



# Intraoperative Vascular Surgical Consultation during Non-Vascular Surgeries in Tertiary Centers by Vascular Surgeon

Sung-Bin Park<sup>1</sup>, Keun-Myoung Park<sup>1</sup>, Yong Sun Jeon<sup>2</sup>, Soon Gu Cho<sup>2</sup>, and Kee Chun Hong<sup>1</sup>

<sup>1</sup>Department of Surgery, Inha University College of Medicine, Incheon, <sup>2</sup>Department of Radiology, Inha University College of Medicine, Incheon, Korea

**Purpose:** There are many types of intraoperative consultations by vascular surgeons during non-vascular surgery. Therefore, we examined the current state of intraoperative consultations during non-vascular surgery in a single center.

**Materials and Methods:** From January 2014 to December 2015, we reviewed records of 40 patients (0.3%) who received an intraoperative consultation from a vascular surgeon for 10,734 non-vascular surgeries in Inha University Hospital. We examined patient characteristics, operative details, and clinical results.

**Results:** There were 40 intraoperative vascular surgical consultations relating to bleeding (n=14, 35.0%), dissection from the vessel (n=13, 32.5%), arterial occlusion (n=10, 25.0%), and retroperitoneal approach (n=3, 7.5%). The locations of surgery were lower extremity (n=10, 25.0%), kidney (n=8, 20.0%), spine (n=6, 15.0%), pelvis (n=6, 15.0%), head and neck (n=4, 10.0%), abdomen (n=4, 10.0%), and upper extremity (n=2, 5.0%). The methods of surgery included primary closure or ligation (n=17, 42.5%), end-to-end anastomosis (n=12, 30.0%), bypass (n=10, 25.0%), thrombectomy (n=4, 10.0%), retroperitoneal approach (n=3, 7.5%), and embolization (n=2, 5.0%). Postoperative treatment was performed in the intensive care unit for 13 patients (32.5%), while 3 patients (7.5%) died following surgery.

**Conclusion:** Intraoperative consultation by vascular surgeons during non-vascular surgery occurred in approximately 0.3% of non-vascular surgeries. The region undergoing operation and type of surgery were variable. Therefore, it is necessary for vascular surgeons to have a comprehensive knowledge of vascular anatomy and to make rapid surgical decisions.

**Key Words:** Vascular surgical procedure, Referral and consultation

Received September 22, 2017

Revised October 15, 2017

Accepted October 25, 2017

**Corresponding author:** Keun-Myoung Park

Department of Surgery, Inha University Hospital, 27 Inhang-ro, Jung-gu, Incheon 22332, Korea

Tel: 82-32-890-2738

Fax: 82-32-890-3549

E-mail: redfrag@naver.com

Conflict of interest: None.

Copyright © 2017, The Korean Society for Vascular Surgery

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Vasc Spec Int 2017;33(4):156-159 • <https://doi.org/10.5758/vsi.2017.33.4.156>

## INTRODUCTION

There are many types of intraoperative consultations by vascular surgeons during non-vascular surgery. Vascular surgeons are consulted to assist other surgical specialties with bleeding control, dissection from a vessel, and resolving arterial occlusion. Furthermore, vascular surgeons are

consulted during the resection of anatomically complex tumors that are treated with a curative intent in an effort to improve the quality and safety of RO resection [1,2].

Yet, few studies have assessed the overall incidence and outcomes of intraoperative vascular consultations [1]. Furthermore, the importance of intraoperative vascular consultations during non-vascular surgery is understated. As a

result, the procedures performed by vascular surgeons are not fairly compensated by insurance.

This study sought to evaluate the current state of intraoperative consultations for non-vascular surgery at a single tertiary center. We further sought to emphasize the role of the vascular surgeon as a provider about intraoperative vascular consultations in support of other surgical services and their patients.

## MATERIALS AND METHODS

We retrospectively analyzed vascular surgery consultations during non-vascular surgery from January 2014 to December 2015 at Inha University Hospital. Vascular consultations were resolved by 2 vascular surgeons.

We examined demographic data (sex, age, co-morbidity, and cause of main surgery), consultation details (cause of consultation, location of consultation, consulting department), and clinical results (blood loss, mortality, hospital days and intensive care unit [ICU] stay days) by reviewing electronic medical records.

The types of consultation were divided by surgical approach, bleeding, dissection from the vessel, or arterial occlusion. The types of vascular surgery were divided by retroperitoneal approach (Fig. 1A), embolization (Fig. 1B), primary closure or ligation (Fig. 1C), thrombectomy, bypass or interposition (Fig. 1D), or end-to-end anastomosis.

## RESULTS

From January 2014 to December 2015, vascular surgeons resolved 40 intraoperative consultations (29 male [72.5%]; mean age,  $58.6 \pm 10.9$  years) during non-vascular surgery.

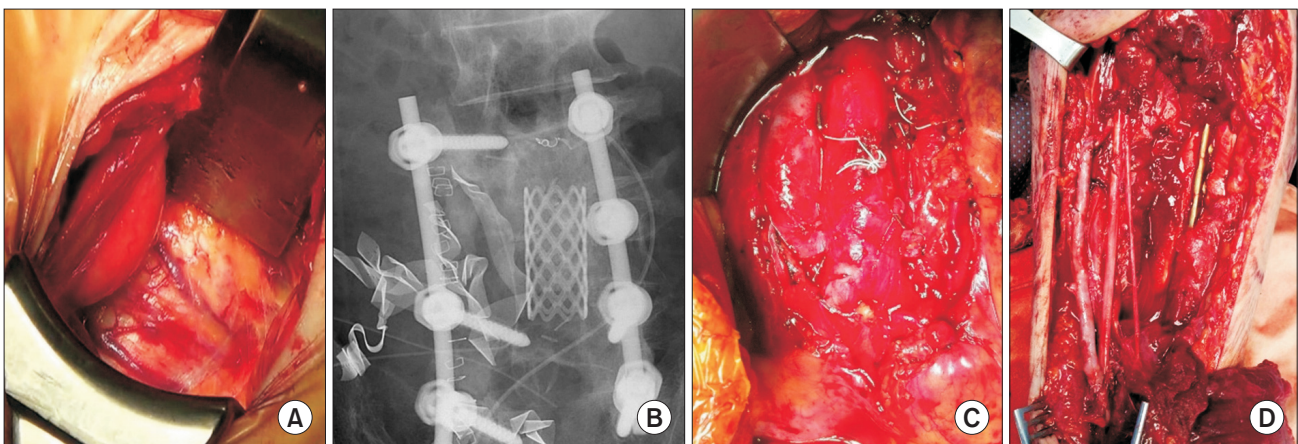
There were 27 patients (67.5%) with hypertension, 19 patients (47.5%) with diabetes mellitus, 19 patients (47.5%) with hyperlipidemia, 13 patients (32.5%) who smoked, 6 patients (15.0%) with coronary artery disease, and 6 patients (15.0%) with cerebrovascular disease. Among the patients, 26 patients (65.0%) were being treated for cancer and 8 patients (20.0%) were being treated for trauma (Table 1).

The causes of consult were bleeding ( $n=14$ , 35.0%), dissection from a vessel ( $n=13$ , 32.5%), arterial occlusion ( $n=10$ , 25.0%), and retroperitoneal approach ( $n=3$ , 7.5%). The locations of surgery were lower extremity ( $n=10$ , 25.0%), kidney ( $n=8$ , 20.0%), spine ( $n=6$ , 15.0%), pelvis ( $n=6$ , 15.0%), head and neck ( $n=4$ , 10.0%), abdomen ( $n=4$ , 10.0%), and upper extremity ( $n=2$ , 5.0%). The consulting departments were orthopedic surgery ( $n=16$ , 40.0%), urology ( $n=8$ , 20.0%), gastrointestinal oncologic department of surgery ( $n=5$ ,

**Table 1.** Patients co-morbidity and cause of surgery

Variable	Consult (n=40)
Co-morbidity	
Coronary artery disease	6 (15.0)
Diabetes mellitus	19 (47.5)
Cerebrovascular disease	6 (15.0)
Hypertension	27 (67.5)
Hyperlipidemia	19 (47.5)
Smoking	13 (32.5)
Cause of main surgery	
Cancer	26 (65.0)
Trauma	8 (20.0)
Other	6 (15.0)

Values are presented as number (%).



**Fig. 1.** This pictures show example of vascular consultation during non-vascular surgery. (A) Retroperitoneal approach for spinal fusion. (B) Embolization of lumbar artery bleeding during spine chordoma removal. (C) Primary closure of aorta injury during nephrectomy. (D) Brachial artery interposition during humerus open internal fixation.

12.5%), head and neck surgery (n=4, 10.0%), neurosurgery (n=4, 10.0%), and obstetrics and gynecology (n=3, 7.5%). In 18 cases (45.0%), intraoperative vascular consultations were done on emergency basis. Of the 40 patients, 17 patients (42.5%) required primary closure or ligation, 12 patients (30.0%) required end-to-end vessel anastomosis formation, 10 patients (25.0%) underwent bypass or interposition, 4 patients (10.0%) underwent thrombectomy, 3 patients (7.5%) required the retroperitoneal approach, and 2 patients (5.0%) required embolization (Table 2).

The mean time of intervention was  $74.1 \pm 0.9$  minutes. The mean total blood loss was  $500.2 \pm 780.3$  mL. The mean length of hospital stay was  $14.2 \pm 42.2$  days. Postoperative

care was delivered in the ICU for 13 patients (32.5%) and the mean ICU stay was  $2.7 \pm 3.8$  days. Among all patients, 3 patients (7.5%) died due to disseminated intravascular coagulation (n=2) or myocardial infarct (n=1).

## DISCUSSION

It has been previously documented that vascular surgeons perform relevant techniques in emergencies to control hemorrhage. In addition, their expertise in dissections around major arteries and veins and in reconstructions of major vessels can improve the likelihood of success of R0 resection in cancer surgery, using such vascular reconstruction techniques [1,2].

This study provides quantitative data vascular surgical involvement in non-vascular surgeries. Previous studies have not reported the incidence of vascular injury that required treatment during non-vascular surgeries [1]. However, in this study, the incidence of intraoperative vascular consultation was estimated to be approximately 0.3%. The actual overall incidence of vessel injury during non-vascular surgery maybe is higher than our study.

Despite the low incidence, our data demonstrate that the need for intraoperative vascular surgical expertise in support of other surgeons is urgent and unpredictable. Furthermore, the in-hospital mortality rate in patients who received an intraoperative vascular surgery consultation was high (7.5%). Other studies reported that the mortality rate during initial hospitalization was 6.2% to 9.2% [1,3,4]. Therefore, a vascular surgeon's specialized technique and ability to make prompt decisions are needed.

Primary closure or ligation was the most common intervention in this study, with bleeding (35.0%) and dissection from vessels (32.5%) being the more common causes of consultation. Conversely, other studies reported that the most common cause of consultation was vascular reconstruction. Because the history of vascular surgery in Korea is shorter than that in Western society, intraoperative consultation of vascular surgery has based on recanalization of vessel rather than reconstruction. Need of reconstruction, such as bypass or interposition, will increase like other studies [1,4,5].

Additionally, endovascular intervention, such as embolization, will increase for vascular intraoperative consult because surgical procedure becomes more complex and endovascular procedure progresses.

The principal limitation of this study is that this was a retrospective review. Furthermore, our analysis was based on data from a single tertiary referral center and in a short period. Despite these limitations, the data indicate that vascular surgeons support non-vascular surgeons in the op-

**Table 2.** Details of vascular consultation

Variable	Consult (n=40)
Cause of consult	
Bleeding	14 (35.0)
Dissection from vessel	13 (32.5)
Arterial occlusion	10 (25.0)
Retroperitoneal approach	3 (7.5)
Location of surgery	
Lower extremity	10 (25.0)
Kidney	8 (20.0)
Spine	6 (15.0)
Pelvis	6 (15.0)
Head and neck	4 (10.0)
Abdomen	4 (10.0)
Upper extremity	2 (5.0)
Department of consult	
Orthopedic surgery	16 (40.0)
Urology	8 (20.0)
GI oncologic department of surgery	5 (12.5)
Head and neck surgery	4 (10.0)
Neurosurgery	4 (10.0)
Obstetrics and gynecology	3 (7.5)
Timing of consultation	
Emergent	18 (45.0)
Elective	22 (55.0)
Type of intervention	
Primary closure or ligation	17 (42.5)
End to end anastomosis	12 (30.0)
Bypass or interposition	10 (25.0)
Thrombectomy	4 (10.0)
Retroperitoneal approach	3 (7.5)
Embolization	2 (5.0)

Values are presented as number (%).

GI, gastrointestinal.

erating room for the care of their patients, and contribute to the safety and success of surgical process under various situations. Vascular surgeons will be consistently required to assist in various open vascular and endovascular surgical techniques for intraoperative vascular consultations.

In conclusion, intraoperative vascular consultations during non-vascular surgery occurred in approximately 0.3% of non-vascular surgeries. The location, type of surgery, and timing of consultation were variable. Therefore, vas-

cular surgeons will improve not only the knowledge of the vascular anatomy but also surgical technique and then could aid other surgeons in making prompt decisions in urgent situations.

## ACKNOWLEDGEMENTS

This work was supported by Inha University research grant.

## REFERENCES

- 1) 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;62:177-182.
- 2) Yoo TK, Min SK, Ahn S, Kim SY, Min SI, Park YJ, et al. Major vascular injury during nonvascular surgeries. *Ann Vasc Surg* 2012;26:825-832.
- 3) Oderich GS, Panneton JM, Hofer J, Bower TC, Cherry KJ Jr, Sullivan T, et al. Iatrogenic operative injuries of abdominal and pelvic veins: a potentially lethal complication. *J Vasc Surg* 2004; 39:931-936.
- 4) Giswold ME, Landry GJ, Taylor LM, Moneta GL. Iatrogenic arterial injury is an increasingly important cause of arterial trauma. *Am J Surg* 2004; 187:590-592; discussion 593.
- 5) Manzur MF, Ham SW, Elsayed RS, Simcox T, Weaver FA. Vascular surgery: an essential hospital resource in modern health care. *J Vasc Surg* 2016; 64:543.