Civil War Surgical Experience: Gun Shot or Shell Fragment Injuries

İç Savaş Cerrahi Deneyimi: Ateşli Silah veya Şarapnel Yaralanmaları

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ABSTRACT Objective: A number of patients with gunshot wounds come to Turkey because of the ongoing civil war in Syria. In this study, patients who admitted our hospital, diagnosed with vascular trauma due to gun shot or shell fragments in the civil war in Syria were evaluated, and the factors associated with mortality were identified. **Material and Methods:** The study included 28 patients who admitted our hospital between June 2012 and October 2013. **Results:** There were 24 (85.7%) male and 4 (14.3%) female patients with a mean age of 28.05±6.28 years. The mean time from trauma to admittance was 16.32±15.21 hours (range 4 to 48 hours). Five (17.9%) patients were intubated before admission. Nine patients (32.1%) received fasciotomy after operation. Amputation rate was 7.1% in 2 patients. The inhospital mortality was seen in 4 (14.2%) patients. The most important factor associated with mortality was presence of preoperative shock and intubation (p=0.001). **Conclusion:** Our study showed that preoperative clinical findings affected the mortality associated with vascular trauma. A correct basic medical intervention would help to further reduce mortality rates.

Key Words: Vascular system injuries; wounds gunshot; mortality

ÖZET Amaç: Suriye'de sürmekte olan iç savaş nedeniyle ülkemize birçok ateşli silah yaralanması gelmektedir. Bu çalışmada; hastanemize başvuran, Suriye' de ateşli silah veya şarapnel ile vasküler travma geçirmiş hastalar değerlendirilmiş, ve mortaileye etki eden faktörler araştırılmıştır. **Gereç ve Yöntemler:** Çalışmaya hastanemize Haziran 2012 - Ekim 2013 tarihleri arasında başvuran 28 hasta dahil edilmiştir. **Bulgular:** Yaş ortalaması 28,05± 6,28 yıl olan 24 (%85,7) erkek ve 4 (%14,3) kadın hasta çalışmaya dahil edilmiştir. Travmadan hastaneye başvuruya kadar geçen süre ortalama 16,32±15,21 saatti (4-48 saat). Beş (%17,9) hasta başvuru öncesi entübe edilmişti. Dokuz (%32,1) hastaya operasyon sonrası fasiotomi uygulandı. Amputasyon oranı 2 hasta ile %7,1 idi. Hastane mortalite oranı 4 hasta ile %14,2 idi. Mortalite ile ilgili en önemli faktör preoperatif şok ve entübasyon varlığı olarak bulundu (p=0,001). **Sonuç:** Bizim çalışmamız preoperatif klinik verilerin, vasküler travma ile ilişkili mortaliteyi etkilediğini göstermiştir.Doğru yapılmış temel tıbbi müdahale mortaliteyi azaltmada yardımcı olacaktır.

Anahtar Kelimeler: Vasküler sistem yaralanmaları; yaralar ateşli silah; ölüm oranı

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A number of patients with gunshot wounds come to Turkey because of the ongoing civil war in Syria. The common features of these patients are the lack of basic medical intervention and late admission to hospital. Gunshot wounds comprise 64% of all arterial injuries, and 78% of all vascular injuries.[1]

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As the mean ischemic time decreases, mortality and morbidity rates also decrease. In second world war, Korea and Vietnam vascular traumas resulted in amputation, but today amputation rate is very low.[2] Although the amputation rate was as high as 73% in the past with ligation being the preferred technique for arterial injuries, today this rate has fallen to as low as 1% through the developments in early transport, diagnosis and the complex treatment techniques evolved.[3,4]

In this study, patients who admitted our hospital, diagnosed with vascular trauma due to gun shot or shell fragments in the civil war in Syria were evaluated, and the factors associated with mortality were identified.

MATERIAL AND METHODS

PATIENTS

The study included patients who admitted our hospital between June 2012 and October 2013 with vascular trauma in civil war in Syria. Data regarding the patient demographics, operative parameters and the data from the postoperative course were prospectively collected.

MANAGEMENT

The initial assessment was made with participation of the orthopedist and the vascular surgeon. The vascular surgeon immediately took control of the bleeding in the emergency room when necessary. The plain and lateral X-rays were taken to plan reconstruction. The vascular diagnosis was made by physical examination or Doppler ultrasound (US). When all participating disciplines agreed that the patient would benefit from vascular repair and a concomitant bone and soft tissue reconstruction, the patient was taken into operating room, in emergency conditions. All patients received tetanus vaccine and dual antibiotics before the operation. Following surgical antisepsis and draping, the initial surgical exploration was performed by the vascular surgeon for arterial or venous repair. After this procedure, orthopedists began exploration for the reconstruction of bone, if needed. After the operation, all patients were transferred into the tertiary intensive care unit (ICU). In order to prevent struggling and uncontrolled motion during recovery from anesthesia, the patient was not extubated in the operating room. In addition to intravenous fluids, analgesics and antibiotics, the patients also received heparin infusion in the first 24 hours. If needed, fasciotomy was performed in ICU after the operation.

STATISTICAL ANALYSIS

Statistical analyses were performed with SPSS 17.0 software (SPSS Chicago, Illinois). Normally distributed continuous variables were expressed as mean±standard deviation (SD), abnormally distributed continuous variables were expressed as median (25%-75%,) and categorical variables were defined as frequencies and percentages. Mann Whitney-U test was used to determine differences between continuous variables. Fisher Exact Chi-square test was used determine differences between categorical variables. The p values smaller than 0.05 were considered as statistically significant.

RESULTS

The patients' demographic characteristics are given in Table 1. There were 24 (85.7%) male and 4 (14.3%) female patients with a mean age of 28.05±6.28 years. The mean time from trauma to admittance was 16.32±15.21 hours (range 4-48 hours). Five (17.9%) patients were intubated before admission. Eleven (39.3%) patients also had bone pathology. All patients had close range gunshot or shell fragments injuries confined to only one extremity for vascular trauma. All patients came from civil war in Syria. The symptoms and findings on admission are given in Table 2.

TABLE 1: Preoperative characteristics of the patient group.

	Patient group Mean±SD (n=28)
Age (year)	26.75±6.37
Males (%)	24 (85.7%)
Admission time	16.32±15.21
Preoperative shock	5 (17.9%)

SD: Standard deviation.

TABLE 2: Symptoms and clinical findings on admission.

	Patient group (n=28)
Hypovolemic shock	5 (17.9%)
Hematoma	19 (67.8%)
Pulsatile bleeding	9 (32.2%)
Paresis	6 (66.6%)
Ischemia	28 (100%)

All patients were taken into the operating room within the first hour of their admission. Reoperation was performed in 2 patients for vascular complications. Bone pathology was repaired after vascular repair during the same operation. Ten patients initially received an external fixation, and 1 patient received intramedullary stabilization procedure to achieve recovery. Mean time of hospital stay was 13.68±7.54 days (1-33 days). Mean bleeding amount into the surgical drains was 350.43±85.34 ml in the postoperative first day. The drains were removed when the volume was less than 25 ml per day. None of the patients had a systemic infection whereas two patients had local wound infections. Complete recovery was achieved with appropriate antibiotic treatment and wound care.

The vascular injuries are summarized in Table 3. Four (14.3%) patients received primary revascularization to the extremity, 18 (64.3%) received autologous graft interposition with great saphenous vein, and 5 (17.9%) received polytetrafluoroethylene (PTFE) graft interposition and 1 (3.6%) received PTFE and saphenous vein graft interposition.

Nine patients (32.1%) received fasciotomy after the operation. Fasciotomy was performed because of reperfusion injury. Amputation rate was 7.1% performed in 2 patients. In one patient, there was a huge tissue defect under the knee, and amputation was performed after the saphenous vein bypass was performed. In another patient, multiple bullet emboli occurred, and after embolectomy, a vessel dissection was seen under the knee. When we compare patients with fasciotomy and without fasciotomy, there were no statistically differences. The inhospital mortality rate was 14.2% (4 patients). The most important factor associated with mortality was presence of preoperative shock and intubation (p=0.001) (Table 4).

DISCUSSION

Vascular injuries occur frequently in the lower extremity due to gunshot or shell fragment injuries. Severe bone fracture and soft tissue damage are mostly accompanied with these injuries. Similar to our study, most frequently femoral artery injuries have been reported in the literature. Bleeding, an enlarging hematoma or the ischemia of the limb may all guide the physician for the correct diagnosis. Penetrating and shotgun wounds have different mechanisms of injury along with their direct effects on the vessels. Although angiography remains the gold standard for the diagnosis, presence of some physical findings may be enough.[5] In Van Waes et al.'s series, the authors described a selective

TABLE 3: Vascular injuries.

	Patient group (n=28)
Arm artery	7 (25%)
Arm vein	1 (3.6%)
Leg artery	7 (25%)
Leg vein	2 (7.1%)
Leg artery&vein	11 (39.3%)

TABLE 4: Factors associated with mortality.

	Mortality		
	(-) (n:24)	(+) (n:5)	p value
Age*	25 (22-29.75)	26.50 (25.25-33)	0.428
Admission time*	12 (8.50-19)	9 (8-14.50)	0.372
Gender			
Female	4 (16.7%)	0	1.000
Male	20 (83.3%)	4 (100%)	
Preoperative Shock& Intubation	1 (4.2%)	4 (100%)	0.001
Bone fracture	10 (41.7%)	1 (25%)	1.000
Fasciotomy	9 (37.5%)	0	0.273

*Median (25%-75%).

non-operative management based on clinical examination and additional investigations for penetrating vascular injuries, and suggested additional investigations just in hemodynamically stabilized patients.[6] In this study, we used physical examination and only Doppler US for diagnosis to be as fast as possible.

Mechanism of injury varies between different countries, and certainly when injuries in the peace and war conditions are compared.[7] A review of vascular trauma in a big USA city, Boston, reported that gunshot wounds occurred 50%.[8] On the other hand, there were no gunshot wounds in Oxford, but 23% of injuries were due to knife wounds.[9] In our study, all wounds were military, and they consisted of gunshot or shell fragment injuries.

The severity of tissue ischemia depends on its duration, level of arterial injury and the extent of soft tissue damage. Tolerance of muscle tissue to ischemia without any irreversible damage is generally agreed to be 4-6 hours. Early de-compression fasciotomy prevents this damage.[10] In this study, we performed fasciotomy to those who needed just after the operation, in ICU.

Amputation rate is small in our series when compared with previous reports in the literature. Dua et al. compared military and civilian popliteal artery trauma outcomes and amputation rates, and reported them as 29% in the military group and 13% in the civilian group.[11] Mullenix et al. identified four factors independently associated with amputation: ipsilateral fracture, complex soft tissue injury, nerve injury and high extremity abbreviated injury score.[12] In our assay, amputation rate is 7.1%, seen only in 2 patients. One had a huge tissue defect, just as described in the literature.

CONCLUSION

Mortality is rarely seen after extremity trauma.[5] In our series, mortality rate was 14.2% (4 patients). All of the mortal cases were intubated before their admission to hospital. They were all in hypovolemic shock. When we compare our results with the literature, mortality rate is quite high. This can be associated with the patients' preoperative conditions. Our study showed that preoperative clinical findings affected the mortality associated with vascular trauma. A correct basic medical intervention would help to further reduce mortality rates.

Conflict of Interest

Authors declared no conflict of interest or financial support.

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