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ORIGINAL ARTICLE

Colorectal anastomotic leakage can be predicted by abdominal aortic calcification on preoperative CT scans: A pilot study

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KEYWORDS
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Summary
Background: There have been no solid data regarding whether patients with aortic calcification (AC) who have undergone colorectal surgery are at increased risk for anastomotic leakage. Our study aim to investigate the impact of AC on anastomotic leakage (AL) and postoperative morbidity after colorectal resection.
Methods: This was a cohort study of 60 patients who were prospectively registered in a database. We evaluated the relationship between an aortic calcification score (ACS), measured on preoperative computed tomography (CT) imaging, and surgical complications in patients undergoing colorectal surgery.
Results: ACS was strongly correlated with mortality rate. All three of the deceased patients were in the ACS-2 group (5%; $P = 0.021$). The rate of AL was positively correlated with ACS; no leakage was found cases of ACS-0, with a rate of 18% in cases of ACS-1 and 44% in cases of ACS-2 ($P = 0.022$). The consequences of AL were more serious according to the grade of ACS.
Discussion: This study suggested that aortic calcification score is correlated with surgical outcomes, particularly anastomosis leakage, after colorectal surgery. These findings could provide useful tools for adapting surgical strategies by delaying colorectal anastomosis in high-risk patients.

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Introduction

Anastomotic leakage, with a prevalence of 2.4 to 19% [1], is a major complication of colorectal resection, and it has been associated with repeated surgery and with increased hospitalization durations and costs; the reported postoperative morbidity rate is 0 to 32% [2—6]. Several risk factors for anastomotic leakage have been described and could be patient-related, such as malnutrition, corticosteroids, smoking, leukocytosis, heart disease, alcoholism, ASA score and diverticulitis. Tumor and surgery-related factors have also been reported, such as advanced tumor stage, distal site, the need for postoperative blood transfusion, poor anastomotic vascularization, long operative times, bowel obstruction and a septic environment [7]. Other factors are more specifically related to low colorectal anastomosis, including male sex and obesity [8]. Moreover, in oncological surgery, anastomotic leakage has been associated with negative impacts on overall, cancer-related, and disease-free survival [7,9,10].

Better knowledge of these risk factors could allow surgeons to improve the information given to patients about postoperative morbidity and to adapt surgical strategies. At most, in cases with high risk, non-anastomotic management using the Hartmann procedure could be proposed. Concerning anastomotic leakage, there is a vascular hypothesis underlying the association with anastomotic ischemia [11,12]. Evaluation of vascular function could be necessary to predict the impact of this vascular leakage hypothesis. Agatson et al. identified coronary artery calcium scoring [13], using a method of non-invasive CT scans to detect and quantify coronary artery calcification, as a predictor of coronary artery disease. Other scores calculated by studying the aortic arch [14] and thoracic aorta calcification [15—17] have been correlated with the severity of atherosclerosis and clinical manifestations.

For the first time, in our study, we analyzed the risk of anastomotic leakage and the overall postoperative morbidity of patients who underwent left colonic or rectal resection for benign or malignant tumors, as well as these variables' correlations with the degree of abdominal aortic calcification on preoperative CT scans.

Patients and methods

Patient population

With the approval of our institutional review board, we reviewed the clinical and surgical files of patients who underwent left colonic or rectal resection for benign disease or malignant tumors in our institution between July 2007 and September 2010. All of the patients were included from a prospective database and reviewed. The exclusion criteria were right colonic resection, surgery followed by hyperthermic intraperitoneal chemotherapy (HIPEC) or previous left colonic or rectal resection. The clinical characteristics of the patients, (age, sex, body mass index (BMI) and their ASA scores (American society of anesthesiologists) as well as details regarding the surgical procedures, are reported in Table 1.

Surgical data

Characteristics related to surgery were analyzed: the type of resected colonic segment (left angle, sigmoid and left colon, total colectomy, proctectomy, abdominoperineal resection), the type (hand-sewn or stapled) and level of anastomosis (colonic, high or low colorectal, coloanal, or ileorectal or -anal), conservation of the left colic artery and the establishment of pelvic drainage were noted.

Abdominal aortic calcification

The degree of the circumference of abdominal aortic calcification was analyzed on preoperative unenhanced computerized tomography (CT) scans or after intravenous administration of iodinated contrast material during the venous phase on the axial plane. The level of abdominal aorta analysis was between the origin of the celiac trunk and the bifurcation of the aorta. In cases of heterogeneous levels of calcification, the most important area was chosen. The degree of the circumference of abdominal aortic calcification was classified by the same physician (VL) into 3 stages of abdominal calcification (ACS): stage 0, with no abdominal aortic calcification; stage I, with abdominal aortic calcification on less than 50% of the circumference; and stage II, with calcification on more than 50% of the circumference.

Postoperative complications

Early postoperative morbidity was defined as complications occurring within 30 days following surgery and graded on a five-point scale, according to the previously published Clavien-Dindo grading system [18]. Grade 0 indicated no complications. Grade I indicated complications that required no or minor interventions. Grade II complications required moderate interventions, such as intravenous medications, and grade III complications required surgical, endoscopic or radiological interventions. Grade IV indicated life-threatening complications requiring intensive care management. Grade V indicated complications causing death. Grades I and II were combined into ''minor'' complications, and grades III to V were considered ''major'' complications.

Anastomotic leakage was defined as anastomotic dehiscence with communication between the endo- and extraluminal compartments. It was classified according to the classification of the International study group of rectal cancer [19], into 3 grades. Grade A requiring no active therapeutic intervention; grade B, requiring active therapeutic intervention but manageable without relaparotomy were treated medically (fasting, antibiotics, sandostatin), radiologically (percutaneous drainage) or surgically (transanal drainage). In grade C, requiring relaparotomy patients exhibited signs of peritonitis, severe sepsis or septic shock requiring emergency surgical management (washing and drainage, Hartmann or colostomy procedures and mucus fistula) and intensive care support. Anastomotic leakage not meeting the criteria for severity were clinically suspected (fever, pain, purulent drainage) and/or biologically (hyperleukocytosis, elevated CRP) and radiologically confirmed (perianastomotic collection).

Statistical analysis

The results are expressed as medians with first and third quartiles and as proportions with percentages. The main outcome measure was the occurrence of postoperative complications at 30 days. All patients were followed at least at 30-day with no loss of follow-up. Univariate associations between single variables and early postoperative complications were assessed using the Mann-Whitney test