En bloc pelvic resection of ovarian cancer with rectosigmoid colectomy: a literature review

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Abstract: Maximal cytoreductive surgery is an important prognostic factor in advanced epithelial ovarian cancer (EOC). To achieve maximal cytoreductive surgery, en bloc pelvic resection with rectosigmoid colectomy can be an effective surgical strategy. This surgical methodology was first described in 1968 as "radical oophorectomy." Since then, it has been adopted by many medical institutions around the world, and its safety has been shown by many studies. However, research on the surgical method is still lacking due to the limited number of prospective comparative studies. We will review the journals on *en bloc* pelvic resection with rectosigmoid colectomy published to date and discuss its efficacy, complications, and surgical techniques of the procedures.

Keywords: Ovarian cancer; ovariectomy/methods; ovarian neoplasms/surgery; cytoreductive surgery; colectomy; *en bloc* pelvic resection with rectosigmoid colectomy; radical oophorectomy; optimal debulking

Introduction

Role of maximal cytoreductive surgery in ovarian cancer

Maximal cytoreductive surgery followed by platinum-based adjuvant chemotherapy is considered the most effective therapeutic strategy in the treatment of advanced epithelial ovarian cancer (EOC) to date (1,2). Patient survival has been shown to be negatively correlated with residual tumor diameter in many studies, emphasizing the role of maximal cytoreductive surgery. The favorable prognostic effect of maximal cytoreduction on advanced EOC has been investigated since it was first reported in 1975 by Griffiths (3-10). Griffiths showed that patient survival improved as residual tumor size decreased in 102 patients with FIGO (Fédération Internationale de Gynécologie et d'Obstétrique) stage II–

III EOC. Bertelsen also reported significant differences in five-year survival rates between the patients who received optimal debulking surgery and those who received suboptimal surgery in advanced EOC (46% *vs.* 15%, P<0.001). These differences were also shown in the disease progression rates (10% in optimal surgery group *vs.* 43% in suboptimal surgery group, P<0.001) (11). In another study in which Bristow *et al.* performed meta-analysis of 81 cohorts of patients with advanced EOC (6,885 patients), the authors found each 10% increase in maximal cytoreduction was associated with a 5.5% increase in median survival time (10).

Role of rectosigmoid colectomy to achieve optimal debulking

Rectosigmoid colectomy is an important part of the

debulking procedures in advanced EOC. In a retrospective review in which the authors analyzed 527 patients who underwent primary cytoreductive surgery for FIGO stage II–IV EOC, 458 (79%) patients were optimally cytoreduced (largest residual tumor diameter less than 2 cm), and 144 (27.3%) of these required bowel resections in order to accomplish this. Of the 144 patients who received bowel resections, 81 patients received rectosigmoid resection only (12). Other studies have also demonstrated that the most commonly involved bowel segment in surgeries for advanced EOC is the rectosigmoid colon (12,13).

There are two surgical techniques for rectosigmoid colectomy—the total mesorectal excision (TME) and the close rectal dissection (CRD). The main difference between the two techniques is whether it preserves mesorectum and its vascular supply. The TME removes all mesorectal tissue, thereby reducing blood supply to its nearby bowels whereas the CRD technique preserves them. The TME technique has been associated with the reduction of local recurrence in colorectal cancer (14,15). However, these results may not be directly applied to EOC, because EOC has a different biology and patterns of metastasis compared to colorectal cancer. EOC often spreads into the peritoneal cavity along the peritoneal surface and makes tumor deposits on the serosa of rectosigmoid colon first, then invades into the muscular layers followed by the mucosa, which is the opposite of the direction in colorectal cancer. In fact, studies have shown that there was no difference in pelvic recurrence or progression free survival (PFS) between the patients with advanced EOC who received rectosigmoid colectomy by the CRD technique versus the TME technique (16). They further showed that rectosigmoid colectomy by the CRD technique was associated with less anastomotic leakage and low incidence of prolonged ileus over 7 days in comparison with the TME technique, presumably due to the preserved blood supply (16). Since there are only limited studies comparing the TME versus the CRD in rectosigmoid colectomy in advanced EOC, further studies are needed.

Kim *et al.* investigated the survival impact of low anterior resection (LAR) and tumorectomy in patients with EOC whose tumors were grossly confined in the pelvis (17). The authors retrospectively reviewed and compared the outcomes between LAR and tumorectomy of 92 patients with rectosigmoid lesions. There were no significant differences between the two groups in PFS and overall survival (OS). However, postoperative ileus was more frequently observed in the patient treated with LAR than those with tumorectomy. The authors concluded that if

tumor infiltration was up to the serosa and subserosa of the rectosigmoid colon, then rectosigmoid lesion could be resected completely via tumorectomy. In other words, LAR seemed to be not mandatory to improve prognosis in patients with EOC with gross tumors confined in the pelvis. However, due to limited data, further research may be needed to standardize the results of the aforementioned study to all patients with advanced EOC. Therefore, except when completely removed by tumorectomy, bowel surgery is an important part of the debulking procedures for optimal cytoreductive surgery.

Concept of *en bloc* pelvic resection

En bloc pelvic resection of ovarian cancer with rectosigmoid colectomy was first described in 1968 and 1973 independently by Hudson and Chir, which was termed "radical oophorectomy" (18,19). Since then, it has been adopted by many medical institutions around the world and various terminologies have been developed to describe the procedures with additional modifications: *en bloc* rectosigmoid colectomy (20-24), reverse hysterocolposigmoidectomy (25), complete parietal and visceral peritonectomy (26), *en bloc* pelvic peritoneal resection of the intrapelvic viscera (27), and modified posterior exenteration (28).

In advanced EOC, pelvis and cul-de-sac are often obliterated due to tumor invasion. Therefore, it is not uncommon to confront indistinguishable anatomical structures of the pelvic organs during surgery. Tumor spreads to the peritoneal surfaces of bowel and bladder are common findings in advanced EOC. In such cases, *en bloc* pelvic resection of tumors with the affected nearby organs such as the uterus, pelvic peritoneum, or rectosigmoid colon is recommended. Considering the spread patterns of EOC and potential residues of microscopic lesions that may be invisible at the time of surgery, it may rather be advantageous for patients to undergo *en bloc* pelvic resections with rectosigmoid colectomy.

Efficacy of *en bloc* pelvic resection with rectosigmoid colectomy

Because EOC shows in many ways distinctly different disease characteristics from other solid neoplasms, it is difficult to perform randomized controlled trials (RCTs) to evaluate the efficacy of *en bloc* pelvic resections in patients with advanced EOC. Surgeons often make decisions in

Table 1 Published journals of en bloc pelvic resection with rectosigmoid colectomy

Author	Year	Patient, n	Stage	Median HS, days	Optimal rate, %	Complication
Bridges et al. (24)	1984–1988	43	II–IV	16	74.4[§]	Prolonged ileus (9.3%)
Sainz de la Cuesta et al. (29)	1989–1993	30	–	11	100	No major complications
Obermair et al. (23)	1996–2000	65	II–IV	11	73.8	Ileus (7.7%); anastomotic leak (3.1%); fistula (1.5%)
Clayton et al. (20)	1989–2000	129	I–IV		79.2	Prolonged ileus (7.8%); anastomotic leak (0.8%); fistula (1.6%)
Bristow et al. (31)	1997–2001	31	III–IV	11	87.1	Anastomotic leak (3.2%)
Park et al. (30)	2001–2005	60—primary: 46; recur: 14	Primary: III–IV; Recur: I–III	18	Primary: 97.9; Recur: 78.6	Prolonged ileus: primary (4.3%); recur (0.0%). Anastomotic leak: primary (2.1%); recur (0.0%). Fistula: primary (2.1%); recur (7.1%)

[§], <2 cm maximal size of residual tumor. HS, hospital stay; Recur, recurrent.

regards to the execution of particular surgical procedures intraoperatively after completion of thorough surgical exploration the disease status. Surgery for ovarian, fallopian, and peritoneal cancer is difficult to predict of surgical method before surgery, contributing reasons as to why it is often difficult to perform randomized controlled trials (RCT). The reported success rate of the scheduled *en bloc* pelvic resection was almost 100% in published journals (20,23,24,29-31) (*Table 1*). In the United States, optimal resection is reported in about 70% of primary cytoreductive surgery in advanced EOC (32). Although it is difficult to make a direct comparison, in journals with *en bloc* surgery, the rate of optimal debulking is reported to be 73.8–100% (20,23,24,29-31). Bristow *et al.* reported 87.1% of optimal rate of type II–III radical oophorectomy in the advanced EOC with FIGO stage III–IV (31). Bridges *et al.* reported the retrospective surgical outcomes of 43 patients with advanced EOC treated with *en bloc* pelvic resection with concomitant rectosigmoid colectomy (24). Optimal cytoreduction was over 70% of the cases. There was no postoperative leakage of fistula. Sainz de la Cuesta *et al.* also reported the surgical outcomes of 30 patients who underwent *en bloc* resection of the pelvic peritoneum and all pelvic viscera with a rectosigmoid reanastomosis in advanced EOC (27). All patients underwent cytoreduction with residual disease less than 1 cm. Andreas Obermair *et al.* reported safety and efficacy of low anterior *en bloc* resection with rectosigmoid resection followed by an end-to-end

anastomosis for 65 consecutive patients with advanced EOC. No gross residual and residual tumors less than 1 cm was in observed in 14 patients (21.5%) and 34 patients (52.3%) respectively. Residual tumor size 1–2 cm and over 2 cm was in 10 patients (15.4%) and 4 patients (6.2%) respectively. Thirty-three patients had a diverting loop ileostomy and five patients had a colostomy. They reported that surgical-related complications such as wound complication, septicemia and anastomotic leakage were more frequent in patients with serum albumin level of ≤30 g/L preoperatively. Clayton *et al.* reported a retrospective review of 129 consecutive patients who underwent *en bloc* pelvic resection with concomitant rectosigmoid colectomy (20). Optimal cytoreduction (residual tumor less than 2 cm) was 79.2% and suboptimal cytoreduction was 18.5%. Median survival of patients with optimal debulking was 37.6 months whereas patients with suboptimal debulking was 11.6 months. Park *et al.* reported a retrospective review of *en bloc* resection of 46 primary and 14 recurrent EOC patients who underwent *en bloc* resection (30). For primary advanced EOC patients, no residual tumor and optimal cytoreduction (residual tumor less than 5 mm) were 43.5% and 89.5%, respectively. For recurrent patients, no visible tumor at the completion of surgery was 42.9% and optimal cytoreduction was achieved in 64.3%. The patients with no residual tumor showed longer disease-free survival than those with residual tumor (median survival, 30 *vs.* 7 months, P=0.0082) in primary advanced EOC. For recurrent patients, patients

with no visible tumors also had longer disease-free survival than those with residual tumor (median survival, not reached *vs.* 5 months, P=0.0156). Chi *et al.* reported that surgical trends moving towards retroperitoneal *en bloc* pelvic resection including rectosigmoid colectomy in the mid-1990s led to a 40% increase in surgical radicality and at least 10% improve of median OS (33).

Preoperative and postoperative managements of the rectosigmoid colectomy

Bowel preparation and prophylactic antibiotics

The necessity of mechanical bowel preparation (MBP) in patients undergoing colectomy has been controversial. Recent meta-analyses demonstrated benefits of oral antibiotic bowel preparation (OABP) but it also showed that performing MBP only did not provide any benefits (34-36). It was also reported that MBP did not significantly reduce postoperative complications in elective colorectal surgery (36,37). Moreover, it has been shown that patients who received MBP prior to surgery had a higher incidence of bowel content spillage, which might increase the rates of postoperative complications (38). In another study in which the authors investigated postoperative complications in elderly patients who were 75 years or older undergoing elective colectomy, both OABP and OABP plus MBP were associated with reduced morbidity compared with no bowel preparation (38). Even in the absence of MBP, OABP seemed to reduce the incidence of surgical site infection (SSI) following elective colectomy (39). The enhanced recovery after surgery (ERAS) protocols recommend to avoid routine MBP in colonic surgery due to the concerns of dehydration, distress to patients, prolonged ileus, and lack of efficacy (40,41).

In the Cochrane review, the authors also found high quality evidence that antibiotics covering aerobic and anaerobic bacteria delivered orally or intravenously prior to elective colorectal surgery adequately reduced the risk of surgical wound infection by as much as 75% (42).

Fluid management

Fluid management plays key roles in achieving optimal recovery after bowel surgery. Intravascular volume is the key elements of cardiac output that deliver oxygen to the peripheral tissues. Intravascular hypovolemia especially after surgery can lead to hypoperfusion of organs including

the bowel and it can lead to the disturbance of the healing process, subsequently resulting in postoperative complications (41). Preoperative dehydration should be minimized if possible. Studies have shown that the intake of clear fluid up to 2 hours prior to the induction anesthesia did not increase surgical morbidity (40). Postoperative fluids should be administrated minimally to maintain normovolemia and be careful of fluid excess. Balanced crystalloid such as 0.9% saline is recommended as a fluid management after bowel surgery (41).

Oral feeding

Studies have consistently showed that early feeding after surgery was associated with significantly faster recovery of bowel function with shorter times to flatus and to tolerance of regular diet (43). The RCTs for early enteral or oral feeding also showed that it reduced the risk of postoperative infection and that it was not associated with an increased risk of anastomotic leakage or dehiscence (44-46). Based on the results of these studies, early feeding practices have been adopted widely and numerous professional societies advocate it.

Complications of *en bloc* pelvic resection with rectosigmoid colectomy

None of the studies published to date have reported major mortalities directly associated with *en bloc* pelvic resection with rectosigmoid colectomy. Anastomotic leakage is considered the major complication of the surgical procedures so far. Some minor complications reported are prolonged ileus longer than 7 days, blood transfusion during or after operation, and the formation of fistula with nearby organs (47). Although it may be difficult to predict the risk of developing complications attributable to the surgical procedures beforehand, researchers have associated the levels of preoperative serum albumin less than 30 g/L with anastomotic leakage, wound complications and septicemia (23).

Anastomotic leakage

Concerns remain about anastomotic leakage or dehiscence in patients undergoing *en bloc* pelvic resections with rectosigmoid colectomy. Patients with advanced EOC often have large volumes of ascites and are nutritionally compromised due to extensive disease burden and perhaps

bowel obstruction accompanied with it. Such patients may undergo transient or permanent intestinal diversion such as colostomy or ileostomy to alleviate the symptoms. However, intestinal diversion does not seem to be superior to *en bloc* resections with rectosigmoid colectomy in regards to the rates of developing anastomotic leakage. Studies have reported 0 to 8% of incidence of anastomotic leakage among the patients who underwent rectosigmoid colectomy (20,22-25). Although these figures may increase to some extent when patients have large volumes of ascites and disease burden, it still seems to remain acceptably low. Researchers have reported 2.1% to 3.1% of incidence of anastomotic leakage in EOC patients with ascites greater than 500 mL at the time of the surgery (23,28). From these data, prophylactic intestinal diversion is not required and anastomosis by using the staples and hand-sewing is considered as safe for rectosigmoid colectomy for advanced EOC. It is in general consensus that *en bloc* pelvic resections with rectosigmoid colectomy permits a high rate of complete debulking with acceptable morbidity and mortality rates.

The incidence of anastomotic leakage in *en bloc* pelvic resection with rectosigmoid resection seems to be no greater than that of general colectomy.

Prolonged ileus after surgery

Although variations exist in terms of the definition of the duration, it is generally considered that no return of bowel function in 7 days after surgery indicates that the patients suffer postoperative ileus. Postoperative ileus is one of the most common complications following colorectal surgery. The most commonly used indices are delayed return of flatus and/or defecation (90%), intolerance of diet (63%), reinsertion of a nasogastric tube (20%), radiologic measures of bowel transit (11%), and delayed return of bowel sounds (7%) (22). It has been reported that male gender, advanced age, and major blood loss during operations are associated with high risk of developing postoperative ileus (48,49). Despite diverse measures to prevent postoperative ileus such as early ambulation and feeding, 10–30% of patients are reported to develop postoperative ileus after colorectal surgery (50-56). The incidence of prolonged ileus in patients who underwent *en bloc* resection with rectosigmoid colectomy for advanced EOC has been reported to be 4.3–9.3%, which is similar to that in general colorectal surgery (19,22-24,36). It is well known that adequate perioperative nutritional status is important to prevent of postoperative

ileus, along with short limitation of preoperative fasting to 6 hours for solid food and 2 hours for liquids. Coffee and chewing gum are also known to have preventive effect for postoperative ileus (57). With the utilization of these measures to prevent postoperative ileus, *en bloc* pelvic resections with rectosigmoid colectomy can be safely performed in patients with advanced EOC.

Procedures of radical oophorectomy

Classification of radical oophorectomy

To define the scope of surgical resection with uniform terminology, the classification of radical oophorectomy has been applied (31).

Type I radical oophorectomy: retrograde modified radical hysterectomy with *en bloc* resection of the adnexa, pelvic cul-de-sac, and involved pelvic peritoneum.

Type II radical oophorectomy: broadened to include an *en bloc* resection of the rectosigmoid colon below the peritoneal reflection with complete parietal and visceral pelvic peritonectomy.

Type III radical oophorectomy: an extension of the type I or II procedure incorporating a portion of urinary bladder and/or pelvic ureter.

Of these classifications, type II radical oophorectomy has been reported to be the most used: type I (18%), type II (74%), type III (8%) (58).

Surgical procedure of type II radical oophorectomy

The radical oophorectomy is initiated by incising the paracolic gutters bilaterally. The paracolic gutter incisions are extended caudally, along the psoas muscles, to the posterior margin of the symphysis pubis (*Figure 1*).

Identifying the infundibulopelvic (IP) ligaments and round ligaments bilaterally, then suture ligatures bilaterally. Extensive tumor infiltration of the pelvis can obscure the round ligaments, in which case they can be located retroperitoneally, ligated, and divided as laterally as possible.

The pelvic dissection proceeds in a centripetal fashion. The pararectal and paravesical spaces are developed identifying the uterine artery and the cardinal ligament. The uterine vascular pedicles are skeletonized, doubly ligated, and divided at the level of the ureter bilaterally (*Figure 2*).

The ureters are identified within the pararectal space and mobilized from their attachments of the medial side of
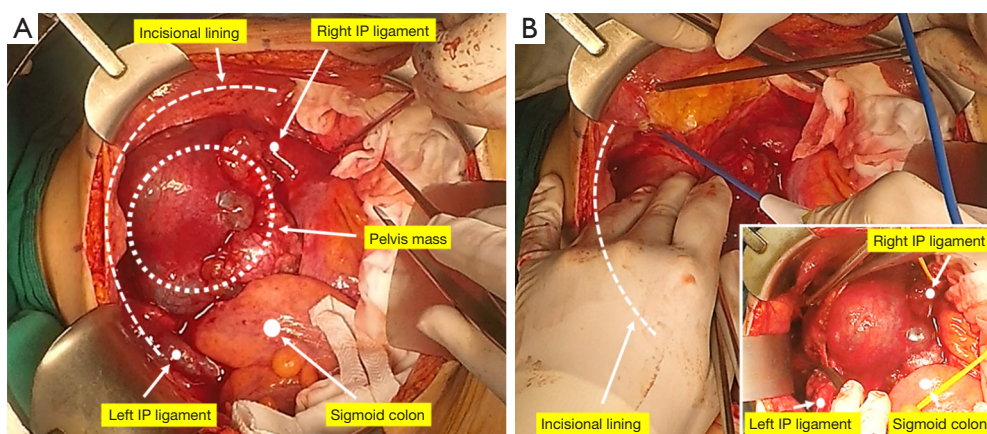
Figure 1 Radical oophorectomy initiated by the paracolic gutter incisions. (A) Pelvic mass (circle with white dots) causes adhesion of the organs of pelvis to obliteration. Sigmoid colon (bigger white dot) does not move due to adhesion of the pelvic mass. (B) Anterior pelvic peritonectomy. The paracolic gutter incisions are extended caudally to the anterior pelvic peritoneum. The bladder is placed in traction and the peritoneum of anterior pelvis is deperitonealized by using the electrosurgical unit.
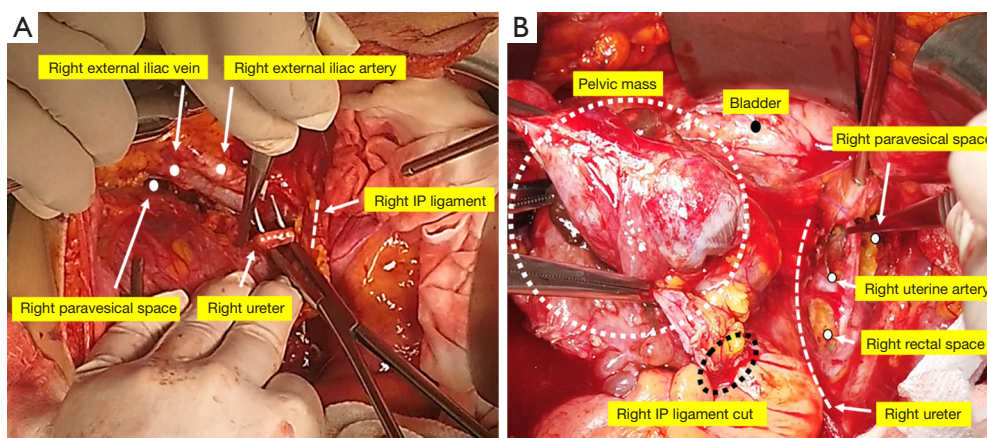
Figure 2 The pelvic dissection. (A) Identifying retropelvic space structure. The ureter is identified and mobilized from their attachment of the medial side of the pelvic peritoneum. (B) By suture ligatures of the IP ligament early in the course of operation, the pelvic mass is devascularized.

the pelvic peritoneum, coursing from the pelvic brim to the tunnel of Wertheim (*Figure 3*).

The anterior pelvic peritoneum is deperitonealized by traction with Allis clamps, and the retropubic space of Retzuis is developed. A plane of dissection is established between the anterior pelvic peritoneum and the bladder dome muscularis using the electrosurgical unit (ESU) or Metzenbaum scissor. The deperitonealizing direction is ventral to dorsal and lateral to medial toward the uterus until the pubovesicocervical fascia is reached.

The bladder is sharply mobilized ventrocaudally to

expose the proximal 2–3 cm of vagina and vesicovaginal space developed.

The ureter is extricated from within the bladder pillar bilaterally by developing the ureteral tunnel using a right-angle clamp and suture ligating or advanced bipolar devices.

The hysterectomy is completed in a retrograde fashion by first making an anterior colpotomy. Bimanual vaginal examination or placement of a sponge stick into anterior vaginal fornix will facilitate selecting the proper colpotomy site of vagina. Anterior colpotomy expand transversely to the lateral vagina. Allis clamps are used on the cutting edge
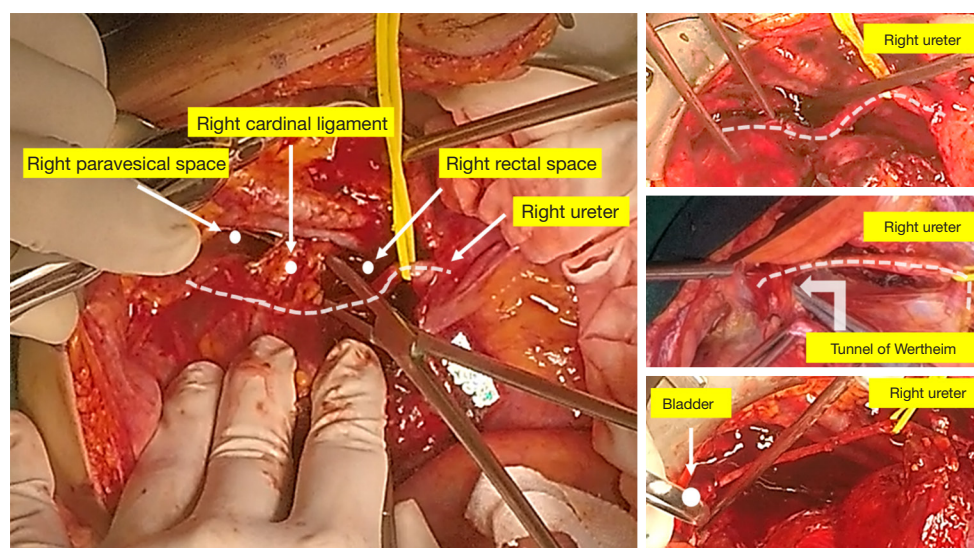
Figure 3 The cardinal ligament is identifying by developing the pararectal and paravesicle spaces. Mobilize the ureter to see the path to the bladder. After developing the Tunnel of Wertheim, place the ureter anterolaterally and cut the Tunnel of Wertheim. Then we can see the ureter entering the trigone of the bladder.
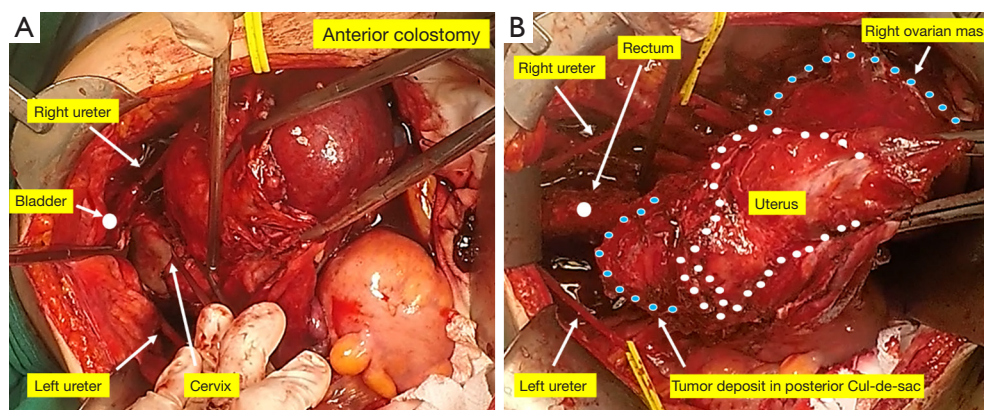

Figure 4 The hysterectomy is completed in a retrograde fashion by first making an anterior colpotomy. (A) Anterior colpotomy expose the vaginal lumen. Allis clamps are used to clamp on the cutting edge of anterior vagina. (B) Using the Allis clamp, traction the cervix and uterus helps dissection. The posterior vaginal wall is also incised and the rectovaginal space developed caudally along the rectum until it reached to the lowest 2–3 cm of margin from tumor deposit.

of vagina in sequence. Tractions of the cervix and uterus helps dissection. The posterior vaginal wall is incised with the ESU and the rectovaginal space is developed caudally along the rectum until it reaches to the lowest safety margin (2–3 cm) from tumor (*Figure 4*).

The retrograde approach is continued by retracting the posterior cul-de-sac upward, exposing the remaining cardinal ligament, the uterosacral ligaments, and the rectal pillars. These are sequentially divided using clamp and

suture ligatures or advanced bipolar devices.

The type I or type II radical oophorectomy can be selected depending on the extent of tumor involvement with the anterior rectal wall or sigmoid colon.

Type I modification

With only superficial involvement of tumor to the rectum, the tumor and peritoneum can be sharply dissected from
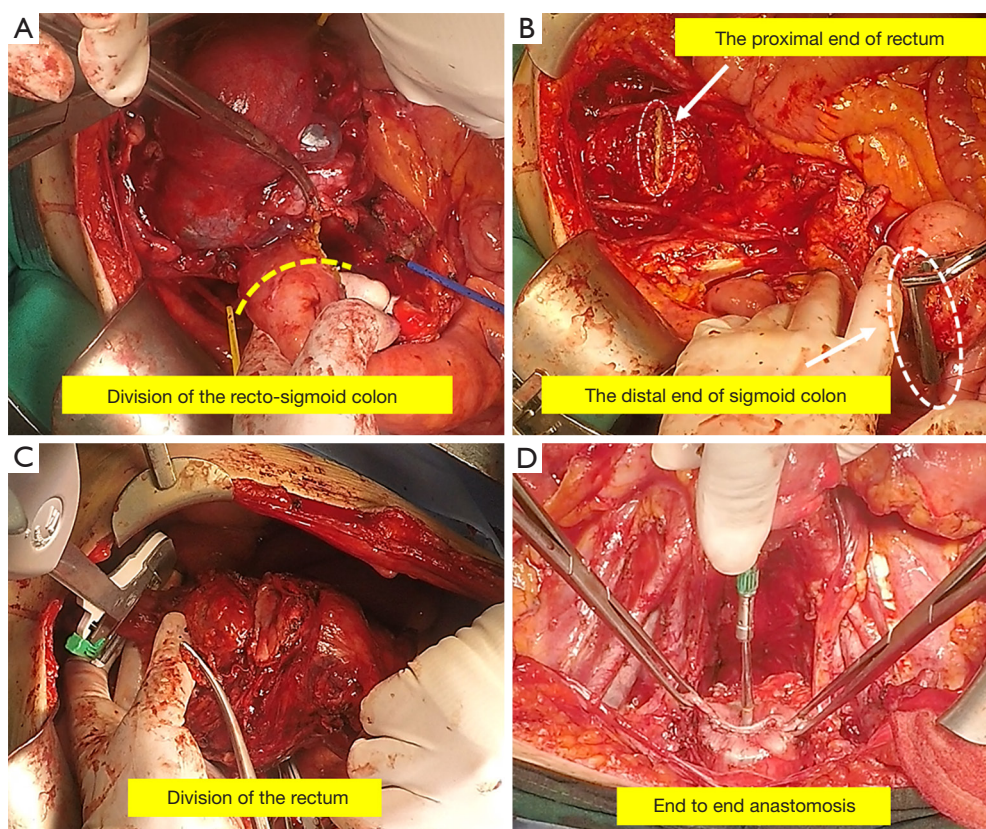
Figure 5 The recto-sigmoid colon is divided. (A) The rectum is dissected at 2–3 cm from at the lowest of tumor for safety margin; (B) the rectum is divided at 2–3 cm from at the lowest of tumor by using TA stapler and a proximal bowel clamp; (C) the pelvic mass removed en bloc with uterus and rectosigmoid colon; (D) the anvil shaft inserted into the cartidge shaft of the main CEEA instrument, until it sounds click.

the anterior surface of the rectum and the sigmoid colon. If the tumor penetrates into the muscularis of the rectum within limited extent (≤2 cm), "wedge-shaped" segment of rectal wall can be excised and repaired by using a fine monofilament suture in interrupted inverting stitches, incorporating minimal mucosa, placed perpendicular to the long axis of the bowel or by using stapling technique.

Type II modification

The type II modification of radical oophorectomy is indicated for disease which has extensive involvement of the posterior cul-de-sac and rectosigmoid colon.

Division of the proximal sigmoid colon can be performed whenever it is most convenient during the operation (*Figure 5A*), once it has been determined that bowel resection is necessary to achieve an optimal cytoreduction after surgery. The sigmoid colon is divided 2–3 cm above

the most proximal of tumor. Depending on the planned anastomosis, a variety of methods can be used to divide the sigmoid colon. The GIA™ (Medtronic, Inc., Minneapolis, MN, USA) stapling device is the most expedient and has advantage of placing double rows of staples on either side of the divided bowel. Or using a purse-string clamp, circular end-to-end (CEEA) anvil is inserted and purse-string suture tied within the notch on the anvil shaft. It is important that the bowel wall be cleared of fat for a 2–3 cm from distance to the planned anastomotic site.

The deep dissection proceeds from the pararectal spaces posteromedially toward the entrance of the presacral space just caudal to the sacral promontory. Depending on the surgeon's preference, one can choose to dissect either TME or CRD. If the inferior mesenteric artery and vein are sacrificed, be careful to preserve the left colic artery with its blood supply to the descending colon. The posterior pelvis is further mobilized by developing the presacral space

caudally to the level of pelvic floor musculature.

The posterior cul-de-sac tumor mass is mobilized by exposing the rectovaginal space and dissecting to the point at which the tumor directly invades the bowel wall. The bowel wall should be cleared of fat and any remaining mesorectal attachments. The rectum is then divided at 2–3 cm from the lowest of tumor by using TA™ (Medtronic, Inc., Minneapolis, MN, USA) stapler and a proximal bowel clamp (*Figure 5B*).

The central pelvic mass is removed *en bloc* with the rectosigmoid colon (*Figure 5C*).

The divided end of the proximal colon is brought down to the rectal stump to confirm that anastomosis will be tension-free. If it needs additional mobilization of the sigmoid and descending colon, several maneuvers can be applied.

Intestinal continuity can be reestablished by a variety of methods using either automated stapling devices or hand-sewn technique. The transanal double-stapling technique using the CEEA is a safe and efficient method of reestablishing intestinal continuity. In general, at least a 28 or 31 mm stapler should be used. Blunt rectal sizing instruments are gently passed into the distal bowel segment. The main CEEA instrument is lubricated and inserted into the rectum transanally (with closed trocar status), grasp the handle of the main CEEA instrument and place the cartridge head on the staple line of the rectal stump. The wing nut is rotated counterclockwise until the trocar pierces the closed rectal stump adjacent to or through the staple line. If there is concern that the colonic tissue between the circular and linear rows of staples may become ischemic or leakage, the trocar can be directed 2 cm anterior or posterior to the linear row of staple, avoiding a staple-to-staple intersection in the anastomotic ring.

The anvil shaft inserted into the cartridge shaft of the main CEEA instrument until it sounds click (*Figure 5D*).

The wing nut is rotated clockwise, keeping the bowel on stretch and pressure, until the color bar indicator on the handle of the main CEEA instrument is in the proper position indicating adequate compression of the anastomotic site.

Hold several seconds for reforming of the tissue of the anastomotic site and stapler fired by squeezing the handles together as far as they go until it sounds crunch. The handles are released and the wing nut rotated counterclockwise 180°–360° (no more than 360°) to release the anastomotic site. The handpiece of the main CEEA instrument is removed carefully to avoid disrupting the staple line during the removal.

Some surgeons recommend manually hand-sewing with interrupted stitches over the staples to reinforce the anastomotic site. The security of the anastomosis is confirmed by several means. First, the resection rings around the cartridge shaft should be inspected to ensure two complete donuts of colonic tissue. Second, the "bubble test" or "water test" is performed by filling the pelvis with normal saline or water and obstructing the proximal colon manually prior to insufflating the rectum with 200–300 cc of air through a rectal tube or Asepto syringe. The presence of air bubbles indicates an anastomotic leak. It should be repaired by oversewing the defect with interrupted stitches of 3-0 delayed absorbable or silk suture.

Conclusions

In summary, primary debulking procedures with the aim of maximal cytoreduction is strongly advocated in patients with advanced EOC. The techniques of *en bloc* resection of the rectosigmoid colon with the pelvic tumor mass may assist complete removal of all visible pelvic tumor, thereby improving survival benefits that optimal cytoreduction allows. Literatures reported to date on *en bloc* pelvic resection with rectosigmoid colectomy in advanced EOC implies that the benefits of the surgical procedures outweigh the potential morbidity issues with feasibility and safety. For achieving complete resection of pelvic disease, *en bloc* pelvic resection with rectosigmoid colectomy may be considered as a highly effective and safe surgical technique.

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Footnote

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