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Review

Management of war-related vascular wounds in French role 3 hospital during the Afghan campaign

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ABSTRACT

Objectives: To describe the management of war-related vascular injuries in the Kabul French military hospital.
Methods: From January 2009 to April 2013, in the Kabul French military hospital, we prospectively included all patients presenting with war-related vascular injuries. We collected the following data: site, type, and mechanism of vascular injury, associated trauma, type of vascular repair, amputation rate and complications.
Results: Out of the 922 soldiers admitted for emergency surgical care, we recorded 45 (5%) patients presenting with vascular injuries: 30 (67%) gunshot-related, 11 (24%) explosive device-related, and 4 (9%) due to road traffic accident. The majority of injuries (93%) involved limbs. Vascular injuries were associated with fractures in 71% of cases. Twelve (26.7%) had an early amputation performed before evacuation. Twenty (44.4%) patients underwent fasciotomy and three (6.6%) sustained a compartment syndrome.
Conclusions: This was the first French reported series of war-related vascular injuries during the last decade's major conflicts. The majority of injuries occurred in the limbs. Autologous vein graft remains the treatment of choice for arterial repair. Functional severity of these injuries justifies specific training for military surgeons.

Contents

Introduction

During the recent conflicts (Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom), vascular lesions represented approximately 10% of combat-related wounds [1,2], of which limb injuries predominated with an incidence of 75% [3]. This proportionally high incidence of limb injuries was due to the

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efficient protective gear that decreased the rate of head and trunk injuries. Moreover, with the widespread implementation of tactical combat casualty care and rapid evacuation, increasing numbers of casualties suffering from massive hemorrhage have presented to forward surgical teams raising issues regarding their surgical management [1,3]. To our knowledge, there is no data regarding the treatment of war-related vascular wounds (WRVW) by French military surgeons during recent conflicts.

The objective of our study was to describe the practice of French military surgeons regarding the management of WRVW during the Afghan campaign.

Methods

From January 2009 to April 2013, we prospectively included all casualties presenting with WRVW to the Kabul French military hospital (role 3) located at the Kabul International Airport.

The following data was collected: age, gender, nationality, affiliation (allied forces, insurgents, civilians) date of injury, mechanism and type of lesion, nature of associated lesions (if present), tourniquet application, evacuation duration, radiological investigations, « damage control » procedure, type of vascular lesion treatment (ligation, direct repair, autologous or prosthetic venous graft, shunt), primary amputation, fasciotomy, duration of ischemia, length of stay in intensive care, total length of hospital stay, occurrence of compartment syndrome, sepsis, ischemia and secondary amputation.

Data was then entered using Microsoft Excel® software. The data were analyzed using the Epi Info Software (v5.01, CDC Atlanta, USA). Median and range were given for continuous variables. Logistic regression was performed to assess predictive factors of complications (for the continuous variables). Odds ratios and 95% confidence intervals were calculated. Shapiro-Wilk test was used to test for normality. The Fisher exact test and the Mann-Whitney *U* test were performed to evaluate associations ($\alpha = 5\%$). The differences were considered statistically significant when $p \leq 0.05$.

Results

We recorded 45 (5%) subjects presenting with WRVW out of the 922 soldiers admitted to the French role 3 hospital for emergency surgical care at the same period. Median age was 25 years (12–50). Only one of the injured was female. French soldiers represented approximately 38% (n = 17) of casualties. All the others were Afghan National Army members. The median duration of medical evacuation was 120 min (10–300). Median Injury Severity Score (ISS) was 29 (0–72).

The majority of vascular injuries involved limbs (93%) (Fig. 1); predominantly lower limbs (approximately 80%) with popliteal and lower leg arteries being the most frequently injured (51.1% combined) followed by the superficial and common femoral arteries (26.6% and 2.2% respectively) (Table 1). Regarding upper limb injuries (13%), the humeral artery appeared to be the most frequently injured (20%). Moreover, we observed a high proportion of venous injuries (62%).

Firearms were the predominant mechanism of injury representing 67% (n = 30) of vascular injuries; followed by explosive weapons (improvised explosive devices, hand-grenades, and anti-personnel mines) (n = 11) and road traffic accidents (n = 4), 24% and 9% respectively (Fig. 2). Upon admission, hematological work-up revealed coagulation disorders (prothrombin ratio < 60%) in 16 patients.

Regarding radiological investigations, 13 (29%) hemodynamically stable patients underwent preoperative imaging: duplex ultrasonography (n = 8) and computed tomography angiography (n = 5). Twelve patients had intraoperative angiography for vascular assessment and treatment.

As to associated injuries, soft-tissue loss, bone fractures and peripheral nerve injuries occurred in respectively 41 (91%), 32 (71%) and 23 (51%) patients (Fig. 3).

Management

A tourniquet was applied in 19 cases (42%) prior to their admission with 65 min [0–600] median ischemic time. Seven patients with a median injury severity score of 43 [25–72], underwent a damage control procedure (15.5%). They underwent a limited surgical intervention (<1 h) to control hemorrhage (packing, simple hemostasis techniques) along with intensive care unit resuscitation for preventing the lethal triad of hypothermia, coagulopathy and metabolic acidosis. The aim was to prevent mortality rather than correct the anatomy during the first 24 h. Two out of the seven patients had a vascular damage control procedure with vascular ligation and/or shunt for injuries of the superficial femoral artery. These seven patients were then reoperated upon the subsequent day for final vascular repair.

Sixteen patients were transfused following hemorrhagic shock and coagulopathy. Ten patients received a massive transfusion (>10 red blood cell units transfused in 24 h) and six a whole-blood transfusion procedure.

Median surgery duration was 90 min (12–465). As for the five patients who sustained chest as well as vascular injuries, the single stable patient first underwent tube thoracostomy in order to treat limb vascular injuries. The four hemodynamically unstable patients underwent an emergency bilateral anterolateral thoracotomy (Clamshell incision) for assessment of critical intrathoracic structures and surgical hemostasis. Their limb vascular injuries were then treated.

Regarding specific types of vascular surgery (Table 1), 14 patients (31%) required vascular replacement by vein or prosthetic graft due to partial artery loss: 13 (29%) using a reversed autologous saphenous vein graft, and only one with polytetrafluoroethylene (PTFE) prosthetic bypass. Ten patients (22%) had direct repair by lateral suture or en-to-end anastomosis after resection of the damaged segment.

Twelve (26.6%) and nine (20%) patients respectively had venous ligation and arterial ligation. Ten (22%) subjects underwent thrombectomy, two had an arterial shunt (4.4%) and one a covered stent via endovascular procedure. Twenty (44.4%) subjects had prophylactic decompression fasciotomies. Fractures were treated by temporary external fixation. Soft-tissue loss and nerve injuries were treated following evacuation to France.

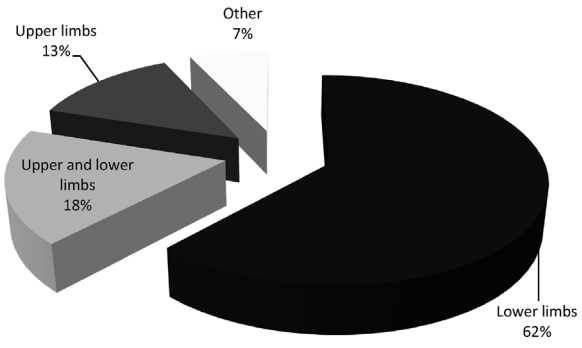

Fig. 1. Distribution of vascular injuries.

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