International Orthopaedics (SICOT) (2016) 40:861–864
DOI 10.1007/s00264-016-3114-6

ORIGINAL PAPER

Infectious risk for suicide bomber attack victims: management of penetrative wounds in French Army personnel

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Received: 17 December 2015 / Accepted: 4 January 2016 / Published online: 16 January 2016

Abstract
Introduction In suicide bomber attacks (SBAs), the explosive forces may disperse fragments from the body of the bomber to which the device is attached. This biologic material can cause physical injury to bystanders and may represent a source of severe infectious diseases.
Patients and methods Two French soldiers, victims of an SBA in Africa, were managed in the Percy Military Teaching Hospital. They sustained multiple injuries, including some caused by bony fragments converted into projectiles by the explosion. One patient had multiple superficial wounds managed conservatively. The other was treated surgically by serial debridement with removal of a bony piece related to the suicide bomber. The decision not to prescribe antiretroviral therapy was determined after discussion with infectious disease specialists.
Results Blood tests for HIV, HCV and HBV were taken at months zero, three and six; all were negative.
Conclusion In the French Military Health Service, guidelines are based on evaluation of the viral status of the bomber and on the regional HIV prevalence breakpoint. There is no indication for HCV post-exposition prophylaxis (PEP). Accessible human foreign bodies related to an SBA should be removed as soon as possible, in association with antibiotic medication and a possible HIV PEP. These infectious risks have been discussed in some military and law enforcement literature. It should be a risk-based decision supported by medical intelligence.

Keywords Suicide bombers · Infectious diseases · HIV · HCV · HBV · French Army

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Introduction

Suicide bomber attacks (SBAs) are symbolic of the modern asymmetric conflicts. The explosive forces that disperse projectiles embedded in the explosive device may also disperse fragments from the body of the bomber to which the device is attached. This biologic material can cause physical injury to bystanders and may represent a source of severe infectious diseases. The main risks are hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV). Three cases of penetrating injuries by suicide bomber (SB) bone fragments were documented in the Israeli literature [1]. Two HBV-positive SBs were reported, but there was no reported transmission to survivors. Recommendations in the USA and are based on recommendations for blood exposition in medical situations [2, 3]. After the 7 July 2005 London bombings, an expert group convened by the Health Protection Agency wrote a risk assessment for post-exposure prophylaxis against HBV for bomb victims and immediate care providers with a consideration for other blood-borne viruses (HCV and HIV) [4]. All French soldiers are immunized for HBV, which represents the most important risk of transmission for SBs victims. However, the HCV and HIV transmission risk must also be considered, especially in areas of

high prevalence, such as Africa. There are no international recommendations for military trauma. Those cases are relatively rare, and most of the time, it is not possible to perform an HIV test from the remains of dead terrorists in the deployed military environment.

Decisions regarding the implementation of prophylaxis are complex, and drawing parallels from existing guidelines is difficult. For any prophylactic intervention to be implemented effectively, guidance must be simple, straightforward and logistically undemanding. Here we describe two case reports of French soldiers, victims of an SBA in Africa and, following a literature review, give our recommendations for post-exposure interventions to prevent infection with HCV and HIV in military personnel wounded during SBAs.

Cases reports

Two French soldiers were victims of an SBA in Africa. This bombing occurred in front of a French embassy, where the two soldiers were standing. They were located <2 m from the SB. The victims were immediately managed in a dispensary, where they received wound care and antibiotic prophylaxis (amoxicillin and clavulanic acid). No blood tests or measures to identify blood -born virus infection were taken. The victims were repatriated to France 48 h later and admitted to the Percy Military Teaching Hospital.

Case 1

A 37-year-old male patient, located close to the SB during the attack, presented >90 superficial soft-tissue injuries over his body associated with exposure to the SBs blood. These lesions were treated conservatively by local wound care and antibiotic medication (amoxicillin and clavulanic acid for 8 days). No surgical procedure was necessary. Additional exam in France only revealed a tympanic perforation. The patient was immunized for HBV and tetanus. The decision was made not to prescribe antiretroviral therapy (ART), even though the HIV status of the SB was unknown, because of a delay of three days between blood exposure and the subsequent health care decision. He was tested for HCV and HIV at months zero, one, three and six; all test were negative. No long-term follow-up was done.

Case 2

A 38-year-old male patient sustained multiple soft-tissue injuries caused by missiles from the SBs vest. He also presented second-degree burns on the face and both arms and legs, involving <10 % of total body surface area. Two large wounds (left shoulder and left leg) were treated by débridement and primary closure in a local facility before medical evacuation. In France, he was found to have missiles (screws) in the left leg, the thorax and the left forearm, and an unidentified foreign body in the penis. These foreign bodies were accessible and were surgically removed. The one located in the penis was identified as a bony fragment from the SB, as the victim presented no bony injury. Serial débridement and delayed primary closure were required, and antibiotic medication was given (amoxicillin and clavulanic acid for 8 days). Local evolution was favorable for all wounds. He was immunized for HBV and tetanus. The decision was made not to prescribe ART for the same reason as in case 1. He was tested for HCV and HIV at months zero, one, three and six months; all tests were negative. No long-term follow-up was done.

Discussion

These cases reports illustrate two situations at risk for infectious disease transmission after an SBA. The first is related to a large number of wounds in a person who was located close to the bomber and the second to a bone fragment from the bomber embedded in the victim's body. The interest in medical consequences of suicide bombing mass casualty incidents led to guidelines concerning their management, but preventing the possibility of preventing infectious diseases from the bomber is seldom mentioned [5].

Prevention of blood-borne virus transmission

Several articles have been published regarding infectious risks for victims of terrorist attacks in the civilian setting [2, 6]. However, most of them deal with HBV transmission [4–9] and are not pertinent for the military population, which is immunized against HBV and tetanus at 95 %. Recommendations concerning prevention of HCV and HIV transmission in persons wounded during suicide bombings or other mass-casualty events were given by the US Centers for Disease Control and Prevention in 2008 [2]. In those recommendations, testing for early identification of HCV infection following mucous membrane exposure may be considered, and the decision to perform testing should be made on the basis of the judgment of the treating physician and the preference of the individual patient. In most cases HIV post-explosion prophylaxis (PEP) is not warranted. HIV PEP might be considered only in settings in which exposure to an HIV-infected source is known or thought to be highly likely (e.g. a blast injury in a research facility containing a large archive of HIV-infected blood specimens). HIV PEP should not be administered universally in response to mass-casualty events unless recommended by the local public health authority. In the rare event that HIV PEP is considered, it should be initiated as soon as possible after exposure. Those recommendations are from the new guidelines for occupational exposure to blood-borne viruses [3].

According to Clint [10], the decision must be based on SB status for HIV determined by identification tests. Frickman et al. [11] consider that rapid HIV testing from the physical remains of terrorists in the deployed military environment is possible. Samples should be acquired quickly, and basic sample preparation is advisable. Decisions concerning PEP should take into account the diagnostic gap in early infections.

Retained human fragments

Management of fragment wounds is based on surgical débridement with removal of foreign bodies, including easily accessible fragments. As projectiles can cause long-bone fracture, external fixation is considered to be the best primary form of stabilisation on the battlefield [12]. Most fragments are composed of inert metals and can be tolerated as long as they do not cause damage to soft tissues [7, 13]. In contrast, few recommendations exist in the literature concerning management of human foreign bodies. These biologic projectiles, which are usually identified on X-rays, may be managed differently than inert fragments, particularly considering the risk of viral diseases transmission.

Few articles deal with management of human foreign bodies after SBA [8, 10]. Braverman et al. [6] reported a case of HBV transmission due to a retained bony fragment from the SB in the 7 July 2005 bombing in London. In a multicentric study Eshkol et al. [1] reviewed 94 patients with multiple penetrating fragment injuries of the musculoskeletal system due to SBAs. Most of them were treated by wound débridement with removal of identified human foreign bodies and delayed primary closure. Broad-spectrum antibiotic treatment was started immediately on admission, and all patients were inoculated with antitetanus toxin and hepatitis B vaccine. None of the patients developed clinical signs of hepatitis B, HIV or other severe infections during follow-up.

French Military Health Service (FMHS) guidelines

Recommendations given by the FMHS are designed for military patients immunized for HVB and tetanus and are based on national guidelines for HCV and HIV management and the World Health Organization and the International Labour Organization (WHO/ILO) guidelines concerning PEP for HIV infection [14, 15]. Even though not used in our experience to date, testing SB remains should be encouraged in the acute period. If the SB cannot be reliably tested, the regional HIV prevalence breakpoint seems to be a significant parameter to start victim ART. If the regional HIV prevalence in the country in which the SBA occurred is >1 %, PEP is indicated. The recommended PEP is a three-drug combination therapy including a boosted protease inhibitor for HIV (tenofovir, emtricitabine, lopinavir and ritonavir) for 28 days [15]. Blood tests should be done at zero, thrre and six months if there is no treatment and zero, two and four if there is a PEP.

Concerning HCV risk, there are no indications for PEP. Polymerase chain reaction (PCR) is performed at four to six weeks. If the result is negative, no more tests are required; if positive a new test is done at 3 months. If this second test is positive, curative treatment is discussed.

Retained human fragments must be removed as soon as possible when no major structural or functional disability is anticipated. An eight day course antibiotic medication (based on penicillin and clavulanic acid) is associated, and HIV PEP is considered. In case of inaccessible fragments or delayed surgical management, conservative management is preferred.

Conclusion

Any blood-borne disease with a carrier stage, such as HBV, HCV and HIV, can be passed to blast victims by penetration of biologic material from an infected SB or by contaminated metal fragments. The risks of exposure to infectious agents when in close proximity to a pedestrian SBA is real and have been discussed in some military and law enforcement literature. Treatment should be determined on a risk-based basis supported by medical intelligence.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

The information and views set out in this article are those of the author(s) and do not necessarily reflect the official opinion of the French Military Health Service.

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