European Journal of Obstetrics & Gynecology and Reproductive Biology 240 (2019) 215–219

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Full length article

Morbidity of multiple bowel resection compared to single bowel resection after debulking surgery for ovarian cancer

Roberto Tozzi[a,*], Jvan Casarin[a,b], Ahmet Baysal[a], Ciro Pinelli[a,b], Luka Matak[a,c], Nahid Ghanbarzadeh[a,d], Moiad Alazzam[a], Riccardo Garruto-Campanile[a], Hooman Soleymani Majd[a], Yakup Kilic[a,1], Matteo Morotti[a,1]

[a] Department of Gynaecologic Oncology, Division of Women's and Children, Churchill Hospital, Oxford, UK
[b] Department of Obstetrics and Gynecology, University of Insubria, Varese, Italy
[c] Department of Obstetrics and Gynaecology, General Hospital Zadar, Croatia
[d] Department of Obstetrics and Gynaecology, Birjand University of Medical Sciences, Iran

ARTICLE INFO

Article history:
Received 11 April 2019
Received in revised form 21 May 2019
Accepted 8 July 2019

Keywords:
Bowel resection
Debulking surgery
Morbidity
Ovarian cancer

ABSTRACT

Objectives: To assess the impact of multiple bowel resections on postoperative outcomes in stage IIIC-IV ovarian cancer (OC).
Methods: From the Oxford OC database we retrieved consecutive patients who underwent bowel resection between January 2009 and November 2017. Patients were divided into two groups: single bowel resection (SBR) and MBR (≥2 bowel resections). The following outcomes were compared between the two groups: 30-day related and not related morbidity to bowel surgery, bowel diversion rate and time to start/restart adjuvant chemotherapy.
Results: Thirty-five patients were in the MBR and 146 in the SBR group. The 30-day overall surgical-related complication and bowel specific complications rate was higher in MBR group than SBR group (54.3% vs. 23.9%, $p < 0.001$) and (25.7% vs. 10.5%, $p = 0.035$), respectively. The rate of bowel diversion was 97.7% in MBR vs. 26.7% in the SBR group ($p = 0.021$). Trend analysis showed a significant reduction in the rate of MBR after the introduction of NACT (p- for trend <0.001).
Conclusions: Our data show that MBR during OC surgery is associated with a higher rate of overall and bowel specific complication compared to SBR. The introduction of NACT is associated with a reduced rate of MBR.

Introduction

Ovarian carcinoma (OC) is the fifth cause of cancer-related death in women and it is responsible for more than 14,000 deaths every year in the United States [1]. Standard of care is surgery and platinum-taxane based chemotherapy [2]. Recently the use of neoadjuvant chemotherapy (NACT) has been incorporated in the first line treatment of women with OC [3,4]. Despite primary debulking surgery (PDS) is associated with better prognosis, NACT might have a role in the treatment of stage IV OC or women with poor performance status or high volume disease [5]. Irrespective of the initial treatment modality, the absence of any visible disease at the end of the surgery, so-called complete resection (CR), is associated with the best survival outcome [6]. Since the majority of OC patients present with an advanced stage of the disease and widespread peritoneal dissemination, multi-visceral surgery, including bowel resection, is often necessary to achieve CR [7–11]. Rectosigmoid resection represents the most common extra-gynecological procedure during debulking surgery, with an estimated rate between 40% and 60% [12,13]. Due to peritoneal spread, concomitant tumor involvement of other bowel segments is common in patients with stage IIIC-IV OC. In such patients, the resection of multiple bowel segments is necessary to pursue a CR. The rate of multiple bowel resections (MBR) ranges between 5.9% [14] and 30.1% [15] when a CR is attempted. So far few studies published on the morbidity associated to MBR in patients with stage IIIC-IV OC, reporting a significantly higher rate of postoperative complications compared to single bowel resection (SBR) and a benefit in overall survival [16], but also higher anastomotic leakage and mortality rate [14] after surgery with MBR. The majority of

* Corresponding author at: Department of Gynecology Oncology, Division of Women's and Children, Oxford University Hospital, Old Road, OX37LE, Oxford, UK.
E-mail address: roberto.tozzi@wrh.ox.ac.uk (R. Tozzi).
[1] These authors contributed equally to the manuscript.

https://doi.org/10.1016/j.ejogrb.2019.07.011
0301-2115/

these studies were performed during primary cytoreductive surgery. In the current study, we investigate the related and not-related complications rate associated to SBR and MBR, the rate of bowel diversion and the time to chemotherapy in patients who underwent MBR (≥2 bowel resections) comparing to patients who had SBR during debulking surgery for advanced OC. In addition, we assessed if the introduction of NACT decreased the number of MBR over time.

Materials and methods

From the Oxford advanced OC database, we extracted all consecutive patients who underwent bowel resection during debulking surgery at the Department of Gynecological Oncology of the Oxford University Hospitals (OUH) between January 2009 and July 2017.

Inclusion and exclusion criteria for surgery were previously reported [10,17]. Briefly, before September 2011 upfront surgery was offered to all patients considered fit for surgery with CR as the only valuable target. Starting from October 2011, after the publication of the EORTC trial [4] all patients with preoperative stage IIIC/IV OC were electively treated with neoadjuvant chemotherapy (NACT) and interval debulking surgery (IDS) due to internal OUH guidelines. IDS was offered to all the patients showing response to NACT or stable disease as assessed by RECIST criteria and exploratory laparoscopy. Patients were not offered surgery if were scored as ASA > 3 or a negative cardiopulmonary exercise test and pre-operative anesthetic assessment; CT scan showing lung or multiple parenchymal liver metastases and the preoperative explorative laparoscopy demonstrated features of unresectable disease (see Querleu et al [18]). Patients with progressive disease after NACT were not offered surgery. Exclusion criteria for this analysis were: histology consistent with low-grade, borderline, recurrent OC and synchronous tumor. We divided the patients into two groups: single bowel resection (SBR group) and multiple bowel resections (≥ 2 bowel resections, MBR group). Over the study period, there were no significant differences in the facilities available for patient care and in the referral pattern to our service. The techniques of en-bloc pelvic resection, colorectal anastomosis, and formation of bowel diversion were previously described [7,19,20]. The indications for DLI were: 1) Rectosigmoid resection <6 cm from anal verge 2) non-tension free anastomosis 3) poor tissue quality or 4) air spillage through the anastomosis at trans-anal air test. In patients with MBR, we applied the same concepts with a lower threshold towards bowel diversion taking into account that MBR has been described as a risk factor for anastomotic leak [14,15]. All our patients received mechanical bowel preparation with Bisacodyl 20 mg the day prior to the operation. Patient's characteristics including age, ASA (American Society of Anesthesiologists) score, pre-operative albumin, pre-operative hemoglobin, and history of abdominal and/or pelvic surgery were retrieved from the electronic clinical notes. Intra-operative details such as operative time, complications and bowel diversion were recorded; peri- and postoperative outcomes (including hospital length of stay, length of intensive care stay, postoperative readmission rates, 90 days mortality rate and time to start chemotherapy) were also collected. We used the Clavien–Dindo classification for the assessment of surgical-related complications [21]. Only grade 2 or ≥complications were registered. Bowel specific complications were defined as the number of patients experiencing any of the following: anastomosis breakdown, prolonged ileus, stoma retraction, pelvic abscess or enteric fistula [19,22]. The endpoints of the study were the comparison of 30-day related and not-related complications of MBR and SBR. Other endpoints were the rate of bowel diversion defined as the number of patients with a diverting ileostomy, colostomy or end colostomy and the time to start/restart adjuvant chemotherapy defined as the days between surgery and initiation of chemotherapy. In addition, we assessed if the introduction of NACT (after September 2011) was associated with a decreased number of MBR over time. The current study was performed retrospectively and was approved by the Oxford University Hospital NHS Foundation Trust Institutional Review Board (Trust number 4889). Only patients that at the time of the surgery consented for their data to be used for research and audits activities were included.

Statistical analysis

Descriptive statistics for continuous and categorical variables have been reported as an absolute number, rate, and percentage (%). A normality test (D'Agostino-Pearson test) was used to determine whether sample data followed a Gaussian distribution. Comparison between SBR and MBR groups was performed using the chi-square test or Fisher's exact test for categorical variables, and the Student's *t*-test or Wilcoxon rank-sum tests for continuous variables. All calculated p-values were two-sided, and p-values less than 0.05 were considered statistically significant. A linear trend model was used to establish a trend in the application of OC surgery and bowel resection across the time period. A supplemental analysis stratified by type of bowel resection (SBR and MBR) was also performed. The analyses were performed with Graph Pad Prism version 6.0 (Graph Pad Software, San Diego CA) and JMP 13.0.0 software (SAS© 2016 SAS Institute Inc.).

Results

Patient characteristics

During the study period, 481 patients underwent surgery for stage IIIC-IV OC. Overall 189 patients (39.3%) had bowel resection as part of the surgery. Thirty-nine patients underwent the resection of 2 or more bowel segments (MBR, 20.6%) and 150 patients underwent single bowel resection (SBR, 79.4%). Complete data were available for 181 out of 189 patients (95.7%), representing the study population. Among those, 35 (19.3%) patients had MBR and 146 had SBR (80.7%), respectively (Supplementary Fig. 1). The two groups were similar in terms of patient's baseline characteristics and tumor features (Table 1). MBR patients had more ascites (51.4% vs. 34.9%, p = 0.044) and lower albumin (31.2 ± 9.7 vs. 38.2 ± 7.0, p = 0.009). Among women who had MBR, 21 (60.0%, 21/35) received rectosigmoid and small bowel resection; 5 (14.3%, 5/35) rectosigmoid and transverse colon resection; 3 (8.6%, 3/35) rectosigmoid and caecum resection; and 3 patients

Table 1
Demographic characteristics and tumour details of patients who underwent single bowel resection (SBR) vs. multiple bowel resection (MBR).

	SBR n = 146	MBR n = 35	*p* value
Age, mean (SD), years	63.7 (±10)	60.8 (±14)	0.319
Previous abdominal surgery, n (%)	39 (26.7%)	11 (31.4%)	0.516
ASA score ≥2, n (%)	23 (15.7%)	5 (14.3%)	0.958
Ascites, n (%)	51 (34.9%)	18 (51.4%)	0.044
Pre-op CA125, mean, (SD), IU/ml	768 (±1206)	997 (±867)	0.434
Pre-op Hb, mean, (SD) g/L	11.96 (±2.49)	10.95 (±1.9)	0.786
Pre-op Albumin, mean, (SD) g/L	38.2 (±7.0)	31.2 (±9.7)	0.009
FIGO stage,	–	–	0.042
Stage IIIC, n (%)	89 (60.9%)	16 (45.7%)	
Stage IV, n (%)	47 (39.1%)	19 (54.3%)	
Histology type,	–	–	0.815
Serous, n (%)	115 (78.8%)	29 (82.9%)	
Others, n (%)	31 (21.2%)	6 (18.1%)	

Legend: FIGO = International Federation of Gynecology and Obstetrics; n = absolute number; Pre-op = pre-operative data within 30 days of surgery; SD = standard deviation.

(8.6%, 3/35) underwent rectosigmoid plus transverse colon and ileum resection and 3 received transverse colon and small bowel resection (8.6%, 3/35).

Intra- and postoperative outcomes

Surgical outcomes are detailed in Table 2. No statistical difference was found in terms of CR between patients who had MBR (30/35, 85.7%) and SBR (114/146, 81.5%, p = 0.361). Patients who underwent MBR had a higher number of lymphadenectomy and appendectomy, higher median estimated blood loss (654 ± 234 ml vs. 515 ± 388 mL, p = 0.029) and longer mean operating time (443 ± 87 vs. 379 ± 98, p = 0.004). More surgical procedures, as stated by the surgical complexity score (SCS) were performed in the MBR vs. SBR group (mean 8.3 ± 6.1 versus 6.4 ± 4.8; p = 0.012). The overall 30-day complication rate was significantly higher in MBR group compared to the SBR group (54.3% vs. 23.9%, p < 0.001). Bowel specific complications occurred to 9 and 15 patients (25.7% vs.10.3%, p = 0.035) in MBR and SBR group respectively (Table 3). The median length of hospital stay was also significantly longer in patients who underwent MBR compared to SBR (14.4 ± 6.8 vs.10.8 ± 6.2 days, p = 0.020). Other parameters such as intensive care admissions, 30-day readmission rate, and 90-day mortality rate were not different between the groups (Table 4). No significant difference was noticed regarding the anatomic level of the colorectal anastomosis: averagely 7 cm from the anal verge (range 3–11) in MBR group and 8 cm (range 5–12) in the SBR group (p = 0.712). Bowel diversion was performed more frequently in patients who underwent MBR (34/35, 96.7%) vs. 26.7% (39/147) compared to SBR group (p < 0.001) (Table 2). A sub-group analysis of patients who received bowel diversion confirmed that women with MBR had a higher postoperative complications rate compared to women who received SBR and bowel diversion (Supplementary Table 2). Overall, 147 women (81.2%), received adjuvant chemotherapy or restarted chemotherapy with no differences between the two groups (Supplementary Table 1). Twenty-seven patients (14.9%) had already completed 6 cycles of NACT before surgery, and 7 (3.9%) were not offered adjuvant treatment due to the presence of severe co-morbidities. Interestingly, 17 patients in the MBR group (48.6%, 17/35) started chemotherapy later than 6 weeks from the surgery compared to 33 patients in the SBR group (22.6%, 33/146, p = 0.003) (Table 4).

Table 2
Surgical details of patients who underwent single bowel resection (SBR) vs. multiple bowel resections (MBR).

SURGICAL PROCEDURES	SBR (n = 146)	MBR (n = 35)	*p* value
Pelvic surgery, n (%)			
Total Hysterectomy	125 (85.6%)	31 (88.6%)	0.783
Bladder resection	10 (10.5%)	6 (17.1%)	0.273
Appendectomy	13 (13.7%)	9 (25.7%)	0.005
Supracolic Omentectomy	138 (94.5%)	32 (91.4%)	0.861
Lymphadenectomy, n (%)*	27 (18.5%)	15 (42.8%)	0.018
Peritonectomy, n (%)	136 (91.1%)	33 (94.3%)	0.692
Upper abdominal surgery n (%)			
Splenectomy	10 (6.8%)	6 (17.1%)	0.145
Gastric resection	9 (6.2%)	3 (8.6%)	0.742
Liver resection	13 (8.9%)	4 (11.4%)	0.321
Cholecystectomy	2 (2.1%)	2 (5.7%)	0.142
Pleurectomy, n (%)	23 (15.8%)	11 (31.4%)	0.119
Surgical complexity score, n (SD)	6.4 ± 4.8	8.3 ± 6.1	0.012
Bowel Diversion, n (%)	29 (26.7%)	34 (97.1%)	<0.001
Estimated blood loss, ml (SD)	515 (±388)	654 (±234)	0.029
Mean operative time, min (SD)	379 (±98)	443 (±87)	0.004
Complete resection, n (%)	114 (81.5%)	30 (85.7%)	0.361

Legend: n = absolute number; SD = standard deviation; *Pelvic and/or para-aortic lymphadenectomy/enlarged lymph node(s) resection.

Trend analysis on the impact of NACT over time

We performed a trend analysis to assess the number of bowel resections and MBR over the study period. Although we found a consistent number of bowel resections performed (p for trend = 0.230) (Supplementary Fig. 2), the overall rate of bowel resection reduced after the introduction of NACT (61/131, 46.5% in upfront surgery period vs. 128/350, 36.5% in interval debulking period; p = 0.040). Interestingly, when we analyzed only the patients who required bowel surgery, we found a significant reduction in the rate of MBR and a concomitant increase in the rate of SBR over time (p- for trend <0.001) (Fig. 1). These data suggest that the introduction of NACT is associated with a decreased number of MBR and to a shift in the type of bowel resection performed compared to primary cytoreductive surgery.

Discussion

In the present study, we found that patients undergoing MBR during surgery for stage IIIC-IV OC experience increased overall morbidity when compared to patients who had SBR. The MBR group also faced a higher rate of bowel specific complications, longer hospitalization and delayed start of adjuvant chemotherapy. Our data are in line with a previous study showing a post-operative complications rate of 47.1% for patients undergone MBR compared to 20.6% in patients undergone SBR and a delayed start of chemotherapy when MBR was performed [14,16]. The increased overall surgical morbidity may be related to a more conspicuous intra-abdominal tumor load, which is scarcely reflected by the FIGO stage [16]. In fact, stage IIIC disease may include very different surgical findings. Better reflective of the true tumor load is the number of surgical procedures (SCS) required to achieve a CR [23]. In this study, the MBR group patients underwent more surgical procedures and had longer operative time. In addition, the involvement of multiple segments of bowel may imply a worse nutritional and baseline performance status. This was confirmed in our cohort where we found that women with MBR had a higher volume of ascites and lower preoperative albumin levels. The latter is considered an independent prognostic factor for severe post-operative complications in patients with OC [24]. More relevant to the subject of this study is the higher occurrence of bowel-specific complications, which is likely related to the MBR. We found that patients undergoing MBR experienced more frequently bowel-specific complications compared to women undergoing SBR. However, probably due to low number of cases, we could not find an individual bowel-specific complication that was clearly more frequent in the MBR group. Women in the MBR group had a higher rate of bowel diversion. While the criteria to consider a diversion were identical for the 2 groups, the MBR per se is considered a risk factor for bowel anastomosis dehiscence [14,15]. Inevitably, the leniency towards a bowel diversion of the surgeon was increased. We assess if the formation of stoma could have impacted the postoperative complication rate in these patients [19]. Interestingly, our sub-analysis assessing only the patients receiving bowel diversion in both cohorts, found that the rate postoperative complications were still higher in the MBR group compared to SBR group with bowel diversion (Supplementary Table 2). To the best of our knowledge, there is no clinical trial prescribing the use of diversion in patients with MBR, however, it is probably for the colo-rectal groups with larger numbers to advice on the matter. In any case, patients likely to receive MBR should be clearly informed on the morbidity associated with a bowel

Table 3
Overall and bowel specific complications (Clavien Dindo > 2) in patients who underwent surgery: single bowel resection (SBR) vs. multiple bowel resections (MBR).

	SBR (n = 146)	MBR (n = 35)	p-value
Overall complications, n (%)	35 (23.9%)	19 (54.3%)	p < 0.001
Clavien-Dindo Grade≥3 complications, n (%)	11 (7.5%)	6 (17.1%)	0.104
Cellulitis/wound breakdown, n (%)	6 (4.1%)	3 (8.6%)	0.194
Sepsis, n (%)	4 (2.7%)	2 (5.7%)	0.283
Respiratory distress, n (%)	3 (2.1%)	1 (2.9%)	0.540
Pulmonary embolism, n (%)	4 (2.7%)	2 (5.7%)	0.283
Pneumonia, n (%)	3 (2.1%)	2 (5.7%)	0.540
Bowel specific complications, n (%)	15 (10.3%)	9 (25.7%)	0.035
Anastomosis breakdown, n (%)	3 (2.1%)	1 (2.9%)	0.540
Prolonged ileus, n (%)	6 (4.1%)	4 (11.4%)	0.194
Stoma retraction, n (%)	1 (0.7%)	1 (2.9%)	0.320
Pelvic abscess, n (%)	4 (2.7%)	3 (8.6%)	0.104
Enteric fistula, n (%)	1 (0.7%)	0 (0%)	0.644
Surgical re-operation, n (%)	4 (2.7%)	3 (8.6%)	0.133

Legend: n = absolute number.

Table 4
Peri- and post-operative outcomes analysis after bowel surgery: single bowel resection (SBR) vs. multiple bowel resections (MBR).

	SBR (n = 146)	MBR (n = 35)	p-value
ICU admission, n (%)	92 (63.0%)	27 (77.1%)	0.094
ICU length of stay, day: mean (SD)	1.4 (± 0.6)	1.6 (±0.6)	0.187
Length of hospital stay, days: mean (SD)	10.8 (±6.2)	14.4 (±6.8)	0.020
30-day readmission, n (%)	9 (8.9%)	6 (17.1%)	0.074
90-day mortality rate, n (%)	3 (2.1%)	1 (2.8%)	0.540
Adjuvant chemotherapy, n (%)	119 (88.3%)	28 (80.0%)	0.813
Time to chemotherapy (>42 days), n (%)	33 (22.6%)	17 (48.6%)	0.003

Legend: n = absolute number; SD = standard deviation; ICU: Intensive Care Unit.

diversion with a preoperative stoma team review [19,25]. Our bowel diversion rate (40,1%, 73/182) with a cohort mainly of IDS patients is higher compared to other studies, such as the LION study (10.1%) that have similar CR rate but in the context of PDS [26]. We have previously postulated that NACT might affect tissue and that this might affect the decision towards a diversion during the surgery [17]. However further studies in this topic are warranted.

The trend analysis showed a significant decrease in the bowel resection rate and the rate of MBR compared to SBR over time in our Department. This seems to be associated with the systematic adoption of NACT in the treatment of stage IIIC-IV OC. The use of NACT has been already shown to decrease the need for MBR in patients with high tumor load in a phase III randomized trial with similar CR rate [27]. In our cohort, although we did not assess the tumor load with preoperative laparoscopic index, the patients receiving MBR had more SCS, suggesting a higher tumor load compared to the SBR group. Strengths of the study are the number of patients, the consistency of the protocol, the provision of the same surgical expertise to patients in both groups over time. Moreover, due to internal guidelines, the timing was the only factor responsible for switching from upfront surgery to NACT and IDS, which means that no preoperative selection was performed. Clearly, the retrospective nature of the study implies a risk of selection bias. The results of our study on the morbidity and complexity of the surgery only apply to a cohort of patients who required multivisceral surgery. They cannot be extended to patients with a complete or good partial response after NACT, who were excluded from our analysis as not requiring multivisceral procedures including bowel surgery. In conclusion, our analysis showed that patients with MBR experience a more complex surgery, increased postoperative morbidity (probably as a reflection of a higher tumor load) and a higher rate of bowel diversion when compared to SBR group. The adoption of NACT might be associated with a decreased reduction in MBR. Further

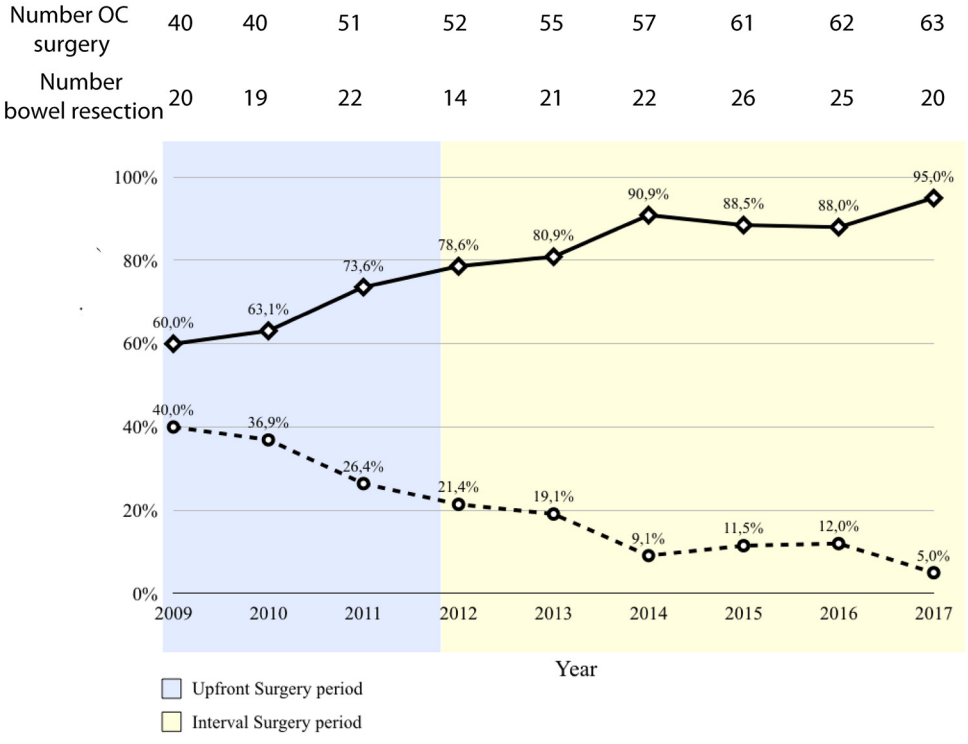

Fig. 1. Rate of single bowel resection (SBR) and multiple bowel resections (MBR) in patients who underwent bowel surgery during the study period.

randomized studies in this setting (such as the TRUST trial, NCT02828618) are awaited.

Disclosures

This study received no funding and all the named authors have no conflicts of interest to disclose

Acknowledgments

We would like to thank our cancer specialist nurses for help in the data collection.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ejogrb.2019.07.011.

References

[1] Siegel RL, Miller KD, Jemal A. Cancer statistics. CA Cancer J. Clin. 2016;2016 (66):7–30.
[2] Morotti M, Becker CM, Menada MV, Ferrero S. Targeting tyrosine-kinases in ovarian cancer. Expert Opin. Invest. Drugs 2013;22:1265–79.
[3] Kehoe S, Hook J, Nankivell M, Jayson GC, Kitchener H, Lopes T, et al. Primary chemotherapy versus primary surgery for newly diagnosed advanced ovarian cancer (CHORUS): an open-label, randomised, controlled, non-inferiority trial. Lancet 2015;386:249–57.
[4] Vergote I, Trope CG, Amant F, Kristensen GB, Ehlen T, Johnson N, et al. Neoadjuvant chemotherapy or primary surgery in stage IIIC or IV ovarian cancer. N Engl. J. Med. 2010;363:943–53.
[5] Vergote I, Coens C, Nankivell M, Kristensen GB, Parmar MKB, Ehlen T, et al. Neoadjuvant chemotherapy versus debulking surgery in advanced tubo-ovarian cancers: pooled analysis of individual patient data from the EORTC 55971 and CHORUS trials. Lancet Oncol. 2018;19:1680–7.
[6] Bristow RE, Tomacruz RS, Armstrong DK, Trimble EL, Montz FJ. Survival effect of maximal cytoreductive surgery for advanced ovarian carcinoma during the platinum era: a meta-analysis. J. Clin. Oncol. 2002;20:1248–59.
[7] Tozzi R, Hardern K, Gubbala K, Garruto Campanile R, Soleymani Majd H. En-bloc resection of the pelvis (EnBRP) in patients with stage IIIC-IV ovarian cancer: a 10 steps standardised technique. Surgical and survival outcomes of primary vs. Interval surgery. Gynecol. Oncol. 2017;144:564–70.
[8] Soleymani Majd H, Ferrari F, Manek S, Gubbala K, Campanile RG, Hardern K, et al. Diaphragmatic peritonectomy vs. Full thickness resection with pleurectomy during Visceral-Peritoneal Debulking (VPD) in 100 consecutive patients with stage IIIC-IV ovarian cancer: a surgical-histological analysis. Gynecol. Oncol. 2016;140:430–5.
[9] Shih KK, Chi DS. Maximal cytoreductive effort in epithelial ovarian cancer surgery. J. Gynecol. Oncol. 2010;21:75–80.
[10] Tozzi R, Giannice R, Cianci S, Tardino S, Campanile RG, Gubbala K, et al. Neo-adjuvant chemotherapy does not increase the rate of complete resection and does not significantly reduce the morbidity of Visceral-Peritoneal Debulking (VPD) in patients with stage IIIC-IV ovarian cancer. Gynecol. Oncol. 2015;138:252–8.
[11] Papadia A, Morotti M. Diaphragmatic surgery during cytoreduction for primary or recurrent epithelial ovarian cancer: a review of the literature. Arch. Gynecol. Obstet. 2013;287:733–41.
[12] Chi DS, Zivanovic O, Levinson KL, Kolev V, Huh J, Dottino J, et al. The incidence of major complications after the performance of extensive upper abdominal surgical procedures during primary cytoreduction of advanced ovarian, tubal, and peritoneal carcinomas. Gynecol. Oncol. 2010;119:38–42.
[13] Aletti GD, Podratz KC, Jones MB, Cliby WA. Role of rectosigmoidectomy and stripping of pelvic peritoneum in outcomes of patients with advanced ovarian cancer. J. Am. Coll. Surg. 2006;203:521–6.
[14] Kalogera E, Dowdy SC, Mariani A, Weaver AL, Aletti G, Bakkum-Gamez JN, et al. Multiple large bowel resections: potential risk factor for anastomotic leak. Gynecol. Oncol. 2013;130:213–8.
[15] Grimm C, Harter P, Alesina PF, Prader S, Schneider S, Ataseven B, et al. The impact of type and number of bowel resections on anastomotic leakage risk in advanced ovarian cancer surgery. Gynecol. Oncol. 2017;146:498–503.
[16] Salani R, Zahurak ML, Santillan A, Giuntoli 2nd RL, Bristow RE. Survival impact of multiple bowel resections in patients undergoing primary cytoreductive surgery for advanced ovarian cancer: a case-control study. Gynecol. Oncol. 2007;107:495–9.
[17] Tozzi R, Casarin J, Baysal A, Valenti G, Kilic Y, Majd HS, et al. Bowel resection rate but not bowel related morbidity is decreased after interval debulking surgery compared to primary surgery in patents with stage IIIC-IV ovarian cancer. J Gynecol. Oncol. 2019;30:e25.
[18] Querleu D, Planchamp F, Chiva L, Fotopoulou C, Barton D, Cibula D, et al. European society of gynaecologic oncology quality indicators for advanced ovarian Cancer surgery. Int. J. Gynecol. Cancer 2016;26:1354–63.
[19] Tozzi R, Casarin J, Garruto-Campanile R, Majd HS, Morotti M. Morbidity and reversal rate of ileostomy after bowel resection during Visceral-Peritoneal Debulking (VPD) in patients with stage IIIC-IV ovarian cancer. Gynecol. Oncol. 2018;148:74–8.
[20] Chang SJ, Bristow RE. Surgical technique of en bloc pelvic resection for advanced ovarian cancer. J. Gynecol. Oncol. 2015;26:155.
[21] Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, et al. The Clavien-Dindo classification of surgical complications: five-year experience. Ann. Surg. 2009;250:187–96.
[22] Scarborough JE, Schumacher J, Kent KC, Heise CP, Greenberg CC. Associations of specific postoperative complications with outcomes after elective Colon resection: a procedure-targeted approach toward surgical quality improvement. JAMA Surg. 2017;152:e164681.
[23] Aletti GD, Dowdy SC, Podratz KC, Cliby WA. Relationship among surgical complexity, short-term morbidity, and overall survival in primary surgery for advanced ovarian cancer. Am. J. Obstet. Gynecol. 2007;197 (676):e1–7.
[24] Ataseven B, du Bois A, Reinthaller A, Traut A, Heitz F, Aust S, et al. Pre-operative serum albumin is associated with post-operative complication rate and overall survival in patients with epithelial ovarian cancer undergoing cytoreductive surgery. Gynecol. Oncol. 2015;138:560–5.
[25] Vonk-Klaassen SM, de Vocht HM, den Ouden ME, Eddes EH, Schuurmans MJ. Ostomy-related problems and their impact on quality of life of colorectal cancer ostomates: a systematic review. Qual. Life Res. 2016;25:125–33.
[26] Harter P, Sehouli J, Lorusso D, Reuss A, Vergote I, Marth C, et al. A randomized trial of lymphadenectomy in patients with advanced ovarian neoplasms. N Engl. J. Med. 2019;380:822–32.
[27] Fagotti A, Ferrandina G, Vizzielli G, Fanfani F, Gallotta V, Chiantera V, et al. Phase III randomised clinical trial comparing primary surgery versus neoadjuvant chemotherapy in advanced epithelial ovarian cancer with high tumour load (SCORPION trial): final analysis of peri-operative outcome. Eur. J. Cancer 2016;59:22–33.