this study, these superficial intestinal lesions were not considered as intestinal DIE. This type of superficial intestinal lesion is secondary to associated pelvic adhesions that result in more or less complete obliteration of the pouch of Douglas in a context of USL and/or vaginal DIE. This fact explains why, in series that sometimes contain a high number of patients with DIE, treatment can be carried out exclusively by operative laparoscopy without any digestive tract procedure (Donnez et al., 1995). The situation is quite different for patients presenting true intestinal DIE with infiltration of the muscularis. In this situation, two crucial parameters have to be taken into account. Firstly, the multifocal character of bowel

Table V. Deeply infiltrating endometriosis (DIE) classification: proposition for surgical procedure

DIE classification	Operative procedure
A: Anterior DIE	
A1: Bladder	Laparoscopic partial cystectomy
P: Posterior DIE	
P1: Uterosacral ligament	Laparoscopic resection of USL
P2: Vagina	Laparoscopically assisted vaginal resection of DIE infiltrating the posterior fornix
P3: Intestine	
Solely intestinal location	
Without vaginal infiltration (V–)	Intestinal resection by laparoscopy or by laparotomy
With vaginal infiltration (V+)	Laparoscopically assisted vaginal intestinal resection or exeresis by laparotomy
Multiple intestinal location	Intestinal resection by laparotomy

USL = uterosacral ligament.

involvement, that we observed in almost 40% of cases; multiple sites of bowel disease are more easily treated by laparotomy than by operative laparoscopy (Redwine and Wright, 2001). Secondly, in nearly 70% of cases intestinal DIE is associated with other DIE lesions that require specific procedures with respect to the vagina, bladder and/or the USL. The other parameters to be taken into consideration are as follows: the patient's past surgical history; the existence and extent of associated pelvic adhesion process; the extent of intestinal DIE; the distance between the intestinal DIE lesion and the linea dentata (Possover *et al.*, 2000); the depth to which the DIE lesions penetrate into the bowel wall (Redwine and Wright, 2001). All these reasons explain why, in a recent study reported by a highly experienced laparoscopic surgeon perfectly familiar with DIE, only 9.1% of patients presenting with intestinal DIE underwent segmental resection by operative laparoscopy (Redwine and Wright, 2001). Although several cases of laparoscopic management or laparoscopically assisted vaginal resection of intestinal endometriosis are reported in the literature (Redwine, 1991b; Nezhat *et al.*, 1992; Redwine *et al.*, 1996; Reich *et al.*, 1998; Possover *et al.*, 2000), this does not mean that laparotomy should be abandoned in this context (Crosignani and Vercellini, 1995). For the majority of patients with true intestinal DIE, laparotomy remains the surgical technique of reference (Coronado *et al.*, 1990; Bailey *et al.*, 1994; Canis *et al.*, 1996).

The importance of the DIE anatomic distribution when deciding on surgical management prompted us to propose a classification system for DIE lesions (Table V). Our classification is based on where DIE lesions are located (Table V). Other classifications were previously proposed (Koninckx and Martin, 1992; Adamyan, 1993; Martin and Batt, 2001); that of Koninckx and Martin is essentially based on the pathogenesis of DIE [infiltration (Type 1); retraction (Type 2); adenomyosis externa (Type 3)]. We feel that our approach is advantageous in that whatever the pathogenesis, the operative technique is defined by the location of the DIE lesions. Two other methods of classification have been proposed (Adamyan, 1993; Martin and Batt, 2001) which also take the DIE lesions' topography into account; in our opinion these are limited by two factors: (i) they do not take into account the possibility of associated anterior disease (bladder DIE) in cases of posterior DIE

(present study; Donnez *et al.*, 2000); (ii) they place patients requiring different operative techniques into the same category. For example with the classification of Martin and Batt (2001), surgical management (approach: operative laparoscopy or laparotomy; modality of exeresis) will be very different according to whether a bowel lesion is isolated or not and whether or not it is associated with infiltration of the posterior vaginal fornix. Similarly with Adamyan's classification the operative technique would not appear to differ much according to whether the disease is stage I or stage III, since in stage III there is no rectal wall invasion. Furthermore Adamyan's stage IV (Adamyan, 1993) groups together patients for whom the surgical treatment may be very different. The originality of our classification is that there is a well-defined operating technique for each location.

These techniques must of course be combined if there is disease in several locations (Table V). Multifocality is a major characteristic of DIE lesions. It is essential to take this parameter into account when deciding on the surgical strategy, as complete exeresis is essential if functional improvement is to be obtained. Although operative laparoscopy has been shown to be efficient in this context for a very large number of patients, there are still indications for carrying out laparotomy, notably in the case of intestinal DIE lesions that are isolated and unifocal in only 20% of cases.

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