

From the Western Vascular Society

Vascular surgery: An essential hospital resource in modern health care

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Objective: In modern health care, vascular surgeons frequently serve as a unique resource to other surgical specialties for vascular exposure, repair, reconstruction, or control. These services occur both in planned and unplanned clinical settings. We analyzed the frequency, outcomes, and value of vascular services in this setting to other surgical specialties and the hospital.

Methods: Intraoperative planned and unplanned vascular surgery operative consultations were reviewed over a 3-year period (2013-2016). Patient demographics, requesting surgical specialty, indication and type of vascular intervention, and work relative value units generated were recorded. Univariate and multivariate analysis of factors affecting a composite outcome of in-hospital and 30-day mortality or morbidity, or both, was performed.

Results: Seventy-six vascular surgery intraoperative consultations were performed, of which 56% of the consultations were unplanned. The most common unplanned consultation was for bleeding (33%). The aorta and lower extremity were the most common vascular beds requiring vascular services. The mean work relative value units generated per vascular surgery intervention was 23.8. In-hospital and 30-day mortality was 9.2%. No difference in mortality and morbidity was found between planned and unplanned consultations. Factors associated with the composite mortality/morbidity outcome were coronary artery disease ($P = .002$), heart failure ($P = .02$), total operative blood loss ($P = .009$), consultation for limb ischemia ($P = .013$), and vascular consultation for the lower extremity ($P = .01$). On multivariate analysis, high operative blood loss (>5000 mL) remained significant ($P = .04$), and coronary artery disease approached significance ($P = .06$).

Conclusions: The need for vascular surgery services is frequent, involves diverse vascular beds, and occurs commonly in an unplanned setting. When requested, vascular surgery services effectively facilitate the completion of the nonvascular procedure, even those associated with significant intraoperative blood loss. Vascular surgery services are essential to other surgical specialties and the hospital in today's modern health care environment. (*J Vasc Surg* 2017;■:1-7.)

As surgical disciplines evolve, the use of a multidisciplinary approach to operative intervention has increased. The contribution to this approach for vascular surgeons is the reconstruction of critical vascular structures or providing vascular control and repair during a specific operative procedure.

Unfortunately, many requests for vascular surgery expertise occur as an unplanned emergency intraoperative consultation. The tacit assumption underlying these requests is that vascular surgeons are ready and available at a moment's notice (ie, 24/7). Administrators, other medical providers, hospital systems, and modern health care in general underappreciate the value and necessity

of vascular surgery services in this context.¹ In addition, the contribution to patient safety of readily available vascular surgery services to a given hospital has rarely been quantified or reported. One recent study from the University of Oregon did focus on unplanned intraoperative vascular consultations and the associated value to the hospital.² This study demonstrated the important role vascular surgeons play in this setting. The goal of our study was to provide a more global view of hospital-based vascular surgery services by including planned and unplanned operative consultations in a tertiary academic medical center with a focus on patient outcomes and economic value.

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METHODS

A retrospective review of all vascular surgery operative consultations during a 3-year period (2013-2016) was performed. The Keck School of Medicine Institutional Review Board approved this study and waived informed consent. Consultations included in this review involved those that required the vascular surgeon to provide vascular exposure, control, repair, or reconstruction. Trauma consultations were not included because our institution does not have a functioning emergency department to accept trauma-related transfers.

Consultations requested exclusively for exposure of the spine to facilitate fusion or disc replacement were excluded.

Patient demographics, indication for the primary operation, reason for the vascular surgery operative consultation, specialty requesting the operative consultation, vascular bed requiring vascular intervention, type of vascular intervention, graft type, operative times, and blood loss were collated. Postoperative morbidity, re-intervention, and in-hospital and 30-day mortality were gathered. Graft patency was determined by postoperative imaging studies using duplex ultrasound imaging, computed tomography angiography, or magnetic resonance imaging.

Operative vascular consultations were classified as planned or unplanned. Planned was defined as a consultation in which the vascular surgeon had been involved in the preoperative planning and was scheduled to be available on the day of the operative procedure. An unplanned consultation was defined as one in which the vascular surgeon had no prior patient contact and was asked provide an emergency intraoperative consultation. Accessing a vascular surgeon from our group for unplanned consultations occurred mainly through the published vascular surgeon on-call schedule. Physician work relative value units (wRVUs) generated for the primary surgeon and the consulting vascular surgeon were calculated using billing records and Current Procedural Terminology (CPT; American Medical Association, Chicago, Ill) codes.

The primary outcome was a composite end point of in-hospital/30-day mortality and morbidity. Other outcomes analyzed included the incidence of unplanned and planned consultations, primary patency of vascular repairs, and wRVUs.

Data were captured on an Excel spreadsheet (Microsoft Corp, Redmond, Wash) and transferred to Stata 12 software (StataCorpLP, College Station, Tex) for statistical analysis. Continuous variables were compared using unpaired two-way Student *t*-test, and categorical variables were compared using the two-tailed Fisher exact test and χ^2 analysis. A multivariable logistic regression model was constructed for the composite end point by including variables with *P* value of $<.05$ from univariable analyses. Primary patency of the vascular repair was derived using life-table methods, and significance was estimated using the log-rank test.

RESULTS

During the 36-month period, 76 consultations were requested, of which 43 (56%) were unplanned. Preoperative patient demographics and preoperative variables of the planned and unplanned consultations are listed in [Table I](#). There were no significant differences in any variable between the two groups. The requesting specialties are collated in [Table II](#). The most common

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center retrospective study
- **Take Home Message:** Analysis of the data of 76 intraoperative vascular surgery consultations shows the need for vascular surgery services is frequent and it is many times unplanned. High operative blood loss was associated with increased mortality and complications.
- **Recommendation:** The authors suggest that vascular surgery is essential for the current health care environment.

specialty requesting an unplanned consultation was urology (23%), and the most common surgical specialty requesting a planned consultation was cardiac surgery (30%). An unplanned operative consultation was most commonly requested for bleeding (33%), whereas a planned consultation was most commonly requested for a vascular reconstruction (43%). Intraoperative bleeding was significantly more common in the unplanned group. Other indications for intraoperative surgical consultations in the planned and unplanned settings are summarized in [Table III](#).

Additional operative variables are also listed in [Table III](#). The distribution of the vascular beds managed were similar between the two groups with the exception of the inferior vena cava and its major branches, in which management was more commonly required in the unplanned setting. The most common vascular structures requiring ligation, repair, or reconstruction overall and in the planned setting were the aorta and common femoral artery. The aorta and the popliteal artery were the most common in the unplanned setting. There were no significant differences in type of repair or graft used between the planned and unplanned groups.

The vascular procedure time was significantly lower, at 91 minutes vs 158 minutes ($P = .003$), and the overall mean procedure blood loss significantly higher in the unplanned setting, at 2267 mL vs 1011 mL ($P = .036$). Total mean wRVUs per procedure were 64.5 (range, 9.21-158.4). The wRVUs were 40.6 (range, 1.14-129.3) for the primary nonvascular procedure and 23.8 (range, 0-69) for the vascular procedure. There was no difference between total and nonvascular and vascular wRVUs between the planned and unplanned groups. Total wRVUs for the entire cohort were 4905.09.

Postoperative variables, including morbidity and mortality, are listed in [Table IV](#). Intensive care unit and hospital length of stay were similar between the two groups. Postoperative complications occurred in 11 patients in the unplanned setting and in five patients in the planned setting. The comparison of unplanned vs planned found no significant difference in overall postoperative morbidity ($P = .396$).

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