



**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCE, DEPARTMENT OF**

**ORTHOPEDICS & TRAUMA SURGERY**

SELF-ASSESSMENT OF ORTHOPEDIC AND TRAUMA SURGEON'S  
ATTITUDE, SKILLS AND PRACTICE TOWARDS EXTREMITY VASCULAR  
INJURY MANAGEMENT IN ETHIOPIA: A NATIONAL SURVEY (2024)

**BY: MEHARIW ZENA, MD**

A thesis to be submitted to the Department of Orthopedics and Traumatology, School of Post Graduate Studies, College of Health Sciences, Addis Ababa University in partial fulfillment of the requirements for a specialty certificate in Orthopedics and Trauma Surgery

**Addis Ababa, Ethiopia**

**October, 2024**

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**ADDIS ABABA, ETHIOPIA**

**OCTOBER, 2024**

## **ADVISOR'S APPROVAL SHEET**

This is to certify that the thesis entitled “Self-assessment of Orthopedic and Trauma Surgeon’s Attitude, skill and Practice Towards Extremity Vascular Injury Management in Ethiopia: A National Survey (2024) is submitted in partial fulfillment of the requirements for the Specialization Certificate in Orthopedic surgery to the department of orthopedic surgery and Traumatology, Addis Ababa University college of health science and has been carried out by Mehariw Zena under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence hereby can submit the Thesis to the Department.

\_\_\_\_\_ Bezawit, MD \_\_\_\_\_

**Name of Major Advisor**

\_\_\_\_\_ **Signature**

\_\_\_\_\_ **Date**

## **Acknowledgment**

First, I would like to thank Addis Ababa University, department of Orthopedic and Trauma Surgery for giving me this golden opportunity to practice research, especially Professor Biruk who encourages and monitors our progress regularly. Secondly, my gratitude goes to my adviser Dr. Bezawit Teferi who had given me a good deal of her time and skills in providing me with guidance and advice to do this thesis. Dr. Gedefaw who had given me a good deal of his time and skills in providing me with guidance and advice on biostatic calculation and interpretation as well as his reconstructive comments about this research.

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## Abbreviation/Acronyms

AAU-Addis Ababa University

SPMMC-St. Paul Millenium Medical College

BDU-Bahirdar University

TASH – Tikur Anbessa Specialized Hospital

UOG-University of Gondar

AAU-Addis Abeba University

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## ABSTRACT

**INTRODUCTION:** Traumatic vascular injuries of the extremities are a major challenge, especially in third-world countries. Orthopedic and trauma surgeons are usually consulted to evaluate and manage orthopedic-related vascular injuries. this study aims to assess orthopedic and trauma surgeons' attitudes, skills, and practice toward extremity vascular injury management in Ethiopia: A national survey.

**METHOD:** a nationwide cross-sectional survey study was conducted from June 1 to August 30, 2024, in Ethiopia, all over the country with self-administered questionnaires prepared with Google form. Data were analyzed using SPSS version 27, using descriptive statistics.

**RESULT:** In this study, according to 84 participant responses 45.2% cannot perform any vascular intervention, 23.8% can perform vascular procedures with help from a general surgeon and 18.6% can perform some basic vascular repair by themselves. Among those who try to treat by themselves, 14 (87 %) end-to-end anastomosis, 5 (31.2%) interposition grafting, and thrombectomy 2 (12.2 %) are skills that are identified. Ninety-nine percent of the participants strongly agree vascular training is necessary for orthopedic and trauma surgeons and 89.3% agreed it should be given during residency.

**CONCLUSION:** In this research, we found that most orthopedic and trauma surgeons' skills and practice toward orthopedic-related extremity vascular injury management were very low which is necessary for trauma patient care and their subsequent outcome. On the contrary, almost all participants had a strong attitude toward the necessity of those skills and practice.

**Keywords:** Trauma, Vascular injuries, Extremities, Developing countries

# 1. INTRODUCTION

## 1.1 Background

Vascular trauma of the extremities is a relatively rare injury but its burden is huge, especially in the developing world.(1) Especially those associated with orthopedic trauma are challenging for caregiving physicians as well as a common cause of morbidity and mortality of the patient.(2) Vascular trauma associated with disability leads to a socioeconomic burden for the country.(3) There are 5 types of vascular injury: intimal injury (flaps, disruptions, or subintimal/intramural hematomas), complete wall defects with pseudoaneurysms or hemorrhage, complete transections with hemorrhage or occlusion, arteriovenous fistulas, and spasm. (1,2(8)) Intimal defects and subintimal hematomas with possible secondary occlusion are most commonly associated with blunt trauma, while wall defects, complete transections, and arteriovenous fistulas usually occur with penetrating trauma.(4)

To the best of our knowledge, we didn't find prior research done in Ethiopia about common vascular injury types, their epidemiology, common mechanisms of injury, and the association between vascular injury and orthopedic trauma. However, vascular injury associated with orthopedic trauma may be relatively common from our observation in recent years. This may be attributed to the recent war and conflict outbreak.

Vascular surgeons are limited in number in Ethiopia. Tikur Anbessa Specialized Hospital is the sole government hospital in the country that has been providing vascular intervention up to recent years. Orthopedic-related vascular injury is associated with increased morbidity, disability, and even mortality due to the loss of golden hour to save limbs and the associated complications. This research aims to fill the gap by assessing the skills, practices, and attitudes of orthopedic and trauma surgeons about some basic vascular surgical skills, practices, and attitudes.

This research may also help measure improvement in patient care with extremity vascular trauma, and subsequent limb and life salvage outcomes after implementing this research finding in the future.

## 1.2. Statement of the Problem

Orthopedic surgeons are often called to evaluate and manage vascular injuries. However, there is limited data on their skills, practices, and attitudes towards orthopedic-related vascular injury management. This study aims to fill this gap by assessing orthopedic and trauma surgeon's skills, practices, and attitudes toward extremity vascular injury management. This study identified areas where orthopedic and trauma surgeons require additional training and support to provide optimal care for patients with extremity vascular injuries

Delays in the treatment of emergency patients may be determined by the skill of the orthopedic or trauma surgeon and a higher number of referrals may be observed inversely related to the skills. It is also important to note referrals to vascular centers cost money, and time and as a result lead to disability, and loss of life or limb.

In hospital setups of our country, where the availability of an adequate number of vascular surgeons is limited despite the high burden of patients with vascular injury particularly with the recent surge of vascular injury patients due to the outbreak of war and frequent conflicts shows there is a high mismatch between burden and availability of intervening team of surgeons from observation.

### 1.3. Significance of the Study

The significance of this research on self-assessment of skills, practice, and attitudes of orthopedic and trauma surgeons toward vascular injury management is that it can help to identify areas where surgeons may need additional training or support. This can lead to improved patient care and outcomes.

Vascular injuries are a serious problem, and they can be difficult to treat. Orthopedic and trauma surgeons are often called upon to manage these injuries, here and there so it is important for them to have the skills and practice necessary to do so. This research identifies gaps in orthopedics and trauma surgeons about basic vascular skills. This research is important in a developing country like ours with limited vascular surgeons. However, there is limited research on how orthopedic and trauma surgeons self-assess their skills and attitudes in this area.

This research could also help identify areas where surgeons' attitudes about vascular injury may be contributing to poor patient outcomes. Vascular injuries that are thought too difficult to treat by the surgeon, may have less likelihood of being attempted for treatment leading to delayed execution of alternative treatments or worse outcomes for patients.

## 2. LITERATURE REVIEW

Vascular trauma was described in the earliest era, but significant advancements in diagnosis and management have been achieved in the twentieth century. Improvements in diagnostic capabilities, resuscitation approaches, vascular techniques, and prosthetic device options have afforded considerable advancement in the care of these patients. (5)

In civilian extremity trauma vascular injury is uncommon: the incidence has been reported to be approximately 1.6% of all extremity trauma.(5) However, among hospitalized patients for extremity trauma, vascular injuries account for 3.8-6.5% (6) While anatomical location indicates knee joint trauma accounts for 54.5% of the presenting cases, followed by a calf at 14.5%, shoulder at 10.9%, upper arm at 9.1%, thigh at 7.3%, and elbow at 3.6(5). The vasculature in the lower extremity was involved more commonly as compared to the upper extremity, as the popliteal artery in 41.7 % and femoral artery in 27.4 % were top on the list. Associated bone injuries were found in 36.5 % of patients, 25.5 % had muscle/tendon injuries and 21.1 % had nerve injuries (1)

Vascular injury in orthopedic trauma is challenging since clinical signs initially can be subtle. Recognition and management should be a critical skill for every orthopedic and trauma surgeon. (2) There are hard and soft signs of vascular injuries, those hard signs highly ascertain the presence of vascular injuries. (1,2,4) Vascular patient evaluation should be side by side while resuscitating according to ATLS principles. Teamwork, familiarity with the often-subtle signs of vascular injuries, a high index of suspicion, effective communication, appropriate use of imaging modalities, sound knowledge of relevant techniques, and sequence of surgical repairs are among the essential factors that will lead to a successful outcome. (2) In addition to a thorough history and physical examination doppler ultrasound-aided ankle brachial index is highly sensitive to rule out vascular injury.(7)

Orthopedic injury-related vascular trauma blunt trauma, penetrating injury, blast injuries, and other mechanism. In the United States, the most common cause of extremity arterial trauma is penetrating trauma.(8) In countries where the availability of firearms is restricted, a larger proportion of extremity vascular injuries are caused by blunt trauma. Penetrating trauma can be

caused by gunshot wounds, stab wounds, lacerations, and iatrogenic injuries, and blunt trauma caused by road traffic accidents, falling from height, and other occupational hazard-related injuries.(8)

Vascular injury was there with human development and the common management principle was ligation and amputation but since the beginning of the 20th century, the standard management vascular operative techniques including repair of the lateral arterial wall, end-to-end anastomosis, and insertion of venous interposition grafts. Since then, the management of vascular trauma has evolved mainly through the contribution of armed conflicts. Vascular surgical skills and practice are more advanced due to the Vietnam War and the conflicts in Iraq and Afghanistan (2) with significant advances in the management of vascular injuries in trauma, including redefinition of the concept of damage control resuscitation, widespread early use of battlefield tourniquets, routine use of personal protective gear (body armor), frequent application of temporary vascular shunts.(9)

In one study done in Afghanistan with a sample constituting 90.2 % males and 9.8 % females with a mean age of  $43 \pm 7$  years; the presentation was found to be early (within 8 hours) in 79.2 % of patients. The mechanism of trauma was road traffic accidents (RTA) constituting slightly over half of the cases (53 %), gunshots/firearms (21 %), and bomb blasts (7 %) (1)

The study done by MetroHealth Hospital shows Patients repaired by vascular surgeons had more transfusions, longer arrival-to-operation time, surgery duration, and hospital stay but lower mortality (P, .05) compared to trauma surgeons.(10)

Up to our knowledge, no study has been done about orthopedic and trauma surgeon skills, practice, and attitude towards extremity vascular injury which are associated with orthopedic trauma management especially basic vascular surgical skills which are crucial for trauma patient care and outcome. So, this study plans to identify this gap and work on it.

### 3. OBJECTIVE

#### 3.1. General Objective

Self-assessment of orthopedic and trauma surgeon's attitude, skill, and practice toward extremity vascular injury management in Ethiopia

#### 3.2. Specific Objective

- To assess the adequacy of vascular trauma surgical care in Ethiopia.
- To determine factors associated with orthopedic and trauma surgeons' ability to provide basic vascular care.
- To assess the need for formal vascular surgery training for orthopedic and trauma surgeons.
- To determine orthopedic and trauma surgeon's attitudes toward extremity vascular surgery skills training.
- \_ To assess orthopedics and trauma surgeons' practice in extremity vascular injury management.
- To provide new insight for orthopedic and trauma surgeons to improve orthopedic-related vascular injury management.
- To assess what vascular skills are commonly used by orthopedic and trauma surgeons frequently.

### 4. METHODS AND MATERIALS

**4.1. Study design, area, and period:** A nationwide cross-sectional survey study was conducted from June 1 to August 30, 2024, in Ethiopia where orthopedic and trauma services were found. Ethiopia is one of the world's oldest countries in the world located in the Horn of Africa. It is the second-most populous country in Africa after Nigeria, with over 110 million inhabitants with a

wide range of ethnic groups, languages, and cultures. It is a developing country with a low Human Development Index. Health services do not provide to most of the population demand especially trauma and related conditions. There are a few centers where vascular intervention is given and most are located in the capital, Addis Ababa, The majority of the population has no access to appropriate trauma services.

The Ethiopian orthopedic service was started as a unit in 1962 when Dr. Tadesse Melka became the first orthopedic and trauma surgeon. Orthopedic surgery separated from general surgery and began operating independently as a department on September 25, 1987, at Addis Ababa University College of Health Sciences. To date, over 302 orthopedic and trauma surgeons have graduated, and there are currently more than 300 orthopedic surgeons practicing in the country.(11)

4.2 Sample size and sampling procedure: The required sample size of eligible participants for the study will be determined by using a single population proportion formula

$$n = \frac{\left( Z_{\alpha/2} \right)^2 p(1 - p)}{d^2}$$

Where: n = the desired sample size

P= 50%, estimated proportion I;

d =5% (maximum margin of error the researcher is willing to allow)

Z =1.96 (standard normal deviation value corresponding to 95% confidence level)

$$n = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} = 384$$

$$(0.05)^2$$

The total number of active orthopedic surgeons is around 250 all over Ethiopia. So, since this figure is below 10,000, used the following correction formula for the sample size determination:

$$S = n / (1 + n/N)$$

n = sample size for a population of size (384)

N = number of active orthopedic surgeons in Ethiopia at study time (250)

$$S = 384 / (1 + 384/250) = 150$$

S=151 adding 10 % (15) for the non-response rate, Therefore, the required sample size of this study is 151 +15 = 166.

**4.3. Source Population:** all orthopedic and trauma surgeons who resided all over the country during the study period

**4.4. study population:** those who were willing to participate in the study and practice in the country during the study period

**4.5. Inclusion criteria** -All orthopedic and trauma surgeons working in Ethiopia as surgeon

-All surgeons who are willing to participate

**4.6. Exclusion Criteria** -Retired orthopedic and trauma surgeons

-surgeons not willing to participate in the study

-those surgeons working out of the country currently

-foreign orthopedic and trauma surgeons practicing in Ethiopia

**4.7. Data Collection Instrument:** A structured self-administered questionnaire prepared on Google form was used to collect data from participants. It was prepared by the researcher from different literature and textbooks after validation from experts of orthopedic and trauma surgeons and vascular surgeon experts. It was presented in English and filled data in English version since the medium of instruction was English.

**4.8. Data Collection Methods:** The questionnaire was administered via Google form and sent to the participants with different social communication platforms like telegram, email, Facebook, etc. There are around 29 questionnaires consisting of multiple-choice questions that are focused on sociodemographics, attitudes, skills, and practice.

**4.9. Data Quality Control:** One week before data collection, the questionnaire was pre-tested on surgeons located at Tikur Anbessa Specialized Hospital on 5% of the final sample by the principal investigator; it was not included in the final data. This initial study was conducted to test the content applicability, clarity, and arrangement of the items needed for each questionnaire. After pre-testing, necessary adjustments were made accordingly.

**4.10 Data Processing and Analysis:** Data was checked, cleaned, and entered into SPSS version 27.0 software for analysis. Incomplete data was excluded and inconsistent data was cleaned. Descriptive statistical analysis including frequencies, mean, and standard deviation for continuous variables and percentages for categorical variables was conducted.

## 5. RESULT

### 5.1. Sociodemographic

Eighty-six orthopedic and trauma surgeons participated in this research who were below the calculated sample size, among those 78(90.7%) and 8(9.3%) were male and female respectively and their mean age was 34 +/-3.9 years

Among the participants, 71(82.6%) are general orthopedic and trauma surgeons, 6(7%) advanced trauma and arthroplasty, 4(4.7%) pediatric orthopedic surgeons, and 1(1.2%) sport and orthopedic oncology surgeon each. The majority are working in teaching hospitals 58 (67.8%) nonteaching specialty hospitals 16(18.6%) and General hospitals 7(8.1 %). Most are graduates from Addis Ababa University 65(75.6 %) and 13(15.1 %) from Bahir Dar University and St. Paul Millennium Medical College each. Most of the participants reside in Addis Ababa 30(34.9 %), Amhara regional state 22(25.6 %), and Oromia regional state 12(14 %) with the majority of the participants having 75(84.9 %) experience years in the workforce of 1 -5 years and 10(11.6%) of them having 6 to 10 years of job experience. (as depicted on the table.1)

Figure 1 sex distribution of participants

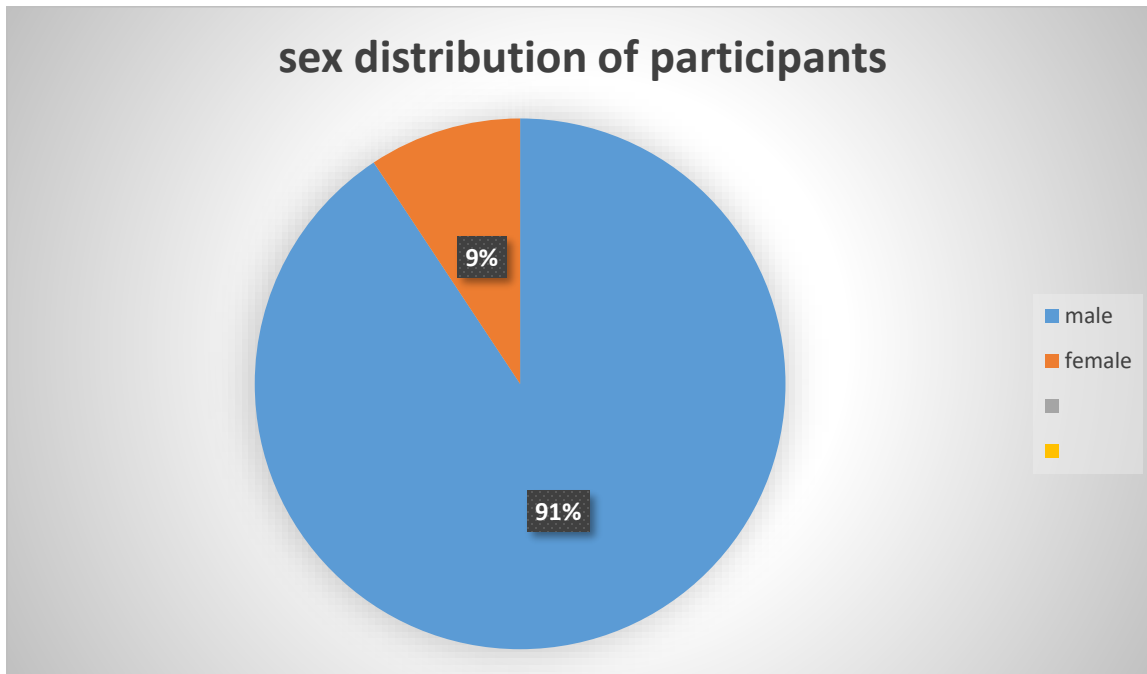


Figure 2.orthopedic surgeon distribution by region

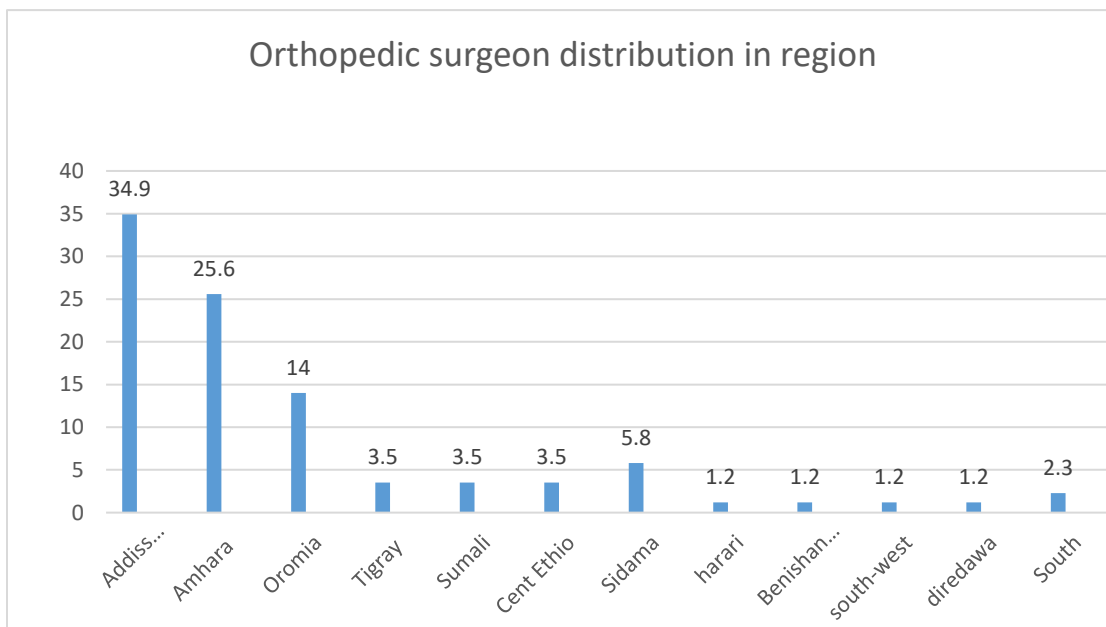


Table 1. Sociodemographic characteristics participant

		Frequency	Percentage
Educational level	General ortho surgeon	71	83.5
	Advanced trauma and arthroplasty	6	7.1
	Pediatric orthopedic surgeon	4	4.7
	Sport and arthroplasty	1	1.2
	Oncology and orthopedic surgeon	1	1.2
Experience in years	1-5	73	84.9
	6-10	10	11.6
	11-15	2	2.3
	16-20	1	1.2
	More than 20		
School of residency	AAU	52	60.5
	BDU	13	15.1
	UOG	2	2.3
	SPMMC	13	15.1
	Mekelle	3	3.5
	Other	3	3.5
Working hospital	Teaching	58	66.7
	Non-teaching	16	18.4
	General Hospital	7	8.0
	Private	5	5.7

## 5.2. skill and practice

In this study, we identified 57 (62.8 %) surgeons who worked in institutions where there was no vascular surgeon. To get vascular intervention it takes one to six hours of driving for 43.9 % and a majority of them work in areas that take more than six hours to drive which accounts for 56.1% of the participants. as shown in (fig. 3)

The most common mechanism of injury was penetrating trauma as reported by surgeon. which accounts for 65(76.5%) followed by the blast and blunt trauma which each account for 19(22.4%) and 18(21.2%) respectively (Fig.4). The most commonly injured blood vessel was the popliteal artery 59(70.5%), anterior tibial artery 39(46.4%), superficial femoral artery 34(40.5%), and posterior tibial artery 33(39.5%) among the lower extremity blood vessels. For the upper extremity, the most common were brachial artery 76(91.1%) and radial and ulnar artery 45(54.2%) and 30(36.1%) respectively (as shown in Table 2&3). Ninety-five percent of the participants have encountered vascular injury in their practice on average one to five cases per month among 69% of the participants. A common type of vascular injury was complete wall defect with bleeding at 51(62.2%), intimal injury at 26(31.7%), arterial thrombosis at 24(29.3%,) and complete wall defect with pseudoaneurysm at 19(23.2%) are among the common types. (Fig.4) Ninety-two percent of the participants confidently diagnose extremity vascular injury.

There is some form of advanced imaging modality in 81% percent of centers among them 82% have Doppler ultrasound, 49% have CT angiography and 12.8% have angiography. (Fig.8)

Among the participants in this research common action for this challenge is 32.6% consulting vascular surgeons, another 32.6% consulting general surgeon, 17.6% applying temporary shunting and referral to a vascular center, 16.5% immediate referral vascular center, and 18.6% trying to repair by themselves. (fig. 7)

Among those trying to treat by themselves, the procedures encountered were observed to be 14(87.5%) end-to-end anastomosis, 5(31.2 %) interposition grafting, and thrombectomy 2(12.5 %) (fig.6)

According to 84 participant responses, 45.2% cannot perform any vascular intervention, 23.8% can perform vascular procedures with help from a general surgeon and 16.7% can perform some basic vascular repair themselves. (Table. 4)

Based on 85 orthopedic and trauma surgeons' responses 44.7% had encountered intraoperative vascular injury mainly complete wall defect with bleeding 68.1% followed by intimal wall defect which 29.8% and for these 31.1% managed by intraoperative vascular surgeon consultation, 28.9 percent of them treat by themselves, 17.8% intraoperative general surgeon consultation, 11.1% ligation and another 11.1% temporary shunting and referral to a vascular center.

Figure. 3 nearby vascular intervention center

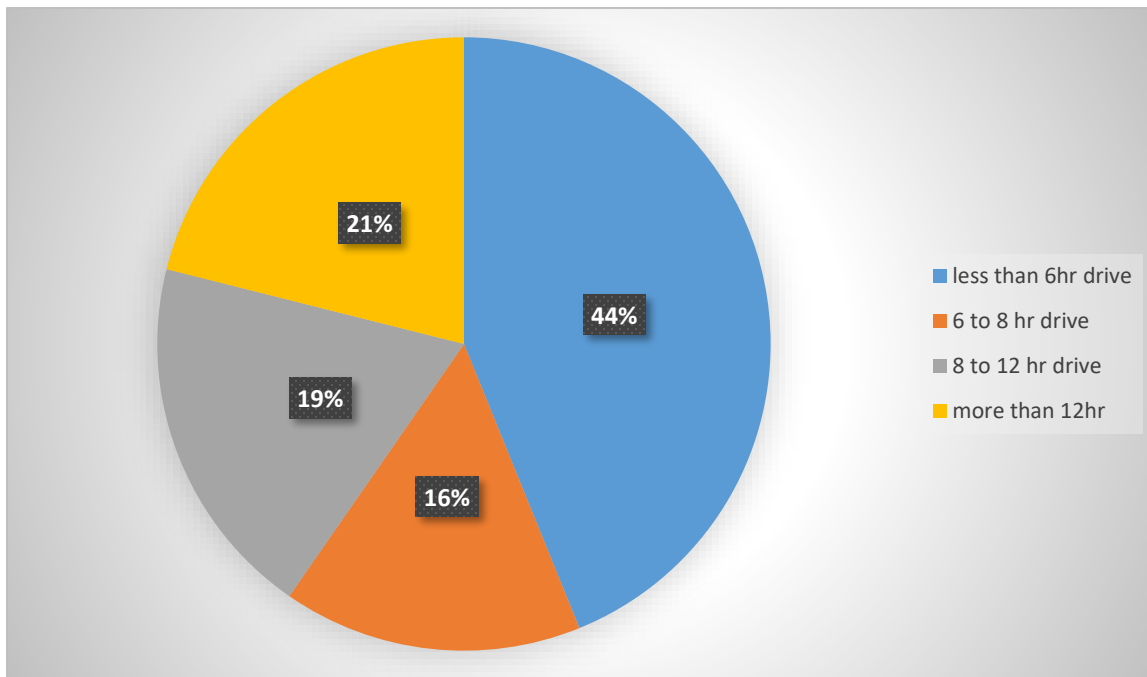


Table 2 Lower extremity vascular injury frequency

Lower extremity vascular injury	Frequency (%)
External iliac artery	2(2.4%)
Common femoral artery	11(13.1%)
Superficial femoral artery	34(40.5%)
Deep femoral artery	13(15.5%)
Popliteal artery	59(70.5%)
Anterior tibial artery	39(46.4%)
Posterior tibial artery	33(39.5%)
Superior gluteal artery	3(3.6%)
Tibioperonal trunk	6(7.1%)

Table 3.Upper extremity vascular injury

Upper extremity arterial injury	Frequency (%)
Axillary artery	11(13.3)
Brachial artery	76(91.1)
Radial artery	45(54.2)
Ulnar artery	30(36.1)

Figure 4 Types of vascular injuries

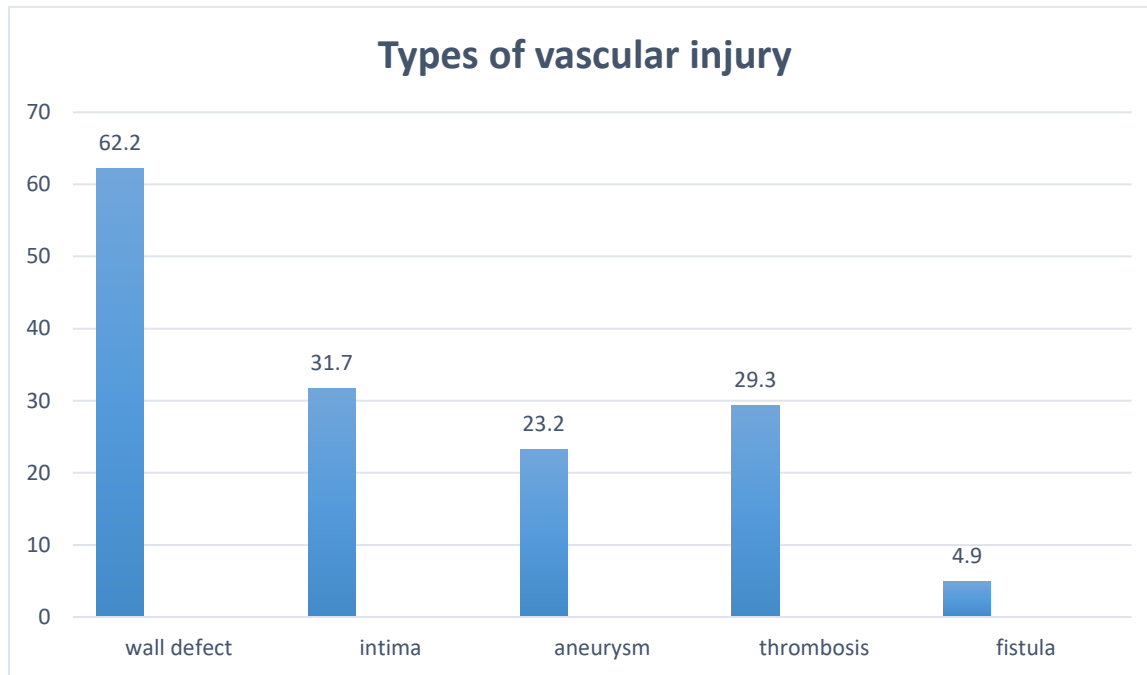


Table 4. vascular surgical practice for orthopedic surgeon

<i>Can you do vascular repair?</i>	<i>Frequency (%)</i>
<i>I can do it on my own</i>	16(18.6%)
<i>I can do this with the help of a general surgeon</i>	12(14.3%)
<i>I can do this with the help of a vascular surgeon</i>	20(23.8%)
<i>I can't do vascular repair</i>	38(45.2%)

Figure 5. common mechanism of injuries.

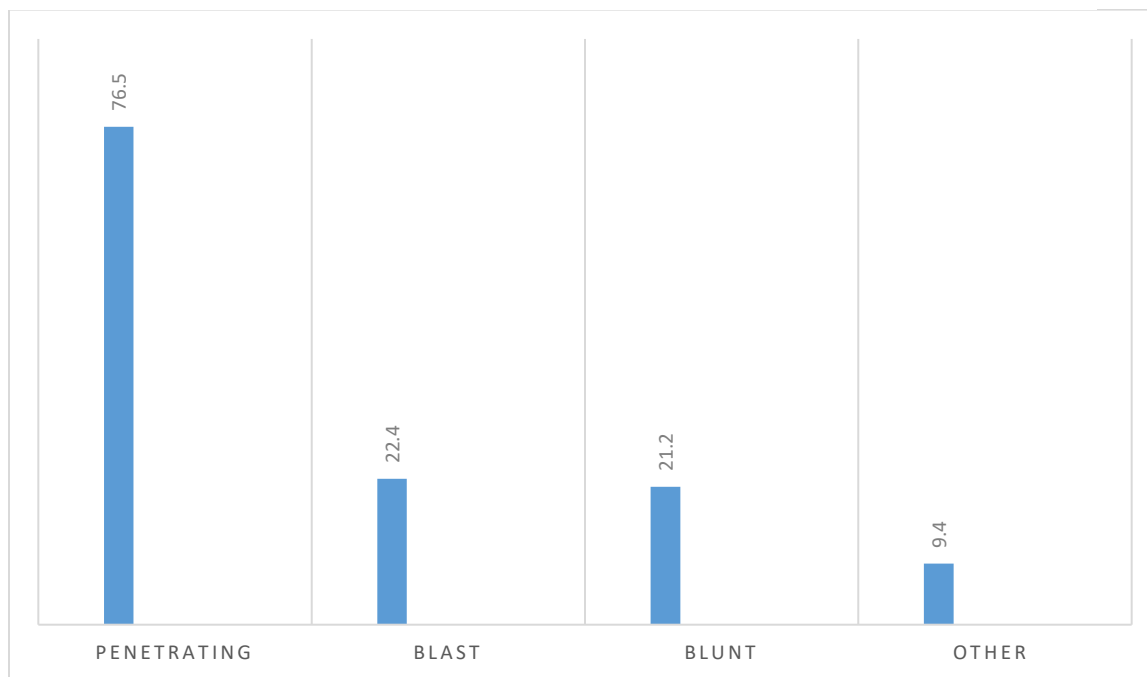


Figure 6 common vascular skills employed by participants

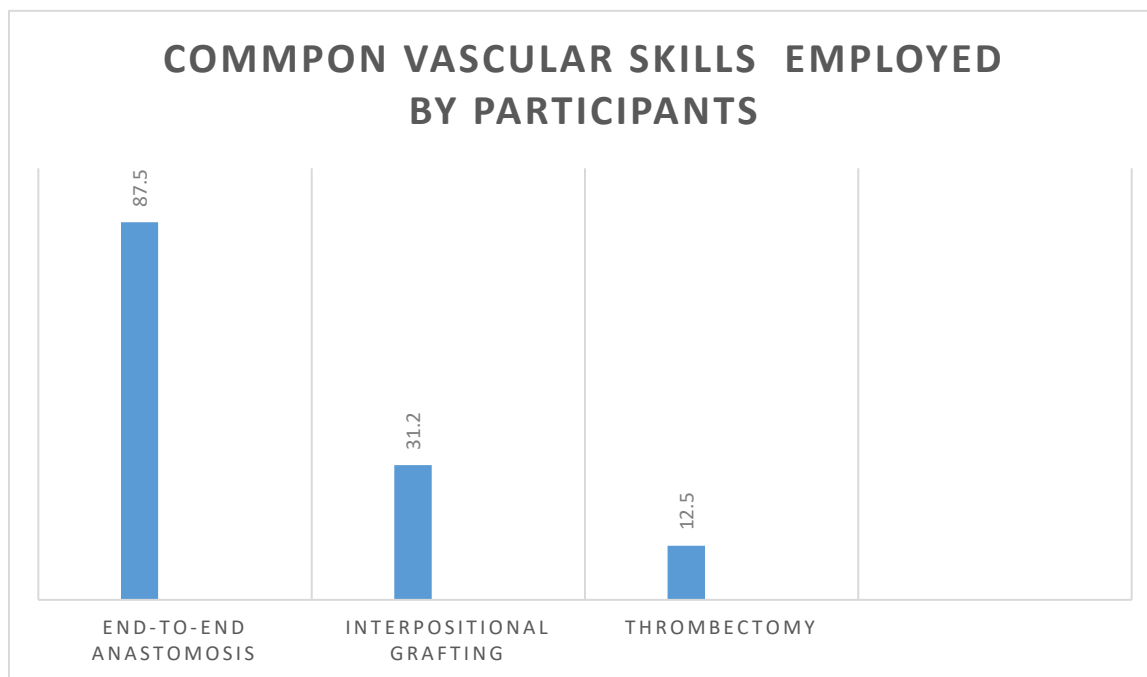


Figure 7 response to vascular injuries

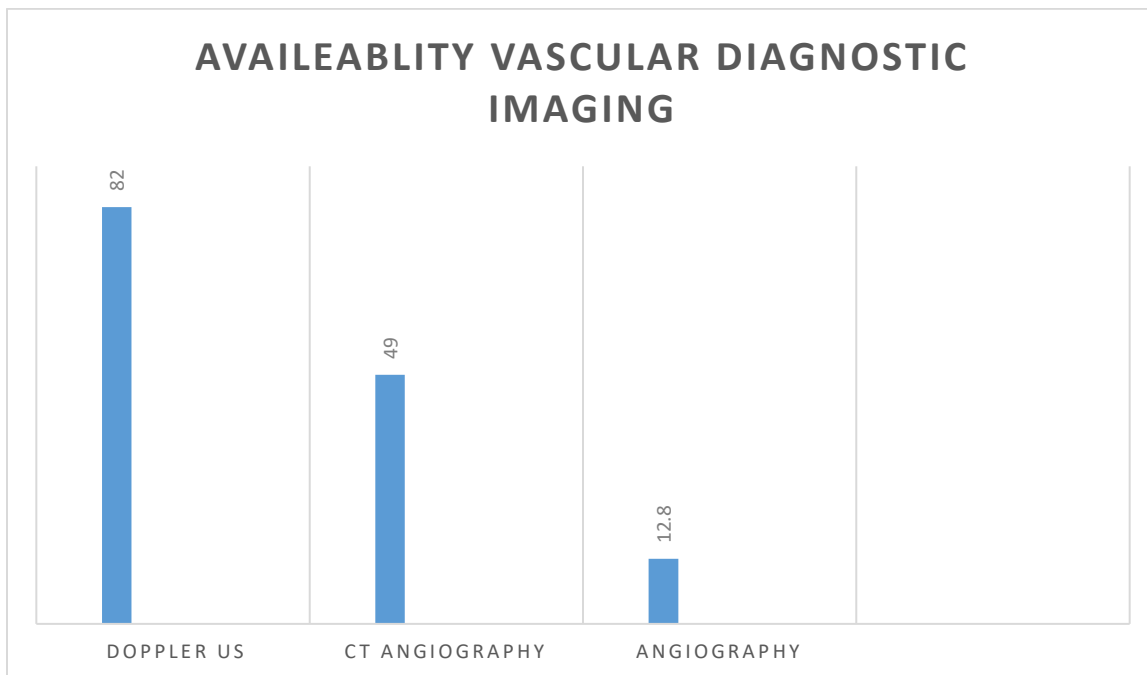
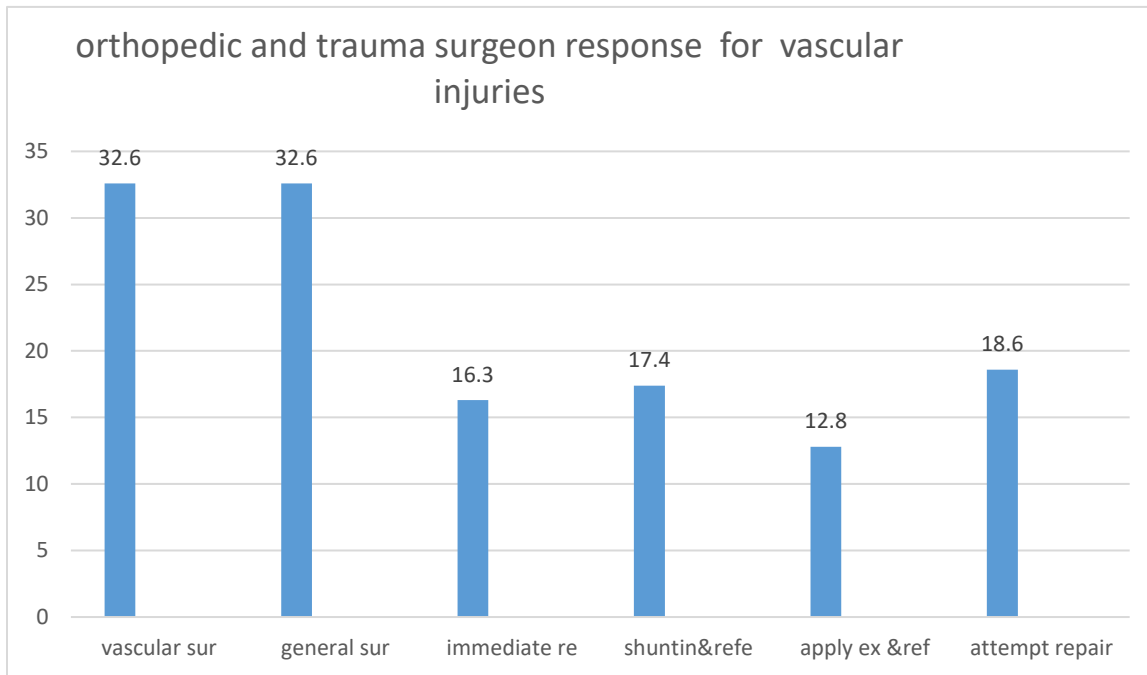


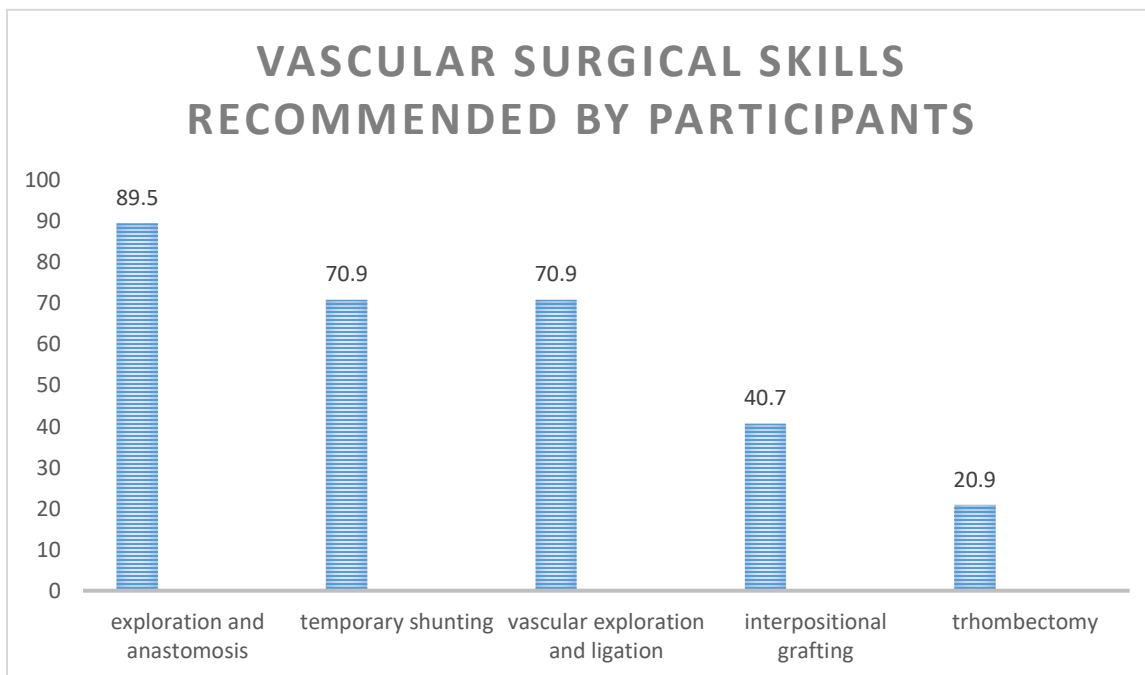
Figure 8 vascular imaging

### 5.3. Attitude

Seventy percent of participants have no formal basic vascular surgery skills in their residency program or as a surgeon but 30% have some training during residency.

Ninety-nine percent of the participants strongly recommend vascular training is necessary for orthopedic and trauma surgeons. They recommended it should be delivered during residency according to 89.3% of participants among which are 55.5% third year of residency and 39.2% fourth year of residency according to the majority of the participants. Most of the participants agreed on some basic vascular skills that should be included in the training 89.5% of participants recommended basic end-to-end anastomosis, 70.9% temporary shunting, and another 70.9% vascular exploration and ligation according to the participants' view. (fig .8)

Figure. 9 vascular surgical skills



## 6. DISCUSSIONS

Extremity vascular injury is one of the challenges that orthopedic and trauma surgeons face in daily practice. Especially in a third-world country like Ethiopia with depraved infrastructure and an inadequate number of vascular surgeons. (1,2,3)

This study reveals that 16(18.6%) of orthopedic and trauma surgeons have some basic vascular surgical skills. Among them, 87.5% can perform end-to-end vascular anastomosis, 31.2 % interpositional grafting, and 12.5% thrombectomy. This showed that most orthopedic and trauma surgeons have inadequate basic vascular surgical skills which may be necessary for this developing country which has a scarcity of vascular surgeons and is far from vascular centers with limited other infrastructures like road, ambulance, and other means of transportation furthermore vascular injury is common due to recent war and conflict outbreak from our observation from Tikur Anbesa specialized Hospital where most injured patient referred from all over the country.

Ninety-five percent of participants had encountered vascular injury in their practice. On average, one to five cases per month were attributed to vascular causes according to 69% of the participants. A common type of vascular injury was complete wall defect with bleeding at 51(62.2%), intimal injury at 26(31.7%), arterial thrombosis at 24(29.3%), and complete wall defect with pseudoaneurysm at 19(23.2%) were among the common types which were consistent to another research finding. (2,3)

According to participants, the most commonly injured blood vessel was the popliteal artery 59(70.5%), anterior tibial artery 39(46.4%), superficial femoral artery 34(40.5%), and posterior tibial artery 33(39.5%) among the lower extremity blood vessels. For the upper extremity, the most common were brachial artery 76(91.1%) and radial and ulnar artery 45(54.2%) and 30(36.1%) respectively. This finding depicts that the majority of the injured blood vessels are the most determinant for limb and life and subsequent disability.

According to this research common mechanism of injury was penetrating trauma which accounts for 76.5% followed by blast and blunt trauma which each account for 24.2% and 21.2% respectively in contrast to research done in Sri Lanka blunt trauma related to road traffic accidents

(1). This may be related to recent break out war, conflict, and social unrest in this country and it can be the most common cause of disability and loss of life in the engaging group from the researcher's view.

This research revealed that the most common practices of orthopedic and trauma surgeons were: 32.6% consult a vascular surgeon, another 32.6% consult a general surgeon, 17.6% apply temporary shunting and referral to a vascular center, 16.5% immediate referral vascular center without any intervention and 18.6% try to repair by themselves. Thus, this infers most vascular injured patient receives sub-optimal care which leads to loss of limb and life.

Ninety-nine percent of the participants strongly agreed vascular training is necessary for orthopedic and trauma surgeons. 89.3% agreed it should be given during residency programs like other orthopedic and trauma skills and the majority recommended it to be delivered during the third and fourth year of residency program. This signifies that orthopedic and trauma surgeons have a good attitude toward vascular surgical skills and practice to improve their patient care and outcomes in their post-trauma care. Most of the participants could diagnose vascular injuries related to orthopedic trauma but the common vascular imaging available was 82% Doppler US, 49% CT angiography, and 12% angiography which was necessary for definitive diagnosis. From this, we inferred that imaging and other necessary equipment scarcity.

The most commonly recommended skills from this study were: ninety percent of participants stating basic end-to-end anastomosis skills as a primary choice, 72.6% temporary shunting, and another 72.6% vascular exploration and ligation according to the participant's view. From this, we found that the majority of orthopedic and trauma surgeons are willing to improve their skills and practice toward vascular injured patients care especially for those associated with orthopedic trauma.

**Strength:** This is novel research and tries to identify the most common challenges that surgeons face in day-to-day practice and result in poor outcomes in patient care.

Tries to include surgeons all over the country who are licensed and working as orthopedic and trauma surgeons.

**Limitation:** This is a cross-sectional study conducted with a self-administered questionnaire and may be biased Research conducted with a relatively small number of participants which reduces the response rate.

## 7. CONCLUSION

In this research, we found that most orthopedic and trauma surgeons' skills and practice toward orthopedic-related extremity vascular injury management are very low which is necessary for trauma patient care and their subsequent outcome. This is necessary due to the limited number of vascular surgeons in third-world countries like Ethiopia and most sub-Saharan countries which have a large number of trauma due to road traffic accidents, war-related injury other trauma. In addition to this: infrastructure is also limited to transport from the trauma bay and another hospital to a specialized center which results from the loss of golden hour to save the life and limb and subsequent complications.

Most participants have a strong attitude toward vascular surgical skills and practice to incorporate into their day-to-day activity and to have subsequent training necessity about incorporation into the residency program.

## 8. RECOMMENDATION

**Orthopedic and Trauma Surgeons:** It is essential for orthopedic and trauma surgeons to acquire fundamental vascular surgical skills, particularly for managing patients with orthopedic trauma. In the absence of vascular surgeons, it becomes their responsibility to address vascular injuries as part of patient care. Surgeons should cultivate a compassionate approach towards injured patients, especially those facing both orthopedic and vascular trauma, as timely intervention is critical for positive outcomes.

**Ministry of Health and Hospitals:** The Ministry of Health and healthcare facilities should ensure the availability of vascular surgical equipment, diagnostic imaging, and other necessary resources. Additionally, they should raise awareness among stakeholders about orthopedic-related vascular injuries, their management, potential complications, and preventive measures. They should arrange training for junior orthopedic surgeons who work in remote areas without the availability of vascular surgeons.

**Universities and the Department of Orthopedics and Trauma Surgery:** Academic institutions and orthopedic departments should prioritize training in vascular surgical skills for their trainees. This includes education on diagnosis and management. Fostering a proactive attitude towards these issues, incorporating them into their training curriculum, and providing hands-on experience for junior surgeons.

As a benchmark for future studies about epidemiology, outcome, a common mechanism of injuries, and subsequent improvement in orthopedic-related vascular injuries.

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## 10. ANNEX

### 10.1. participants' information sheet and informed consent

I am Dr. Mehariw Zena, who is conducting this research for the partial fulfillment of my specialty in orthopedics and trauma surgery at AAU. We are trying to assess the attitude, skill, and practice of orthopedic and trauma surgeons in Ethiopia towards extremity vascular injury management. You will participate if you give me consent after you have understood the following information sheet:

**Purpose:** The purpose of this study is to assess orthopedic and trauma surgeons' attitudes, skills, and practice on extremity vascular injury.

**Procedure:** To assess the attitude, skill, and practice of orthopedic and trauma surgeons towards extremity vascular injury in Ethiopia. If you are willing to participate in this project, you need to understand and say "yes" on the agreement form.

**Risk/ Discomfort:** By participating in this research project, there are no payments and risks or discomfort you should fear as a result of participating in this study except, that you may feel that it has some discomfort, especially on spending time about 10 minutes. We hope you will participate in the study for the sake of the Benefit of the research result. I am sure there is no risk in participating in this research project.

**Benefits:** There may not be a direct benefit to you but your Participation is likely to help us in the assessment of attitude, skill, and practice of orthopedics and trauma surgeons towards extremity vascular injury in Ethiopia ultimately.

**Confidentiality:** The information collected from this research project will be kept confidential and information about you that will be collected by this study will be stored in a file, without your name. In addition, it will not be revealed to anyone except the principal investigator and will be kept locked with a key.

Right to refuse or withdraw: You have full right to refuse to participate in this research. You can choose not to respond to some or all questions if you do not want to give your response.

If you have questions: If you have additional questions regarding this study, you can contact the principal investigator.

Address of the principal investigator

NAME: Dr.Mehariw Zena

Email: mehariwzena4@gmail.com

PHONE: +251927631153

I understand all the conditions stated above. I have understood that Participation in this study is entirely voluntary. I have been told that my answers to the questions will not be given to anyone else and no reports of this study ever identify me in any way. Therefore, I am Ready and willing to participate in this study. You decided:

1. Agree to participate [  ] \_\_\_\_\_ continue
2. Not agreeing to participate (stop here); thank you very much!

## 11. QUESTIONNAIRE

1. Sex

B. Female

A. Male

Other:

2. Age (In completed years) \_\_\_\_\_

Your answer

3. Highest label of your current educational status:

A. General orthopedic surgeon

B. Advanced trauma and arthroplasty surgeon

- C. Sport and arthroscopy
- D. Pediatric orthopedic surgeon
- E. Upper extremity and hand surgeon
- F. Ankle and foot surgeon
- G. Orthopedic tumor and reconstruction surgeon
- H. Other (Specify) \_\_\_\_\_

4. How many years have you worked as an orthopedic surgeon after completing your residency?

- A, 1-5 years,
- B, 6-10 years
- C, 11-15 years
- E,16-20 years
- F. More than 20 years[U2]

5. Where did you complete your residency?

- A, AAU
- B, St. Paul MMC
- C, Bahir Dar University
- D, Hawassa University
- E, University of Gondar
- F, Jimma University
- G, Adama University
- H, Haromia University
- I, Wachamo University
- J, Soddo Christian Hospital
- k. Mekelle university
- L. Other (Specify)

6-What kind of hospital are you working at currently?

- A. Teaching hospital
- B. General hospital
- C. non-teaching specialized comprehensive hospital
- D. Primary hospital
- E. Private orthopedic centers
- F. Other (Specify)\_\_\_\_\_

7. In which region your current institution is located?

- A, Tigray
- B, Afar
- C, Amhara
- D, Oromia

- E. Somali
- F, Dire Dawa
- G, Addis Ababa
- H, Benishangul Gumuz
- I, Sidama
- J, Central Ethiopia
- K, Southwest Ethiopia
- L, Harari
- M. South Ethiopia

8-Is there a trained vascular surgeon at your hospital?

- A, yes
- B, no

9-If your response is “no” how far is the nearest referral center where a vascular surgeon is available (just give an approximate picture)?

- A less than 6 hrs. drive
- B, 6-8 hrs. drive
- C, 8-12 hrs. drive
- D, more than 12 hrs. drive

### **Section 2-Skill, Attitude, and Practice Pertaining questions**

10. Have you ever received basic vascular surgical skill training?

- A, yes
- B, no

11. If your response is “yes” when during your orthopedic practice did you take it?

- A. during residency
- B. After completing residency

12. Do you routinely evaluate patients with extremity vascular injuries

- A. yes
- B. No

13. on average, how many patients with vascular injury do you evaluate per Month?

- A. None
- B. 1 to 5
- C. 5 to 10
- D. More than 10

14. What are the most common patterns of vascular injury you encounter, choose all that apply

- A intimal injury (flaps, disruption, sub intimal or sub mural hematoma)
- B, complete wall defect with pseudoaneurysm
- C, complete wall defect with acute bleeding
- D, arteriovenous fistula
- E, arterial contusion with thrombosis
- F, others
- Others -----

15. in your practice, what are the commonest anatomical sites for traumatic vascular injuries? Choose all that apply.

**Lower extremity**

- A external iliac artery
- B, Superior gluteal artery
- C, inferior gluteal artery
- D, common femoral artery
- E, superficial femoral artery
- F, deep femoral artery
- G, popliteal artery
- H, anterior tibial artery
- I, posterior tibial artery
- J, tibioperonal trunk

**Upper extremity**

- A Subclavian vessels
- B, axillary artery
- C, brachial artery
- D, radial artery
- E, ulnar artery

16. What is the commonest cause of vascular injury you see in your daily practice (multiple selection is possible)?

- A. Penetrating injuries
- B. Blunt trauma
- C. Blast injuries
- D. Other (Specify) \_\_\_\_\_

17. Do you think you can confidently diagnose extremity vascular injuries?

- A, yes
- B, no

18. Is advanced vascular imaging accessible at your working institution?

- A, yes
- B, no

19. If your response is "yes", choose all that apply

- A, doppler sonography
- B. angiography
- CT angiography
- D. MR angiography

20. What treatment measures do you take in your institution when you encounter patients with vascular injury? Choose all that apply

- A. An immediate referral to a vascular center
- B, apply ex-fix and referral.
- C. Apply temporary shunting and refer
- D, ligation for bleeding control
- E, vascular surgeon consultation within the institution
- F. General surgeon consultation within the institution
- G, vascular surgeon consultation from a nearby institution
- H, Attempt treatment by myself
- Other:

**21. If your choice is (H) what was the method**

- A end-to-end anastomosis
- B, Interpositional grafting
- C, thrombectomy
- Other:

22. do you think you can perform basic vascular procedures confidently?

- A, yes I can confidently do vascular procedures without help
- B. yes I can confidently do vascular procedures with assistance from a general surgeon
- C. I can confidently do vascular procedures with assistance from a vascular surgeon
- D. I cannot perform vascular procedures

23. If your response is "yes" which one among the following

- A temporary shunting
- B, vascular exploration and ligation

C, basic end to end anastomosis  
D, interposition grafting  
E, thrombectomy  
Other:

24.-Do you think formal vascular surgery training is necessary for orthopedic and trauma surgeons

A, yes  
B, no

-If your response is “yes” when should it be delivered?

A, during residency  
B, as separate training after graduation

-If your response is “A” which year of residence is the curricular module it should be included?

A, year one  
B, year two  
c, year three  
D, year four E. year five [U2]

25-What basic vascular surgical skills do you think should be expected from orthopedic and trauma surgeons? choose all that apply

A temporary shunting  
B, vascular exploration and ligation  
C, basic end to end anastomosis  
D, interposition grafting  
E, thrombectomy[U3]

26, Have you ever encountered intraoperative iatrogenic vascular injury during orthopedic procedures?

A, yes  
B, no

27, What severity of Injury of the vascular anatomy

A, intimal injury( flaps, disruption,sub intimal or sub mural hematoma)  
B, complete wall defect with pseudoaneurysm  
C, complete wall defect with hemorrhage  
D, arteriovenous fistula

E, arterial contusion with thrombosis  
F, others[U4]

28, What measure did you take?

- A, apply temporary shunting and referral.
- B, intra-op consultation with a general surgeon
- D.intra-op consultation with a vascular surgeon
- C, ligation for bleeding control
- D, Attempted Primary surgical treatment by myself

29, If your choice is (D) what was the method of treatment used

- A end-to-end anastomosis
- B, Interpositional grafting
- C, thrombectomy
- D, other (specify).....