The Royal Medical Services Experience in Vascular Injuries during the Palestinian Uprising

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Objectives: This report summarizes the experience of two vascular surgeons in dealing with vascular injuries at Rafidia surgical hospital- Nablus during the bloody conflict between the Palestinians and Israel.

Material and Methods: Between January 2000 and June 2001 thirty-nine Palestinians with vascular injuries were received alive at Rafidia Hospital in the city of Nablus. All patients were received in profound shock and underwent emergency surgery. Massive blood transfusion was given almost to all patients. We retrospectively evaluated the outcome and the surgical results.

Results: There was one operative death in a patient with injury to the vertebral artery. There were serious complications in 14 patients related to other injuries but all of them were discharged alive from Hospital with no limb loss.

Conclusion: War vascular injuries are lethal. However, the presence of an experienced vascular surgeon and anesthesiologist, unlimited supply of blood and blood products combined with the young age of patients who tolerate the state of shock better can tremendously improve the outcome.

(J Med J 2006; Vol. 40 (1): 35- 39)

Received	***Accepted***
April 6, 2005	*January 2, 2006*

Introduction

The Royal Medical Services (RMS) has gained wide and great experience in field and war medicine through its constant participation with the Jordan Armed forces peacekeeping missions in world's conflicts. The good reputation gained in Croatia, Eritrea, East Timor, Sera Lyon, Yemen, and other parts of the world during the regional conflicts made the two parts of the Palestinian-Israeli conflict to agree on the participation of Jordanian medical personnel in helping the Palestinian people. War injuries have become more difficult to deal with as more lethal weapons are constantly put into use.

Rapid transport system from the field, experienced paramedics, and massive transfusion enable some of the patients to arrive to the hospital alive.

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The aim of the vascular surgeon in order of importance is to keep the patient alive, limb salvage, minimize complications, and enable other surgeons to deal with associated injuries in a more favorable situation. There has been growing use of blood and blood products in vascular injuries; the presence of a blood bank is of paramount importance for success.

Patients and Methods

Between January and June 2001, thirty-nine vascular injuries were treated by emergency vascular reconstruction at Rafidia Surgical Hospital. The age ranged between 14 and 48 (mean of 26). Thirty patients had their trauma to the groin, and the others to different parts of the body. All patients had bullet injuries of the high velocity type except four patients who had rubber bullets. All patients were received in profound shock as they usually were injured in a remote area and had to pass through many checkpoints before they reach the hospital. Experienced anesthesiologist was available as part of the team and enabled rapid institution of venous access in the emergency room, rapid transfusion of blood, and most importantly rapid induction without any hemodynamic collapse.

The surgical technique was according to the situation and the injured part. In injuries to the femoral vessels, proximal control, exposure of the severed vessel, and then vascular reconstruction was followed in that order. In traumas to the upper extremities (5 cases), to the neck (1 case), and to the abdomen (3 cases) direct exposure of the injured vessel was the rule. In 25 patients having femoral artery or vein injury with tissue loss, an interposition graft was used in order to bridge the vascular loss (19 autologous and 6 synthetic).

Although synthetic tube grafts are not recommended in contaminated war injury, we were forced to use them because of discrepancy between the diameter of the injured vessel and the saphenous vein precluding its use.

Primary repair was achieved in the rest of the cases (5cases). Only one case of brachial artery injury needed a saphenous vein graft, while the three Axillary arteries needed vein interposition graft to restore continuity of the severed vessel, while all the three axillary arteries needed iterpositionvein grafts to achieve vascular continuity. Only in one case, the bleeding vessel was ligated (internal iliac artery). Most patients had other associated injuries (24), which were dealt with concomitantly by other surgeons. Stable patients were extubated in the OR (22); the others were transferred to the intensive care unit intubated. The patients received between 2 and 21 units of blood (average 8 units), fresh frozen plasma and platelets were given liberally to patients as plasma expanders or when haemostatic defects occurred. The patients' number and surgical strategy are summarized in the table.

Morbidity occurred in most of the patients, and ranged between wound infection to limb paralysis due to irreparable nerve injuries.

Table: Surgical technique as related to the site of injury.

	Femoral and upper thigh	*Abdominal injuries*	*Upper limb*	*Neck*	*Negative explorations*
Number of cases	*30*	*3*	*5*	*1*	*2*
Primary repair	*5*		*1*		
Interposition graft	*25*		*4*		
Morbidity	*16*	*3*	*5*		
Mortality				*1*	
Ligation		*1*		*1*	

Discussion

Vascular injuries have been documented during episodes of armed conflict as far back as the Greek and Roman civilizations and undoubtedly occurred before those eras. [1] In many areas of the world, military weapons are widely available, [2, 3] this has been argued to contribute to regional instability, increased civilian injuries, and violence that is not directly related to international combat. [4, 5]

We retrospectively examined the circumstances surrounding injury for people with weapon injuries admitted to Rafidia Hospital during 6 months of Second Palestinian Uprising. Incidence of vascular injuries by weapons was calculated using admissions data from January 2001 to June 2001 and figures for the population of Nablus obtained from patients, relatives, and first aid persons. Several limitations should be considered, injuries were under ascertained since some people die before reaching care or survive without presenting for care.

Therefore, our findings may have been biased toward underestimating civilian interfactional injuries. In wartime circumstances, the number of injuries may be extreme. Sherif reported 224 extremity vascular injuries in 18 months during Afghanistan war. [12] Fason et al reported 94 patients in 3 months on the Thailand – Cambodia border. In both studies, antipersonnel mines caused the majority of civilian vascular injuries, while either high velocity missiles or rubber bullets injured most of our patients.

The incidence of weapon injuries remained high when the disarmament component of peacekeeping operation achieved only limited success. [6]

As noted by the preponderance of penetrating injury in the published medical literature, when the arterial vessel is transected, vascular spasm coupled with low systemic blood pressure appear to promote clotting at the site of injury and to preserve vital organ perfusion better than which occurs with ongoing uncontrolled hemorrhage that occurs with partial vessel injuries.

Clinical examination and reexamination remain the mainstays for identifying and treating vascular injuries. Hard signs of vascular injury include, observed pulsatile bleeding, arterial thrill by manual palpation, bruit by auscultation, visible expanding hematoma, and signs of distal ischemia.

Soft signs of vascular injury, which should promote evaluation by angiography, Doppler studies, or even diagnostic surgical exploration include, significant hemorrhage found on history, decreased pulse compared to the contra lateral extremity, bony injury or proximity penetrating wound, and neurological abnormality.

The physical examination is augmented by measurement of the Ankle-Brachial Index (ABI). If (ABI) is lower than 0.9, many authors now recommend Doplex Doppler Vascular Studies as a rapid, non invasive methods of assessing vascular injury. [1, 9]

However, both angiography and Doplex were not available at Rafidia Hospital at the time of the study. Operative exploration remains the sole criterion standards of care. We explored surgically any patient who was in shock state, or with history of massive bleeding, hypotension, mainly depending on the hard signs of vascular injuries. [2] Negative explorations gave other surgeons the chance to repair soft tissue injuries.

Simple lab studies as CBC, platelet count, BUN, creatinine, blood sugar, typing and cross matching, plain X- ray films of the injured extremity to determine the fractured bones and foreign bodies were the only preoperative investigation most of the time.

Surgical intervention when suspecting vascular injury varies between operative visualization of normal vascular anatomy for diagnostic purposes, and extensive repair/ replacement of entire segment of injured vessels.

Primary anastomosis usually possible if the injured segment is 2 centimeters or less. Simple ligation of the bleeding vessels may be all that is possible to save lives especially with more severe cases with multiple associated injuries. The risk of amputation after any ligation is much higher, [8] but patients with severe brain injury or hemodynamic instability may not tolerate 2-3 hour operation to repair a vascular injury.

Utilizing the Mangled Extremity Syndrome Index Score to predict amputation and functional outcome based on criteria of degree of skeletal/soft tissue injury, limb ischemia, shock and age of patient were sensitive prediction of amputation but poor in prediction of functional outcome. [7]

Many authors reported reduction at amputation rates, morbidity and mortality because of improvement in emergency medical services system; faster transport time, maintenance of hydration, and improvement in technique. [10,11]

However, measuring suffering and morbidity is difficult, changes in trends cannot be established without prewar information. [13] The presence of an experienced anesthesiologist was of paramount importance, as most patients were received in profound shock. Prompt and rapid resuscitation with smooth induction were life saving in our group of patients. The post operative management centered on the well being of the patient and the blood pressure, heart rate, and urine output were the most important hemodynamic parameters, while the limb temperature, neurologic function, presence of pulses were the most important criteria of successful vascular repair.

In conclusion, war vascular injuries has become very complex and difficult to manage, however, the presence of the Jordanian surgeons at Rafidia hospitals with their wide experience greatly reduce the mortality.

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