

# Evaluation of Non-Fatal Forensic Vascular Injuries

Ölümlle Sonuçlanmayan Adli Nitelikli Damar Yaralanmalarının Değerlendirilmesi

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## Abstract

In the forensic report, whether the injury includes "vascular injury" or not, the life-threatening situation is important for the investigation. In this study, it was aimed to evaluate the vascular injury status and share the data with the literature in cases related to forensic traumatology, which were reflected in the Forensic Medicine Department of Eskisehir Osmangazi University Faculty of Medicine. In the 5-year period between 2015 and 2019, the cases with vascular injury, who applied to the Eskisehir Osmangazi University Faculty of Medicine, Department of Forensic Medicine, were retrospectively analyzed. Report contents and demographic data of the cases were evaluated. It was determined that 52 (1.2%) of 4378 forensic cases evaluated within the scope of the study had vascular injury. 90.3% of the patients with vascular injury were male, they were most frequently in the 19-29 age group, 69.3% of the cases were stab wounds, and the most commonly injured vessel was a.femoralis and its branches (n=11, %21.2). The data obtained in the study were found to be compatible with the literature. It was thought that in-service trainings on this subject were important, especially for emergency room doctors to be more attentive in issuing forensic reports, to take necessary measures to prevent them from being held responsible in cases of vascular injury and other forensic cases, to protect the legal rights of victims.

**Keywords:** Vascular injury; Forensic report; Forensic medicine

## Özet

Adli raporda, yaralanmanın "damar yaralanması" içerip içermemesine bağlı olarak hayati tehlikeye sebep olma durumu soruşturma açısından önem arz eder. Bu çalışmada, ESOGÜ Tıp Fakültesi Adli Tıp Anabilim Dalı'na yansıyan, adli travmatoloji ile ilgili olaylarda, damar yaralanması durumunun değerlendirilmesi ve verilerin literatürle paylaşılması amaçlandı. 2015 ile 2019 yılları arasındaki 5 yıllık dönemde, ESOGÜ Tıp Fakültesi Adli Tıp Anabilim Dalı'na başvuran olgulardan damar yaralanması olan olgular retrospektif olarak incelendi. Olguların rapor içerikleri ve demografik verileri değerlendirildi. Çalışma kapsamında değerlendirilen 4378 adli olgunun 52'sinde (%1,2) damar yaralanması olduğu belirlendi. Damar yaralanması olan olguların % 90,3'ünün erkek olduğu, en sık 19-29 yaş grubunda oldukları, olgulardan % 69,3'ünün kesici delici alet yaralanması şeklinde olduğu, en sık yaralanan damarın A.femoralis ve dalları (n=11, % 21,2) olduğu belirlendi. Çalışmada elde edilen veriler literatürle uyumlu bulundu. Özellikle acil servis hekimlerinin, adli rapor düzenleme konusunda daha özenli davranmaları damar yaralanması ve diğer adli nitelikli olgularda, sorumlu duruma düşmemeleri için gerekli tedbirlerin alınması, mağdurların hukuki haklarının korunması için ve bu konudaki hizmet içi eğitimlerin önemli olduğu düşünüldü.

**Anahtar Kelimeler:** Damar yaralanması; Adli rapor; Adli tıp

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## 1. Introduction

Forensic cases are basically defined as the injuries occurring due to an external factor. The physicians have also legal responsibilities as well as well-known duties such as examination of the patients, ordering tests, making diagnosis and administering treatment (1). Forensic cases are usually observed in the emergency services that are known as the gate of healthcare facilities and the first stage of forensic examination (2). These cases should be reported to the security chief officer, gendarmerie station or public prosecution office in the hospitals without police force, the forensic reports prepared for the cases should be delivered due to signature, besides, the cases reported by phone call also should be recorded (3).

The 1st sub-article of Turkish Penal Code Article No:87 has evaluated “Aggravated Injuries due to the consequence”. As known related with forensic medicine practices; preparation of the report necessitates urgency in the life-threatening cases.

The preparation of the forensic reports properly as earliest as possible constitutes the primary and the most important stage for providing the right to due to process timely and most accurately as one of the most fundamental rights of the human beings. Almost all physicians will experience the responsibility of preparing forensic report for few or many times depending on their duty places in any stage of their career. While the physicians are preparing these reports, meeting the criteria stated in the guideline created for guidance to be used in preparing a forensic report will substantially reduce the possible mistakes in these processes.

In the present study, it was aimed to evaluate the forensic reports prepared for the cases of vascular injury without causing death of a person and to create awareness by determining the forensic medical problems in the process. The cases of vascular injury that occurred in Eskişehir Province without causing death of a person will be analyzed and consequently injury reasons, injury sites, case types and demographic data will be shared in the literature.

## 2. Materials and Methods

The study included the cases with non-fatal vascular injuries from the patients who admitted to the Department of Forensic Medicine, Eskişehir Osmangazi University Medical Faculty in a period of 5 years between 2015 and 2019. The evaluation involved the cases that required final forensic report. The cases that required forensic psychiatric evaluations such as sexual crime cases, legal capacity and mental health, and determination of disablement degree were excluded from the study.

The study was carried out via retrospective analysis method in the Department of Forensic Medicine. The demographic data of the cases such as age and gender were reviewed. The season that the case occurred, case type, its origin, the fact whether surgical intervention was performed, hospitalization duration, injured vein and accompanying additional lesions were evaluated. The relationships between age and gender, and also gender and origin of the injury were statistically analyzed.

In our department, the forensic reports are usually prepared based on the documents. Therefore, some data could not be reached because of missing information in the medical documents presented to our institution. This situation is the limitation of the study.

Study data were evaluated by uploading to a statistical software package, Chi-square and percentage analyses were performed.

The study was carried out after obtaining approval from the Non-Invasive Clinical Research Ethics Committee of T.R. Eskişehir Osmangazi University due to the Decision Dated 22.10.2019 and Numbered 14.

## 3. Results

Fifty-two vascular injury cases that did not result in death were determined out of 4378 forensic traumatological cases that were evaluated for preparation of forensic report by our department in the 5-year duration of the study. The rate of vascular injury cases was

1.2% in all forensic traumatological cases in the 5-year period.

Of the cases; 47 (90.3%) were male and 5 (9.7%) were female. The youngest and the oldest ages of the cases were 16 and 58 years old, respectively, mean age was  $31.4 \pm 11.4$

years. The cases were most commonly in the age group of 19-29 years (n:22, 42.3%) (Table 1). Of the cases; 9.6% (n=5) were younger than 18 years old. No statistically significant difference was found between the cases regarding the distribution of age groups according to gender (Table 2,  $P > 0.05$ ).

**Table 1.** The distribution of the cases according to age groups

Age group	n	%
0-18	5	9,6
19-29	22	42,3
30-39	11	21,2
40-49	11	21,2
50-59	3	5,7
Total	52	100

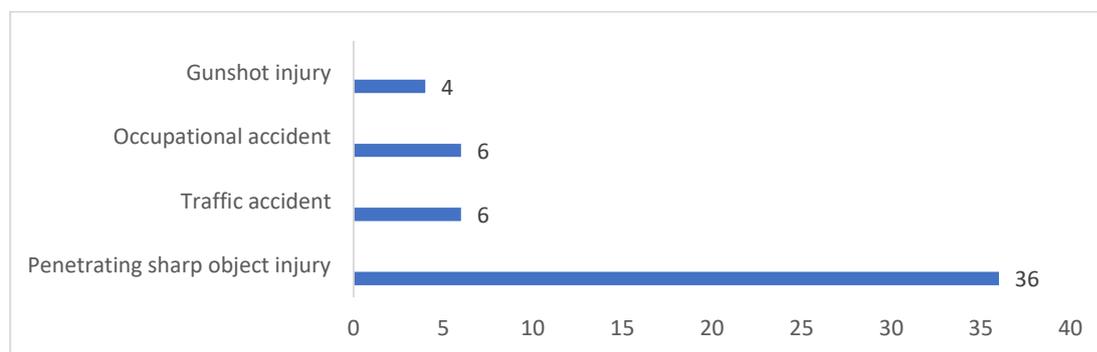
**Table 2.** The distribution of the genders of the cases according to age groups

Age group	Gender				Total	
	Male		Female		N	%
	n	%	n	%		
Below 18 years of age	4	8,5	1	20,0	5	9,6
Above 18 years of age	43	91,5	4	80,0	47	90,4
Total	47	100	5	100	52	100

Pearson  $\chi^2 = P > 0.05$

Injury types of the cases were presented in Graphic 1. The evaluation of injury occurrence types revealed that penetrating sharp object injury was the most common injury type (n=36, 69.3%). It was found that 4 (7.7%), 6 (11.5%) and 6 (11.5%) cases were injured because of gunshot, traffic accident and occupational accident, respectively. It was determined that totally 40 (77%) cases were gunshot and penetrating sharp object injuries which occurred due to battery and that the origin of the remaining 12 (23%) cases was accident. It was observed that all the traffic

accident injuries were blunt injuries while occupational injuries were blunt and crash-type injuries in 3 and 3 cases, respectively. Crush-type injuries occurred by crushing in the machine. Therefore, it was ascertained that 40 (76.9%), 9 (17.3%) and 3 (5.8%) of the cases were wounded by penetrating, blunt and crush-type injuries, respectively. The distribution of origins of injuries according to gender was presented in the Table 3. No statistically significant relationship was detected between the origin of injury and gender ( $P > 0.05$ ).



**Graphic 1.** The distribution of the cases according to injury types

**Table 3.** The distribution of the genders according to origins of injuries

Origin of injury	Gender				Total	
	Male		Female		n	%
	n	%	n	%		
Battery (Penetrating sharp object injury 36) (Gunshot injury 4)	36	76.6	4	80.0	5	76.9
Accident (Traffic accident 6) (Occupational accident 6)	11	23.4	1	20.0	47	23.1
<b>Total</b>	<b>47</b>	<b>100</b>	<b>5</b>	<b>100</b>	<b>52</b>	<b>100</b>

*Pearson  $\chi^2 = P > 0,05$*

Although, no significant difference was identified between the seasons, it was monitored that injuries occurred most frequently in the early spring and summer seasons (n=30, 57.7%). The distribution of the injured veins and body regions was presented in the Table 4. It was determined that 71 different veins were injured in 52

cases. It was detected that 1, 2 and 3 different veins were injured in 34, 8 and 7 cases, respectively. It was found that the most frequently injured vein was a. femoralis and its branches (n=11, 21.2%). Of the injured veins; 65.4% (n=34) and 63.5% (n=33) were located in the upper and lower limbs, respectively.

**Table 4.** The distribution of the body regions with vascular injury

<b>The distribution of the injured veins and body regions</b>	<b>N</b>	<b>%</b>
Head, neck		
A. Carotis Communis	2	3.8
V. Jugularis Externa	1	1.9
Chest		
Aort	1	1.9
Upper Limb		
A. Axillaris	3	5.8
V. Axillaris	3	5.8
A. Brachialis	1	1.9
V. Sefalica	2	3.8
A. Radialis	9	17.3
V. Radialis	1	1.9
A. Ulnaris	8	15.4
V. Ulnaris	1	1.9
A. Digitalis	5	9.6
Lower Limb		
A. Iliaca Externa	3	5.8
A. Femoralis and its branches	11	21.2
V. Femoralis and its branches	6	11.5
A. Poplitea and its branches	6	11.5
V. Politea and its branches	3	5.8
V. Tibialis Posterior	1	1.9
V. Tibialis Anterior	1	1.9
A. Peronealis	2	3.8
V. Peronealis	1	1.9
<b>Total</b>	<b>71</b>	

It was determined that all the cases were hospitalized for treatment and surgical intervention was performed for vascular repair in all the cases. The shortest and the longest durations of hospital stays were 1 and 21 days, respectively. It was identified that the cases were treated in the services of

Cardiovascular Surgery, Orthopaedics, Neurosurgery, General Surgery and Intensive Care Unit. It was encountered that the patients experienced a dynamic treatment process and were transferred between the departments when needed.

It was detected that vascular injury was accompanied by bone fracture in 10 (19.2%) cases and that 9 (17.3%) cases had amputation-type injuries including total and subtotal amputations in 5 and 4 cases, respectively. Visceral organ injury was detected in 5 (9.6%) cases.

When vascular injuries were evaluated as an isolated issue, it was determined that all the cases were life threatening and the injuries were too critical to be treated with a simple medical intervention.

#### 4. Discussion

The 87th Article of Turkish Penal Code which defines the crime of intentional injury and the 89th Article of TPC which defines the crimes of non-accidental injuries have emphasized that it should be clarified whether “danger to life” occurred (4). In forensic traumatology, the fact whether vascular injury occurred is a crucial situation that should be evaluated in practice. The vascular injuries causing danger to life have been listed in details in the guideline titled “The Evaluation of the Injury Crimes Defined in the Turkish Penal Code with respect to Forensic Medicine”(4).

Vascular injuries are the frequently seen cases in the practice of forensic medicine. It has been stated that vascular injury was present in 5.9% (n=365) in the forensic death cases that were performed autopsy in Izmir in the 3-year period between the years of 2010-2012 (5). It was detected that vascular injury was the death cause in 1.3% (n=37) of the cases that were performed autopsy in Eskişehir in the 10-year period between the years of 2003-2012 (6). It was reported that 0.9% of the cases that underwent autopsy in Bursa between the years of 1996-2006 died because of vascular injury (7). It has been considered that different mortality rates due to vascular injury sourced from the regional differences. It has been encountered in the present study that 1.2% (n=52) of the forensic traumatological cases referred to our department had vascular injuries.

It has been reported in the literature that vascular injuries were most frequently caused

by penetrating-sharp object injuries (5-10). It has been reported in a study which evaluated the vascular injuries in Sakarya that penetrating-sharp object injuries caused vascular injury in 47.5% of the cases (10). It has been noted in a study conducted in Bursa that 58.7% of the vascular injury cases developed due to penetrating-sharp object injuries (7). It has been determined in the present study consistently with the literature that 69.3% (n=36) of the cases had penetrating-sharp object injuries. It has been ascertained that 4 (7.7%) cases had gunshot injury while 6 (11.5%) and 6 (11.5%) cases were injured because traffic and occupational accidents, respectively. It was monitored that totally 40 (77%) cases of gunshot and penetrating-sharp object injuries occurred as a result of battery while origin of injury was accident in the remaining 12 (23%) cases.

It has been reported in the studies related with vascular injuries that cases were mostly male like other our forensic injuries (5-11). It has been stated in a study conducted in Thailand that 81% of the cases with vascular injury were male (11). It is encountered that 90.5% of the cases were male in the study carried out in Bursa by Bilgen et al. (7) while the rate of male cases was 83.5% performed by Altundağ et al. in İzmir (5). It has been noted in the literature that penetrating-sharp object injuries known as the most common cause of vascular injuries are also more frequently seen in male. It has been found in a study conducted in Adana that 93.5% of the cases with penetrating-sharp object injuries evaluated in the Group Directorate of Forensic Medicine were male (12). It has been reported in the literature that penetrating-sharp object and vascular injuries most frequently occurred in the age range of 20-40 years (5-12). It was detected in the present study that 47 (90.3%) and 5 (9.7%) of the cases were male and female, respectively, the youngest and the oldest age of the cases were 16 and 58 years old, respectively while the mean age was  $31.4 \pm 11.4$  years and that the cases were most frequently in the age range of 19-29 years. The higher frequency of young males between the vascular injury cases like all other forensic cases is considered to be associated with the

facts that male individuals in this age group are more frequently found in the outdoor surroundings, they work in more risky workplaces and they are more frequently involved in a fight.

It has been reported in the literature that vascular injuries are mostly penetrating-type injuries while blunt vascular injuries are usually traffic accidents (5, 6, 9, 13-16). It has been denoted in a study carried out in Georgia that 87% of the vascular injuries were penetrating-type injuries (17). It was monitored that 40 (76.9%), 9 (17.3%) and 3 (5.8%) of the cases in the present study were penetrating-type, blunt and crush-type injuries, respectively. It has been stated in a study conducted in İzmir that 71% of blunt vascular injuries were caused by traffic accident (5). It was determined in our study consistently with the literature that two third (n=6/9) and remaining one third of blunt vascular injuries occurred by traffic accident and occupational accident, respectively.

It has been reported in the studies related with forensic injuries in our country that injuries were more frequently seen in the summer and spring months whereas less frequently in the winter months (16-19). It was found in our study consistently with the literature that vascular injuries occurred more frequently in the spring and summer seasons (n=30, 57.7%).

It has been noted in a study that evaluated the deaths due to peripheral vascular injuries that femoral artery was injured most frequently (7). It was denoted in another study which analyzed the fatal vascular injuries in the whole body that thoracic aortic injury was the most common vascular injury causing mortality (5). In the present study, 71 different veins were found to be injured in 52 cases. Of the 71 injured veins, 67 (94.4%) were determined to be in the limb region. It was encountered that one, two and three different veins were injured in 34, 8 and 7 cases, respectively. The most frequently injured vein was a. femoralis and its branches (n=11, 21.2%). The second most frequently injured vein was radial artery (n=9, 17.3%). Non-fatal vascular injuries were evaluated in our study. Of the injured veins, 65.4% (n=34) and 63.5%

(n=33) were located in the lower and upper limbs, respectively. Vascular injuries were found in the cervical and thoracic veins in 3 (5.8%) and 1 (1.9%), respectively. It can be concluded from the study results that vascular injuries in the limb regions were more treatable while the vascular injuries in the cervical, thoracic and abdominal regions were more fatal.

Andrikopoulos et al. have reported that 40% of the lower limb vascular injuries were accompanied by bone fractures (20). It has been noted in a study performed in Bursa that 19% of the fatal vascular injuries were accompanied by bone fractures while 4.8% were amputation injuries (7). In the present study, vascular injury was accompanied by bone fracture in 10 (19.2%) cases. 9 (17.3%) cases had amputation-type injuries including total and subtotal amputations in 5 and 4 cases, respectively. Visceral organ injury was encountered in 5 (9.6%) cases.

All the cases were treated as admitted in the hospital and surgical intervention was needed for vascular repair. The shortest and the longest durations of hospital stays were 1 and 21 days, respectively. It was identified that the cases were treated in the services of Cardiovascular Surgery, Orthopaedics, Neurosurgery, General Surgery and Intensive Care Unit. It was understood that the patients experienced a dynamic treatment process and were transferred between the departments when needed. It was stated in the prepared reports that all the cases carried vital risk.

As a conclusion, our study results were found to be consistent with the literature. Vascular injury was detected in 1.2% of the cases related with forensic traumatology who admitted to the Department of Forensic Medicine, Eskişehir Osmangazi University Medical Faculty. Of the cases with vascular injury, 90.3% were male and 9.7% were female. Mean age of the injured cases was 31.4 years while vascular injury was identified most frequently in the age group of 19-29 years. Vascular injuries were most commonly due to penetrating-sharp object injuries (n=36, % 69,3). It was ascertained that vascular injuries were most frequently in

the lower limbs and the most commonly injured vein was a. femoralis.

The meticulous evaluation of forensic cases by all physicians and perfect reporting of the history, examination, test results and treatment process are important. The present study has shown that there were deficiencies in the preparation of emergency service notes, discharge reports from the service and forensic reports. The test reports for alcohol, hypnotic and narcotic drugs were lacking in the hospital documents. The forensic duties of the physicians include recognizing forensic case, reporting and prepare the hospital file involving the information from history to treatment process. Related with vascular

injuries as the subject of our study, the facts that how vascular injury happened, which tested were performed, treatment type and treatment outcomes should be noted down. It was observed in our study that physicians exhibited important deficiencies in keeping records properly. It is concluded that awareness should be created by in-service trainings and further high qualitative education programs related with approach to the forensic case and keeping proper records should be prepared. Taking necessary precautions is important for protecting the physicians from being put into a difficult situation in vascular injuries and other forensic cases, and to provide the victims to have their legal rights fast and justicely.

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### Ethics

**Ethics Committee Approval:** The study was approved by Eskişehir Osmangazi University Noninterventional Clinical Research Ethical Committee (Decision no: 14, Date: 22.10.2019).

**Informed Consent:** The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.

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