Early Vascular Consultation in the Setting of Oncologic Resections: Benefit for Patients and a Continuing Source of Open Vascular Surgical Training

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Background: Oncologic surgeons have become more aggressive at tumor resections that often require complex open vascular interventions. Vascular surgeons may be consulted preoperatively to aid in these cases, or commonly called into the operating room for an urgent consult. These operations provide a challenge to the vascular surgeon and also an opportunity for open vascular surgical training of residents. We present our experience with vascular surgical interventions during oncologic resections.

Methods: A retrospective review of a prospectively maintained vascular registry was performed to identify patients undergoing vascular surgery in the setting of oncologic resections. Tumor histology, location, type of vascular intervention, vascular, and oncologic outcomes were recorded and reviewed.

Results: Over a 7-year period, 21 oncologic cases involving vascular surgeons were identified. Tumor types included sarcoma (9), adenocarcinoma (4), germ cell (4), paraganglioma (2), and others (2). Tumor locations included abdominal/pelvic (15), cervical (3), and extremity (3). Complete resection was achieved in 18 of the 19 patients; 2 patients underwent exploration alone for carcinomatosis. Vascular surgical procedures included bypass grafts in 7 patients, resection with primary repair in 5 patients, ligation/excision in 4 patients, and arterial mobilization in 3 patients. No major vascular complications occurred. Short-term patency rates were 100%. Survival rates following therapeutic resection were 90%, 80%, and 80% at 1, 3, and 5 years, respectively. Vascular surgeons were involved in the preoperative planning in 11 cases (52%). Patients with preoperative vascular consultation had significantly fewer vascular injuries, a nonsignificant trend toward lower blood loss, and a nonsignificant trend toward improved survival than those with urgent intraoperative vascular consultation.

Conclusions: Vascular interventions can lead to favorable long-term outcomes during definitive oncologic resection of diverse tumor histologies and locations. Vascular surgeons must be prepared to participate, frequently urgently, in oncologic procedures. Standard open techniques employing all aspects of vascular exposures continue to be integral to vascular surgery training. Preoperative consultation between the oncologic and vascular surgeons may lead to improved outcomes.

INTRODUCTION

Vascular resection and reconstruction are required in the various settings in which oncologic resections are conducted. These settings can fall into 3 major groups: head and neck, abdominal/pelvic/retroperitoneal, or extremity. As surgical oncologists continue to push the envelope for complete resection, vascular

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resection and/or reconstruction have become increasingly necessary. Benefit for patients requiring vascular reconstruction or resection has been demonstrated in various settings. Rates of limb preservation as high as 94% and recurrence-free survival of 80% have been observed in extremity sarcoma.[1] Portal vein resection and reconstruction can be completed without increasing the complication rate which provides more opportunity for R0 resections in pancreatic cancer.[2–6] Vascular reconstruction/resection has also made more cancers resectable in retroperitoneal surgery with acceptable disease-free survival and overall survival benefits.[7–11] Vascular reconstruction in the setting of resection of squamous cell carcinoma of the head and neck has been shown to be advantageous.[12–15]

Although these patients undergo extensive imaging before surgery, the extent of the vascular structures involved is often known preoperatively. However, in many cases the extent of vascular involvement is not realized until the patient is undergoing surgery. Correspondingly, vascular surgeons may be consulted preoperatively or called into the operating room for an urgent consult. There is general consensus that appropriate planning with careful preparation is favorable to on-the-spot intraoperative decision making.

As endovascular techniques are more frequently employed in nononcologic settings, the opportunity for trainees in open surgery is decreasing. This decrease is especially true in the academic setting.[16,17] Vascular resection and reconstruction in the setting of oncologic resection will enrich the open experience of any training program. Overall outcomes following complex combined vascular and oncologic cases remain debated. We reviewed our experience with these complex cases to shed some light on the issues of outcomes related to the timing of vascular surgery consultation and the experiences these cases offer to vascular surgery trainees.

MATERIALS AND METHODS

The patients included in this study were any patients in whom the vascular surgery team was consulted who underwent surgery with the intent of oncologic resection. Those excluded from the study were patients in whom vascular surgery was involved in the preoperative planning that never underwent oncologic resection or in whom the operation was ultimately conducted without the need for vascular surgery involvement.

A retrospective review of patients recorded in a prospective patient registry was conducted over a period of 7 years. Vascular operations were conducted on either an elective or emergent setting. Both vascular and oncologic outcomes were recorded including tumor histology, location, recurrence, history of irradiation, resection margins, vascular procedure, graft material, intraoperative vascular injury, estimated blood loss, perioperative complications, and patency. Follow-up was conducted at 30 days, 1, 3, and 5 years by either chart review or telephone call. Complete resection was defined as R0 resection without residual microscopic disease.[18] Tumor recurrence was defined as histologic confirmation of tumor of identical histologic characterization after a disease-free interval as defined by current standards in each subset tumor location and type.[19–21] Vascular injury was defined as any injury to a named artery or vein requiring repair with prolene suture or ligation. Vascular-related complications and mortality were defined as any bleeding, thrombosis, stenosis, or occlusion that required re-intervention.

Notation was made of the timing of vascular surgery involvement as either preoperative consultation or urgent/emergent intraoperative consultation. The vascular surgery involvement preoperatively varied depending on the complexity of the case. The preoperative involvement ranged from planning the operation with the operating surgeon(s) in a multidisciplinary fashion or simply a review of the case and images before the day of surgery by the attending vascular surgeon.

Statistical analyses were conducted using Statistical Analysis Software version 9.4 (SAS Institute, Inc., Cary, NC). A chi-squared test and a Fisher's test were used to compare proportions. Student's *t*-test was used to compare quantitative variables (5% α level, assuming normal distribution and homogeneity of variance). A Kaplan–Meier curve was plotted to compare deaths between groups. Approval from the local Institutional Review Board was obtained.

RESULTS

A total of 30 patients were identified in the registry and 9 were excluded because they either did not undergo resection or vascular surgery assistance was not ultimately needed. Twenty-one patients were included in the prospective registry in which either planned vascular surgical involvement was the intention or unplanned vascular intervention occurred. About half of the patients included were female (11/21) and the mean age was 46.5 years. The incidence of obesity, diabetes

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