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SCIENCE DIRECT

Gynecologic Oncology 97 (2005) 852–857

Gynecologic Oncology

www.elsevier.com/locate/ygyno

Division of pedicles by stapling during cytoreductive surgery for ovarian cancer

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Received 22 November 2004
Available online 15 April 2005

Abstract

Objective. To determine the potential of dividing vascular pedicles by stapling to reduce operative time, blood loss, and morbidity associated with cytoreductive operations for advanced ovarian cancer.

Methods. A case-control study was undertaken to compare operative outcomes for patients undergoing primary cytoreductive operations for ovarian cancer using two different operative strategies. Between 2002 and 2004, both stapling and conventional techniques were used to divide vascular pedicles for 50 consecutive patients requiring modified posterior exenterations (en-bloc resection of internal reproductive organs, pelvic peritoneum, and recto-sigmoid colon) and upper abdominal procedures in the context of primary cytoreduction for stage IIIC and IV ovarian cancer. The operative time, blood loss, transfusion rate, hospitalization, and incidence of complications were compared to outcomes of 50 consecutive patients operated on between 1994 and 1997 for whom stapling was not used to divide pedicles (chi-square test for binomial data, and *t*-test analysis for continuous data).

Results. Both groups were equivalent with respect to disease severity, extent of upper abdominal surgery, and cytoreductive outcomes. The group for whom stapling devises were used to divide pedicles had a significantly reduced total operative time 179 min vs. 284 min, $P < 0.001$), estimated blood loss (1170 ml vs. 1782 ml, $P = 0.004$), and transfusion rate (3.6 units packed red cells vs. 5.0 units packed red blood cells, $P = 0.03$).

Conclusion. Stapling of vascular pedicles significantly reduces the operative time and blood loss for patients undergoing extensive primary cytoreductive operations for advanced ovarian cancer.

Keywords: Cytoreduction; Stapler; Operative time; Blood loss

Introduction

Survival correlates with the completeness of cytoreductive surgery for patients with both newly diagnosed and recurrent epithelial ovarian cancer [1–7]. Procedures are described to enable resection, ablation, or aspiration of disease at virtually all intra-abdominal locations [8–14]. However, cytoreductive operations typically require multiple procedures in one setting, may be necessary for the elderly and medically compromised, and therefore have risk of morbidity and mortality [15–17]. Few reports specifically focus on the issue of morbidity, and those that do tend to report incidences of complications as well as clinical findings and specific procedures associated with untoward outcomes rather than techniques and strategies to diminish morbidity [15–30].

Stapling techniques allow rapid intestinal and rectal resection with reanastamosis, and have assumed roles in cytoreductive operations for ovarian cancer [8,10,31,32]. Additionally, a laparoscopic stapling devise is reported to reduce operative time and blood loss if used to divide cardinal and uterosacral ligaments during "open" radical hysterectomy [33]. We previously reported combination of regional blood flow interruption by aortic clamping (in the

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doi:10.1016/j.ygyno.2005.03.001

absence of distal aortic plaque and/or calcification) and division of pedicles with a laparoscopic stapler to reduce the operative time and blood loss for patients requiring en-bloc resection of internal reproductive organs, pelvic peritoneum, and recto-sigmoid colon (modified posterior pelvic exenteration, MPE) during cytoreductive operations [34,35]. However, such a strategy is not ubiquitously applicable and only reduces operative time and blood loss for the pelvic phase of cytoreduction.

In an effort to further reduce operative time, blood loss, and morbidity, we have also used stapling techniques to divide vascular pedicles during upper abdominal procedures for advanced ovarian cancer. In this case-control report, operative outcomes of patients for whom stapling as well as conventional techniques were used to divide pedicles during upper abdominal and pelvic phases of primary cytoreductive operations for advanced ovarian cancer are compared to historical controls for whom only conventional techniques were used, to determine if division of pedicles by stapling during extensive cytoreductive operations reduces operative time, blood loss, and morbidity.

Methods and materials

From 2002 to 2004, patients with stage IIIC and IV ovarian cancer requiring both MPE and upper abdominal procedures during primary cytoreductive operations had vascular pedicles divided by using stapling devises in addition to conventional techniques. Vascular pedicles were transected with staplers in the context of both pelvic and upper abdominal procedures (Table 1). Operative outcomes and morbidity of 50 consecutive patients for whom stapling was used, excluding any who had aortic clamping during performance of MPE, were compared to 50 consecutive historical controls (1994–1997) with stage IIIC and IV disease having cytoreductive operations using conventional techniques.

Patients had mechanical and antibiotic bowel preparation and were placed in low lithotomy to facilitate resection of their disease and possible rectal anastamosis. All had general anesthesia and a minority (<5%) of each group also had an epidural catheter placed prior to induction of anesthesia at the discretion of the patient and anesthesiologist for the purpose of postoperative pain control. Virtually all patients (>95%) in each group had placement of a Swan–Ganz catheter to assist in intraoperative and postoperative fluid management [36].

The operative objective was a visibly disease-free cytoreductive outcome, using previously described procedures, while minimizing operative time and blood loss [8–14]. Previously described stapling techniques were used for both groups to perform side-to-side small and large bowel, as well as rectal anastamosis [8,10,31,32]. However, for the study group operated on between 2002 and 2004, a 35-mm endoscopic stapler (endoscopic linear cutter; Ethicon Instruments, endoscopic GIA; US Surgical) and 55-mm stapler (linear cutter; Ethicon Instruments, GIA; US Surgical), both with thin tissue/vascular staples, were also used to divide vascular pedicles (Table 1). The decision of whether pedicles were transected with cautery, hemoclipped and cut, sutured after clamping and cutting, or divided by stapling was based entirely on choosing the technique judged to enable hemostatic division of tissue as rapidly as possible. Cautery and hemoclips were typically used to secure small vessels that could be rapidly isolated. Suturing was used for vessels adjacent to flat surfaces and for tissue that was too thick to staple, as well as pedicles that could not be secured with a stapler due to anatomic locations. Stapling was generally used for all other potentially vascular pedicles. The decision of whether to use a 35-mm or 55-mm stapler was based on the size of the pedicle and accessibility. Hence, the 55-mm devise was typically used to resect the gastrocolic ligament from the stomach as well as mesentery when performing extensive large and small bowel resections. The 35-mm endoscopic devise was typically used to divide parametria and perirectal tissue when performing an MPE, particularly if exposure was difficult to attain. Any areas of oozing within staple lines were hemoclipped, cauterized, or sutured depending on the extent of bleeding and proximity to vital structures. Staplers were reused with reloads until

Table 1
Applications of vascular pedicle stapling

Anatomic site	Application of stapling[a]
Infra-colic omentum and gastro-colic ligament	1—Separation of gastro-colic ligament from stomach, gastro-splenic ligament, and doudenum 2—Separation of omentum from transverse colon, hepatic and splenic flexures
Lesser omentum	1—Separation of lesser omentum from stomach and portal area
Liver	1—Division of ligamentum teres and falciform ligament
Spleen and distal pancreas	1—Division of gastro-splenic and spleno-renal ligaments, and separation of spleen from splenic flexure of colon 2—Division of splenic artery and vein 3—Resection of distal pancreas
Pelvis	1—Division of pedicles and tissue in the context of modified posterior pelvic exenteration: ovarian vessels, parametria, rectal pillars, para-rectal tissue, attachment to sacrum midline
Intestine and mesentery	1—Division of segments of mesentery in the context of large or small intestinal resection

[a] Use of 55-mm and 35-mm endoscopic staplers to divide tissue does not include use of stapling devises to complete intestinal anastamosis.