From the Society for Clinical Vascular Surgery

Incidence and outcomes of intraoperative vascular surgery consultations

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Objective: **Vascular surgeons may aid in primarily nonvascular procedures. Such activity has not been quantified, and hospital administrators may be unaware of the importance of vascular surgeons to support other hospital-based surgical programs. This study reviewed intraoperative consultations by vascular surgeons to support other surgical services.**
Methods: **Intraoperative vascular consultations were reviewed from January 2006 to January 2014 for consulting service, indication, and whether consultation occurred with advanced notice. Patient demographics, operative times, estimated blood loss, length of stay, and relative value units (RVUs) assigned for each consultation were also assessed. Consultations for trauma and iatrogenic injuries occurring outside the operating theater were excluded.**
Results: **Vascular surgeons performed 225 intraoperative consultations in support of procedures by nonvascular surgeons. Requesting services were surgical oncology (46%), orthopedics (17%), urology (11%), otolaryngology (7%), and others (19%). Reasons for consultation overlapped and included vascular reconstruction (53%), control of hemorrhage (39%), and assistance with difficult dissections (43%). Seventy-four percent were for intra-abdominal procedures, and venous (53%) and arterial (50%) problems were encountered equally with some overlap. Most patients were male (59%), overweight (56%; body mass index $\geq$25 kg/m^2), had previous surgery (72%) and were undergoing elective procedures (89%). Mean total procedural anesthesia time was 9.4 hours, mean procedural operating time was 7.9 hours, and mean total and vascular-related estimated blood loss was 1702 mL and 327 mL, respectively. Mean length of stay was 14.7 days, mean intensive care unit stay was 2.9 days, and 30-day mortality was 6.2%. Mean nonvascular RVUs per operation were 46.0, and mean vascular RVUs per operation were 30.9.**
Conclusions: **Unexpected intraoperative need for vascular surgical expertise occurs often enough that vascular surgeons should be regarded as an essential operating room resource to the general operating room, nonvascular surgeons, and their patients. Intraoperative vascular surgical consultation in support of other surgeons requires a high level of open technical operative skills and is time and labor intensive. (J Vasc Surg 2015;62:177-82.)**

Reconstructing defects of arteries and veins can be daunting for surgeons who do not routinely perform vascular reconstruction. Vascular surgeons are therefore called on to assist other surgical specialties in the dissection, repair, and reconstruction of arteries and veins. As surgical oncologists, urologists, and colorectal surgeons increasingly resect anatomically complex tumors with curative intent, vascular surgeons are called to reconstruct the associated vascular anatomy, hoping to improve the quality and safety of R0 resections, where margins of the resected specimen are microscopically free of cancer cells, through a multidisciplinary approach. Other surgeons may also benefit from vascular surgery expertise because critical vascular structures are ubiquitous.

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Previous studies have addressed the role of vascular surgeons in the treatment of iatrogenic injury[1-5] and portal vein reconstruction during pancreatectomy[6]; however, to our knowledge, no publication has discussed the depth and breadth of all intraoperative consultations performed by an academic vascular surgery service. We therefore conducted a retrospective review of our intraoperative consultations. The goal of the study was to define the role of the vascular surgeon as it pertains specifically to intraoperative consultation provided in support of other surgical services and their patients.

METHODS

This study was an Institutional Review Board-approved retrospective review (IRB #8539) using the Oregon Health & Science University electronic medical record (EMR) system and the prospectively maintained Division of Vascular Surgery database. Consent was waived. We identified 225 patients for whom vascular surgeons performed intraoperative consultations in support of procedures by nonvascular surgeons between January 1, 2006, and January 1, 2014. Consultations for trauma and iatrogenic injuries occurring outside the operating theater were excluded. Also excluded were those procedures for which there was no operative dictation charted and those in which the vascular surgeon was involved in the preoperative planning of the operation.

Demographic data, clinical characteristics, operative data, vessel injury-related data, imaging, and 30-day and overall mortality data were collected. The presence of comorbid diseases was assessed through review of the EMR for each patient. The operative data included the consulting service, indication for the index procedure, reason for vascular consultation, operative history, and prior radiation treatment. Vessel injury-related data included vessels involved, vascular procedure performed, type of reconstruction, and conduit used when the vessel was reconstructed. To indicate the overall complexity of the procedures performed, hospital and intensive care unit (ICU) length of stay and patient follow-up were also included in our analysis. In addition, we queried the relative value units (RVUs) assigned for each operation, including vascular and nonvascular procedures. For the purposes of this study, 30-day mortality and mean overall survival were determined using the EMR and the publicly available Social Security Death Index database. Data were analyzed using SPSS 22.0 software (IBM Corp, Armonk, NY).

RESULTS

Patient characteristics

From January 2006 to January 2014, vascular surgeons performed 225 intraoperative consultations in support of procedures by nonvascular surgeons. Of these patients, 133 (59.1%) were male and 92 (40.9%) were female, and their mean age was 54.6 years (standard deviation ± 16.6 years; Table). There were 17 patients (7.6%) with coronary artery disease, 38 (16.9%) with diabetes mellitus, 73 (32.4%) with hypertension, 41 (18.2%) with hyperlipidemia, 9 (4.0%) with congestive heart failure, 19 (8.4%) with renal insufficiency (creatinine ≥1.5 mg/dL), 7 (3.1%) with chronic obstructive pulmonary disease, and 33 (14.7%) were smoking at the time of their operation. In addition, 83 patients (36.9%) were former smokers. As defined by body mass index (BMI), 175 patients (78.2%) were overweight (BMI ≥25 kg/m^2) and 50 were obese (BMI >30 kg/m^2).

Before surgery, 42 patients were taking aspirin, 2 were taking clopidogrel, 13 were taking warfarin, and 5 patients were receiving therapeutic enoxaparin. Patients were instructed to hold their aspirin and clopidogrel 7 days before surgery. Patients taking warfarin were bridged using enoxaparin for 5 days before surgery, with enoxaparin discontinued 24 hours before surgery, or were instructed to hold their warfarin 5 days before surgery. Patients receiving enoxaparin were instructed to discontinue their treatment 24 hours before surgery.

Most of the patients (163 [72.4%]) had undergone a prior abdominal operation and were being treated for cancer (150 [66.7%]). Eighteen patients (8%) had a history of radiotherapy, of whom 8 patients were treated with abdominal radiotherapy in the setting of pancreatic adenocarcinoma, 1 was treated with pelvic radiotherapy for bladder cancer, 4 were treated with neck radiotherapy, and 5 were treated with radiotherapy to an extremity (1 axilla, 4 lower extremities).

Table. Clinical characteristics of patients

Variables[a]	*Consults (N = 225)*
Age, years	54.6 ± 16.6
Male sex	133 (59.1)
Comorbidities	
Coronary artery disease	17 (7.6)
Diabetes mellitus	38 (16.9)
Hypertension	73 (32.4)
Hyperlipidemia	41 (18.2)
Chronic renal insufficiency[b]	19 (8.4)
Past tobacco use	83 (36.9)
Current tobacco use	33 (14.7)
BMI <25 kg/m^2	86 (38.2)
BMI ≥25 kg/m^2	126 (56.0)
BMI >30 kg/m^2	50 (22.2)
Preoperative history	
Prior operation	163 (72.4)
Cancer	150 (66.7)
Radiotherapy	18 (8.0)

BMI, Body mass index.
[a]Age is shown as mean ± standard deviation and the categoric variables as number (%).
[b]Defined as creatinine >1.5 mg/dL.

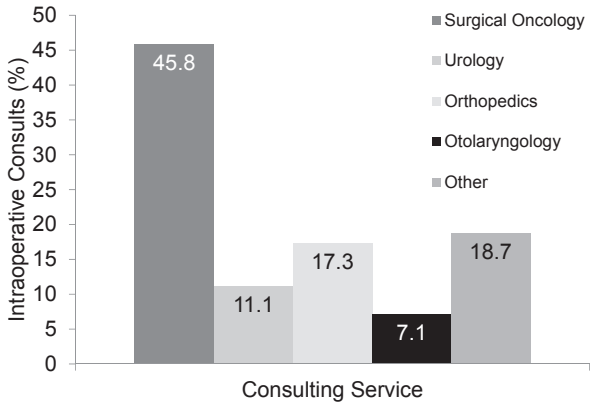

Fig 1. Distribution of intraoperative consults by consulting services.

Nature of intraoperative consults

Requesting services. The services requesting intraoperative consultation included surgical oncology (103 [45.8%]), orthopedic surgery, including orthopedic oncology (39 [17.3%]), urologic surgery, primarily urologic oncology (25 [11.1%]), otolaryngology (16 [7.1%]), and other (42 [18.7%]), including general surgery, neurosurgery, obstetrics and gynecology, cardiothoracic, pediatric surgery, colorectal surgery, and trauma surgery (Fig 1).

Timing of consults. Of the 225 consults, 183 (81.3%) were unexpected, without any prior thought or knowledge of the need for an intraoperative vascular surgery consultation, and in 42 (18.7%), the vascular surgeon had prior knowledge of the potential need for intraoperative vascular surgery consultation. In 32 cases (14.2%), the vascular