ELSEVIER

European Journal of Cancer 40 (2004) 1842–1849

European Journal of Cancer

www.ejconline.com

Impact of surgical staging in patients with macroscopic "stage I" ovarian borderline tumours: analysis of a continuous series of 101 cases

Sophie Camatte [a], Philippe Morice [a,*], Anne Thoury [a], Virgine Fourchotte [a], Patricia Pautier [b], Catherine Lhomme [b], Pierre Duvillard [c], Damienne Castaigne [a]

[a] *Department of Surgery, Institut Gustave Roussy, Service de Chirurgie, 39 rue Camille Desmoulins, 94805 Villejuif Cedex, France*
[b] *Department of Medical Oncology, Institut Gustave Roussy, 39 rue Camille Desmoulins, 94805 Villejuif, France*
[c] *Department of Pathology, Institut Gustave Roussy, 39 rue Camille Desmoulins, 94805 Villejuif, France*

Received 2 March 2004; received in revised form 15 April 2004; accepted 20 April 2004
Available online 19 June 2004

Abstract

The aim of this study was to assess the patient's clinical outcome following complete or incomplete surgical staging in cases treated for an early stage low-malignant-potential ovarian tumour (LMPOT). One-hundred and one patients treated between 1965 and 1998 for a early stage I LMPOT were reviewed according to whether the initial surgical staging was complete (Group 1/defined by peritoneal cytology + peritoneal biopsies + infracolic omentectomy) or incomplete (Group 2/omission of at least one of the peritoneal staging procedures described above). Complete and incomplete surgical stagings were carried out in 48 (48%) and 53 (52%) patients, respectively. Four (8%) LMPOT recurrences were observed in Group 2, all following conservative management, but there were no recurrences in Group 1. No relapses with invasive carcinoma or peritoneal disease and no tumour-related deaths were observed. The absence of complete peritoneal staging in patients with an apparent "stage I" LMPOT increased the recurrence rate. However, this surgical restaging (in cases of incomplete initial surgery) does not modify the survival of patients with apparent "stage I" LMPOT misdiagnosed during the initial surgery. This procedure could probably be omitted: (1) if the peritoneum is clearly reported as "normal" during the initial surgery; (2) in the absence of a micropapillary pattern; and (3) if the patient agrees to be carefully followed-up.
© 2004 Elsevier Ltd. All rights reserved.

Keywords: Borderline tumour; Ovarian tumour; Surgical staging; Conservative surgery

1. Introduction

Low-malignant-potential ovarian tumours (LMPOT) are defined as being devoid of frank stromal invasion at histological examination and are characterised as exhibiting less aggressive behaviour than invasive epithelial ovarian tumours [1]. Between 60% and 85% of LMPOT are diagnosed at an early-stage (tumour confined to one or both ovaries) [2]. The 10-year relative survival in patients with "stage I" disease (according to the 1987 The International Federation of Gynecology and Obstetrics (FIGO) classification) is excellent (99% in the series reported by Trimble and collegues) [2]. The usual treatment of "apparently early-stage" LMPOT is a hysterectomy with bilateral salpingo-oophorectomy (or conservative surgery in young patients) and peritoneal staging procedures (peritoneal cytology, multiple peritoneal biopsies and infracolic omentectomy) [3].

Most LMPOT develop in young patients. However, many tumours are misdiagnosed at the time of initial surgery and in such cases, peritoneal staging procedures are not performed. A further operation is often required for adequate surgical management and to verify the initial stage of the disease. Very few series in the literature have compared the outcomes of patients with "apparently early-stage" LMPOT [4]. The aim of this

* Corresponding author. Tel.: +33-1-42-11-54-41; fax: +33-1-42-11-52-13.
E-mail address: morice@igr.fr (P. Morice).

0959-8049/$ - see front matter © 2004 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ejca.2004.04.017

study was to assess clinical outcomes following complete and incomplete surgical staging in patients treated for an early-stage LMPOT.

2. Patients and methods

2.1. Patients

From 1965 to 1998, 101 patients treated at and/or referred to the Institut Gustave Roussy for a LMPOT that was macroscopically confined to the ovary(ies) were reviewed. We did not request Institutional Review Board (IRB) approval for this study because of its retrospective nature. The histopathological review of the ovarian tumour and peritoneal implants was performed by one of the authors. LMPOT was defined as an ovarian tumour with: (1) stratification of the epithelial lining; (2) the formation of microscopic papillary projections; (3) the presence of nuclear atypia and most of all; (4) the absence of frank stromal invasion [5–7]. The staging system used was the 1987 FIGO classification [8]. The stage was recorded using the macroscopic description during the surgical procedure. The definition of stage I disease is a tumour limited to one or both ovaries (with or without positive peritoneal cytology – if performed). During this period, 101 patients were considered as having macroscopic stage I disease, based on the macroscopic exploration at the initial surgery.

2.2. Surgical treatments

In patients with apparent "stage I" disease (no macroscopic disease on the omentum and/or abdominopelvic peritoneum), complete surgical staging was defined as: peritoneal cytology, routine multiple peritoneal biopsies and infracolic omentectomy (±total) (Group 1). Incomplete staging was defined as the lack of at least one of the above-mentioned procedures (Group 2). Additional surgical staging procedures were occasionally performed (biopsies of the contralateral ovary during conservative treatment and a pelvic and/or paraaortic lymphadenectomy), but they had no influence on the assignment of patients to one of the 2 groups. These staging procedures were performed when the ovarian tumour was removed (during initial surgery) if the diagnosis of LMPOT was made during the surgical procedure (frozen section analysis) or during reassessment surgery if the LMPOT had been misdiagnosed during treatment of the ovarian tumour.

The surgical treatment of the ovarian tumour could be radical (bilateral salpingo-oophorectomy with or without hysterectomy) or conservative (preserving the uterus and salvaging at least a portion of one ovary) in order to preserve fertility. Four types of conservative surgical procedures were possible: unilateral adnexectomy (UA), UA + contralateral cystectomy (UA + CC), unilateral cystectomy (UC) and bilateral cystectomy (BC). The type of surgical procedure performed (treatment of the ovarian tumour and staging procedures) was dependent on the date of treatment, on the team of surgeons and on whether the LMPOT was diagnosed during or after the surgical procedure.

Patient follow-up included a clinical examination, blood tests (CA 125), and an ultrasound scan (US) every 3 months during the first year following the procedure, then every 6 months for 2 years and then yearly thereafter. Follow-up was defined as the time from the end of treatment to the last visit. Clinical outcomes were studied according to the completeness/incompleteness of the peritoneal staging procedures: complete (Group 1) or incomplete (Group 2).

Overall survival could not be studied because of a lack of events (no disease-related deaths). The χ^2 test was used for the statistical analysis and a P value of <0.05 was considered statistically significant. Medians were compared using the Mann–Whitney test.

3. Results

3.1. Patient characteristics

The median age of the patients at the time of the surgical procedure was 45 years (range, 17–82 years). Seventy-three patients underwent only one surgical procedure and 28 were submitted to reassessment surgery in order to complete the staging procedure in a median delay of 90 days (range, 8–243 days). The histological types of LMPOT were serous in 60 cases, mucinous in 30 cases, mixed in 10 cases and endometrioid in 1 patient. Among the patients with a serous tumour, stromal microinvasion was found in 10. The surgical procedure was performed by laparotomy in 98 patients and by laparoscopy in three.

Conservative treatments (during initial and/or reassessment surgery if performed) were carried out in 37 patients (37%): UA ($n = 31$), UA + CC ($n = 2$), UC ($n = 3$) and BC ($n = 1$). In 9 patients treated by UA or UC, a biopsy of the macroscopically normal contralateral ovary was performed. These systematic biopsy specimens of the macroscopically normal contralateral ovary were all normal at histological analysis. Surgical staging was complete in 48 patients (48%) and incomplete in 53 (52%). Complete surgical staging was more frequently performed in cases of radical treatment (56%) compared with conservative management (32%). None of the 3 patients treated by laparoscopy had complete peritoneal staging whereas 48 (49%) of the patients treated by laparotomy had complete staging ($P = 0.09$). Details concerning the patient's age, histological subtypes and the characteristics of the surgical procedures

Table 1
Characteristics of 101 patients according to the group of treatment (Group 1: complete staging and Group 2: incomplete staging)

	Group 1	Group 2	Total
Median age/years (range)	49 (17–82)	44 (19–69)	45 (17–82)
Histological subtypes			
Serous	28	32	60
Mucinous	12	18	30
Mixed	7	3	10
Endometrioid	1	0	1
Presence of stromal microinvasion	7	3	10
Stage[a]			
IA	30	39	69
IB	4	5	9
IC	14	9	23
Surgical staging procedures			
Peritoneal cytology	48	19	67
Omentectomy	48	8	56
Peritoneal biopsies	48	6	54
Pelvic lymphadenectomy	11	4	15
Para-aortic lymphadenectomy	3	0	3
Surgery of the ovarian tumour			
Conservative[b]	12	25	37
UA	10	21	31
UA + CC	0	2	2
UC	1	2	3
BC	1	0	1
Contralateral ovarian biopsies	5	4	9
Radical	36	28	64
Laparotomy	48	50	98
Laparoscopy	0	3	3
Total	48	53	101

BC, bilateral cystectomy; CC, contralateral cystectomy.
[a] Stage of the disease defined on the basis of histological results of ovary(ies) and peritoneal cytology (if performed) in Group 2.
[b] U, Unilateral; A, adnexectomy; C, cystectomy.

in both groups are given in Table 1. In patients in Group 1, the procedures performed at initial and reassessment surgery (if performed) are given together in one group in Table 1. In 40 patients with mixed and/or mucinous tumours, 7 had a previous appendectomy. Overall, an appendectomy was performed in 14 patients (2 of them had mucinous tumours). The histological analysis of the appendix was normal in all patients.

Histological results of extra-ovarian disease led to upstaging of 14 patients who had a serous tumour (9 diagnoses based on isolated positive peritoneal cytology and 5 on peritoneal implants): 8 (17%) patients were upstaged in Groups 1 and 6 (11%) in Group 2. The diagnoses in some of the upstaged patients in Group 2 were based on peritoneal cytology or omentectomy (among the 8 patients who had undergone an omentectomy without other staging procedures). Fourteen patients had positive peritoneal cytology. One of these patients was upstaged due to positive implants on the omentum and four had macroscopic excrescences on the surface of both ovaries (stage IC). In the other 9 patients with positive cytology, the initial stage was IA in 7 and IB in 2 patients. Among these 9 "upstaged" patients, 6 (5 stage IA and 1 stage IB) were in Group 1 and 3 (2 stage IA and 1 stage IB) in Group 2. Five patients had microscopic peritoneal implants (without suspicious lesions during the surgical procedure) in the omentum (stage IIIA according to the 1987 FIGO classification). Upstaging was not based on the histological analysis of multiple peritoneal biopsies and/or resected lymph nodes in any patient. None of the patients with a mucinous tumour were upstaged.

3.2. Clinical outcomes

The median duration of follow-up was 75 months (range, 0–351 months). The median duration of follow-up in Groups 1 and 2 were (respectively) 60 months (range, 0–264 months) and 120 months (range, 0–351 months), respectively ($P = 0.006$). There were no tumour-related deaths. Twelve patients died of intercurrent disease that was not related to their pelvic malignancy. Four (8%) patients relapsed in Group 2 and none (0%) in Group 1 ($\chi^2 = 3.24/P = 0.07$). All of the recurrences were serous tumours and all developed on a spared ovary following conservative management. Conservative management in these 4 patients (with stage IA in 2, IB in 1 and IC in last one) was: UA ($n = 2$); UA + CC ($n = 1$) and UC in the last patient. One of these patients had a routine ovarian biopsy of the remaining ovary (proven normal at histological analysis). The delay in recurrence (from the initial conservative treatment) was: 7, 10, 15 and 243 months. None of the patients relapsed with peritoneal disease and/or ovarian carcinoma in a spared ovary. None of the 5 patients who were upstaged following reassessment surgery (to stage IIIA with non-invasive implants) relapsed. All recurrences were treated surgically: contralateral adnexectomy with hysterectomy ($n = 2$), UA + CC ($n = 1$) and UC ($n = 1$). In 2 patients conservative treatment was also performed for the recurrence. All patients whose recurrence was initially treated conservatively are currently alive without disease (8, 42, 110 and 197 months after treatment of the in recurrent disease).

In patients treated conservatively, 4 pregnancies (in 4 patients) were observed in Groups 1 and 9 (in 5 patients) in Group 2. The median delay between the treatment of the LMPOT and pregnancy was 39 months (range, 3–84 months). One patient had 2 pregnancies following conservative treatment (cystectomy) of a recurrent LMPOT. These 13 pregnancies were obtained spontaneously.

4. Discussion

Surgical staging is considered an important step in the management of LMPOT. Complete surgical staging helps determine the true disease stage so that, ideally, adjuvant therapy can be administered to patients with unfavourable histological results (invasive peritoneal implants). In fact, surgical staging is complete at initial management of LMPOT in only a minor proportion of patients, one of the chief explanations being that malignancy is not suspected at initial surgery (main reasons: the cyst does not look suspicious; the frozen section analysis is not available, or this peroperative analysis misdiagnoses the borderline nature of the ovarian tumour. In a recent large series concerning staging procedures in patients treated for a LMPOT, only 12% of patients had complete surgical staging (including multiple biopsies of the peritoneum and lymph node sampling) [9]. This rate is related to the specialty of the surgeon: 50% of gynaecological oncologists performed complete staging compared with 9% of obstetrician–gynaecologists and 0% of general surgeons [9]. Three points need to be considered when studying the results of surgical staging in LMPOT: (1) the characteristics of upstaged patients; (2) the impact of staging on survival; and (3) patients in whom staging could be safely omitted need to be defined.

Table 2 presents a review of the literature data concerning the results of surgical restaging in patients with stage I disease [4,10–16]. The rates of upstaged patients varies between 7% and 47% (Table 2). These rates are high and could justify performing systematic surgical staging. However, restaging was also associated with significant morbidity: in the series by Snider and colleagues [14] 2/27 (7%) patients experienced major morbidity following surgical staging by laparotomy. Querleu and colleagues [15] observed a similar complication rate in patients treated by laparoscopy.

What are the clinical implications of upstaging? We know that the most important prognostic factor in patients with LMPOT is the disease stage and, particularly, the histological subtype of peritoneal implants in patients with stage II/III disease. Progression to invasive disease occurs in 2–30% of patients with non-invasive

Table 2
Literature review of results of surgical restaging in patients with a "stage I" borderline ovarian tumours

References	*N* stage I	*N* (%) upstaged	Characteristics of upstaging				
			Location	Macroscopic	Microscopic	Non-invasive implants	Invasive implants
Nation and Krepart [10]	55	NI	Omentum = 2 Nodes = 3	NI[a]	NI	NI	NI
Helewa and colleagues [11]	9	1 (11%)	NI	NI	NI	NI	NI
Yazigi and colleagues [12]	25	6 (24%)	Perit. cytology = 2 Nodes = 4 Spared ovary = 2	NI	NI	0	0
Hopkins and Morley [13]	15[b]	7 (47%)	Peritoneum = 3 Omentum = 2 Contralateral ovary = 1	5	2	NI	NI
Snider and colleagues [14]	27	5 (19%)	Peritoneum = 3 Omentum = 1 Omentum = 2	0	5	4	1 (peritoneum)
Winter III and colleagues [4]	31	8 (26%)	Appendix = 2 Uterine serosa = 1 Nodes = 3 Perit. cytology = 5	NI	NI	NI	1 (peritoneum)
Querleu and colleagues [15]	30	8 (27%)	Omentum = 1 Peritoneum = 1 Nodes = 1 Perit. cytology = 2	NI	NI	2	0
Land and colleagues [16]	56	4 (7%)	Contralateral tube = 1 Contralateral ovary = 1	NI	4	NI	NI
Present series	48	8 (17%)	Perit. cytology = 6 Omentum = 2	0	8	2	0

[a] NI, Not indicated; perit., peritoneal.
[b] Mixed stages of the disease (I and II).

implants on the peritoneum, while 30% of patients with invasive implants experience such progression [17–19]. Treatment of patients with peritoneal disease is based on complete surgical resection which is the only procedure in patients with non-invasive implants. Spontaneous regression of non-invasive implants is also possible after salpingo-oophorectomy [20]. Chemotherapy is only indicated in patients with invasive peritoneal implants even if adjuvant treatment has not been demonstrated to afford a gain in survival in LMPOT patients. The most frequent sites of extra-ovarian disease are the peritoneum and the omentum according to the characteristics of upstaged patients in the literature. In the series by Lin and colleagues [9], the pelvis and the abdominal peritoneum were positive in 58% and 48% of the patients, respectively, and invasive implants were found in only 9% and 14%. The omentum was positive in 39% (with invasive implants in 9%) [9]. In the series by Johnson and colleagues [21], positive samples were found in: peritoneal biopsy specimens in 30%, the omentum in 21% and the diaphragm in 5%. However, it is very difficult to know whether those lesions were macroscopically visible or only discovered after microscopic examination in patients without macroscopic disease. In the series by Johnson and colleagues [21], 24 of 29 patients with positive biopsy specimens had visible identifiable disease: 16 of 17 with omental disease and 20 of 23 with peritoneal disease. Unfortunately, the initial stage and histological subtypes in the 5 patients with implants diagnosed only following histological examination were not detailed [21]. In our series, 5 upstaged patients had microscopic non-invasive implants found at histological examination of the omentum. The yield of multiple peritoneal biopsies was zero in our study. Furthermore, the discovery of implants on the omentum did not change the management of our patients. The 5 patients never relapsed after treatment of their LMPOT. In the experience reported by Leake and colleagues [22], 9 patients (17%) with an apparently normal omentum were found to have microscopic disease, but the peritoneal status was not discussed. Positive peritoneal cytology was found in 14 patients and this led to upstaging in 9 of them (from stage IA to IC in 7 and IB to IC in 2). However, this finding had no implications for the management of these patients and therefore treatment was not modified.

With the exception of patients who are upstaged following lymph node resection for they represent special cases, the only way to modify the management of patients with apparent ''stage I'' LMPOT is to determine the percentage of patients with an apparently normal peritoneum who are upstaged because invasive implants are found at microscopic examination. We have previously seen that surgical resection of macroscopic disease should be performed if macroscopic excrescences are found on the peritoneum at initial surgical staging or restaging in patients with LMPOT confined to one or both ovary(ies). If non-invasive implants are found in a patient with a macroscopically normal peritoneal cavity, following microscopic examination of specimens removed during complete peritoneal staging, further surgical management is not necessary. Completion surgery is pointless in the absence of visible macroscopic peritoneal disease. For patients with microscopic invasive implants found only during microscopic examination (with an apparently normal peritoneum at surgical staging), upstaging does not modify surgical management, but the only question in such cases is whether adjuvant treatment is required. This is the only case where, in theory, treatment could be modified following peritoneal staging in patients with LMPOT. What is the frequency of such cases? It is very difficult to clearly determine this rate because, several aspects (were peritoneal implants visible or found only microscopically? If so, were implants invasive or non-invasive disease?) were not mentioned in the papers in the literature. In actual fact, only two series reported one patient with invasive implants unveiled at the histological examination [4,14]. In the series by Snider and colleagues, ''1 patient had a positive biopsy of the peritoneum of the sigmoid and in the series by Winter and colleagues'' ''only 1 patient had invasive peritoneal implants'' [4,14]. However, we do not know whether the latter patient had stage I or II disease [4]. In our series, as in the series by Querleu and colleagues [15], none of the upstaged patients had invasive implants following peritoneal or omental biopsies. In the series by Land and colleagues [16], 4 of 56 surgically staged patients with stage 1A disease were upstaged: 2 of them due to positive cytology (but this fact did not change the treatment of the patient), 1 patient based on microscopic disease in a Fallopian tube and the last 1 based on residual disease in the contralateral ovary after initial cystectomy. In none of these cases did the discovery of microscopic extra-ovarian spread alter the post-operative treatment of patients (indication for adjuvant therapy). Thus, in patients with an apparently normal peritoneum, the yield of systematic surgical staging in identifying patients in whom adjuvant therapy should be delivered (microscopic invasive implants) is very low.

In several series reported in Table 2, patients were upstaged based on the histological analysis of lymph nodes [4,10,12,15]. In the series by Querleu and colleagues [15], the only patient who received adjuvant treatment after surgical restaging was a patient with a borderline lesion in pelvic nodes. In the literature, 0–36% of patients with a borderline tumour apparently confined to the ovary (stage I disease according to the FIGO classification) had nodal involvement (stage IIIC according to the FIGO classification) [12,16,23,24]. Land and colleagues [16] reported on the absence of nodal spread in a series of 26 patients who underwent

lymph node sampling for stage I disease. In one of our previous reports, 8 patients had nodal spread from a LMPOT [25]. None of the patients with early-stage disease had nodal involvement found at the histological analysis of lymph nodes removed during initial surgery [25]. Only one patient with a primary stage II serous LMPOT had para-aortic nodal involvement (stage IIIC) discovered at the para-aortic lymphadenectomy performed during second-look surgery (at the end of chemotherapy) [25]. Furthermore, the prognosis is excellent in these patients: none of our patients with nodal spread died of their disease. Leake and colleagues [24] observed that the survival of patients with nodal involvement was not statistically different from that of patients with negative nodes. However, the risk of recurrence was higher in patients with nodal involvement associated with peritoneal lesions [24]. In Di Re's study [23], no recurrences occurred among the 9 patients with positive nodes and survival was identical to that of patients with negative nodes. These results seem to suggest that systematic lymphadenectomy need not be performed in patients treated for early-stage LMPOT [3]. Only enlarged or suspicious nodes should be removed during the surgical procedure. If patients are treated for LMPOT using a laparoscopic approach, palpation of pelvic and para-aortic areas is impossible. Then, pre-operative imaging (CT scan) should be performed to explore these areas and to detect nodal enlargement.

The clinical impact (modification of treatment) of surgical restaging appears to be low in LMPOT, but is there any impact on survival? In the comparative series by Land, 1/25 patients not submitted to a restaging procedure died of their disease [16]. This patient relapsed at the age of 79 years, 108 months after treatment of the borderline tumour. Details about the characteristics of the initial tumour were not given [16]. Furthermore, the authors stated in the Table of their interesting paper about this patient: "one death from disseminated cancer?" [16]. The precise diagnosis of the recurrence was apparently not available. In the group of 56 staged patients, no deaths were observed [16]. However, the rates of recurrent disease in both groups were not given. Consequently, only 1 recent series has compared clinical outcomes (recurrences and deaths) of completely staged and incompletely staged patients with stages I and II LMPOT [4]. Survival and recurrences rates were similar in both groups of patients [4]. Nevertheless, 2 patients died in both groups in this study [4].

Our study is a larger series. Although there were no LMPOT-related fatalities, the recurrence rate was higher in the incompletely staged patients in our study. The longer median duration of follow-up in Group 2 compared with Group 1 (120 versus 60 months) could account for this difference. Another explanation for this difference in the recurrence rates is that the number of patients treated conservatively was higher in Group 2 compared with Group 1 (47% versus 25%); indeed, there was a greater number of young patients with an initial diagnosis of LMPOT in Group 2. In the literature, the rate of ovarian recurrence following conservative treatment varies from 0% to 22% [26–33]. This rate is higher following cystectomy (12–37.5%) [26,28,34,35]. As cystectomy yields high recurrence rates, unilateral adnexectomy should be the preferred conservative treatment. Cystectomy should be reserved for patients treated for a recurrent borderline tumour with a previous history of an adnexectomy and obviously wishing to preserve their fertility. Even if conservative surgery increases the risk of ovarian recurrences, recurrent disease is in most cases a new LMPOT on the remaining ovary which can be easily treated with surgery alone. As recurrent invasive ovarian carcinoma is unusual, patients' survival is not affected by this conservative approach [32,33,36]. The recurrence rate was higher in Group 2 because more patients were treated conservatively, but this higher recurrence rate had no influence on survival. As there appears to be no impact on survival, surgical restaging could probably be safely omitted in young patients who were initially treated conservatively without complete staging procedures (due to misdiagnosis during initial surgery).

Thus, in clinical practice, if initial surgery for LMPOT is incomplete, two options could be considered: (1) surgical restaging by laparoscopy (with completion of the unilateral oophorectomy if a cystectomy alone was initally carried out, peritoneal washings, multiple peritoneal biopsies and an infracolic omentectomy); or (2) careful follow-up (based on clinical examination, US and blood markers). A new surgical approach would only be considered in cases of an ovarian recurrence. The final decision to restage must therefore be individualised, taking into consideration the patient's desires and possibilities (compliance with follow-up) and the surgeon's concerns.

If surgical restaging could be avoided in some patients with LMPOT, could it be dispensed within all cases? We think that this could only be possible in patients in whom the aspect of the peritoneum of the abdomino-pelvic cavity is normal at initial surgery and clearly documented. If the status of the peritoneum is not clearly stated, patients should undergo a staging procedure.

Histological subtypes also have an influence on the procedures required during surgical staging. In patients with a mucinous tumour, an appendectomy should be included in the peritoneal staging because mucocoele of the appendix could be discovered during treatment of a mucinous LMPOT. However, in our series as in the series by Snider and colleagues, none of the patients with a mucinous LMPOT confined to the ovary(ies) were upstaged. In the series by Land and colleagues [16], 1 of 23 patients with a mucinous tumour was restaged

due to positive peritoneal cytology. This result did not modify the treatment of this patient. Considering these results, surgical restaging could probably be omitted, particularly in this subgroup of patients. A new LMPOT entity, "micropapillary serous carcinoma" (MPSC) has recently been described [37]. This micropapillary pattern was more often associated with invasive than non-invasive implants [37]. In this initial report, recurrences and mortality rates were higher in patients with MPSC than among patients with a borderline tumour without a micropapillary pattern [37]. Nevertheless, the prognostic value of a MPSC component remains debatable [38,39]. As LMPOT with a micropapillary pattern is more frequently associated with invasive peritoneal disease, perhaps complete surgical staging should be maintained in this subgroup.

Finally, the apparent stage of the disease is also important. In patients with stage II disease (implants in the pelvic peritoneum), the rate of upstaging is high and could modify post-operative therapy; indeed, even if only non-invasive implants are found on the pelvic peritoneum, invasive implants could arise in the upper abdomen. In the series by Yazigi and colleagues [12], 3/4 (75%) stage II tumours were upstaged based on the histological examination of the omentum. Patients with stage II disease should therefore undergo complete peritoneal staging (omentectomy and peritoneal biopsies of the upper abdomen). This is why, unlike the other series reported [4], only patients with stage I disease were included in our analysis.

In conclusion, this series seems to suggest that surgical restaging (in case of incomplete initial surgery) does not modify the survival of patients with apparent "stage I" LMPOT misdiagnosed during initial surgery. This procedure could probably be omitted: (1) if the peritoneum is clearly reported as "normal" during initial surgery; (2) in the absence of a micropapillary pattern; and (3) if the patient agrees to be carefully followed-up.

Acknowledgements

We thank Lorna Saint Ange for editing this manuscript.

References

1. Taylor HC. Malignant and semi-malignant tumours of the ovary. *Surg Gynecol Obstet* 1929, **48**, 204–230.
2. Trimble CL, Kosary C, Trimble EL. Long-term survival and patterns of care in women with ovarian tumours of low malignant potential. *Gynecol Oncol* 2002, **86**, 34–37.
3. Trope C, Kaern J. Management of borderline tumours of the ovary: state of the art. *Semin Oncol* 1998, **25**, 372–380.
4. Winter III WE, Kucera PR, Rodgers W, McBroom JW, Olsen C, Maxwell GL. Surgical staging in patients with ovarian tumours of low malignant potential. *Obstet Gynecol* 2002, **100**, 671–676.
5. Scully RE. Common epithelial tumours of borderline malignancies (carcinoma of low malignant potential). *Cancer* 1982, 228–238.
6. Hart WR, Norris HJ. Borderline and malignant mucinous tumours of the ovary. *Cancer* 1973, **31**, 1031–1044.
7. Duvillard P. Tumeurs ovariennes à la limite de la malignité. *Ann Pathol* 1996, **16**, 396–405.
8. International Federation of Gynecology and Obstetrics. Changes in definitions of clinical staging for carcinoma of the cervix and ovary. *Am J Obstet Gynecol* 1987, **156**, 263–4.
9. Lin PS, Gershenson DM, Bevers MW, Lucas KR, Burke TW, Silva EG. The current status of surgical staging of ovarian serous borderline tumours. *Cancer* 1999, **85**, 905–911.
10. Nation JG, Krepart GV. Ovarian carcinoma of low malignant potential: staging and treatment. *Am J Obstet Gynecol* 1986, **154**, 290–293.
11. Helewa ME, Krepart GV, Lotocki R. Staging laparotomy in early epithelial ovarian carcinoma. *Am J Obstet Gynecol* 1986, **154**, 282–286.
12. Yazigi R, Sanddstad J, Munoy AK. Primary staging in ovarian tumours of low malignant potential. *Gynecol Oncol* 1988, **31**, 402–408.
13. Hopkins MP, Morley GW. The second-look operation and surgical reexploration in ovarian tumour of low malignant potential. *Obstet Gynecol* 1989, **74**, 375–378.
14. Snider DD, Stuart GC, Nation JG, Robertson DI. Evaluation of surgical staging in stage I low malignant potential ovarian tumours. *Gynecol Oncol* 1991, **40**, 129–132.
15. Querleu D, Papageorgiou T, Lambaudie E, Sonoda Y, Narducci F, LeBlanc E. Laparoscopic restaging of borderline ovarian tumours: results of 30 cases initially presumed as stage IA borderline ovarian tumours. *BJOG* 2003, **110**, 201–204.
16. Land R, Perrin L, Nicklin J. Evaluation of restaging in clinical stage IA low malignant potential ovarian tumours. *Aust NZ J Obstet Gynaecol* 2003, **42**, 379–382.
17. Gershenson D, Silva E, Levy L, Burke TW, Wolf JK, Tornos C. Ovarian serous borderline tumours with invasive peritoneal implants. *Cancer* 1998, **82**, 1096–1103.
18. Gershenson D, Silva EL, Tortolero-Luna G, Levenback C, Morris M, Tornos C. Serous borderline tumours of the ovary with non invasive peritoneal implants. *Cancer* 1998, **83**, 2157–2163.
19. Morice P, Camatte S, Rey A, *et al*. Prognostic factors of patients with advanced stage serous borderline tumour of the ovary. *Ann Oncol* 2003, **14**, 592–598.
20. Morice P, Thoury A, Sabourin JC, *et al*. Spontaneous regression of peritoneal implants in borderline ovarian tumour after salpingo-oophorectomy. *J Clin Oncol* 2003, **21**, 3536–3538.
21. Johnson GA, Gould N, McMeekin DS, Kamelle S, Gold M, Walker J, Mannel R. Frequency and distribution of extra-ovarian disease in borderline tumours of the ovary. *Proc ASCO* 2002, **21**, 885.
22. Leake JF, Currie JL, Rosenshein NB, Woodruff JD. Long-term follow-up of serous ovarian tumours of low malignant potential. *Gynecol Oncol* 1992, **47**, 150–158.
23. Di Re F, Paladini D, Fontanelli R, *et al*. Surgical staging for epithelial ovarian tumours of low malignant potential. *Int J Gynecol Cancer* 1994, **4**, 310–314.
24. Leake JF, Ader JS, Woodruff JD. Retroperitoneal lymphatic involvement with epithelial ovarian tumours of low malignant potential. *Gynecol Oncol* 1991, **42**, 124–130.
25. Camatte S, Morice P, Atallah D, *et al*. Lymph node disorders and prongnostic value of nodal involvement in patients treated for borderline ovarian tumour: an analysis of a series of 42 lymphadenectomies. *J Am Coll Surg* 2002, **195**, 332–338.

26. Lim-Tan S, Cajigas H, Scully R. Ovarian cystectomy for serous borderline tumours: a follow-up study of 35 cases. *Obstet Gynecol* 1988, **72**, 775–780.
27. Rice LW, Berkowitz RS, Mark SD, Yavner DL, Lage JM. Epithelial ovarian tumours of borderline malignancy. *Gynecol Oncol* 1990, **39**, 195–198.
28. Gottlieb W, Flikker S, Davidson B, Korach Y, Kopolovic J, Ben-Baruch G. Borderline tumours of the ovary: fertiliy treatment, conservative management, and pregnancy outcome. *Cancer* 1998, **82**, 141–146.
29. Kennedy AW, Hart WR. Ovarian papillary serous tumours of low malignant potential (serous borderline tumours). A long term follow-up study, including patients with microinvasion, lymph node metastasis, and transformation to invasive serous carcinoma. *Cancer* 1996, **78**, 278–286.
30. Tamakoshi K, Kikkawa F, Nakashima N, Tamakoshi A, Kawai M, Furuhashi Y, *et al*. Clinical behavior of borderline ovarian tumours: a study of 150 cases. *J Surg Oncol* 1997, **64**, 147–152.
31. Darai E, Teboul J, Fauconnier A, Scoazec JY, Benifla JL, Madelenat P. Management and outcome of borderline ovarian tumours incidentally discovered at or after laparoscopy. *Acta Obstet Gynecol Scand* 1998, **77**, 451–457.
32. Morice P, Camatte S, El Hassan J, Pautier P, Duvillard P, Castaigne D. Clinical outcomes and fertility results after conservative treatment for ovarian borderline tumour. *Fertil Steril* 2001, **75**, 92–96.
33. Morice P, Camatte S, Wicart-Poque F, *et al*. Results of conservative management of epithelial malignant and borderline epithelial ovarian tumour. *Human Repod Update* 2003, **9**, 185–192.
34. Tazelaar H, Bostwick D, Ballon S. Conservative treatment of borderline ovarian tumours. *Obstet Gynecol* 1985, **66**, 417–421.
35. Camatte S, Rouzier R, Boccara-Dekeyser J, *et al*. Pronostic et fertilité après traitement conservateur d'une tumeur ovarienne à la limite de la malignité: revue d'une série continue de 68 cas. *Gynecol Obstet Fertil* 2002, **30**, 583–591.
36. Zanetta G, Rota S, Chiari S, Bonazzi C, *et al*. Behavior of borderlin tumours with particular interest to persistence, recurrence, and progression to invasive carcinoma: a prospective study. *J Clin Oncol* 2001, **19**, 2656–2664.
37. Seidman JD, Kurman RJ. Subclassification of serous borderline tumours of the ovary into benign and malignant types. A clinicopathologic study of 65 advanced stage cases. *Am J Surg Pathol* 1996, **20**, 1331–1345.
38. Prat J, De Nictolis M. Serous borderline tumours of the ovary: a long-term follow-up study of 137 cases, including 18 with a micropapillary pattern and 20 with microinvasion. *Am J Surg Pathol* 2002, **26**, 1111–1128.
39. Eichhorn JH, Bell DA, Young RH, Scully RE. Ovarian serous borderline tumours with micropapillary and cribriform patterns: a study of 40 cases and comparison with 44 cases without these patterns. *Am J Surg Pathol* 1999, **23**, 397–409.