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Retrospective analysis of case series of patients with vascular war injury treated in a district hospital

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ABSTRACT

Introduction: As the Syrian civil war continues, medical care of the injured remains a priority for health facilities receiving casualties. Ziv Medical Centre, the closest hospital in Israel to the Syrian border, has received 500 casualties since February 2013. Seventeen of these patients had vascular injuries. This research reports the care of these seventeen patients and explores the challenges of treatment in patients with little antecedent clinical history and improvised initial care that may be complicated by delay to definitive care, sepsis and limb ischaemia.

Method: Electronic and paper patient records were examined. Descriptive case series data are presented.

Results: Fifteen of the 17 patients were male. The mean age was 20 years (range 8–30 years). Causes of injury included gunshot wounds (4 patients), shrapnel (multi-fragment) injury (12 patients), and 1 patient was run over and dragged behind a car. The time from injury to transfer to definitive care ranged from 5 h to 7 days (mean 43 h). All but one patient had associated non-vascular multiple-trauma.

Thirteen patients presented with limb ischaemia. Four patients had arterio-venous fistula (AVF) or pseudoaneurysm. There were 5 upper and 10 lower limb major vascular injuries. Three patients had neck vessel injuries.

All patients were investigated with CT angiography and underwent surgical or endovascular intervention. In 12 patients, 4 vessels were debrided and re-anastomosed and 13 vessels bypassed. Endovascular repair was performed in 4 patients. After initial revascularisation, 4 patients went on to amputation. There were no deaths.

Conclusions: The injuries treated are heterogeneous, and reflect the range of high energy vascular trauma expected in conflict. The broad range of vascular solutions required to optimise outcomes, in particular, limb salvage, in turn, reflect the challenges of dealing with such injuries, especially within the context of sepsis, ischaemia and delay.

As war continues, there is a pressing need to address the needs of patients with high energy injuries in austere environments where there is a dearth of health resources and where definitive care may be days away.

Introduction

Current practice in the treatment of war-related vascular injuries is based on military experience from recent global conflicts [1–3]. Although this has influenced the management of civilian trauma care [4–7], there is a dearth of literature on the management of trauma, in particular, vascular trauma, amongst

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civilians with war injuries [8] who may present to healthcare facilities after considerable delay and with advanced sepsis. Some of these patients are chronically malnourished after years of war.

Since February 2013, over 1500 patients from Syria have been treated in Israel. Many are women and children. Vascular injuries amongst the 450 patients treated in an Israeli district hospital close to the Syrian border are discussed. The range and complexity of vascular trauma is described in relation to their causes and the difficulties in management of limbs that are grossly infected and extensively denuded of soft tissue in patients with protracted shock and ischaemia. These limbs may arguably have been amputated, but with advanced and multi-disciplinary care they were salvaged. Limb salvage in four instances was made possible through endovascular techniques, hitherto underused in peripheral artery trauma. As is often the case, the necessity to treat these challenging injuries was the driver to pursue a novel approach using endovascular procedures not yet a standard of care.

Methods

With hospital ethics committee approval, data were collected on all patients wounded in the Syrian civil war admitted to Ziv Medical Centre (Ziv) from February 2013 (when the first patients arrived). Data from the hospital trauma registry and paper and electronic patient files were collected and stored in a password protected file available only to the researchers. No identifying information was collected or stored. All data include details from initial admission via the Trauma Room, operative and non-operative care and final discharge. Follow-up of most patients was not possible as they returned to Syria.

Of 450 patients, 17 patients had vascular injury. Orthopaedic patients who suffered traumatic amputations at the time of injury are not included in this paper as no vascular procedure was indicated.

Results

Table 1 summarises the clinical data of the 17 patients with vascular injury on admission to the Trauma Room. Fifteen patients were male. The mean age was 20 years (range 8–30 years). The time from injury to transfer to definitive care in Ziv ranged from 5 h to seven days (mean 43 h). All but one patient had associated non-vascular multiple trauma.

Nerve injury (within the same neurovascular bundle) and bone fracture were the most commonly encountered associated non-vascular injuries within this cohort of patients (10 and 7 patients, respectively Table 2). The majority of vascular injuries (21 vessels in total) were combined arterial and venous injuries (Table 3). Venous repair was performed before arterial repair in order to reduce limb congestion and to assist distal run-off in the reperfused limb.

Table 1
Initial clinical data of patients with vascular trauma.

	Range	Mean
Heart rate on admission (beat/min)	100–145	118
Blood pressure on admission (mmHg)	Systolic 72–171	123
	Diastolic 40–116	78
Core temperature in operating room (°C)	32–36.5	35.6
Age (years)	8–30	20
Time from injury to Ziv Hospital (h)	5–170	N/A
Initial Haemoglobin (g/dl)	7.4–13.2	10.6
Initial white blood cells (WBC) ($\times 10^9$/l)	6.4–26.0	17.5
Packed cells transfusion per patient	0–23	10.5
Albumin within 24 h from of admission (g/l)	2.32–3.59	2.73
Total protein within 24 h of admission (g/l)	3.56–5.92	4.47

Table 2
Associated polytrauma in patients with vascular injury.

Associated injuries	Number of patients
Nerve injury	10
Femur fracture	4
Humerus fracture	2
Abdominal trauma	3
Humerus fracture + chest wall injury + burns	1
Radius + ulna fracture + median nerve damage	1
Pelvis + femur + Tibia fractures	1
Fibula/tibia fracture	3
Pharynx	1

Vascular injuries were classified as either those causing ischaemia (13 patients), or those resulting in arterio-venous fistula (AVF) or pseudoaneurysm (4 patients). Ischaemic limbs were cold and pale, had reduced capillary filling, neurological deficit and advanced infection. At the time of presentation, no limb was irreversibly ischaemic. There were five upper and ten lower limb major vascular injuries. Three patients had neck vessel injuries. Thirteen patients were transferred immediately to the Operating Room (OR) for surgical repair and four patients underwent endovascular procedures. All but one patient underwent fasciotomy.

In each instance vascular treatment was determined by the nature and location of the injury, the severity of injury and the quality of the soft tissues (affected by delay). Table 4 summarises the vascular procedures performed. Four vessels were debrided and re-anastomosed; thirteen bypassed (eight using allograft great saphenous vein GSV, and one deep femoral vein (a re-do of a former bypass performed in Syria), and three using synthetic graft). Endovascular repair using covered stents was performed in four patients. Two vessels were ligated in order to achieve haemorrhage control. Table 5 shows the mangled limb severity score calculated for each patient. Two patients with scores greater than 10 underwent amputation after initial reperfusion procedures. All patients accumulated scores exceeding 5 points for delays alone – with over 6 h of limb ischaemia.

In terms of outcome, control of haemorrhage and initial revascularisation were achieved in all patients. Four patients, however, went on to amputation after failure of initial revascularisation procedures. There were no deaths.

Complications

Three patients out of nine who underwent vascular graft procedures suffered infective disruption of vascular anastomoses. Their clinical courses are described below and a strong argument may be made for primary amputation rather than attempted limb

Table 3
Vascular injuries* (vessels injured).

Vascular injury	Number of patients
Internal carotid artery + neck veins	3
Brachial + radial + ulnar artery and vein	8
Common + external iliac arteries	2
Common femoral artery + Vein (CFA/CFV)	4
Superficial femoral artery + Vein (SFA/SFV)	9
Tibial + peroneal arteries	5

* The number of vessel repairs does not correlate with the number of patients as patients had more than one injury.