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Original article

War-related extremity injuries in children: 89 cases managed in a combat support hospital in Afghanistan

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ABSTRACT

Background: Meeting paediatric needs is among the priorities of western healthcare providers working in Afghanistan.
Hypothesis: Insufficient information is available on paediatric wartime injuries to the extremities. Our objective here was to describe these injuries and their management on the field.
Materials and methods: We retrospectively reviewed consecutive cases of injuries to the extremities in children (<16 years of age) due to weapons and managed at the Kabul International Airport (KaIA) Combat Support Hospital between June 2009 and April 2013. We identified 89 patients with a mean age of 10.2 ± 3.5 years and a total of 137 elemental lesions.
Results: Explosive devices accounted for most injuries (78.6%) and carried a significantly higher risk of multiple lesions. There were 54 bone lesions (traumatic amputations and fractures) and 83 soft-tissue lesions. The amputation rate was 18%. Presence of bone lesions was associated with a higher risk of injury to blood vessels and nerves. Of the 89 patients, four (4.5%) died and eight (9%) were transferred elsewhere. Of the 77 remaining patients, at last follow-up (median, one month; range, 0.1–16 months), 73 (95%) had achieved a full recovery (healed wound and/or fracture) or were recovering with no expectation that further surgery would be needed.
Discussion: Despite the absence of paediatric surgeons, the combat support hospital provided appropriate care at the limb salvage and reconstruction phases. The highly specialised treatments needed to manage sequelae were very rarely provided. These treatments probably deserve to be developed in combat support hospitals.
Level of evidence: IV, retrospective study.

1. Introduction

Casualties to civilians, including children, are part of the collateral damage that occurs during modern asymmetric warfare. During the past decade, over 2,000,000 children are estimated to have died due to wars and their consequences [1]. Few epidemiological data are available on paediatric healthcare in combat zones. Creamer et al. [2] reported that 10% of patients admitted to a combat support hospital (CSH) were children. Penetrating wounds due to combat projectiles predominated (76.3% of cases) and the extremities were the most common sites of injury (38.3%) [2].

Combat-related injuries to the extremities in children account for a large proportion of the care provided in CSHs [2]. Nevertheless, few studies have focussed on these injuries, and their results are conflicting. We hypothesised that insufficient information is available in this area. In a study of 37 paediatric patients with non-combat-related gunshot wounds to the extremities, including 29 with fractures, Washington et al. [3] reported that outcomes were favourable overall. Thus, only five patients experienced soft-tissue infection, none had osteitis, and all the fractures healed. Also in the non-combat setting, Arslan et al. [4] concluded from a study of 27 gunshot fractures in 22 children that the treatment was never simple. Late-stage surgery was acquired to achieve union of 6/27 fractures, and several serious complications were noted at last

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follow-up (including non-union in two patients and amputation in one patient).

Here, our objective was to describe the nature and management of combat-related injuries to the extremities in children admitted to a war-zone surgical facility in Afghanistan.

2. Patients and methods

We performed a retrospective single-centre study of patients managed between June 2009 and April 2013 at the Kabul International Airport (KaIA). The patients were identified in the French military healthcare database OPEX (*service de santé des armées français*), which collects information on all patients who undergo surgical procedures in war theatres abroad. We included all patients younger than 16 years of age who required surgery for combat-related injuries to the extremities. Patients with isolated injuries to the pelvis or shoulder girdle were excluded.

2.1. The hospital

The patients were managed at the KaIA CSH, a North Atlantic Treaty Organisation (NATO) facility run by the French military to support troops deployed in the Kabul area of Afghanistan [5]. The main priority is damage control to allow the safe medical evacuation of wounded coalition members to a hospital in continental France, where definitive treatment can be provided. Another goal consists in providing care to civilians, including children, who must then be transferred to local facilities despite the limited healthcare resources available there.

2.2. Patients

During the study period, 155 children received surgical treatment for injuries to the extremities. Combat projectiles were the main causes of injury, with 89 cases. This group of 89 children had a mean age of 10.2 ± 3.5 years and a male-to-female ratio of 3.4. Injuries due to explosive devices (blast effect and/or shrapnel) were far more common ($n = 70$) than were firearm injuries ($n = 19$).

Of the 89 children, 68 were admitted primarily to the KaIA CSH and 21 were transferred after receiving initial treatment at another facility.

2.3. Assessment methods

In the overall cohort, we analysed the mechanisms of injury, topographic distribution of lesions, types of elemental lesions, concomitant injuries, Injury Severity Score (ISS) [6], and all surgical procedures including those performed elsewhere before admission to the KaIA CSH. Elemental lesions were classified as traumatic amputations, fractures (diaphysis, metaphysis/epiphysis, and hand and/or foot), and soft-tissue injuries (STIs). In patients with multiple STIs (multiple shrapnel wounds), we analysed only the main injury in each segment of the involved limb. Lesions to the pelvis or shoulder girdle were classified among the concomitant injuries. We then categorised the elemental lesions into two groups, namely, bone lesions (traumatic amputations and fractures) and STIs. We recorded the hospital stay length, number of operating-room admissions, and number and type of elemental surgical procedures.

When evaluating the outcomes, we excluded the patients who died and those who were lost to follow-up after being transferred elsewhere. We considered only the wound and/or fracture-healing phase. Full recovery at last follow-up was defined as complete healing of the STIs and/or fractures, ongoing recovery as no expectation that further surgery would be required to achieve a full recovery, and ongoing treatment as doubt regarding the surgical outcome. No functional evaluations were performed.

For statistical comparisons, we used Fisher's exact test for qualitative variables and Student's test for quantitative variables. Values of $P \leq 0.05$ were considered significant.

3. Results

3.1. Description of the lesions

We identified 137 elemental lesions (Table 1), i.e., 1.5 lesions/patient on average. More than one limb was injured in 26 patients. Table 2 lists the lesion sites. The hand was the most common site involved (24%), although lower-limb injuries (58%) were more common overall than upper-limb injuries. No distinct wound patterns were identified.

3.1.1. Bone injuries (n = 54)

There were 19 cases of traumatic amputation in 14 children, including 11 at the upper limb (nine below and two above the wrist) and eight at the lower limb (five below and three above the knee).

A total of 35 fractures or fracture sites were present in 31 children. All fractures were open, and the knee was the most common site (60%). Blood vessel and nerve injuries were present in 37% and 20% of fractures, respectively, with no statistically significant differences according to fracture location at the diaphysis, metaphysis/epiphysis, or hand and/or foot. In contrast, bone injuries were significantly associated with a higher risk of injury to blood vessels ($P < 0.001$) and nerves ($P < 0.05$), compared to STIs.

Explosive devices caused all 19 traumatic amputations and 22 of the 23 bone injuries of the hand and/or foot.

Of the 54 bone injuries, 19 (35%) were accompanied with an STI at another site.

Table 1
Description of the lesions in 89 children with combat-related injuries to the extremities.

	n (%)		
Bone injuries	54 (39)		
Traumatic amputation		19 (35)	
Fracture		35 (65)	
Diaphysis			14 (40)
Metaphysis/epiphysis			10 (29)
Hand and/or foot			11 (31)
Soft-tissue injuries	83 (61)		
Total	137 (100)	54 (100)	35 (100)

Table 2
Sites of the lesions in 89 children with combat-related injuries to the extremities.

Site	Bone injuries		Soft-tissue injuries	Total, *n* (%)
	Amputation, *n*	Fracture, *n*	*n*	
Shoulder			3	3 (2)
Arm		1	11	12 (9)
Elbow		2	2	4 (3)
Forearm		2	2	4 (3)
Wrist			2	2 (1)
Hand	11	8	13	32 (24)
Hip		1	5	6 (4)
Thigh	3	6	15	24 (18)
Knee		6	4	10 (7)
Leg	4	5	21	30 (22)
Ankle		1	3	4 (3)
Foot	1	3	2	6 (4)
Total, *n* (%)	19	35	83	137 (100)