

Original Article

The role of vascular surgery in intraoperative emergency consultations

 Aysegul Durmaz,  Ali Ahmet Arikan,  Sibel Gur,  Muhip Kanko

Kocaeli University Medical Faculty, Department of Cardiovascular Surgery, Kocaeli, Türkiye

Received: November 14, 2022 Accepted: January 29, 2023 Published online: March 02, 2023

© 2023 Turkish National Vascular and Endovascular Surgery Society. All rights reserved.
Copyright@Author(s) - Available online at <http://turkishjournalofvascularsurgery.org/>
Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License



Abstract

Aim: Vascular surgery is an important part of the multidisciplinary approach to surgical treatments, and vascular surgeons are often called on intraoperatively to provide immediate assistance to their colleagues. Our aim was to describe the extent of assistance provided during emergency intraoperative consultations at a single tertiary academic centre.

Material and Methods: We reviewed the records of patients who were consulted intraoperatively in our hospital over a period of approximately 4 years (January 1, 2017-December 31, 2020) and organized the data collected.

Results: 40 emergency intraoperative consultations were identified. 55% of the patients were female, with an average age of 48.83 years. The most frequently consulted subspecialty was obstetrics and gynecology (32%). Index cases were elective/nonurgent (90%), most involving tumor resection (77.5%). The primary reason for vascular consultation was revascularization (37.5%). The primary blood vessel and anatomic field of intervention were categorized. Most cases (50%) included preservation of blood flow, including primary arterial repair (20%) and ligation of the bleeding vessels (20%) in the first choice. Postoperative mean length of stay was 13 days, with a 30-day mortality of 5.1%.

Conclusion: Using a wide variety of skills and techniques, vascular surgeons strive to respond to urgent open surgical consultations in various anatomical sites. Our study provides evidence to the wide range of knowledge and skills required for modern vascular surgeons and the place of the subspecialty in the core services offered in a multidisciplinary approach.

Keywords: Vascular surgery, emergency, intraoperative

INTRODUCTION

Multidisciplinary approach in operative treatments has been developing along with surgical disciplines. Today, the success of a tertiary institution in performing major surgical procedures depends not only on the primary surgeon, but also on the supporting team [1,2]. Management of arterial and venous defects can be

daunting for surgeons who do not routinely perform vascular reconstruction. In this respect, vascular surgeons contribute to reconstructing critical vascular structures and provide the necessary vascular surgical control during a particular procedure in a multidisciplinary approach.

The needs for vascular surgery in operating rooms often arise

CITATION

Durmaz A, Arikan AA, Gur S, Kanko M. The role of vascular surgery in intraoperative emergency consultations. Turk J Vasc Surg 2023;32(1):5-10.



Corresponding Author: Aysegul Durmaz, Kocaeli University Medical Faculty, Department of Cardiovascular Surgery, Kocaeli, Türkiye
Email: drayseguldurmaz@gmail.com

as unplanned or urgent intraoperative consultation requests. Previous studies in the literature reveal the role played by vascular surgeons in these situations [3].

This study is a 4-year review of unplanned and emergency consultation requests from vascular surgeons in a tertiary hospital offering a wide range of surgical services. With this study, our aim is to document the diversity of the skills that vascular surgeons need to successfully perform during surgical interventions in short periods and over a wide range of anatomical fields and to describe our results.

MATERIALS AND METHODS

A retrospective review of urgent or unscheduled intraoperative consultation requests from non-vascular surgeons to vascular surgeons at Kocaeli University Medical Faculty hospital, a tertiary healthcare center and the only university hospital in the city, was conducted between January 1, 2017, and December 31, 2020. The consultations included in this review were those in which the vascular surgeon had no prior patient contact and was requested to perform immediate intraoperative evaluation, and in which the patient required vascular exposure, control, repair, or reconstruction.

Patient demographic, surgical, and follow-up information were obtained and collected from electronic medical records. Repaired blood vessels and primarily vascular structures on which the vascular surgeon was called for assistance were considered primary target vessels. Surgical intervention notes were scanned retrospectively, and since some notes did not contain clear explanations, classification was made based on the primary intervention. While endovascular procedures in which cardiovascular surgery was actively involved from the beginning of the case were excluded, angiographic and endovascular procedures for emergency intervention were included.

In the statistical analysis, IBM SPSS 20.0 (IBM Corp., Armonk, NY, USA) package program was used for statistical evaluation. Conformity of the data to normal distribution was evaluated with the Kolmogorov-Smirnov Test. Numerical variables were shown as mean ± standard deviation, median (IQR, 25th to 75th percentile or min-max value), and frequency (percentiles). Fisher's Exact test was used for categorical variables to evaluate group differences. P<0.05 was considered sufficient for statistical significance in two-way tests.

RESULTS

In a total of 40 cases operated in our hospital between January 1, 2017 and December 31, 2020, emergency surgical consultation was requested with intraoperative vascular surgeons. Trauma patients whose existing vascular injury was detected intraoperatively and cases where the medical record was insufficient for data were

excluded from the study.

55% of the patients were female and 45% were male, with a mean age of 48.83 (00 -78 / standard deviation, 21.4 years). Five patients were in the pediatric age group, and two were under one year of age. Comorbidity was present in only 25% of the patients; in some patients, more than one comorbidity accompanied the picture. Patients followed up with diagnoses of malignancy in different body regions constituted 67.5% of all patients. It can be seen that only 7.5% of the patients used preoperative anticoagulants. In the preoperative scoring made by the department of anesthesia and reanimation, 37.5% of the patients were recorded with The American Society of Anesthesiologists (ASA) physical status classification system as ASA 3, while 62.5% were recorded as ASA 1 and ASA 2 (Table 1).

Table 1. Demographic and preoperative data of the patients	
Age	Mean: 48.83/year (Standard deviation 21.4)
Gender	Male: 45.0% Female: 55.0%
Additional Disease	25% (+)
Hypertension	17.5%
Diabetes Mellitus	12.5%
Atrial Fibrillation	7.5%
Chronic Obstructive Pulmonary Disease	2.5%
Myasthenia gravis	2.5%
Anticoagulation	7.5% (+)
New Generation Oral Anticoagulant Drugs	5.0%
Low Molecular Weight Heparin	2.5%
The American Society of Anesthesiologists (ASA) physical status classification system	
ASA 1	22.5%
ASA 2	40.0%
ASA 3	37.5%

It can be seen that 90% of the patients underwent elective surgery, and 77.5% of the patients were operated for oncological resections. Trauma was a less common indication for surgery at a rate of 10%. Most pediatric patients (80%) were operated on due to hydrocephalus. Only one patient was consulted from the Cardiac angiography room. There was no significant relationship between emergency or elective patients and intraoperative emergency vascular consultations.

All included cases were unexpected cases without prior consideration or knowledge of the need for an intraoperative vascular surgery consultation. The surgical subspecialty requiring emergency vascular surgery most frequently was obstetrics and gynecology, with a rate of 32% (Figure 1).

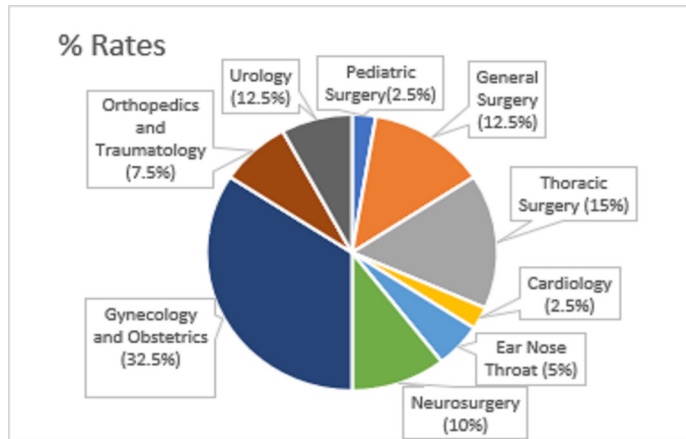


Figure 1. Distribution of primary surgery branches

Among the reasons for consultation, vascular injuries requiring revascularization came first, with a rate of 37.5%. This was followed by requests for help in exploration with 32.5%, and dissection, with 15%. The proportion of patients consulted for control of ongoing active bleeding was 12.5%. In only one patient, thrombus formation in the inferior vena cava was observed while the case was ongoing, and the case was included for venous thrombectomy.

As can be seen in our study, vascular surgeons were called upon to assist in an anatomically wide range. Among the consulted anatomical areas, the lower extremity veins were the most common, with 47.5% (Figure 2). In all cases, the primary target blood vessel leading to vascular surgery consultation was venous with 57.5% and arterial with 42.5%. When we look at the most frequently injured vascular structures, the VCI comes first (Figure 3).

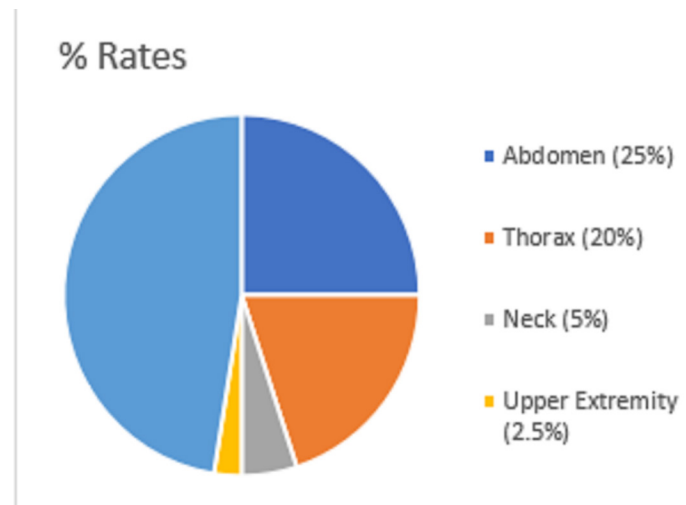


Figure 2. Anatomical distribution of vessels undergoing surgical intervention

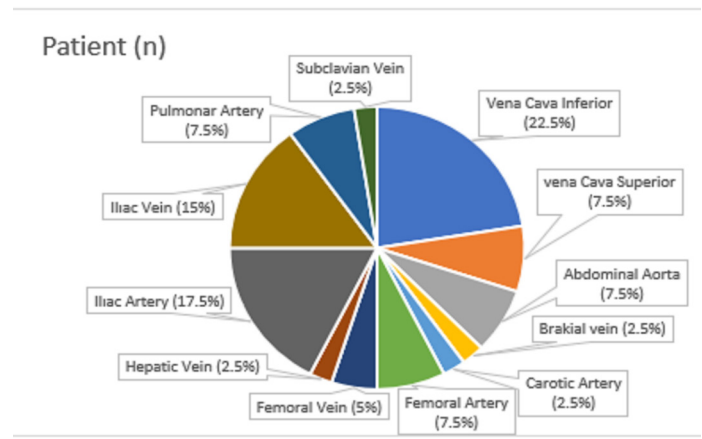


Figure 3. Primary vascular structure involved

Those consulted for injury of blood vessels or uncontrollable bleeding accounted for 50% of all patients. Our treatment choice was ligating bleeding vascular structures in 40% of these patients, and a revascularization method was preferred in 60% (Figure 4).

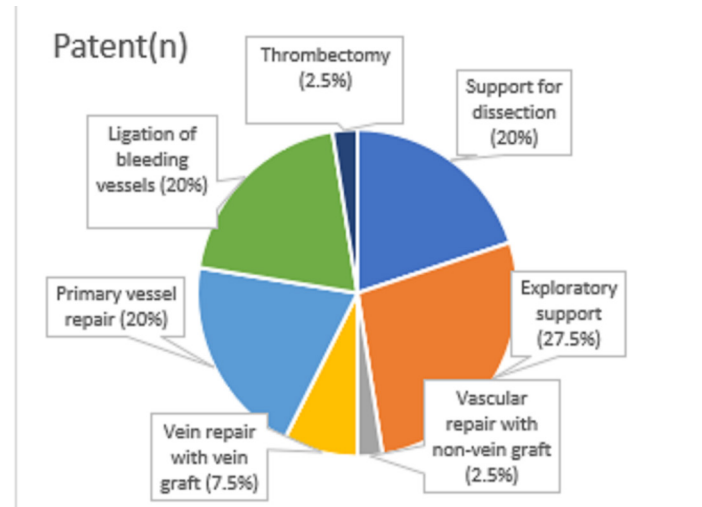


Figure 4. Vascular surgical procedure

Blood was transfused to 50% of the patients. 69 units of erythrocyte suspension, 38 units of fresh frozen plasma, and 3 units of pooled thrombocyte suspension were transfused to the patients. Patients who received the most blood transfusion (25%) were consulted because of vascular injury. However, there was no statistically significant correlation among the reasons for the patients' intraoperative emergency vascular surgery consultation and the treatment options of vascular surgeons, and the amount of bleeding.

While 37.5% of the patients were categorized as ASA 3 by the anesthesia and reanimation department in the preoperative evaluation, it is seen that 55% needed postoperative intensive

care follow-up. Complications were seen in 22.5% of the patients during their hospitalization, and all were associated with wound infection. There was no statistical correlation between the reasons for a vascular surgery consultation and postoperative wound infection. Only two patients needed reoperation in the postoperative period, and these operations were not due to vascular complications, but because of the primary surgeon's need for secondary care. (Table 2)

Table 2. Intraoperative and postoperative follow-up data of patients	
Transfusion	50.0%
Erythrocyte Suspension	50.0%
Fresh Frozen Plasma	25.0%
Pooled Platelet Suspension	5.0%
Operation time	240.79/min. (Standard deviation 111.21/min.)
Postoperative Follow-up	
Intensive care	55.0%
Service	45.0%
Reoperation	5.0% (+)
Complication	22.5% (+)
Hospitalization time	13.05/days (Standard deviation 9.92/days)
Rehospitalization in 30 Days Follow-up	7.50% (+)
Result	
Healing	92.5%
Transfer	2.50%
Exitus	5.00%

Regarding vascular surgery, 92.5% of the patients were discharged without complications. Three patients had to be hospitalized again within 30 days of discharge (7.9%), and no vascular complication or new pathology was detected in these patients.

DISCUSSION

Previously, there were reports in the literature that there may be a need for intraoperative vascular surgery in non-vascular surgical procedures [4,5]. However, these studies did not report an incidence of vascular injury requiring immediate surgical treatment during non-vascular surgery [6]. In a study by Sung-Bin Park et al., the incidence of intraoperative vascular consultation was estimated to be approximately 0.3%, and they stated that even this low incidence indicated the need for intraoperative

vascular surgery expertise to support primary surgeons is urgent and unpredictable [7]. Considering the results, as Sung-Bin Park et al. stated, the urgent and unpredictable nature of intraoperative vascular surgery consultations is understandable. However, unfortunately, the incidence could not be determined in this study since the data of the patients who did not undergo any intraoperative surgical procedure were unfortunately very lacking.

A vascular surgeon needs specialized technique and quick decision-making skills. The literature has previously documented that vascular surgeons perform various procedures to control bleeding in emergencies [7]. In a study by Cassinotto et al., it was shown that computed tomography is less likely to accurately detect the presence of vascular involvement after neoadjuvant chemotherapy in pancreatic head adenocarcinomas. It was stated that vascular surgery expertise is needed, especially in cases of borderline resectable pancreatic adenocarcinoma [8]. In this study, 50% of the intraoperative consultations for vascular surgery were due to injury of important vessels or uncontrollable bleeding during the procedure, while the remaining 47.5% of the consultations were for support in tumor resection, exploration, or dissection.

All intraoperative consultations were cases requiring the salvage of a large blood vessel, control of bleeding, and complex surgical techniques such as vascular exploration or dissection. In particular, in the emergency surgical treatment of a vascular injury occurring intraoperatively, the gold standard is by-pass with a saphenous vein graft if possible [9]. However, using more than one surgical technique simultaneously was necessary in some surgical cases. The need for vascular surgery is more evident in the advent of unplanned consultation than planned consultation. The study shows that although many cases are performed by vascular surgeons who are fully trained in endovascular techniques, the use of endovascular techniques in these emergencies is low, and the study also shows the importance of open surgical procedures in emergency vascular consultations.

While minimally invasive surgical procedures such as laparoscopy or thoracoscopy were not included in the surgical procedures for which emergency consultation was requested in our study, only one patient was consulted for an emergency due to femoral artery injury during coronary angiography. It is thought that such a large number of vascular injuries in open surgical procedures are due to complicated cases that cause patients to be operated in a tertiary hospital.

In a study by Oda et al., the endoscopic submucosal dissection method was examined in early gastric cancers, and the average operation time was 60 minutes, and bleeding complications were found at a rate of 7% in the early period [10]. Lim et al. examined the robotic methods in patients who underwent hysterectomy and lymphadenectomy, and it was shown that both operation

times and complication rates were lower than in open surgical procedures [11]. Studies show that technological advances in recent years have shortened the operation time and reduced the complication rates, especially in cancer surgery. However, there needs to be more information on using the latest technologies in intraoperative cases in the available data.

There needs to be more information in the literature on the effect of intraoperative vascular surgery consultation on the duration of cases. Generally, the need for vascular surgery consultation did not significantly affect the average durations of the operations. In some cases, it can be predicted that it shortens the operation time by preventing vascular complications and accelerating access to primary pathology, thanks to its aids in exploration and dissection.

There are studies in the literature examining long-term vascular patency, especially in oncologic patients, which show that similar results are obtained when emergency vascular surgery is compared with elective planned vascular surgery [1,4,12-14]. In our study, a one-year follow-up of all the patients could not be carried out entirely due to the delay in the follow-up as a result of giving importance to the primary surgical causes of the patients and the fact that most of them were followed up due to malignancy. However, the distal blood flow was found to be patent and uncomplicated in the one-year follow-ups of the patients who were consulted for injuries of the extremity arteries.

In the study of Sung-Bin Park et al., in-hospital mortality rate was 7.5% in patients who underwent intraoperative vascular surgery consultation [7]. However, different studies have reported a mortality rate of 6.2% to 9.2% during the first hospitalization of these patients [3-5]. When the results of the patients included in this study are examined, we see that the mortality rate calculated by excluding the patients transferred to another unit is 5.1%. This rate is below the mortality rates reported in similar studies. This situation can be attributed to the rapid and accurate response to urgent vascular complications, the variety of surgical procedures that have developed in all surgical units in recent years, and the surgical experience in the relevant units. The reasons for consultation of all patients who died were vascular injury and failure to control bleeding. Intraoperative vascular injury is not the leading cause of death in these patients, but there is a possibility that it may have contributed negatively to their underlying severe disease in the postoperative follow-up.

Analysis of consultations is essential for all hospital services to increase efficiency in surgical practice. [15,16] Our data show that vascular surgery consultations are high in number and diverse and they come from all specialties. [17] In an article, Belkin described the vascular surgeon's role as the "fireman of the operating room," providing essential services to other surgeons when complications arise [18].

In such chaotic and urgent conditions, extensive knowledge

and surgical experience of various vascular beds are required to achieve low mortality and high vascular patency rates in the long term in complicated intraoperative cases and cases requiring a wide variety of open vascular surgical procedures [1]. The vascular surgeon's unique knowledge and expertise are at risk mainly due to current vascular surgery training for endovascular procedures [3,19].

We see the management of emergency surgical consultations as an essential part of vascular surgery training. As surgical training and subspecialty areas continue to develop and increase, the importance of the multidisciplinary approach becomes more evident. In cases requiring planned or unplanned multidisciplinary surgical intervention, the vascular surgery contribution increases the overall value of the procedure, which means greater returns for the patient and the hospital.

The limitations of this study are its retrospective nature and the wide variety of patient profiles. One thing the patients had in common was that an intraoperative emergency vascular procedure was required. This situation allowed an analysis focused on the vascular surgical service rendered. However, the limited number of patients made the analysis insufficient.

CONCLUSION

This study confirms the critical role that vascular surgeons play in a busy academic center and previous findings that unexpected vascular complications occur in the hands of all surgeons, regardless of anatomical location or case variety. Intraoperative vascular surgery consultation supporting other surgeons requires high open-technique surgical skill and time. In this respect, our study also shows the depth of knowledge and skill required by modern vascular surgery education.

Ethics Committee Approval: Ethics committee approval was obtained from the non-interventional research ethics committee of Kocaeli University Medical Faculty with the project number 2020/310 and decision numbered GOKAEK-2020/18.22.

Patient Consent for Publication: Individual informed consent was waived due to retrospective design.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: All authors contributed equally to the article.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

REFERENCES

- Manzur MF, Ham SW, Elsayed R, Abdoli S, Simcox T, Han S, et al. Vascular surgery: an essential hospital resource in modern health care. *J Vasc Surg* 2017;65:1786-92.
- Tomita TM, Rodriguez HE, Hoel AW, Ho KJ, Pearce WH, Eskandari MK. Implications of intraoperative vascular surgery assistance for hospitals and vascular surgery trainees. *JAMA Surg* 2016;151:1032-8.
- Danczyk RC, Coleman J, Allensworth J, Azarbal AF, Mitchell EL, Liem TK, et al. Incidence and outcomes of intraoperative vascular surgery consultations. *J Vasc Surg* 2015;62:177-82.
- Oderich GS, Panneton JM, Hofer J, Bower TC, Cherry KJ, Sullivan T, et al. Iatrogenic operative injuries of abdominal and pelvic veins: a potentially lethal combination. *J Vasc Surg* 2004;39:931-6.
- Giswold ME, Landry GJ, Taylor LM, Moneta GL. Iatrogenic arterial injury is an increasingly important cause of arterial trauma. *Am J Surg* 2004;187:590-3.
- Yoo TK, Min SK, Ahn S, Kim SY, Min SI, Park YJ., et al. Major vascular injury during nonvascular surgeries. *Ann Vasc Surg* 2012;26:825-32.
- Park SB, Park KM, Jeon YS, Cho SG, Hong KC. Intraoperative Vascular Surgical Consultation during Non-Vascular Surgeries in Tertiary Centers by Vascular Surgeon. *Vasc Spec Int* 2017;33:156-9.
- Cassinotto C, Cortade J, Belleannee G, Lapuyade B, Terrebonne E, Vendrely V, et al. An evaluation of the accuracy of CT when determining resectability of pancreatic head adenocarcinoma after neoadjuvant treatment. *Eur J Radiol* 2013;82:589-93.
- Yazıcıoğlu Ö, Balcı Hİ. Cerrahi sırasında kanama ve vasküler hasarlar. In: *Ortopedi ve Travmatolojide komplikasyonlar*. Kalenderer Ö, Güven M (eds). TOTBİD, Ankara, 2016, s. 683-6.
- Oda I, Gotoda T, Hamanaka H, Eguchi T, Saito Y, Matsuda T, et al. Endoscopic submucosal dissection for early gastric cancer: technical feasibility, operation time and complications from a large consecutive series. *Digestive Endoscopy* 2005;17:54-8.
- Lim PC, Kang E, Park DH. A comparative detail analysis of the learning curve and surgical outcome for robotic hysterectomy with lymphadenectomy versus laparoscopic hysterectomy with lymphadenectomy in treatment of endometrial cancer: A case-matched controlled study of the first one hundred twenty two patients. *Gynecol Oncol* 2011;120:413-8.
- See KW, Chui KH, Chan WH, Wong KC, Chang YC. Evidence for endovascular simulation training: a systematic review. *Eur J Vasc Endovasc Surg* 2016;51:441-51.
- Krafek BM, Sachs TE, Farber A, Eslami MH, Kalish JA, Shah NK, et al. Assessment of open operative vascular surgical experience among general surgery residents. *J Vasc Surg* 2016;63:1110-5.
- Lee DY, Mitchell EL, Jones MA, Landry GJ, Sheppard BC, Billingsley KG, et al. Techniques and results of portal vein/superior mesenteric vein reconstruction using femoral and saphenous vein during pancreaticoduodenectomy. *J Vasc Surg* 2010;51:662-6.
- Ta K, Gardner GC. Evaluation of the activity of an academic rheumatology consult service over 10 years: using data to shape curriculum. *J Rheumatol* 2007;34:563-6.
- England RW, Ho TC, Napoli DC, Quinn JM. Inpatient consultation of allergy/immunology in a tertiary care setting. *Ann Allergy Asthma Immunol* 2003;90:393-7.
- Leithead CC, Matthews TC, Pearce BJ, Novak Z, Patterson M, Passman MA, et al. Analysis of emergency vascular surgery consults within a tertiary health care system. *J Vasc Surg* 2016;63:177-81.
- Belkin M. The training of firemen. *J Vasc Surg* 2014;59:1144-51.
- Malangoni MA, Biester TW, Jones AT, Klingensmith ME, Lewis FR Jr. Operative experience of surgery residents: trends and challenges. *J Surg Educ* 2013;70:783-8.